

## Implementing Human-Centricity: Exploring the Foundations of Psychological Safety

TJAŠA STEPIŠNIK PERDIH & JANA KRIVEC <sup>1</sup>

**Abstract** While research traditionally frames psychological safety as a group-level, team-based construct, its individual-level understanding remains less explored. This study investigates the subjective meaning of psychological safety through a thematic analysis of qualitative responses from 111 part-time students in Slovenia. Findings revealed three primary themes. The most dominant theme was Interpersonal & Relational (relationships, emotional support and acceptance, values of interpersonal relationships). This was followed by Material Security & Situational Stability (financial and material security, health, stability and peace) and, to a lesser extent, Internal Personal Factors (self-confidence, autonomy, emotional stability). These results indicate that an individual's perception of psychological safety is a broad, socially embedded construct that extends beyond organizational boundaries, linking to one's local community and personal life. By recognizing this interconnected sense of safety, organizations and societies can better align with the holistic, human-centric principles that define the fifth industrial revolution.

**Keywords:** • sense of safety • psychological safety • subjective safety • Industry 5.0

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## 1 Introduction

Industry 4.0, often regarded as the fourth industrial revolution, was characterized by its reliance on advanced technologies such as cyber-physical systems, the Internet of Things (IoT), and artificial intelligence to create data-driven, interconnected, and highly efficient smart organizations. This paradigm primarily focused on automation, productivity, and optimization, placing technology at the centre of industrial processes (Breque et al., 2021; Gamberini & Pluchino, 2024; Majerník et al., 2022; Romero et al., 2016). As such, it has often ignored original principles of social fairness and sustainability (Breque et al., 2021).

Industry 5.0 maintains the technological foundations of its predecessor but reframes them through a human-centric lens. It represents a conceptual expansion and should not be understood as a chronological continuation of, or an alternative to, the existing Industry 4.0 paradigm. Instead, it re-contextualizes the technological advancements of Industry 4.0 and is the result of a forward-looking exercise (Breque et al., 2021).

This new concept provides a different focus, shifting away from a technology-first, efficiency-driven model toward one that is fundamentally sustainable, resilient, and human-centric (Breque et al., 2021; Pathak et al., 2023; Trstenjak et al., 2025). According to the definition by Breque et al. (2021, p.14): ‘Industry 5.0 recognises the power of industry to achieve societal goals beyond jobs and growth to become a resilient provider of prosperity, by making production respect the boundaries of our planet and placing the wellbeing of the industry worker at the centre of the production process’.

A central aspect of this evolution lies in redefining the role of the human within industrial systems. In the Industry 4.0 paradigm, the worker, often labelled the Operator 4.0, was conceived as a technologically augmented component within a cyber-physical system. It was often framed as a ‘resource’, a ‘component to be optimized’, or a ‘human-in-the-loop’ managing an otherwise autonomous process. As such, the Operator 4.0 is a ‘smart and skilled operator’ who collaborates with automation and uses technologies such as augmented reality, cobots, and wearables to enhance performance and safety (Romero et al., 2016). The primary goals were productivity and optimization, often at the expense of human agency and well-being (Majerník et al., 2022). As we can see, in this model, the human’s value was primarily instrumental, defined by their ability to complement machine efficiency.

Conversely, a human-centric approach in industry puts core human needs and interests at the heart of the production process (Breque et al., 2021; Grabowska et al., 2022; Zafar et al., 2024). The central question changes from asking what we can do with new technology, to asking what the technology can do for us (Breque et al., 2021). Technology is intended to serve people and adapt production processes to worker needs, ensuring that its use does not impinge on workers’ fundamental rights, such as the right to privacy,

autonomy and human dignity (Breque et al., 2021; Pathak et al., 2023). The goal is to promote inclusive human-technology collaboration and create a fair social contract where technology enhances humanity and not replaces it (Zafar et al., 2024).

In this model, the worker is considered an investment or asset rather than a cost, enabling parallel development for both the organization and its employees. Such a perspective signifies an employer's strategic interest in investing in the skills, capabilities, and well-being of their employees to attain organizational goals (Breque et al., 2021; Pathak et al., 2023; Zafar et al., 2024). Gamberini & Pluchino (2024) mention a strong link between employee well-being and 'healthy organizations'. Industry 5.0 is characterized by a higher appreciation for human capital, and the entire human-centric framework rests on the prerequisite that technology serves people, not the inverse (Breque et al., 2021).

This distinction in human roles is captured in the evolution from Operator 4.0 to Operator 5.0, or, alternatively, Resilient Operator 5.0, because the evolution to Industry 5.0 is marked by the introduction of resilience. The Operator 5.0 is defined as 'a smart and skilled operator that uses human creativity, ingenuity, and innovation empowered by information and technology as a way of overcoming obstacles in the path to create new, frugal solutions for guaranteeing manufacturing operations sustainable continuity and workforce wellbeing in light of difficult and/or unexpected conditions' (Romero & Stahre, 2021, p. 1090). This concept necessitates a comprehensive approach that prioritizes the human element alongside technology and concentrates on two areas: self-resilience concerning the operator's biological, physical, cognitive, and psychological health, and system-resilience, which ensures the shared adaptability of human-machine systems to maintain optimal performance (Romero & Stahre, 2021).

This vision places the well-being of the worker and the value of unique human contributions, such as critical thinking, creativity, and complex problem-solving, back at the centre of the industrial process. Humans are seen as active participants in technological advancement. Dynamic collaboration between humans and intelligent machines will enable them to perform novel or unfamiliar tasks safely and effectively. This integration of human ingenuity and technological capability is seen as the foundation of Industry 5.0 (Zafar et al., 2024).

