



Leading mindful organizing for safety in air traffic control: A moderated serial mediation model

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ABSTRACT

Mindful organizing, a critical capability within high-reliability organizations like air traffic control, encompasses the ability of team members to foresee, identify, rectify errors, and adapt to unforeseen occurrences. This study primarily investigates the influence of empowering leadership on mindful organizing among air traffic controllers, exploring the underlying mechanisms of this relationship. We hypothesized that employee participation enhances the effect of empowering leadership on trust in leadership. Furthermore, we posited that trust in leadership and critical upward communication would act as sequential mediators between empowering leadership and mindful organizing. Our hypotheses were tested on a sample of 73 employees from six air traffic control towers and their headquarters in Spain. Utilizing Process Macro in SPSS 26.0 for analysis, our findings indicate a positive correlation between empowering leadership and mindful organizing. Significant associations were also observed between empowering leadership, trust, and critical upward communication. These results unveil pivotal interrelations among key variables for safety performance. This paper concludes with suggestions for future research and potential implications of these findings for organizational safety strategies.

1. Introduction

High-Reliability Organizations (HROs) have been traditionally characterized by their safe performance despite operating complex systems where even a mistake could lead to catastrophic consequences or, in the best-case scenario, cessation of services. In addition to that, nowadays the velocity of socio-economic changes generates an extra challenge to some HRO's. For instance, Southern Europe's air traffic control faces a unique situation due to three primary factors affecting air traffic volumes.

Firstly, the closure of Ukrainian airspace to civilian traffic, necessitated by the ongoing conflict, has led to heightened congestion along alternative routes. This closure has escalated operational complexities, intensifying the burden on neighboring airspaces. Secondly, the surge in oil prices – with crude oil rates jumping from approximately \$76 per barrel in January 2022 to over \$110 in March 2022 – has compelled companies towards heightened operational efficiency (Kolaczowski, 2022). This economic pressure has placed air traffic controllers in a crucial position to manage air traffic seamlessly, mitigating delays and runway congestion. Thirdly, seasonality significantly impacts traffic volumes. For example, Spain witnessed a near-complete recovery (93 %

in flight volumes during the summer of 2022 compared to the same period in 2019, surpassing 750,000 flights. This seasonal fluctuation necessitates adaptive resource allocation, challenging both companies and employees with uncertainty and constrained planning.

Consequently, air traffic control in Southern Europe is continuously adapting to evolving circumstances that impact efficient and safe operations. This situation is further underscored by the anticipated increase of air transport by an average of 4.3 per annum over the next 20 years, as outlined by the International Civil Aviation Organization (Civil Aviation Organization, 2023). Hence, ensuring high reliability in these air traffic control operations is more critical than ever.

The literature in recent years suggests that one key predictor of reliability is mindful organization (e.g., Knight, 2004; Vogus & Sutcliffe, 2007a; Rerup, 2009; Sutcliffe et al., 2016; Sutcliffe, 2018). However, despite being a theoretically well-established concept, it requires further empirical development on three main avenues. First, most studies have used qualitative research designs (mostly case studies), and more quantitative research on mindful organizing is needed (Martínez-Córcoles & Vogus, 2020; Sutcliffe, 2018). Second, previous research has focused on the consequences of mindful organizing, whereas the study of its antecedents has been overlooked. Third, a previous research

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study (Gracia et al., 2020) found that empowering leadership can play a critical role in fostering mindful organizing in nuclear power plants. However, further research is needed to disentangle the paths by means of which this leadership style impacts mindful organizing in other HROs.

This study tries to examine the underlying mechanisms of influence in the relationship between empowering leadership and mindful organizing in air traffic control. To do that, we tested a serial mediation of the relationship between empowering leadership and mindful organizing through trust in leadership and upward communication. Additionally, we tested a moderated serial mediation model adding promotion of participation as a moderator of the relationship between empowering leadership and trust in leadership.

