Safety Science 168 (2023) 106321

Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/safety

The role of empowering leadership, safety culture and safety climate in the prediction of mindful organizing in an air traffic management company

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ARTICLE INFO

Keywords:
Empowering leadership
Safety culture
Team safety climate
Mindful organizing
High-reliability organization
Air traffic management

ABSTRACT

Mindful organizing is the collective capability of teams to anticipate, detect, and contain early signs of emerging problems, act proactively, and recover quickly if unexpected events and errors occur. The present study aimed to add to our currently limited understanding of antecedents of mindful organizing: empowering leadership, safety culture, and team safety climate. To do so, we tested a moderated mediation model using a sample of 73 Air Traffic Management company employees. The model evaluated whether safety climate mediates the relationship between empowering leadership and mindful organizing, and whether safety culture understanding as enacted value of safety moderates the effect of empowering leadership on team safety climate. The results showed that a strong safety climate was a significant predictor of mindful organizing. Moreover, empowering leadership influenced mindful organizing indirectly through its positive effect on the safety climate in a work unit. However, the moderating role of safety culture was not confirmed.

1. Introduction

Human history is riddled with man-made catastrophes (Turner, 1978), from nuclear meltdowns and oil spills to chemical explosions and mine collapses. These tragedies cost millions of dollars, took the lives of thousands of people, and resulted in unrepairable ecological damage to the Earth's ecosystem. Fortunately, most high-hazard industries where a minor slip-up can trigger a disaster manage to prioritize safety and maintain continual and reliable performance (Gracia, Silla, et al., 2020). High-reliability organizations (HROs) are organizations that successfully avoid accidents and catastrophes in complex environments with many risk factors where normal accidents can be expected. If an organization could have failed tens of thousands of times due to hazardous working conditions and the complexity of tasks but did not, it can be considered highly reliable (Roberts, 1990). Some examples of HROs are nuclear power plants, aircraft carriers, air-traffic-control teams, firefighting units, and hospital Intensive Care Units (ICUs) (Christianson et al., 2011).

What helps HROs to persistently avoid catastrophes in an environment where normal accidents (Perrow, 1994) can be expected? Trying to find an answer to this question, Weick and Sutcliffe (2007, 2015) systematically reviewed the literature on HROs and analyzed the operations of organizations of this type. They found that the functioning of HROs is grounded in mindful organizing, which refers to the collective capability to detect discriminatory details about emerging issues and respond proactively and quickly to these details (Weick et al., 1999).

Despite being born within HRO theory, the concept of mindful organizing underscores an organization's proactive approach to managing and understanding potential safety risks. It aligns seamlessly with the tenets of resilience engineering (RE). Both frameworks emphasize the importance of foreseeing potential risks and enhancing an organization's ability to adapt to unforeseen challenges. While more early, mindful organizing theory has significant congruence with RE and Safety-II principles (Hollnagel, 2018). Though to a different degree, they all shift the focus from preventing adverse outcomes to ensuring that things go right and emphasize the system's ability to function under varying conditions.

Although mindful organizing displays a set of processes that underlie the near-flawless performance, it is a relatively new and under-investigated concept. There is still a lack of research on how organizations can develop and maintain mindful organizing. Thus, the primary purpose of this research is to contribute to the understanding of the antecedents and conditions of mindful organizing. Specifically, we propose that empowering leadership, team safety climate, and safety

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https://doi.org/10.1016/j.ssci.2023.106321
Received 21 March 2023; Received in revised form 15 September 2023; Accepted 18 September 2023
Available online 28 September 2023

culture conceptualized as the primary value of safety in an organization are important antecedents and determinants of mindful organizing. Furthermore, we aim to determine whether: (a) team safety climate mediates the relationship between empowering leadership and mindful organizing; (b) safety culture moderates the effect of empowering leadership on team safety climate; and (c) safety culture moderates the positive indirect effect of empowering leadership on mindful organizing through team safety climate (see Fig. 1).

Achieving this goal can benefit safety research literature in several ways. First, the existing scarce research on mindful organizing is mostly qualitative. There is undoubtedly value in qualitative studies, especially when exploring such an abstract and complex concept. However, as Sutcliffe et al. (2016) highlighted, quantitative studies are needed to allow the replication and accumulation of knowledge (Denison et al., 2014). Nevertheless, in a recent special issue about mindful organizing for safety (Martínez-Córcoles & Vogus, 2020), only one out of a total of six papers was quantitative.

Second, research on mindful organizing has particularly focused on its outcomes rather than its antecedents. Regarding the outcomes, mindful organizing has been found to predict safety performance (Gracia, Tomás, et al., 2020; Renecle et al., 2021) and less malpractice in healthcare (Ausserhofer et al., 2013; Vogus & Iacobucci, 2016; Vogus & Sutcliffe, 2007a, 2007b), as well as other employee outcomes such as emotional exhaustion and turnover (Renecle, Gracia, et al., 2020; Vogus et al., 2014). However, the question of how to trigger and enhance mindful organizing has yet to be explored, and it will be addressed in the present study.

Third, although there is plenty of research on safety culture, climate, and leadership, and a few studies on empowering leadership and mindful organizing (Gracia, Tomás, et al., 2020), how these four critical-for-safety phenomena can be linked together remains unknown. The moderated mediation model conceptualizing the mechanism through which leaders' behaviors can affect mindful organizing has not been tested in previous research, and so it may be considered a unique contribution of the present study.

Finally, most of the research on empowering leadership, safety culture and climate, and mindful organizing in HROs has been conducted in nuclear power plants (Gracia, Silla, et al., 2020). The present research was carried out in the Air Traffic Management (ATM) industry, which allowed us to not only test the new research model but also to validate some of the previous findings (Gracia, Tomás, et al., 2020; Martínez-Córcoles et al., 2011) in a new organizational context.

2. Theoretical background

2.1. Five processes of mindful organizing

The concept of mindful organizing, introduced by Karl Weick and colleagues (1999), was derived from studying how HROs *"go through a day filled with a million accidents waiting to happen"* (Weick & Sutcliffe, 2015, p.54) and successfully avoid them. It captures the behaviors, reactions, and norms evident in HRO operations that result in nearly faultless performances. The foundation for this reliability lies in five processes: preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience, and deference to expertise (Vogus & Sutcliffe, 2012; Weick et al., 1999; Weick & Sutcliffe, 2015). The initial three relate to anticipating unforeseen events, while the latter two address resilience during unexpected issues (Weick & Sutcliffe, 2015).