In order for this to happen, workers' autonomy, dignity, and mental health must be protected. The 'always-online' and 'always-available' working culture associated with digitization creates new risks, including burnout and cognitive overload; however, digital technologies could also be utilized to support workers in controlling and managing the effects of this new environment on their mental health and well-being (Breque et al., 2021).

Trstenjak et al.'s (2025) systematic review confirms that human-centricity, sustainability, and resilience are the core pillars of the Industry 5.0 concept and that this perspective emphasizes the development of socio-technical systems designed to enhance human health, well-being and safety, but what does safety mean in this new context?

## 1.1 The concept of Safety

Safety is considered a basic human need and a fundamental human right. It is commonly defined as ‘the state of being protected from danger or harm’ (*SAFETY | English Meaning - Cambridge Dictionary*, n.d.) or as ‘the condition of being safe from undergoing or causing hurt, injury, or loss’ (*SAFETY Definition & Meaning - Merriam-Webster*, n.d.). Within injury prevention research, safety is conceptualized as a state of ‘adequate control over physical, material, or moral threats, contributing to a perception of protection from harm’ (Andersson & Svanström, as cited in Nilsen et al., 2004, p. 71). It is often defined and measured more by its absence than its presence (Nilsen et al., 2004).

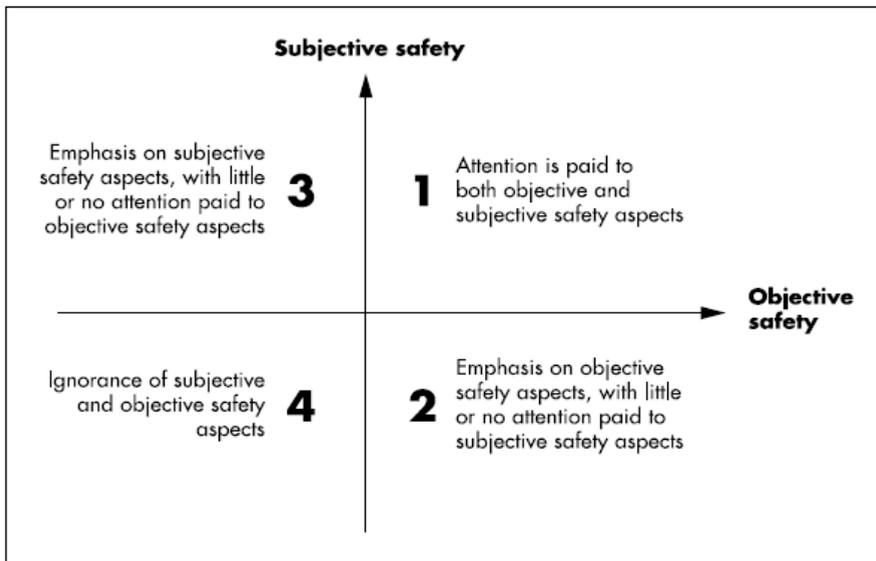
Recognizing the need for a comprehensive and unified definition, the World Health Organization (WHO) initiated an international effort to establish a consensus on the conceptual and operational aspects of safety. Safety has since been defined as ‘a state in which hazards and conditions leading to physical, psychological or material harm are controlled in order to preserve the health and well-being of individuals and the community. It is an essential resource for everyday life, needed by individuals and communities to realise their aspirations’ (Maurice et al., 1998, p. 6). Safety is thus a comprehensive concept that actively safeguards physical, psychological, and material well-being, encompassing far more than the simple absence of injury. Maurice et al. (1998) argue against a narrow, traditional focus on ‘objective safety’ focused on measurable risk reduction. They stress the need to incorporate ‘subjective safety’, the individual’s or community’s perception and feelings of safety, as these perceptions have powerful implications for mental health, behaviour, and social participation. The WHO framework thus distinguishes between two primary dimensions (Maurice et al., 1998):

- 1 Objective (External) Safety: The verifiable, data-based level of safety determined by environmental and behavioural measures, expert criteria, and verifiable data such as accident statistics or hazard assessments.
- 2 Subjective (Internal) Safety: The personal or collective perceived ‘feeling’ or ‘sense of safety’. This feeling is not always rational and can be influenced by factors like media, personal experiences, or social cues.

These dimensions influence each other and interact dynamically. They can also diverge, creating mismatches between ‘real’ and ‘felt’ safety. To conceptualize these relationships, Maurice et al., (1998) propose a two-dimensional matrix which Nilsen et al., (2004) presented in four distinct quadrants (see Figure 1):

- Q1- **High Objective Safety + High Subjective Safety:** The ideal ‘Safe Zone’ in which both measurable safety and perceived safety are high. Individuals are objectively protected from harm and feel safe within their environment.
- Q2 - **High Objective Safety + Low Subjective Safety:** The ‘Anxious/Fearful Zone’, represents a psychologically significant state where, despite low risk, individuals or communities feel unsafe, for example high fear of crime in statistically safe neighbourhoods. This dissonance can lead to stress, social withdrawal, and reduced physical activity, negatively impacting health.
- Q3 – **Low Objective Safety + High Subjective Safety:** The ‘Ignorant/Complacent Zone’, a condition where people feel safe despite genuine hazards. This misperception can encourage risk-taking behaviours and disregard for safety measures, for example ignoring health warnings.
- Q4 – **Low Objective Safety + Low Subjective Safety:** The ‘Dangerous Zone’ is an unambiguous crisis state, characterized by actual and perceived danger. Individuals are both exposed to and aware of high risk, necessitating urgent intervention (Maurice et al., 1998; Nilsen et al., 2004).

**Figure 1:** Approaches to defining and operationalising safety concepts (Nilsen et al., 2004).



This framework underscores that safety promotion must address both objective protection from harm and subjective feelings of security. Enhancing the sense of safety is as crucial

as mitigating actual risks, as it empowers individuals and communities to live fully and confidently within their environments (Nilsen et al., 2004). The evolution from Industry 4.0's Operator 4.0 to Industry 5.0's Operator 5.0 mirrors this conceptual shift in the understanding of safety: it moves from a narrow focus on objective, measurable features toward a holistic, human-centric perspective that also values psychological well-being.