1.1. Mindful organizing

Unlike individual mindfulness that is mostly an intra-psychic experience, mindful organizing is a “collective capability to discern discriminatory detail about emerging issues and to act swiftly and wisely in response to these details” (Sutcliffe et al., 2016, p. 56). It is characterized as a dynamic social process (McPhee et al., 2006) that relies on detailed and continuous real-time communication that occurs in briefings, meetings, updates, and teams’ ongoing work (Schulman, 1993; Vogus & Sutcliffe, 2012; Weick et al., 1999). Thus, developing an integrated bigger picture of operations in the present moment, a key outcome of mindful organizing, is a shared accomplishment grounded in social interaction (Roth, 1997). This is what allows HROs to maintain a social infrastructure for resilience (Weick & Sutcliffe, 2007).

Mindful organizing is composed of five dimensions (Weick et al., 1999; Weick & Sutcliffe, 2007) such as preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience and deference to expertise. Preoccupation with failure refers to the way an organization and its members detect, record and deal with failures. It is an ongoing analysis of vulnerabilities that “treats any failure or near miss as an indicator of a larger problem” (LaPorte & Consolini, 1991; Weick & Sutcliffe, 2007 as cited by Vogus et al., 2010, p. 66) and use those as opportunities to improve. Reluctance to simplify interpretations refers to a constant questioning of received wisdom and looking for alternative explanations. According to the Joint Commission Center for Transforming Healthcare (2013), this principle manifests as pursuing full understanding and appropriate solutions to arising problems instead of accepting simplistic reasoning. The goal is retaining a skeptical perspective during smooth-running operations by continuously probing the process for errors, as well as choosing to maintain vigilance instead of complacency. Sensitivity to operations denotes situational awareness of front-line workers. This principle also implies cross-training and informing employees of critical data to form an up-to-date picture of what’s happening in the organization (Weick et al., 1999). Hence, senior-level managers might be trained for various roles and duties to operate as front-line employees, when necessary (Vogus & Rerup, 2017), while front-line employees are encouraged to expand their skill sets, all to create mission redundancies (Saunders, 2015), in order to increase safety effectiveness during critical times. Commitment to resilience refers to organizational and individual intentions to grow and develop capabilities that will help best adapt, learn, and improvise when faced with unexpected events (Van Dyck et al., 2005). Here, inspired by organizational leaders, employees are encouraged to apply their experience and creative thinking outside of safety context to solve problems. Deference to expertise, in its turn, implies that decision making power is distributed in accordance with the degree of expertise and proficiency in a specific issue at hand, not rank or hierarchy. Summing up, the first three dimensions account for anticipation of unexpected events, while the remaining refer to their containment. Anticipation is sensing early events and putting efforts to stop the development of undesirable events, while containment refers to directing activities toward unexpected events that have already occurred (Weick & Sutcliffe, 2007).

Composed of these five principles, mindful organizing constitutes the ability to notice weak signals, critically evaluate those and reframe them to enlarge the understanding of what is happening/has happened. It is thought to be a dynamic rather than static characteristic that teams practice and reinforce through time. It is reinforced through organizational and individual practices such as constantly re-evaluating reality, readily adapting to chaotic and uncertain situations, reappraising stress as challenge or an opportunity to excel, and “buffering” emotions to focus on immediate tasks (Scott & Myers, 2005; Vogus & Sutcliffe, 2017).

Mindful organizing is still a novel construct that has been barely studied (Sutcliffe et al., 2016). However, in recent years there is a growing interest in studying mindful organizing in reference to safety. A prime example of it is the publication of the first special issue on the topic in Safety Science recently (Martínez-Córcoles & Vogus, 2020), shaped by several empirical studies about mindful organizing in HROs such as nuclear industry, aviation, or air traffic control. In the nuclear field, Gracia et al. (2020) found that empowering leaders increased in-role followers’ behaviors by creating mindful organizing dynamics in their teams. Regarding the commercial aviation industry, Oliver et al. (2019) carried out an exhaustive study of the Air France 447 disaster and found that the “almost totally safe system” involved was too rigid, and crowded out the engagement, interaction and work needed to create and maintain mindful organizing. As far as air traffic control is concerned, Callari and colleagues (2019) explored the Maastricht Upper Area Control Centre (MUAC) and revealed how discussions guided by specific protocols and tools form the operational framework developed mindful organizing. For instance, preoccupation with failure happened through conversation triggered and informed by incident forms and instruments in place to record anomalies. Sensitivity to operations was aided by “briefings” from electronic systems that shape the interpersonal actions and interactions to follow. These authors also pointed out that it is critically proceduralization combined with extensive interaction and talk that aided mindful organizing (Martínez-Córcoles & Vogus, 2020).