Preoccupation with failure refers to continuous attention and alertness to anomalies that could be symptoms of more significant problems in a system (Weick & Sutcliffe, 2015). HROs focus on small failures, anticipate mistakes, and maintain openness to learning. Callari et al. (2019) conducted single case-study research in an Air Traffic Control (ATC) organization to provide insights into how mindful organizing practices and processes are installed in air traffic controllers (ATCOs) work. They showed that the ATC company used specific tools to report, collect, and investigate safety-related issues to be aware of any minor unexpected events, near misses, or system malfunctions.

Reluctance to simplify interpretations means sensitivity to a variety of descriptions and explanations and active questioning of underlying assumptions to avoid generalizations that conceal warning details and create blind spots (Weick & Sutcliffe, 2015). This principle highlights the danger of general labels because they shape and restrict perceptions and actions to what the chosen label prescribes. In their research, Callari et al. (2019) noted that to avoid being blinded by energy-saving heuristics and tempted by ready-made solutions, the ATC used the RISC Group meeting, involving participants from different domains to dissect safety incidents and derive solutions.

Sensitivity to operations entails monitoring real-time changes (Weick & Sutcliffe, 2015). Teams with a high level of mindful organizing are aware of all the details of current operations at any given moment (Renecle et al., 2021; Weick et al., 1999), and their managers are kept informed of the situation on the front line (Renecle et al., 2021; Weick & Sutcliffe, 2015). In other words, there is situational awareness at all the organizational levels. The ATC company adopted tools like alert buttons and daily briefings for this purpose (Callari et al., 2019).

Commitment to resilience implies that HROs are not error-free but quickly recover from mishaps, restoring the system's stability and acting effectively to mitigate the consequences of disturbances and cope with stress without losing adaptability (Weick & Sutcliffe, 2015). In the ATC company (Callari et al., 2019), resilience to the unexpected was sustained through the system established to report, track, and solve every occurrence from the operations room, as well as through mechanisms used to learn from incidents that happened in the past.

Finally, *deference to expertise* allows those with the most relevant

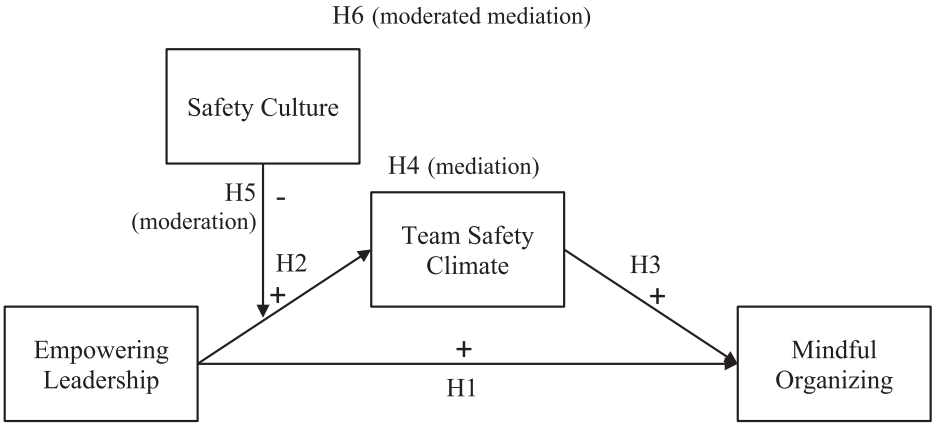

Fig. 1. The hypothesized research model.

expertise to make decisions, irrespective of rank. In other words, problems move toward potential solutions and problem solvers (Weick & Sutcliffe, 2015) for the quickest possible decision-making by the most knowledgeable team member. Callari et al. (2019) found that the ATC center formed groups of specialists with relevant expertise and experience to analyze each incident.

Although the concept of mindful organizing was proposed and developed based on the theory and principles of high-reliability organizations, it has not been a part of the mainstream (Renecle et al., 2021). Until recently, most mindful organizing studies have been qualitative (Martínez-Córcoles & Vogus, 2020; Sutcliffe et al., 2016). In mindful organizing research in the ATC context, to our knowledge, only two qualitative case studies exist (Callari et al., 2019; McDonald et al., 2019). The present study aims to contribute to an emerging body of quantitative research on mindful organizing (Gracia, Tomás, et al., 2020; Renecle et al., 2021; Renecle, Gracia, et al., 2020; Renecle, Tomás, et al., 2020) and its antecedents and outcomes, to empirically support the assumptions of mindful organizing theory and extend our understanding of conditions for safety and sustainable performance.

2.2. Empowering leadership as an antecedent of mindful organizing

In the present study, we investigated the role of leadership as a predictor of mindful organizing. We focused on this predictor because mindful organizing is an emergent collective phenomenon created and sustained at the team level (Renecle et al., 2021; Sutcliffe et al., 2016; Vogus & Sutcliffe, 2012). Formal leaders directly influence team processes associated with mindful organizing, such as creating shared expectations, sensemaking, organizing, and managing (Gracia, Tomás, et al., 2020; Weick & Sutcliffe, 2015). Literature on mindful organizing provides arguments showing that leadership is one of the potential predictors of employees' engagement in mindful organizing practices (Sutcliffe et al., 2016; Vogus & Sutcliffe, 2012). Research has shown that supportive leaders (Vogus & Sutcliffe, 2007b) or trustful leaders (Hoy et al., 2006) create a work atmosphere where errors are perceived as opportunities for learning and improvement. As a result, team members can freely express disagreement, share alternative views, take responsibility for their decisions, and be honest about mistakes. Open communication, learning, sufficient autonomy, and high trust are critical principles of the empowering leadership model and pillars of mindful organizing (Gracia, Tomás, et al., 2020).

The Empowering Leadership model (EL) (Arnold et al., 2000) refers to a leadership style that enhances the team's autonomy and potential for self-management through the leader's behavior. As the term indicates, the primary function of empowering leadership is to give team members the power to organize the work and make decisions. The model includes five dimensions that correspond to different behaviors empowering leaders are expected to show: leading by example, participative decision-making, coaching, informing/explaining, and showing concern for followers' welfare (Arnold et al., 2000).