## 1.2 Psychological safety

The concept of psychological safety emerged from the work of Schein and Bennis (1965, cited in Edmondson & Lei, 2014), who identified it as a critical condition for effective organizational change. They argued that psychological safety enables individuals to overcome defensiveness and learning anxiety when confronted with information that challenges existing assumptions, allowing them to prioritize collective objectives over self-protection.

Following a period of relative neglect, the construct reemerged in the 1990s with Kahn's qualitative research. Kahn (1990) conceptually linked psychological safety to personal engagement, proposing that it determines individuals' willingness to express themselves physically, cognitively, and emotionally in their roles rather than withdrawing to protect their sense of self. He further argued that such safety is fostered by interpersonal relationships characterized by mutual trust and respect.

Since then contemporary research on psychological safety has expanded significantly, driven by the increased importance of organizational learning and innovation. Edmondson & Lei (2014) organized this vast body of work into three levels of analysis:

### 1 Individual-Level Contexts

This research stream examines an individual's personal experience of psychological safety and its impact on their work outcomes. Studies differentiate between two types of outcomes:

- **In-Role Behaviour** where studies focused on employee performance in expected behaviours for their roles, such as individual's engagement in their work. For example, research has shown that psychological safety fosters feelings of vitality, which in turn predict greater involvement in creative work (Kark & Carmeli, 2009). It also motivates knowledge sharing among coworkers (Siemsen et al., 2009).
- **Speaking Up and Voice (Extra-Role Behaviour):** A growing body of work examines psychological safety's relationship to extra-role behaviours such as speaking up or 'voice'. This is an 'upward-directed, promotive verbal communication' (Dyne & LePine, 1998; Premeaux Fontenot & Bedeian, 2003). This behaviour is vital for organizational learning but is often inhibited by interpersonal risk. Studies consistently find that psychological safety is a key

mediator through which leadership fosters voice. For instance, it mediates the relationship between change-oriented (Detert & Burris, 2007) and ethical leadership (Walumbwa & Schaubroeck, 2009) and subsequent employee voice. Furthermore, research has distinguished between promotive voice (expressing improvements that could benefit the organisation) and prohibitive voice (expressing concerns about what might harm the organisation), finding that psychological safety is a particularly strong predictor of the latter, riskier behaviour (Liang et al., 2012).

## 2 Organizational-Level Contexts

At this level, psychological safety is conceptualized as an organizational climate, measured as an average of employee perceptions across the firm.

- **Organizational Performance:** Research in this context links psychological safety to firm-level success. For example, studies of high-technology firms found that commitment-based HR practices foster a ‘social climate of trust’ (a highly similar construct), which predicts knowledge exchange and, ultimately, improved firm performance (Collins & Smith, 2006). A study in German companies found that a climate for psychological safety was positively correlated with firm performance, especially by supporting process innovations (Baer & Frese, 2003).
- **Organizational Learning:** A key application at this level involves ‘learning from failure’. Studies show that high-quality relationships and social capital within an organization build psychological safety, which in turn enabled failure-based learning (Carmeli & Gittell, 2009).

## 3 Group-Level Contexts

This is identified as the largest and most active research stream and was initiated by Edmondson's (1999) foundational work. This research supported the conclusion that psychological safety is essentially a group-level phenomenon, as for it to be a group-level construct, it must characterize the team rather than individual members, and team members must hold similar perceptions of it. Edmondson confirmed this by demonstrating that psychological safety did indeed vary significantly between different groups within the same organization.

In this context, psychological safety has been studied mainly in three roles:

- **As an Antecedent:** Psychological safety is shown to be a direct predictor of team outcomes. Choo et al. (2004) showed that a psychologically safe environment fosters divergent thinking, creativity, and risk-taking. It also motivates engagement in both exploratory and exploitative learning, which in turn promotes team performance.
- **As a Mediator:** This is a common conceptualization, where psychological safety is the mechanism connecting team inputs (structure, leadership, team characteristics)

to team outputs (learning, innovation, performance). For example, inclusive leadership predicted higher team performance through the mechanism of first building psychological safety (Hirak et al., 2012).

- **As a Moderator:** More recent research explores psychological safety as an enabling condition that alters the relationship between other variables. In this context, psychological safety mitigates the negative effects of team challenges. Gibson & Gibbs (2006), for instance, found that in geographically dispersed teams, a psychologically safe communication climate was found to counteract the negative consequences of virtuality (e.g., national diversity, electronic dependence) on team innovation.

Psychological safety has consistently been shown to play a role in enabling performance, particularly when work is characterized by uncertainty and requires creativity or collaboration, and organizational learning as learning behaviours can be limited by interpersonal risks, such as the fear of appearing incompetent. A climate of psychological safety mitigates these risks, making people more likely to offer ideas, admit mistakes, ask for help, or provide feedback. This environment also enables ‘voice’ or speaking up, allowing employees to challenge the status quo or identify problems which is often perceived as too risky without psychological safety (Edmondson & Lei, 2014).

However, safety alone is not enough. When certain conditions supporting teamwork, such as task interdependence, are missing, psychological safety may not lead to team learning and performance. Its impact on knowledge sharing was also found to be lower when individuals had more confidence in their knowledge. Its effect on learning is also stronger when the work itself is more uncertain (Edmondson & Lei, 2014; Siemsen et al., 2009). Accordingly, Edmondson & Lei (2014) emphasize the need for additional research to explore the boundary conditions that shape the effects of psychological safety.