1.2. Empowering leadership as a predictor of mindful organizing

Empowering leadership is defined as leader behaviors such as participative decision-making, giving employees a sense of self-determination and self-directedness, trust, goal focus, self-confidence, and development support on individual and team levels (Chen et al., 2007; Kirkman & Rosen, 1999; Konczak et al., 2000). Up until now research has shown that empowering leadership, being based on a behavioral approach, has a positive impact on work outcomes (Maynard et al., 2012; Kim et al., 2018) through increasing employee authority, autonomy, and responsibility (Leach et al., 2003).

Within the context of HROs specifically, empowering leadership behaviors have proven to predict safety-related outcomes in employees. For instance, empowering leadership has shown to positively influence employee safety climate and safety behaviors both in weak and strong safety cultures (Martínez-Córcoles et al., 2011). Empowering leadership has also shown to enhance workers’ safety participation behaviors by promoting a collaborative learning dynamic, where an open leader–follower communication fosters important conversations about safety issues (Martínez-Córcoles et al., 2012). In a more recent longitudinal study, empowering leader behaviors predicted higher levels of team job satisfaction and team safety satisfaction. This study is important in framing empowering team leadership as a “progressive enabler” (Martínez-Córcoles et al., 2021, p. 7), where incremental empowering practices gradually increase performance-based and safety-related outcomes over time on a team-level.

Besides being inherently supportive, empowering leaders can create environments where team members are not afraid to “express disagreement or alternative views, break new ground, or recognize mistakes, in a context where errors are seen as opportunities for continuous learning” (Gracia et al., 2020, p. 3). According to Weick and

Sutcliffe (2015), the empowerment component of a transformational leadership style, for instance, is what enables employees to think, apply their knowledge, speak up and learn by doing. Leaders may enable mindful organizing by creating a context in which employees are empowered to interact, exchange, share, and act to anticipate and resolve threats (Vogus et al., 2010).

Finally, empowering leadership was found to be the predictor of mindful organizing in several studies (Hoy et al., 2006; Sutcliffe et al., 2016; Gracia et al., 2020). The latest study by Gracia et al., (2020) has shown that empowering leadership serves as a predictor of mindful organizing in nuclear power plants. This relationship is explained by the ability of empowering leaders to increase team's potential for self-management, where team members foster a suitable context to think and act mindfully. According to the authors' rationale, each of the dimensions of empowering leadership somehow contributes to the occurrence of mindful organizing. For instance, increasing employees' participation in decision-making decreases tendencies for simplification (as employees share different perspectives and knowledge) and promotes deference to expertise (decisions are made by the experts regardless of hierarchy). Through coaching and interacting with employees, empowering leaders can increase employees' self-confidence to make decisions by themselves, increase trust in their leader and maintain a psychologically safe atmosphere that are all necessary for preoccupation with failure. These theoretical arguments and previous research findings lead us to our first hypothesis.

Hypothesis 1. Empowering leadership predicts mindful organizing in air traffic controllers.

However, while it has been demonstrated that empowering leaders have the capability to influence mindful organizing, the mechanisms of influence between this leadership style and mindful organizing remain unknown. In the following sections we introduce and elaborate on these mechanisms.