At first glance, HROs in general, and Air Navigation Services Companies (ANSCs) in particular, represent well-structured bureaucracies based on well-defined structures formed by rules, formal procedures and regulations, strict hierarchy, and fixed plans. In other words, they do not stimulate empowerment and autonomy. However, as Weick and Sutcliffe (2015) demonstrated, organizations create self-organizing networks of expertise built on trust, honesty, self-respect, and mutual responsibility to manage the unexpected successfully. A sufficient level of empowerment is needed to create such an environment. In fact, empirical research in nuclear power plants has shown that leaders' empowering behaviors enhance workers' safety performance, leading to higher safety compliance behaviors and higher safety participation behaviors, in addition to reducing employees' risky behavior (Martínez-Córcoles et al., 2011, 2012, 2013, 2021).

Moreover, in a sample of a company in the nuclear generation industry, Gracia et al. (Gracia, Tomás, et al., 2020) showed that mindful organizing is predicted by empowering leaders' behaviors, and it mediates the relationship between leadership and safety outcomes. However, the positive relationship between empowering leadership and mindful organizing in the aviation sector remains unexplored. Nevertheless, several studies on transformational leadership have supported their positive relationship (e.g. Kark et al., 2003; Krear-Klostermeier, 2012). Note that, as in empowering leadership, transformational leadership aims to stimulate employees' autonomy and self-efficiency by inspiring and motivating them (Kark et al., 2003). Krear-Klostermeier (2012) found that transformational leadership is the predominant leadership style among Federal Aviation Administration ATC Managers. Moreover, employees of the ANSC suggested that a transformational leadership style is a desired and effective one (Joubert, 2014).

In sum, we include empowering leadership in our research on mindful organizing in HROs for three main reasons. First, empowering leadership creates conditions for trust, open communication, and mutual responsibility, which provide the foundation for the mindful organizing processes (Hoy et al., 2006; Vogus & Sutcliffe, 2007b). Second, empirical research supports the relationship between empowering leaders' behaviors and safety in HROs (Martínez-Córcoles et al., 2011, 2012, 2013, 2021). Third, there is evidence supporting the proposition that empowering leadership is related to mindful organizing (Gracia, Tomás, et al., 2020). However, additional investigation is needed to extrapolate this relationship to ATC. Based on the arguments discussed above, our first hypothesis is the following:

Hypothesis 1. *(H1).* *Empowering leadership is positively related to mindful organizing.*

2.3. Safety climate and safety culture

Safety culture and safety climate are two key concepts of safety research and practice. Even though both are part of the mainstream in safety literature, their differences are unclear, and their definitions are ambiguous and overlapping (Guldenmund, 2000).

According to Schein (1990), organizational culture refers to the shared values, beliefs, assumptions, and norms that guide individual behavior within an organization. It has a hierarchical structure that comprises three layers: from a deep and intangible layer of fundamental beliefs and assumptions through a middle level of espoused values and norms to a superficial and visible level of artifacts (Schein, 1985). In the organizational literature, there are five different models of culture: values, stories, frames, toolkits, and categories (Giorgi et al., 2015). The definitions used in our study are derived from the values model and view safety culture as one facet of organizational culture with the fundamental value of safety at its core.

The concept of safety culture was introduced after the Chernobyl catastrophe by a committee investigating the causes of this accident (INSAG, 1991). Initially, the International Nuclear Safety Advisory Group (INSAG), whose aim was to introduce, explain, and expand the concept, defined safety culture as "that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance"(INSAG, 1991, p.4). This definition aligns with the aim of the Eurocontrol Safety Culture Program (Eurocontrol, 2021), which is "to ensure that safety remains the top priority in all domains of air traffic management and air service provision" (Eurocontrol, n.d.). In short, safety culture can be defined as "the value or importance that the organization (and all its members) attaches to safety" (Gracia, Silla, et al., 2020, p.1213). It encompasses the organization's commitment to safety, the priority given to safety in decision-making, and safety-related behaviors and practices. All these definitions build a direct bridge between safety culture and safety priority in an organization. Even though safety culture is broader and multi-level in nature, the priority of safety takes its substantial part.

In contrast, organizational climate represents the prevailing

atmosphere, mood, and perceptions of the work environment at a specific point in time (Schneider et al., 2013). It is less stable and can change dynamically over time. Thus, safety climate refers to the current perceptions, attitudes, and beliefs about safety within an organization (Zohar, 2010; Zohar & Luria, 2005). It focuses on employees' perceptions of safety practices, the effectiveness of safety communication, and the overall commitment to safety in the workplace, for example, whether topics related to safety are frequently discussed during the workday or if a manager constantly insists that employees work in a safe way (Latorre et al., 2013). Perceptions of these and similar daily practices make up the safety climate, which can change dynamically based on incidents, near misses, leadership actions, and safety initiatives (Zohar, 2010).

The difference in conceptualization leads to differences in measurement approaches. Conceptualized as perception and originating in psychology, organizational climate was traditionally measured by surveys (Schneider et al., 2017). In contrast, due to the multi-level nature of organizational culture and its socio-anthropological origin, early culture researchers were exclusively qualitative (Schneider et al., 2017). However, according to Denison et al. (2014), three main approaches to diagnosing organizational culture now exist: qualitative, quantitative, and mixed methods. Different approaches to diagnosing organizational culture have their own strengths and limitations. We cannot use the quantitative approach to reach the unconscious core of organizational culture. However, there is theoretical and empirical evidence that it is possible to use the quantitative methodology to reach its shallower levels, including the middle level of espoused and, as in our case, enacted values (Ashkanasy et al., 2000; López de Castro et al., 2017). In the case of safety culture, it is the value of safety over other competing goals, such as profitability, efficiency, or productivity, i. e., safety priority. This priority is espoused in the company's policies, procedures, and norms and enacted in strategic decisions, HR practices, and daily activities. Thus, asking questions about the importance of safety in the company's practices and decisions can allow us to assess the value of safety for an organization, that is, the safety priority aspect of safety culture. This approach has its restrictions, but it allows us to get a quantitative estimation of safety culture and explore its relationship with other safety variables.