To conclude, the concept of psychological safety was defined by Edmondson (1999, p.350) as ‘a shared belief held by members of a team that the team is safe for interpersonal risk taking’. This perspective is strongly supported by research showing that psychological safety is a group-level phenomenon; perceptions tend to converge among people working closely together, and this climate varies significantly between different groups within the same organization. However, a shared belief is necessarily an aggregation of individual perceptions. The literature itself acknowledges a stream of research focusing on the individual-level experiences of psychological safety and their impact on outcomes like engagement and speaking up. Understanding the antecedents of this individual experience is a prerequisite for understanding how a collective, shared perception emerges. Therefore, our empirical research addresses this necessary micro-foundation by investigating what individual people perceive as psychological safety.

## **2 Research**

### **2.1 Aims of the study**

The emergence of the Industry 5.0 paradigm signals a critical shift from a purely technology-driven model to one that is fundamentally human-centric, sustainable, and resilient. This framework explicitly places the well-being of the individual at the centre of the production process. This emphasis on well-being inherently expands the traditional, objective-only definitions of safety (the absence of physical hazards) to prioritize subjective safety, an individual's internal feeling of being sheltered from psychological or material harm. This subjective dimension is increasingly recognized as a necessary precondition for fostering the innovation, resilience, and human agency central to the Industry 5.0 paradigm.

Within organizational scholarship, this concept of subjective, interpersonal safety is most robustly captured by the construct of psychological safety. At its core, psychological safety refers to individuals' perceptions of the potential consequences associated with taking interpersonal risks within a team or organizational setting (Edmondson, 1999). Research has consistently supported this, demonstrating that psychological safety is best considered a group-level phenomenon, as people working closely together form similar perceptions that differ from other groups.

However, the holistic, human-centric principles of Industry 5.0, which aim to serve humanity and society, not just the organization, imply that a sense of safety is interconnected, linking an individual's workplace experience with their wider local and community context. This suggests a need to understand the micro-foundations of this construct. Before a shared belief can emerge at the group level, each individual must first form their own subjective perception of safety. Yet, what constitutes psychological safety for an individual remains less explored. Accordingly, our study addresses this research question.

### **2.2 Sample and Procedure**

The sample ( $n = 111$ ) was composed of students from the Faculty of Advanced Social Studies (SASS) in Slovenia, enrolled in the Psychosocial Support and Social Management undergraduate programs. Data was gathered using the online survey platform Ika over a two-month period, from December 2024 to January 2025. Participation was voluntary and anonymous.

The sample was predominantly female (84.7%,  $n = 94$ ), with 15.3% ( $n = 17$ ) identifying as male. Half of the participants (50%) were under 30 years of age, 39% were aged between 30 and 44, and 11% were over 45.

Regarding their education level, 62% (n = 69) reported secondary education as their highest level, 21% (n = 23) had a 1st Bologna cycle degree (bachelor's), 11% (n = 12) had a 2nd Bologna cycle degree (master's), and 6% (n = 7) held a scientific master's, or doctoral degree. All of the participants were part-time students.

### 2.3 Measures

The data for this paper was drawn from a larger, quantitative study on psychological safety. For the purposes of this paper, only two components of the larger survey were analysed: the demographic data of the subsample (gender, age, and student status) and responses to a single open-ended qualitative question ('What does psychological safety mean to you?').

### 2.4 Data Analysis

This study employed a mixed-methods design, combining quantitative demographic data with a qualitative, open-ended inquiry. The data analysis was conducted in two stages. First, all quantitative demographic data were analysed using descriptive statistics. Second, the 111 qualitative responses were analysed using an inductive, thematic content analysis. This process included open coding (codes were identified as they emerged directly from the text, independent of pre-existing theories), categorization (initial codes were then reviewed, compared, and grouped into broader, semantically-related categories, e.g., 'relationships', 'financial and material security') and frequency analysis (a frequency count was conducted for each category to determine the salience and priority of these themes). Individual responses frequently encompassed multiple categories (e.g., 'partner's support and financial stability'). A single response may therefore contribute to the frequency of several categories.

## 3. Results

The analysis of responses on the open-ended question revealed 136 codes that could be grouped into 7 categories (see Table 1). The participants' feeling of psychological safety is most strongly linked to interpersonal relationships. This is followed by emotional categories (support and values) and only then by material and stability factors. Internal personal factors were mentioned as well. Health comes in last place.

**Table 1:** Categories of Psychological Safety Derived from Open-Ended Responses.

Category	Frequency (No. of mentions)
Relationships	42
Emotional support and acceptance	37
Values of interpersonal relationships	19
Financial and material security	14
Stability and peace	13
Personal factors	7
Health	4
SUM	136

Note: The total frequency (136) is higher than the number of respondents (111) because some participants provided answers that spanned multiple categories.

- 1. Relationships:** By far the most important source of psychological safety is people. Respondents explicitly mentioned partners, family members, and friends as their foundation of safety. Answers include: ‘Partner, family, friends’, ‘Partner’, ‘Family and a positive attitude’, ‘The closeness of people who are important in my life’.
- 2. Emotional support and acceptance** This category is closely related to the first but focuses on the actions within those relationships. It reflects the sense of having someone who stands by you, offers comfort, and provides emotional support and love. Illustrative responses include: ‘That my parents stand by me and help me’, ‘My partner’s closeness, hugs, the fact that he is ‘there for me’’, ‘Love’, This category also includes the feeling that you can be who you are, that you are accepted, and that others listen to you. For example: ‘That I see signs from others that they accept me’, ‘a space where I feel accepted and heard’, ‘That I am heard, that they don’t interrupt me when I speak and respect my opinion...’.
- 3.** In third place are the fundamental **values of interpersonal relationships**. Safety stems from trust, honesty, loyalty, and a feeling of mutual respect. Answers include: ‘Respect’, ‘Loyalty, respect’, ‘Loyalty, respect, dedication, being heard, trust, acceptance’, ‘Honesty’.
- 4. Financial and material security:** The first category, which is not directly related to relationships, is material well-being. This includes stable finances, a regular job, and settled housing conditions (a home). Answers corresponding to this category are: ‘Settled housing situation, financial security...’, ‘My own home, employment...’, ‘Regular financial income, regular job’.
- 5. Stability and peace:** Respondents desire stability, routine, predictability, and peace, which also includes non-conflictual relationships and a sense of control. For example: ‘A sense of stability, and having a routine...’, ‘Peace’, ‘Being in control’.