1.3. Trust in leadership and upward communication as serial mediators

Upward communication, (also named bottom-up communication or speaking up), is the process in which lower-level employees feel free to communicate directly to the supervisors or a leader to provide feedback, complaints, or suggestions regarding the day-to-day operations. Upward communication fosters the process of anticipating and containing unexpected events, as it encompasses (a) reporting problems or deficiencies in one's own performance or other team members' performance; (b) recognizing one's own lack of knowledge about different topics or about how some tasks must be done; (c) favoring the exchange of different opinions and points of view that can lead to better team coordination; and (d) avoiding group thinking (Bresó et al., 2008). Thus, this "challenging" form of participation is necessary for predicting mindful organizing as was shown in a study by Renecke et al. (2020a) using a sample of 47 teams within the nuclear power industry.

Hypothesis 2. Upward communication predicts mindful organizing in air traffic controllers.

However, it seems like encouraging participation (including speaking up) is not enough for mindful organizing to occur in teams. Workers need the perceived feeling of psychological safety to take interpersonal risks and engage in learning behaviors such as sharing unique knowledge, seeking feedback, talking about errors, asking for help, and experimenting (Edmondson, 1999) to engage in upward communication in nuclear power plants (Renecke et al., 2020a).

Trust in leadership facilitates bottom-up communication as it allows employees to speak honestly and without fear of negative consequences for oneself (Silla et al., 2020). The rationale behind this is that trust in leadership helps employees accept risks of speaking up, such as retaliation or punishment, based on positive expectations of leaders' encouraging behaviors or intentions. In line with this, in a meta-analysis

on promotive and prohibitive forms of voice it was found that trust in leadership is positively associated with speaking up among employees (Chamberlin et al., 2017). As discussed by Renecke et al. (2020a), without the perception that employees are safe to "report issues and discuss potential vulnerabilities to their supervisors, mindful organizing is very unlikely to develop" (p. 4). This can be attributed to the importance of having trust in leadership before speaking up, or as the authors put it "discussing errors or emerging issues from defensive or punitive supervisors will cause team members to disengage in the analytical behaviors needed for preoccupation with failure" (p. 4), therefore, decreasing the chances of the occurrence of mindful organizing. Accordingly, our third hypothesis is the following:

Hypothesis 3. Trust in leadership will predict upward communication in air traffic controllers.

Employees often see things but keep the information to themselves when it comes to choosing between voice and silence (Morrison, 2014). In this multi-level approach study, the importance of leaders in employee upward communication is especially highlighted given that bottom-up communication is a type of interpersonal risk. Leaders take the responsibility over developing supportive and trusting relationships with employees to normalize speaking up. All of that is because employees need to have the certainty that voicing their ideas, concerns or disagreements will not be followed by punishment and/or feelings of embarrassment. Therefore, empowering leader behaviors promote employee voice behaviors as empowering leaders can be treated as contextual support that triggers employees' autonomy, which in turn inspires them to voice their thoughts (Seibert et al., 2004, 2011; Zhang & Bartol, 2010) and break the status quo. This same relationship has been supported in a study by Gao and Jiang (2019) of 675 supervisor-subordinate dyads in a large energy group in mainland China.

Hypothesis 4. Empowering leadership predicts trust in leadership in air traffic controllers.

On the other hand, empowering leaders may foster upward communication by increasing employees' trust in them. This is also due to relational-oriented empowering leadership behaviors such as treating employees with respect and showing concern for individual employees through coaching, thereby creating a trusting and supportive atmosphere for them to show up. Empowering leader behaviors such as participatory decision-making facilitate the experience of feeling psychologically safe in employees, which, in turn, facilitates employee behaviors such as sharing information, seeking feedback, talking about errors, asking for help, and experimenting. Therefore, empowering leader behaviors may help create such trusting and supportive environments in which leaders show respect for the subordinate, growing employees' propensity to trust in their leadership, and thus, express themselves or speak up free of fear of judgment. Via ongoing upward communication, employees reduce ambiguity regarding hazards, safety-related problems, and management expectations (Engemann et al., 2020), understand the system better and detect small deviations, and increase their adaptive capability in the face of unexpected events.

Thus, we hypothesize that empowering leadership behaviors enhance follower upward communication (also by creating a sense of trust), which eventually influences positively on the collective capability to discern discriminatory detail and to act resiliently in response to them.