2.4. Leadership and safety climate

Research has shown that the safety climate in the aviation industry is generally robust (e.g. Gao et al., 2013, 2015). Problematic responses to safety climate questionnaires are up to twelve times less frequent in aviators than in hospital workers, indicating a healthy safety climate that is consistent with the status of high-reliability organizations (Gaba et al., 2003). O'Connor et al. (2011) identified safety climate themes relevant to aviation. They encompass management/supervision, operations, personnel, safety systems, procedures/rule, communication, resources, training/education, and risk. Notably, only management and supervision practices were considered relevant for safety climate in all 23 studies reviewed by O'Connor et al. (2011), demonstrating their primary importance in climate formation.

According to Zohar and Luria (2005), organizational climate originates "simultaneously from policy and procedural actions of top management and from supervisory actions exhibited by shop-floor or frontline supervisors" (p. 616). Safety climate is one of the facets of the broader multi-level and multifaceted concept of organizational climate (Schneider et al., 2017; Zohar & Luria, 2005). Consequently, it should have the same antecedents as climates for other processes and outcomes. Empirical research supports the statement that leadership is a significant driver of climates of all kinds (González-Romá et al., 2002; Kozlowski & Doherty, 1989; Schneider et al., 2017), including safety climate (Barling et al., 2002; Hofmann et al., 2003; Martínez-Córcoles et al., 2011; Zohar, 2000). Specifically, Martínez-Córcoles et al. (2011) found that empowering leadership behavior is related to team safety climate in nuclear power plants. Although there is research exploring the relationships between empowering leadership and safety climate, few of these studies were conducted in the settings of HROs (Martínez-Córcoles et al., 2011), and, to our knowledge, none of them investigated this topic in the context of ATC companies. Thus, our second hypothesis is the following:

Hypothesis 2. (*H2*). *Empowering leadership is positively related to team safety climate.*

2.5. The mediating role of safety climate

As we pointed out above, a keyword in the safety climate definition is perceptions, which indicates that the safety climate serves as a lens through which employees see an objective organizational environment and form a consensus about what is valued there. Due to its normative influence on individual and group behavior (Zohar, 2008), a strong safety climate leads to increased motivation to work safely and engage in safe behavior (Martínez-Córcoles et al., 2011), as well as fewer adverse safety outcomes such as accidents and injury. It has been shown in the aviation context that team safety climate in general (Maneechaeye & Potipiroon, 2022) and perceived safety management system practices in particular (Chen & Chen, 2014) have a positive effect on pilots' safety behavior (i.e., safety compliance, courtesy, and participation) via an increase in their safety motivation.

Research has shown that safety climate is an essential predictor of safety behavior and safety outcomes (Griffin & Curcuruto, 2016); however, to our knowledge, only one study has examined the direction and nature of the relationship between safety climate and mindful organizing (Renecle et al., 2021). In a sample of 1112 Russian-based chemical plant workers, Renecle et al. showed that team safety climate is strongly related to mindful organizing ($b = 0.73$, $p < .001$), and that mindful organizing mediates the relationship between team safety climate and individual in-role and extra-role safety behavior. Following Renecle et al. (2021), we argue that team safety climate creates the psychosocial bases for employees to participate in mindful organizing and mediates the relationship between empowering leadership and mindful organizing:

Hypothesis 3. (*H3*). *Team safety climate is positively related to mindful organizing.*

Hypothesis 4. (*H4*). *Team safety climate mediates the relationship between empowering leadership and mindful organizing.*

2.6. The moderating role of safety culture

Companies' founders and top managers play a key role in establishing and maintaining an organizational culture, including the safety culture (Giorgi et al., 2015; Schein, 1985). At the same time, direct supervisors transmit safety culture and impact team safety climate. According to previous research (Martínez-Córcoles et al., 2011), the impact of direct leaders' behavior on safety climate is moderated by safety culture. More specifically, the relationship between empowering leadership and team safety climate is stronger when safety culture is low and weaker when safety culture is high. If the safety culture is already strong, there is not much a leader can do – a strong safety culture will result in a shared perception of the importance of safety in a work unit, in other words, in a strong team safety climate. At the same time, if the safety culture is not strong enough, the leader's behaviors and leadership style impact the group's team safety climate more. Martínez-Córcoles et al. concluded that if a safety culture is weak, it is still possible for the leader to create a strong team safety climate by acting as an empowering leader. This moderation effect was found in nuclear power plant conditions, and we hypothesize that the same thing could be true in the context of an ATC company. Thus, our next hypothesis is:

Hypothesis 5. (*H5*). *Organizational safety culture moderates the relationship between empowering leadership and team safety climate. Namely,*

the relationship between empowering leadership and team safety climate is higher when the safety culture is weaker.

If the safety culture moderates the relationship between empowering leadership and safety climate, it follows that the indirect effect of empowering leadership on mindful organizing (through safety climate) will also be contingent upon safety culture. The current work attempts to integrate this boundary condition into the postulated moderated mediating model.

We propose that the positive influence of empowering leadership on mindful organizing through the safety climate will be weaker when the safety culture is high. However, the positive indirect effect of empowering leadership on mindful organizing will be stronger when the safety culture is low because, under these circumstances, the leader's behaviors become more salient. When safety culture is low, the supervisor's actions become the primary source of information about what is supported and valued in the organization, and, in turn, they indicate whether it is worthwhile to be engaged in mindful organizing processes. Based on the arguments mentioned above, the last hypothesis is formulated:

Hypothesis 6. (*H6*). *Safety culture moderates the positive indirect effect of empowering leadership on mindful organizing through team safety climate. Specifically, among employees who report a high safety culture, the indirect effect of empowering leadership on mindful organizing via team safety climate is weaker.*

3. Method

3.1. Participants

The sample included 73 workers from an Air Traffic Management company. Ninety-five of the 112 employees invited to participate in the research opened an online survey form. However, 15 did not respond to any of the questions, and five other participants did not complete the questionnaire. In addition, two of the 75 informants who completed the survey were excluded because of inattentive responses to the questionnaires.