6. **Internal or personal factors**, such as ‘self-confidence’, ‘autonomy,’ “relying on oneself” formed this theme, as well as emotional balance and inner peace.
7. **Health**: Finally, some respondents (n = 4) mentioned health as a component of psychological safety. Health was always mentioned in connection with other factors, for example: ‘Peace, health, love’ or ‘Financial income, health, good relationships with loved ones’.

These 7 categories can be further grouped into three overarching themes:

**The Interpersonal & Relational Theme** (categories 1, 2 and 3): This theme identifies an individual’s core social network as the primary source of psychological safety, with participants consistently citing partners, family members, and friends as the foundation of their sense of safety. It was closely tied to the affective actions performed within these relationships, such as expressions of love, physical closeness, and the assurance of having dependable support and companionship. This theme also includes qualitative conditions necessary for social interactions to feel safe, such as the presence of fundamental values. Participants associated safety with feelings of mutual respect, trust, honesty, and loyalty, as well as with behaviours reflecting this climate — being accepted, heard, and given space to express oneself without interruption.

A second major theme is related to **Material Security & Situational Stability** (categories 4, 5 and 7), including financial and material security, such as a stable income, regular employment, and secure housing. This was often connected to a broader need for environmental stability, peace, predictability, routine and control. Health, while mentioned less frequently, was often integrated into this broader theme of stability. As can be seen, this theme represents the external, structural, and personal conditions that form a stable base for an individual’s life.

Finally, a smaller number of participants highlighted **Internal or Personal Factors** (category 6), such as self-confidence, emotional balance, or inner peace, as sources of psychological safety. This theme represents a state of safety that is not received from others or the environment, but generated from within through ability, self-reliance, and self-worth.

Overall, the results indicate that the participants’ perceptions of psychological safety are primarily relational and affective in nature and further reinforced by objective life circumstances and internal personal resources.

## 4 Discussion

The emergence of Industry 5.0 marks a paradigmatic shift from the technology-driven efficiency of Industry 4.0 toward a more holistic, human-centric model of industrial and organizational life. While Industry 4.0 was characterized by automation, artificial intelligence, and the optimization of production processes through cyber-physical systems (Breque et al., 2021; Majernik et al., 2022; Romero et al., 2016), it often marginalized the social dimensions of work and overlooked the human need for connection, purpose, and well-being. In contrast, Industry 5.0 repositions the human being as the central actor in production systems and reframes technology as a tool that serves people (Breque et al., 2021; Pathak et al., 2023; Zafar et al., 2024). This conceptual evolution emphasizes productivity and innovation alongside the sustainability, resilience, and dignity of the human workforce. Within this paradigm, the human is viewed as an asset whose creativity, emotional intelligence, and capacity for problem-solving are integral to organizational success (Gamberini & Pluchino, 2024; Grabowska et al., 2022).

The present study was situated within this broader transformation and aimed to explore individual's sense of safety as an important component of the Industry 5.0 vision. The WHO's dual-dimensional framework of safety (objective and subjective) provides a useful lens through which to understand this transformation. Objective safety is verifiable and externally measurable, while subjective safety refers to the internal perception of being free from harm or threat in one's social and professional environment (Maurice et al., 1998; Nilsen et al., 2004). In Industry 4.0, safety was largely treated as an engineering and data problem to be solved, focusing on the mitigation of measurable, physical risks to the human worker. The prevailing understanding of safety in this model was primarily objective, with little recognition of its subjective dimension despite the fact that this technological focus, while reducing physical hazards, often inadvertently created new psychological threats, such as anxiety caused by surveillance, the stress of cognitive overload from an 'always-online' culture, or the existential fear of job obsolescence (Breque et al., 2021). In the Industry 5.0 paradigm, this subjective dimension gains renewed significance, as human well-being, creativity, and resilience depend on physical protection as well as emotional and psychological assurance. Within organizational scholarship, this imperative for subjective, interpersonal safety is most robustly captured by the construct of psychological safety.

Psychological safety is defined as a 'shared belief among team members that the team is safe for interpersonal risk-taking' (A. C. Edmondson, 1999). It reflects the degree to which individuals feel comfortable expressing themselves without fear of embarrassment, rejection, or punishment. This concept, initially framed as a group-level phenomenon, has been repeatedly associated with enhanced learning, innovation, and performance (e.g. Edmondson & Lei, 2014; Kark & Carmeli, 2009; Siemsen et al., 2009). However, much of the literature emphasizes collective perceptions, leaving the micro-foundations of these

shared beliefs, especially how individual people experience and interpret psychological safety, underexplored. Building on Edmondson & Lei's (2014) observation that the boundary conditions and personal antecedents of psychological safety are still underexplored, this study focuses on how individuals themselves interpret and experience safety. Accordingly, the current study explores the individual's subjective understanding of psychological safety, linking the macro-level aspirations of Industry 5.0 to the micro-level experiences of people within social systems.

The analysis of 111 qualitative responses reveal that psychological safety is a multidimensional construct, rooted primarily in three overarching themes: the 'interpersonal & relational', the 'material security and situational stability' and the 'internal or personal factors'.