Hypothesis 5. Empowering leadership predicts mindful organizing through serial mediators of trust in leadership and critical upward communication in air traffic controllers.

1.4. Moderating role of promoting participation

The effectiveness of empowering leadership, inherently context-specific, is influenced by broader organizational factors such as values

or practices (Engemann et al., 2020). The concept of employee participation, which entails involving employees in organizational affairs (Cole, 2005), is integral to this. The organizational promotion of employee participation, defined by the recognition of workers' opinions and encouragement to express ideas, aligns closely with empowering leadership. This leadership style not only enhances followers' participation in decision-making but also fosters initiative-taking and autonomy. A crucial aspect of empowering leadership is its role in facilitating employee autonomy and concurrently developing their decision-making skills (Amundsen & Martinsen, 2014). This synergy between organizational practices and leadership behavior is pivotal for fostering trust and creating a work environment, where employees feel encouraged to express themselves freely (Edmondson, 1999).

Thus, we posit that promoting employee participation within the organization will reinforce the relationship between empowering leadership and employees' trust in leadership. This approach cultivates an environment conducive to open communication and, ultimately, fosters mindful organizing (Weick & Sutcliffe, 2007).

Hypothesis 6. Promotion of employee participation will positively moderate the link between empowering leadership and trust in leadership, while trust and upward communication sequentially mediate the association between empowering leadership and mindful organizing.

2. Method

2.1. Participants and procedure

The sample consisted of 73 air traffic controllers working in six different towers of an air traffic management company in Spain. Forty-seven of them are male (64.4 %) and twenty-two are female (30.1 %), while the remaining 5 % did not indicate their sex. The average age of participants equaled 36.9. The participants were asked to fill in the self-report questionnaires measuring critical upward communication, promotion of employee participation, trust in leadership, mindful organizing and empowering leadership. The response rate is equal to 65.2 %, amounting to 73 responses out of 112. All questionnaires were administered in Spanish.

The questionnaire was distributed electronically by the means of LimeSurvey on the 1st of June 2021. The research team informed all participants that their participation was voluntary as well as guaranteed anonymity and confidentiality of the data. It was made clear in the questionnaire that the data would be used exclusively for research purposes and not transferred to the company.

2.2. Measures

Empowering Leadership was measured by Martínez-Córcoles et al.'s scale (2011). In the study on leadership and employees' perceived safety behaviors in a nuclear power plant, the one-factorial structure of empowering leadership scale has been identified as the best solution (Martínez-Córcoles et al., 2011) as well as useful in predicting workers' safety performance such as safety participation behaviors. The adapted version of the empowering leadership questionnaire has been utilized in multiple studies by Martínez-Córcoles et al., (2012, 2021) within HROs or similar contexts. Thus, the empowering leadership scale of 17 items is well-validated and appropriate for studies in HROs such as nuclear power plants and air traffic control organizations. The scale is composed of 17 items with a 5-point response scale, where "1" accounts for "never" and "5" for "always". Some of the items participants had to rate are "The leader uses my work group's suggestions to make decisions that affect us" or "The leader sets high standards for performance by his or her own behavior".

Trust in leadership was measured using the last two items ("I trust my immediate supervisor" and "I trust the management team") of a questionnaire proposed by Burns and the colleagues (2006). The same

two-item scale was used by Silla et al. (2020) in their study on upward voice in nuclear power plants' operation. The scale has proven its usefulness to predict the mediating role of trust in leadership between participative decision making and upward voice in employees. Similarly, the same adapted scale of two items has been applied by Martínez-Córcoles et al. (2020) in their study of effects of leaders' individualized consideration in extreme contexts among soldiers of NATO Airborne Forces. The scale ranged from 1 to 5, where 1 denoted "completely disagree" and 5 for "completely agree".

Critical upward communication was measured by a three-item scale used in previous studies described above by Martínez-Córcoles et al. (2020) and Silla et al. (2020). The participants were asked to rate their agreement from 1 to 5, where 1 corresponded to "completely disagree" and 5 to "completely agree" with the following statements: "I can express my disagreements with my superior freely", "I can tell my superior when things are going wrong", and "I feel free to comment with my superior about problems and difficulties I have in my work without fear".