Therefore, the final sample was made up of 73 respondents. The participation rate constituted 65.2% of the total 112 employees. Most of the employees worked in the eight different control towers managed by the company (N = 59; 80.8%), whereas 17.8% worked in the headquarters (N = 13). One participant did not answer the work center question. Most of the participants were traffic controllers (N = 58; 79.45%), and 17 out of the 58 traffic controllers working in control towers had employees under their supervision. Moreover, two employees were air traffic safety electronics and maintenance personnel. The final sample consisted of 47 men (64.4%) and 22 women (30.1%). Four respondents did not indicate their sex (5.5%). The participants' ages ranged between 22 and 53 years old, with a mean close to 36 (M = 35.94; SD = 7.78). The tenure range was from 1 to 10 years, with a mean of 4.6 years (SD = 2.80).

3.2. Procedure

Participation was voluntary. Anonymity and confidentiality were guaranteed. The research was part of the safety culture evaluation the company carries out from time to time as one of the practices of operational safety enhancement. Participants completed an online survey that consisted of several questionnaires designed to evaluate empowering leadership, safety culture, group safety climate, and mindful organizing. In addition, three instructed-response items were included (Meade & Craig, 2012) to detect careless responses to the survey. One example of these items is *"Mark the response option 'never or almost never' in this statement."* Participants who answered two of the three false items incorrectly were eliminated.

3.3. Measures

Below, all the measures included in the current study are described. All the scales have been validated in previous studies. Moreover, Cronbach's alpha indexes were satisfactory for all the scales (see Table 1).

Mindful organizing was measured with a 25-item questionnaire developed by our research team. Some sample items are: *"We try to anticipate what could go wrong in our work"*; *"We are encouraged to challenge assumptions made by others";* or *"We share real-time information about current operations through various practices"*. A 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used. High scores indicated a high awareness of weak signals of failure, the ability to address them quickly and effectively, and resilience if unexpected events occur. The questionnaire included five dimensions and five items per dimension. Cronbach's alpha for each dimension was as follows: preoccupation with failure (0.85), reluctance to simplify (0.83), sensitivity to operations (0.85), commitment to resilience (0.85), and deference to expertise (0.81). However, in our research, we treated mindful organizing as a unidimensional construct due to the sample size limitations (Renecle, Tomás, et al., 2020). The entire questionnaire can be seen in Appendix 1.

Empowering leadership was measured with Martínez-Córcoles et al.'s scale (2011). The scale consisted of 17 items describing behaviors initiated by a direct supervisor. Some sample items are: *"He/She is a good example for others because of the way he/she behaves"; "He/She encourages members of the team to express their ideas/suggestions"*; *"He/She teaches our team members how to solve problems on their own"; "He/She explains the rules to follow and what the company expects of us";* or *"He/She takes time to talk patiently about the concerns and/or interests of the team members"*. The response scale was a 5-point Likert scale ranging from 1 (never or almost never) to 5 (always or almost always). A high score indicated that leaders try to empower their team members by giving them more autonomy and responsibilities. Even though the original EL model consists of five dimensions, Martínez-Córcoles et al. (2011) showed that the unidimensional model was the best solution.

Team safety climate was measured with 12 items from the Group Safety Climate Questionnaire adaptation (Latorre et al., 2013) of Zohar and Luria's (2005) instrument. The referent in this questionnaire was the work unit, not the whole organization. Some sample items are: *"We talk about how to improve safety"* and *"We frequently talk about safety issues during the working day."* The original questionnaire consisted of 15 items. Three items were removed because they did not apply to the ATC industry. The response scale had five anchors ranging from 1 (strongly disagree) to 5 (strongly agree). A high score indicated that employees perceived a strong safety climate within their work unit.

Safety culture was measured with the Safety Culture Enactment Questionnaire (López de Castro et al., 2017). The referent in this questionnaire was the organization, and so it measured how safety was valued in the organization as a whole. Questions were preceded by an introduction emphasizing that respondents were expected to share their opinions about the practical importance of safety. According to the criterion proposed by Guttman and Levy in 1976, *"an item belongs to the universe of work value items if its domain asks for an assessment of the importance of a goal in the work context, with a range from very important to very unimportant"* (as cited in López de Castro et al., 2017, p. 46). The SCEQ met this requirement by asking respondents to estimate the importance of the safety goals in three domains of practice: strategic decisions, personnel management, and operating behaviors (López de Castro et al., 2017). These domains were chosen based on the International Atomic Energy Agency's safety culture model, including three levels: policies, managerial, and individual, corresponding to strategic decisions, personnel management, and operating behaviors, respectively. The questionnaire was composed of 20 items. The original questionnaire, developed by López de Castro and colleagues, was used for nuclear power plant workers and consisted of 21 items. One item

Table 1
Descriptive statistics, alpha coefficients, and correlations.

	Variables	Scale	*M*	*SD*	1	2	3	4
1.	Mindful Organizing	1–5	4.10	0.71	(0.96)			
2.	Empowering Leadership	1–5	4.08	0.88	0.73**	(0.97)		
3.	Safety Climate	1–5	4.12	0.64	0.75**	0.78**	(0.93)	
4.	Safety Culture	1–5	4.00	0.72	0.81**	0.78**	0.75**	(0.96)

Cronbach's alphas are provided between parentheses.
** Correlation is significant at the 0.01 level (2-tailed).

related to refueling was deleted due to a lack of relevance for ATC companies. Some sample items are: *"To what degree is safety important … in decision-making processes about the work?"; "… in training personnel?";* or *"in meetings?"*. The response scale was a 5-point Likert scale ranging from 1 (not at all) to 5 (very much). A high score on this scale indicated a high priority of safety or the existence of a strong safety culture within the organization, reflected in all its practices.

3.4. Analysis

First, descriptive and correlation analyses were carried out. Then, we used PROCESS macro version 4.0 for SPSS (version 26) to test our proposed conceptual model and estimate the significance of direct and indirect mediation and overall moderated mediation. To test Hypotheses 1–4, we used the Hayes PROCESS simple mediation Model 4, with group safety climate as a mediator between empowering leadership and mindful organizing. Additionally, to test Hypotheses 5–6, we examined the Hayes PROCESS moderated mediation Model 7, with group safety climate as a mediator and safety culture as a moderator.