The results show that individual perceptions of psychological safety are primarily relational and affective in nature, underpinned by strong interpersonal connections and emotional support. The most frequently mentioned sources of psychological safety were relationships with family, partners, and friends, which participants described as their fundamental foundation of safety. This emphasis on human relationships aligns with the human-centric ethos of Industry 5.0, which recognizes the intrinsic value of human connection and collaboration (Breque et al., 2021; Pathak et al., 2023). In these narratives, safety was conceptualized as an affective experience rooted in interpersonal closeness, trust, and acceptance. Emotional support, expressed through love, understanding, and the feeling of being heard and accepted, emerged as the second most salient category. This indicates that individuals associate safety with the assurance of acceptance and support within their close relationships. This aligns with the theoretical framework proposed by Lynch et al. (2024) that identify a Sense of Safety as a complex awareness of connection to others, specifically mentioning family, partners, and friends. They also identified sub-themes of this relational safety which include 'being heard and understood,' 'belonging,' 'trust,' and 'being treated with dignity', which aligns with our third most prominent category, the values of interpersonal relationships. Participants associated safety with relational qualities such as respect, honesty, loyalty, and trust, which form the moral foundation of safe social environments. Trusting others, feeling valued and respected reduces the fear of negative evaluation, allowing individuals to engage fully and authentically in interpersonal exchanges. As a socio-emotional resource, psychological safety allows individuals to manage perceived risks and collaborate more effectively, ultimately contributing to shared goals and higher organizational performance (Bülbül et al., 2022). Such conditions are particularly critical in environments characterized by uncertainty and interdependence, features increasingly prevalent in digitalized workplaces (Gamberini & Pluchino, 2024).

Together, these three categories (relationships, emotional support and acceptance, values of interpersonal relationships) compose a broader relational theme, suggesting that

individuals perceive safety primarily through the quality and reliability of their social networks. This finding agrees with prior theoretical models emphasizing that psychological safety within teams arises from interpersonal trust and mutual respect (Carmeli & Gittell, 2009; A. C. Edmondson, 1999; Kahn, 1990). This relational-based safety is so fundamental that its absence is linked to loneliness (Hawkey & Cacioppo, 2010), social exclusion (Baumeister et al., 2007), social pain (Eisenberger et al., 2003), and feelings of betrayal (Freyd et al., 2005). The findings also extend this logic beyond formal work settings, implying that relational safety in private and community contexts may serve as a precondition for experiencing psychological safety in professional domains.

A second overarching theme centres on material security and environmental stability. Participants frequently mentioned stable income, housing, and employment as key contributors to their sense of safety. These material foundations, while seemingly external, were often interwoven with psychological and emotional concerns, like stability, predictability, peace and a sense of control. This finding aligns with the WHO's definition of safety as both a physical and psychological condition that enables individuals to pursue their aspirations (Maurice et al., 1998). Health, while mentioned less frequently by our participants, was also integrated into this theme as a component of stability. This theme directly corresponds to the Contextual Security of the Sense of Safety Theoretical Framework (Lynch et al., 2024), which includes social determinants of health, and living conditions such as housing security. Within the Industry 5.0 framework, such structural stability can be interpreted as a prerequisite for achieving resilience, one of its core pillars (Trstenjak et al., 2025). A stable external environment reduces objective risk and allows individuals to allocate cognitive and emotional resources to creative and collaborative endeavours, which are central to human-centric work systems (Romero & Stahre, 2021).

Interestingly, while the majority of responses emphasized external or relational conditions, a smaller portion highlighted personal factors such as self-confidence, autonomy, and emotional stability. These responses suggest that some individuals derive psychological safety from internal resources as opposed to, or along with, external assurances. Such self-generated safety reflects the capacity for self-regulation and resilience, key attributes of the Operator 5.0 envisioned in the Industry 5.0 paradigm (Romero & Stahre, 2021). This perspective implies that psychological safety may emerge from social trust and external stability, and can also be cultivated through personal development and emotional self-efficacy. This aligns with the Sense of Self domain in Lynch et al.'s framework (2024), which is defined by inner attitudes of dignity, self-trust, acceptance, and worthiness. In this sense, individual agency and self-mastery complement the relational and structural determinants of safety. Conversely, a lack of this internal safety, as manifested in self-criticism or self-loathing, constitutes an inner estrangement that is inherently threatening (Lynch et al., 2024).

## 5 Conclusions

The empirical findings of our study offer a multidimensional picture of psychological safety that bridges the subjective and objective domains. On one hand, the strong emphasis on relationships, emotional support, and shared values reflects the subjective, internal experience of safety. On the other hand, the importance of financial and material stability represents the objective, external conditions that enable this subjective sense to flourish. The interplay between these dimensions also mirrors the WHO's two-dimensional model of safety (Maurice et al., 1998; Nilsen et al., 2004) and supports the argument that effective safety promotion must address both. Within the Industry 5.0 context, this integrated approach is crucial: a genuinely human-centric workplace must guarantee both the physical/material and the psychological/emotional security of the workforce.

Furthermore, the results highlight that psychological safety, although often treated as a group-level phenomenon, is deeply rooted in individual perceptions and personal life contexts. Even though (Edmondson, 1999) conceptualized psychological safety as a shared belief, the convergence of these beliefs within a team presupposes that individuals first experience safety personally. An organization cannot reasonably expect an employee to engage in acts of interpersonal risk-taking, such as speaking up about errors or offering creative dissent, if that individual feels fundamentally unsafe in their life (e.g., financial precarity) or their relational world (e.g., social isolation).

Our study suggests that the individual's perception of psychological safety is shaped by a broader social ecology that extends beyond the workplace. The Sense of Safety Theoretical Framework (Lynch et al., 2024) conceptualizes this by including psychological safety at work as one component of a larger contextual security. Cultivating psychological safety requires understanding it as an integral part of a broader system of human relationships and environmental conditions that sustain well-being and cannot rely solely on organizational policies. This aligns with the Industry 5.0 vision of interconnectedness, where technology, society, and individual life are seen as interdependent domains contributing to shared prosperity (Breque et al., 2021).

In interpreting these findings, several limitations should be considered. The sample size was modest ( $n = 111$ ) and drawn exclusively from one faculty in Slovenia, which limits the generalizability of the results to broader populations or different educational and cultural contexts. The sample was also demographically imbalanced, being predominantly female (84.7%), which may have influenced the thematic emphasis on emotional support, trust, and closeness as central to psychological safety. In terms of age, the majority of the participants were young adults, with half under 30 years old and 39% between 30 and 44 years old, while only 11% were over 45. Because the sample was relatively young and homogeneous in age, it may not fully represent the perspectives of

older or more professionally experienced individuals, who might conceptualize psychological safety differently. Moreover, as all the participants were part-time students enrolled in psychosocial and social management programs, their academic and professional orientations may have further shaped their responses, emphasizing relational and affective aspects over structural or organizational factors. The reliance on a single open-ended question provided valuable but limited qualitative insight, restricting the depth and nuance of responses.

Despite these limitations, our study contributes to the theoretical and empirical understanding of psychological safety by situating it within the human-centric paradigm of Industry 5.0 and exploring its micro-foundations at the individual level. The results demonstrate that individuals primarily perceive psychological safety as a ‘whole person’ concept, rooted in a ‘complex integrative awareness of self, other, and context’ (Lynch et al., 2024, p. 18). This is built upon three core themes: relational and emotional foundations, external material stability, and internal personal agency. This multidimensional understanding aligns with the Industry 5.0 vision of sustainable, resilient, and inclusive development. The findings also highlight that psychological safety extends beyond the workplace, connecting individuals’ experiences of trust, support, and stability across their social ecosystems. By recognizing and nurturing this interconnected sense of safety, organizations and societies can better align with the holistic, human-centric principles that define the fifth industrial revolution.

### References:

- Baer, M., & Frese, M. (2003). Innovation is not enough: Climates for initiative and psychological safety, process innovations, and firm performance. *Journal of Organizational Behavior*, 24(1), 45–68. <https://doi.org/10.1002/job.179>
- Baumeister, R. F., Brewer, L. E., Tice, D. M., & Twenge, J. M. (2007). Thwarting the Need to Belong: Understanding the Interpersonal and Inner Effects of Social Exclusion. *Social and Personality Psychology Compass*, 1(1), 506–520. <https://doi.org/10.1111/j.1751-9004.2007.00020.x>
- Breque, M., De Nul, L., & Petridis, A. (2021). *Industry 5.0: towards a sustainable, human-centric and resilient European industry*. Publications Office of the European Union. <https://doi.org/10.2777/308407>
- Bülbül, S., İşıaçık, S., & Aytaç, S. (2022). Measurement of Perceived Psychological Safety: Integration, Review and Evidences for the Scale in the Context of Turkey. *Journal of Economy Culture and Society*. <https://doi.org/10.26650/jecs2021-974757>
- Carmeli, A., & Gittell, J. H. (2009). High-quality relationships, psychological safety, and learning from failures in work organizations. *Journal of Organizational Behavior*, 30(6), 709–729. <https://doi.org/10.1002/job.565>
- Choo, A. S., Linderman, K., & Schroeder, R. G. (2004). Social and method effects on learning behaviors and knowledge creation in Six Sigma projects. *Academy of Management Proceedings*, 2004(1), C1–C6. <https://doi.org/10.5465/ambpp.2004.13857620>

- Collins, C. J., & Smith, K. G. (2006). Knowledge exchange and combination: The role of human resource practices in the performance of high-technology firms. *Academy of Management Journal*, 49(3), 544–560.
- Detert, J. R., & Burris, E. R. (2007). Leadership behavior and employee voice: Is the door really open? *Academy of Management Journal*, 50(4), 869–884.
- Edmondson, A. C. (1999). Psychological Safety and Learning Behavior in Work Teams. *Source: Administrative Science Quarterly*, 44(2), 350–383.
- Edmondson, A. C., & Lei, Z. (2014). Psychological Safety: The History, Renaissance, and Future of an Interpersonal Construct. *Annual Review of Organizational Psychology and Organizational Behavior*, 1, 23–43. <https://doi.org/10.1146/annurev-orgpsych-031413-091305>
- Eisenberger, N. I., Lieberman, M. D., & Kipling, W. D. (2003). Does Rejection Hurt? An fMRI Study of Social Exclusion. *Science*, 302(October), 290–292.
- Freyd, J. J., Klest, B., & Allard, C. B. (2005). Betrayal trauma: relationship to physical health, psychological distress, and a written disclosure intervention. *Journal of Trauma & Dissociation: The Official Journal of the International Society for the Study of Dissociation (ISSD)*, 6(3), 83–104. [https://doi.org/10.1300/J229V06N03\\_04](https://doi.org/10.1300/J229V06N03_04)
- Gamberini, L., & Pluchino, P. (2024). Industry 5.0: A comprehensive insight into the future of work, social sustainability, sustainable development, and career. *Australian Journal of Career Development*, 33(1), 5–14. <https://doi.org/10.1177/10384162241231118>
- Gibson, C. B., & Gibbs, J. L. (2006). Unpacking the concept of virtuality: The effects of geographic dispersion, electronic dependence, dynamic structure, and national diversity on team innovation. *Administrative Science Quarterly*, 51(3), 451–495. <https://doi.org/10.2189/asqu.51.3.451>
- Grabowska, S., Saniuk, S., & Gajdzik, B. (2022). Industry 5.0: improving humanization and sustainability of Industry 4.0. *Scientometrics*, 127(6), 3117–3144. <https://doi.org/10.1007/s11192-022-04370-1>
- Hawley, L. C., & Cacioppo, J. T. (2010). Loneliness Matters: A Theoretical and Empirical Review of Consequences and Mechanisms. *Annals of Behavioral Medicine: A Publication of the Society of Behavioral Medicine*, 40(2). <https://doi.org/10.1007/S12160-010-9210-8>
- Hirak, R., Peng, A. C., Carmeli, A., & Schaubroeck, J. M. (2012). Linking leader inclusiveness to work unit performance: The importance of psychological safety and learning from failures. *Leadership Quarterly*, 23(1), 107–117. <https://doi.org/10.1016/j.leaqua.2011.11.009>
- Kahn, W. A. (1990). Psychological Conditions of Personal Engagement and Disengagement at Work. *The Academy of Management Journal*, 33(4), 692–724.
- Kark, R., & Carmeli, A. (2009). Alive and creating: The mediating role of vitality and aliveness in the relationship between psychological safety and creative work involvement. *Journal of Organizational Behavior*, 30(6), 785–804. <https://doi.org/10.1002/job.571>
- Liang, J., Farh, C. I. C., & Farh, J. L. (2012). Psychological antecedents of promotive and prohibitive Voice: A two-wave examination. *Academy of Management Journal*, 55(1), 71–92. <https://doi.org/10.5465/amj.2010.0176>
- Lynch, J. M., Stange, K. C., Dowrick, C., Getz, L., Meredith, P. J., Van Driel, M. L., Harris, M. G., Tillack, K., & Tapp, C. (2024). The sense of safety theoretical framework: a trauma-informed and healing-oriented approach for whole person care. *Frontiers in Psychology*, 15. <https://doi.org/10.3389/fpsyg.2024.1441493>
- Majernik, M., Daneshjo, N., Malega, P., Drábik, P., & Barilová, B. (2022). Sustainable Development of the Intelligent Industry from Industry 4.0 to Industry 5.0. *Advances in Science and Technology. Research Journal*, 16(2), 12–18. <https://doi.org/10.12913/22998624/146420>