4. Results

4.1. Descriptive statistics, correlations, reliability analysis, and validity

Descriptive statistics, bivariate correlations, and Cronbach's alphas for all the variables are presented in Table 1. All the variables are positively and significantly correlated in accordance with the hypothesized model.

As mentioned above, the number of participants in our research is restricted. Due to the size of the company involved, even though we achieved a relatively high participation rate, the resulting sample size is less than 100 employees. According to a study that used Monte Carlo data stimulation techniques (Wolf et al., 2013) for Confirmatory Factor Analyses (CFA), the minimum sample size for one factor, including more than eight items with factor loadings greater than 0.50, is estimated to be 90. Samples with less than 100 participants tend to produce unstable Pearson correlations; that is, they are not representative of the correlation in the population, and they are not replicated from one sample to another (Ferrando et al., 2022). Therefore, the minimum number recommended to conduct factor analyses is 100 participants. Our sample contained 73 participants, which might not be enough for correct parameter estimation. Thus, to support the validity of our measurement model, we relied on the results of previous research, which convincingly showed the validity of the chosen scales for measuring constructs included in our research model (Latorre et al., 2013; López de Castro et al., 2017; Martínez-Córcoles et al., 2011; Renecle, Tomás, et al., 2020). In addition, the same research demonstrated discriminant validity between safety culture and safety climate (López de Castro et al., 2017), between mindful organizing, safety culture, and safety climate (Renecle, Tomás, et al., 2020), and between empowering leadership, safety culture, and safety climate (Martínez-Córcoles et al., 2011), measured with the same or similar questionnaires.

4.2. Hypothesis testing

Even though the research sample size might be considered undersized for testing the proposed model, the Monte Carlo simulation research (Sim et al., 2022) has shown that to detect a large effect, a sample size of 50–90 participants might be enough even for a complex model with four variables. Moreover, according to power analysis calculations using the G*Power software, under the assumption of a medium effect size ($f^2 = 0.18$) for four predictors and using an alpha level of 0.05, the sample size needed to achieve a statistical power of 0.80 is 72 participants (Faul et al., 2009). This indicates that, while small, our sample size should be adequate for detecting at least medium effect size relationships among the variables under investigation.

Before testing our research model, we ensured that our data met the assumptions the chosen statistical method implied. The Durbin-Watson statistics detecting autocorrelation in the residuals from regression analysis were between 1.5 and 2.5, indicating the independence of residuals. Collinearity diagnostic tests provided in Table 2 showed an absence of collinearity according to the cut-off points recommended by Hair et al. (2013). The Collinearity Tolerance Level was greater than 0.10, and VIF was below 10. Visual diagnostics of partial regression plots showed that relationships between the dependent variable and each independent variable might be considered linear. The scatterplot of regression standardized residuals and predicted values showed that residuals are relatively uniformly distributed in the entire range of predicted values, indicating the homoscedasticity of residuals. The distribution of standardized regression residuals histogram and P-P plot led to the conclusion that they roughly followed a normal distribution. In other words, all assumptions were met, allowing us to follow a standard regression procedure.

First, we tested Hypotheses 1–4. The results of the estimation of the simple mediation model are provided in Table 3. The regression analysis results indicated that the model explains 62.0% of the total variance in the dependent variable ($R^2 = 0.62$, $p < .001$). The direct effect of empowering leadership on mindful organizing was significantly different from zero ($c' = 0.31$, $p < .01$). This result showed the significance of the direct effect and provided evidence supporting Hypothesis 1, which stated that empowering leadership is positively related to mindful organizing.

Regarding Hypotheses 2 and 3, empowering leadership was positively associated with safety climate ($a = 0.57$, $p < .001$), and safety climate was positively related to mindful organizing when controlling for empowering leadership ($b = 0.51$, $p < .001$). Finally, the bootstrap confidence interval for the indirect effect ($ab = 0.29$) was also above zero (95% confidence interval = 0.03–0.63), indicating that our findings supported Hypothesis 4 regarding the mediating role of safety climate.

Table 2
Collinearity diagnostics.

DV	Predictor	Tolerance	VIF
Safety Climate	Empowering Leadership (EL)	0.36	2.78
	Safety Culture	0.40	2.51
	EL*Safety Culture	0.75	1.34
Mindful organizing	Safety Culture	0.36	2.58
	Empowering Leadership	0.36	2.58

Table 3
Regression results for the simple mediation model.

	Safety Climate			Mindful Organizing		
Predictor	***β***	***SE***	***p***	***β***	***SE***	***P***
Constant	1.79	0.23	< 0.001	0.75	0.34	0.032
Empowering Leadership (EL)	0.57	0.05	< 0.001	0.31	0.10	0.002
Safety Climate	–	–	–	0.51	0.13	< 0.001
	$R^2 = 0.612$F (1, 71) = 111.910, *p* <.001			$R^2 = 0.620$F (2, 70) = 57.006, *p* <.001		
Indirect effect	**Coefficient**			**95% Bootstrap CI**		
Safety Climate	0.29			0.03–0.63		

To test Hypotheses 5 and 6, which proposed the moderating role of safety culture in the relationship between empowering leadership and group safety climate, we tested the moderated mediation model. The results of the estimation are provided in Table 4. The relationship of the cross-product term of empowering leadership and safety culture with safety climate was insignificant (β = −0.09, *t* = −1.22, *p* =.23), and so Hypothesis 5 was not supported. The bootstrap confidence interval for the index of moderated mediation included 0 (95% confidence interval = −0.15–0.04), which indicated that the research findings did not support Hypothesis 6. Paths between variables and standardized parameters for the model are presented in Fig. 2.

5. Discussion

Aligned with the HRO literature, our study delves deeper into the organizational policies and practices that foster safety within HROs. Notably, we incorporate a proactive stance by analyzing influential variables such as empowering leadership. This approach not only echoes the themes highlighted in HRO studies but also resonates with the principles of resilience engineering, emphasizing that employees play a pivotal role in contributing positively to safety (Haavik et al., 2019).

The study developed and tested a model that examined why and when empowering leadership would promote mindful organizing. As expected, the results showed that empowering leadership influences mindful organizing directly and positively (H1), and indirectly by improving the safety climate in a work unit (H4). That is, empowering leadership enhances team safety climate, which results in employees' involvement in mindful organizing processes. This pattern of results is consistent with the previous literature showing the indirect effect of leadership on other organizational safety outcomes such as safety knowledge and motivation (Shen et al., 2017), risk perception (Nielsen et al., 2013), safety participation (Clarke & Ward, 2006), and safety behavior (Martínez-Córcoles et al., 2011).

Table 4
Regression results for the moderated mediation model.

	Safety Climate			Mindful Organizing		
Predictor	***β***	***SE***	***p***	***β***	***SE***	***p***
Constant	4.16	0.06	< 0.001	2.01	0.55	< 0.001
Empowering Leadership (EL)	0.34	0.08	< 0.001	0.31	0.10	0.002
Safety Climate	–	–	–	0.51	0.13	< 0.001
Safety Culture	0.31	0.10	0.002	–	–	–
EL × Safety Culture	−0.09	0.07	0.228	–	–	–
	$R^2 = 0.669$ *F* (3, 69) = 46.408, *p* <.001			$R^2 = 0.620$ *F* (2, 70) = 57.006, *p* <.001		
Safety Culture	**Conditional indirect effect at range of values of Safety climate**			**95% Bootstrap CI**		
−1SD (0.719)	0.20			0.02–0.36		
M (0)	0.17			0.02–0.33		
+1SD (0.719)	0.14			−0.00–0.34		
	Index of moderated mediation			**95% Bootstrap CI**		
Safety Culture	−0.04			−0.15–0.04		

However, contrary to our hypotheses, this study did not confirm the moderating effect of safety culture in the relationship between empowering leadership and safety climate (H5) or the magnitude of the indirect effect of empowering leadership on mindful organizing via safety climate (H6). Safety culture predicts group safety climate (b = 0.31, p <.002), but, in contrast to earlier findings (Martínez-Córcoles et al., 2011), the positive influence of empowering leadership on safety climate was equal for all levels of safety culture. One possible reason is that we did not have enough power to detect the moderation effect because of the relatively small sample size. Features of the work environment might also explain the findings. In ATC settings, direct supervisors work very closely with the ATC team and have a stronger influence on their perception of safety procedures. Unlike nuclear power employees working in the same plant, air traffic controllers work in different control towers. When the staff is dispersed, transmitting the safety culture is more complex. Each control tower has its tower manager, who acts as the immediate supervisor of that tower's controllers. Therefore, in these organizations, the role of the direct supervisor can be much more relevant in creating a safety climate within the unit than the safety culture promoted by the organization. However, further research will have to confirm the plausibility of this explanation.

Future studies should incorporate a qualitative, in-depth approach that considers the organizational setting where work takes place and the understanding of "work as done" during standard operations, which is central in fields such as resilience engineering (Haavik et al, 2019). Cross-disciplinary collaboration of organizational psychologists, engineering researchers, and human factor specialists might contribute to the cross-fertilization of HRO and resilience engineering and might help to address both organizational and operational levels of safety.

5.1. Theoretical implications

As Martínez-Córcoles and Vogus (2020) recently pointed out, the existing mindful organizing research provides a limited understanding of the way mindful organizing emerges, spreads, and becomes institutionally embedded in an organization. The present research attempts to address this problem.

This study showed that a strong safety climate creates the foundation for the development of mindful organizing, which is consistent with Renecle et al. (2021). Organizational policies, procedures, and practices supporting safety cultivate mindful organizing, which manifests as continuous attention, effort, and commitment to anticipating and preventing errors. However, the study's unique contribution goes beyond extrapolating results from the chemical industry to ATC.

More specifically, this study shows that safety climate mediates the relationship between empowering leadership and mindful organizing, providing support for a more integrative model. Our findings suggest that leaders should be able to create a robust safety climate if they exhibit empowering behaviors, providing employees with more autonomy, building their self-efficacy, and stimulating engagement. In turn, the safety climate will build the foundations for mindful organizing.

Even though the concepts of "collective mind" and "mindful comprehension" were first illustrated by Weick and Roberts (1993) through an example of flight operations on aircraft carriers, since then, few quantitative studies have investigated mindful organizing processes in the aviation context. Quantitative studies have important advantages because they allow comparisons, benchmarking, and the accumulation of knowledge. Our research took one of the first steps toward developing future research on mindful organizing in air traffic control and aviation in general.

The present study also provides evidence that supports previous

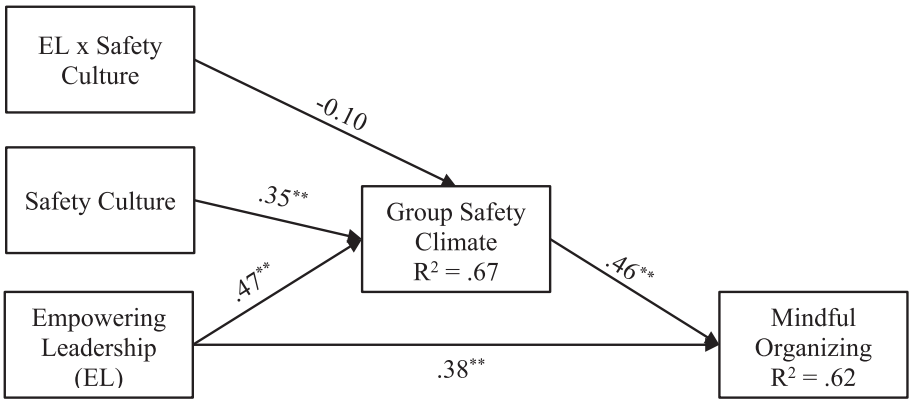

Fig. 2. Paths between variables and standardized parameters. ** p <.01.

findings on the relationship between empowering leadership and safety climate (Martínez-Córcoles et al., 2011) and safety climate and mindful organizing (Renecle et al., 2021; Renecle, Tomás, et al., 2020), obtained mainly from the sample of nuclear power plants and chemical workers, respectively. In sum, the present research takes the next step in building an integrative model of mindful organizing in HROs, and it provides an opportunity to generalize the results found in the ATC field.