- Nilsen, P., Hudson, D. S., Kullberg, A., Timpka, T., Ekman, R., & Lindqvist, K. (2004). Making sense of safety. *Injury Prevention*, *10*(2), 71–73. <https://doi.org/10.1136/IP.2004.005322>
- Pathak, R., Singh, H., & Singh, M. (2023). Industry 5.0: A human-centered Approach for Optimizing Digital Transformation. *The Kashi Journal of Commerce*, *XX*, 1–15.
- Maurice, P., Lavoie, M., Levaque Charron, R., Chapdelaine, A., Belanger Bonneau Helene, Svanström, L., Laflamme, L., Andersson, R., & Romer, C. (1998). *Safety and safety promotion: conceptual and operational aspects*. Centre collaborateur OMS du Québec pour la promotion de la sécurité et la prévention des traumatismes. Retrieved from [https://www.inspq.qc.ca/sites/default/files/publications/150\\_securitypromotion.pdf](https://www.inspq.qc.ca/sites/default/files/publications/150_securitypromotion.pdf)
- Premeaux Fontenot, S., & Bedeian, A. G. (2003). Breaking the Silence: The Moderating Effects of Self-Monitoring in Predicting Speaking Up in the Workplace\*. *Journal of Management Studies*, *40*(6), 1537–1562. <https://doi.org/10.1111/1467-6486.00390>
- Romero, D., & Stahre, J. (2021). Towards the Resilient Operator 5.0: The Future of Work in Smart Resilient Manufacturing Systems. *54th CIRP Conference on Manufacturing Systems*, *104*, 1089–1094. <https://doi.org/10.1016/j.procir.2021.11.183>
- Romero, D., Stahre, J., Wuest, T., Noran, O., Bernus, P., Fast-Berglund, Å., & Gorecky, D. (2016). Towards an Operator 4.0 Typology: A Human-Centric Perspective on the Fourth Industrial Revolution Technologies. *CIE46 Proceedings*, 29–31. Retrieved from <https://www.researchgate.net/publication/309609488>
- SAFETY | *English meaning - Cambridge Dictionary*. (n.d.). Retrieved October 31, 2025, from <https://dictionary.cambridge.org/dictionary/english/safety>
- SAFETY Definition & Meaning - *Merriam-Webster*. (n.d.). Retrieved October 31, 2025, from <https://www.merriam-webster.com/dictionary/safety>
- Siemsen, E., Roth, A. V., Balasubramanian, S., & Anand, G. (2009). The influence of psychological safety and confidence in knowledge on employee knowledge sharing. *Manufacturing and Service Operations Management*, *11*(3), 429–447. <https://doi.org/10.1287/msom.1080.0233>
- Trstenjak, M., Benešova, A., Opetuk, T., Cajner, H., Trstenjak, M., Benešova, A., Opetuk, T., & Cajner, H. (2025). Human Factors and Ergonomics in Industry 5.0—A Systematic Literature Review. *Applied Sciences* *2025*, *15*(4). <https://doi.org/10.3390/AP15042123>
- Dyne, L. Van, & LePine, J. A. (1998). Helping and Voice Extra-Role Behaviors: Evidence of Construct and. *Source: The Academy of Management Journal*, *41*(1), 108–119.
- Walumbwa, F. O., & Schaubroeck, J. (2009). Leader Personality Traits and Employee Voice Behavior: Mediating Roles of Ethical Leadership and Work Group Psychological Safety. *Journal of Applied Psychology*, *94*(5), 1275–1286. <https://doi.org/10.1037/a0015848>
- Zafar, M. H., Langás, E. F., & Sanfilippo, F. (2024). Exploring the synergies between collaborative robotics, digital twins, augmentation, and industry 5.0 for smart manufacturing: A state-of-the-art review. *Robotics and Computer-Integrated Manufacturing*, 89. <https://doi.org/10.1016/j.rcim.2024.102769>