5.2. Practical implications

The results of our study demonstrate that one possible way to increase employees' awareness of safety risks, enabling the process of mindful organizing on the front line and maintaining flawless operations, is to build a strong safety climate through empowering leadership. Training courses and coaching on empowering leadership behaviors for direct supervisors may help them to clearly communicate organizational priorities and strategic goals, create a positive perception of safety norms, procedures, and practices among their employees, and promote mindful organizing. Direct managers in organizations hold a crucial position as a bridge between top administrators, who define the mission and vision and are responsible for strategic outcomes, and frontline employees on whom operational outcomes and safety depend (Vogus & Sutcliffe, 2012).

Moreover, not only hazardous organizations may benefit from the findings discovered. Other firms and businesses can apply empowering leadership principles to their HR and managerial practices to strengthen their organizational climate and improve mindful organizing. Mindful organizing can enhance resilience and sustainability under the constant pressure of uncertainty and contingencies of the VUCA world.

5.3. Limitations and implications for future research

Although the present study advances the current understanding of mindful organizing and its antecedents in the new organizational context, it has some limitations. First, the study sample is relatively small and includes employees from only one ATC company, which limited the complexity of the model we could test, the variables we could control, and the potential generalizability of the results. Future research should test a similar model in a more significant sample of various ATC companies in order to control for confounding variables such as tenure or position, allow a multi-level analysis of interrelations between variables, and show additional evidence of the replicability and generalizability of the results.

Another drawback is the use of self-report measures of attitude and behavior. Despite this, to mitigate the adverse effect of social desirability bias, we ensured anonymity and confidentiality, and we allowed employees to withdraw their responses at any time. Future research should consider including other indicators of leadership behaviors and mindful organizing practices, such as peer and supervisor ratings and field observation, as well as analyzing additional sources of information about organizational culture.

Another issue related to using survey methodology is the applicability of quantitative methods to measure safety culture. Future research might benefit from using a mixed-methods approach that combines quantitative and qualitative methods to reach the deepest levels of culture. Despite their limitations, quantitative studies are also valuable. Surveys have been considered useful in the field of organizational culture to understand behaviors and values (Denison et al., 2014). In addition, they allow the replication and accumulation of knowledge (Denison et al., 2014) and facilitate benchmarking and organizational change process monitoring (Denison et al., 2014; Hofstede et al., 1990).

Because this study is cross-sectional, causal relationships cannot be assumed. Even though there are theoretical arguments that mindful organizing is unlikely to develop without a strong safety climate to begin with (Renecle et al., 2021), and leaders are the primary agents in creating conditions for a strong safety climate (Vogus & Sutcliffe, 2012), the relationship between them might be reciprocal. Further longitudinal research is needed to examine the reciprocal relationship between these variables over time.

Another limitation is that we analyzed mindful organizing and empowering leadership as unidimensional constructs in our study. Our decision was based on the sample size restrictions and justified by previous research showing that these constructs might be treated as unidimensional (Martínez-Córcoles et al., 2012; Renecle, Tomás, et al., 2020). Future research should explore how the subdimensions of empowering leadership may relate differently to the specific subdimensions of mindful organizing.

Finally, future studies should consider exploring the role of another facet–specific climates that may become especially salient depending on the industry under investigation. For instance, in industries where high-quality client service is required, a service climate might stimulate employees' collective awareness of emerging problems and errors, deceitful heuristics, operation routines, and learning and knowledge-sharing processes. It might help introduce mindful organizing into a broader organizational context than HROs and confirm its theoretical applicability and practical usefulness for other industries and organizations.

6. Conclusion

The study findings offer interesting insights into how to promote and maintain employees' engagement in mindful organizing processes through leaders' influence on team safety climate. Although considerable work still needs to be done to create a holistic model of mindful organizing and prove its theoretical and practical relevance within safety management research and practice, the present study enhances

our understanding of the relationship between mindful organizing and other safety-related concepts.

CRediT authorship contribution statement

Alena Mezentseva: Writing – original draft, Methodology, Investigation, Formal analysis. **Francisco J. Gracia:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Conceptualization. **Inmaculada Silla:** Writing – review & editing, Validation, Supervision, Software, Methodology, Investigation, Data curation. **Mario Martínez-Córcoles:** Software, Methodology, Investigation, Data curation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors would like to express gratitude to Professor Doctor Inés Tomás from IDOCAL, University of Valencia, for her support and guidance in dealing with some methodological issues raised by the reviewers. Her invaluable methodological advice and expertise have significantly enriched the quality of this paper.

Appendix. Mindful organizing questionnaire

Preoccupation with error

1. We are aware of the dangers of becoming inattentive in our work.
2. We try to anticipate what could go wrong in our work
3. People always report mistakes and errors
4. We take even small mistakes seriously because they can be symptoms of larger problems in the system
5. Small deviations are treated as signs of something potentially more serious

Reluctance to simplify

1. We are encouraged to challenge assumptions made by others
2. When facing an unexpected event, we don't reach conclusions until a deep analysis of the situation has taken place
3. When making sense of an unexpected situation at work, we pay attention to any new evidence that may tell us that something has changed
4. People are encouraged to express different views of what is happening in our work
5. When making sense of a situation at work, we encourage discussing different explanations among ourselves

Sensitivity to operations

1. We try to have a comprehensive view of current operations
2. We share real-time information about current operations through various practices
3. Leaders and managers are accessible when important situations develop
4. Leaders/managers maintain continuous contact with those working on the front line
5. Leaders/managers pay close attention to day-to-day operations

Commitment to resilience

1. We try to expand people's knowledge and capabilities so that they are able to deal with unexpected events
2. Training is designed to build people's capabilities by simulating how operations can unravel and how they might be corrected
3. We bounce back quickly from errors
4. In order to recover from unexpected events, we are able to improvise if necessary
5. We are flexible enough to react to unexpected events to maintain stability

Deference to expertise

1. If something out of the ordinary happens, people in this unit know who has the expertise to respond
2. If something unexpected occurs here, we involve the most highly qualified people, regardless of rank, in sense-making and decision-making
3. When making decisions during unexpected events, frontline experience and expertise are prioritized over hierarchy
4. We encourage people who can immediately sense a potential problem to make quick decisions to alleviate the problem
5. People on the front line, regardless of years of experience or rank, play an important role in decision making during unexpected events.

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