Promotion of employee participation was measured by the scale developed by our research unit composed of the following three items: "The organization is interested in listening to workers' opinion", "The organization sincerely stimulates employee participation in daily performance" and "The organization encourages workers to express their ideas and suggestions". An equivalent scale of 1 to 5 was utilized to gather participants' ratings of perceived promotion of participation from the organization.

Mindful organizing was measured using a 25-item Spanish version of the Mindful Organizing Scale, originally developed by Vogus (2004) and adapted into Spanish by Reneclé et al. (2020b). Reneclé and colleagues (2020) not only translated and validated this scale but also applied it in their research, which included a study on fostering mindful organizing within teams at a nuclear power plant. The scale is composed of five items for each of the five key dimensions of mindful organizing. For example, under the dimension of commitment to resilience, one item is: "We actively enhance the knowledge and skills of our staff to handle unexpected situations." For reluctance to simplify interpretations, an item is: "We refrain from drawing hasty conclusions in unexpected situations, ensuring thorough analysis." The dimension of sensitivity to operations is represented by an item like: "We disseminate real-time operational information using various methods." The item for deference to expertise is: "In unusual situations, our team readily identifies and defers to those with the requisite expertise." Lastly, for the dimension of preoccupation with failure, an item states: "In this unit, there is consistent reporting of bugs and errors."

2.3. Analyses

First, we run reliability analyses to test internal consistency of all variables (empowering leadership, promotion of participation, trust in leadership, upward communication, and mindful organizing) used in the study. Cronbach alpha values ranging from .70 to .95 were regarded as acceptable (Nunnally & Bernstein, 1994). Later, we run confirmatory factor analysis (CFA) to check the construct validity of the measures. This was done with LISREL 8.0. We conducted a serial mediation analysis (Model 6) for the first five hypotheses, with empowering leadership as the independent variable (X), mindful organizing as the dependent variable (Y), and trust in leadership and critical upward communication as serial mediators (M). For the sixth hypothesis, we conducted a moderated serial mediation analysis (Model 83), where empowering leadership was the independent variable (X), mindful organizing was the dependent variable (Y), and trust in leadership and critical upward communication were serial mediators (M), with promotion of participation as the moderating variable (W). Both analyses were performed using PROCESS Macro (Hayes, 2013) for SPSS 26.0 with 5000 bootstrapped samples.

3. Results

3.1. Preliminary analysis, descriptive statistics, and reliability

In order to check the construct validity of the five scales that were used in our sample, a single factor model was tested through a Confirmatory Factor Analysis (CFA) in LISREL 8.0. Due to the fact that the scales were part of the same battery of questionnaires (participants responded to the scales sequentially and immediately) and some of them such as trust in leadership, promotion of participation, and critical upward communication, contain three or less than three items, a CFA for all five scales together was performed. The empowering leadership and mindful organizing scales were introduced as unidimensional. Later, we examined the possibility that a single factor could emerge for all five constructs due to collinearity.

To determine the goodness of fit of the models the next coefficients were minded: the root mean square error of approximation (RMSEA), comparative fit index (CFI), and non-normed fit index (NNFI). The interpretation of these values is the following: RMSEA values lower than .05 are considered good, between .05 and .08 are acceptable, and between .08 and .10 are marginal, while all values greater than .10 are considered poor (Fabrigar et al., 1999); CFI and NNFI values higher than or close to .90 are considered a relatively good fit (Bentler, 1990). To determine which model was a better fit, a modeling rationale was considered. Differences not larger than .01 between NNFI and CFI values are considered as indication of negligible practical differences, while an increase in RMSEA by less than .015 can also claim support for the more parsimonious model (Chen, 2007).

The two confirmatory factor analyses were performed: a five-factor model (one factor for each scale) and a single-factor model (associated with all the items on the five scales). The five-factor model provided a relatively good fit ($\chi^2 = 1739.776$, $df = 1264$, $p < .01$; RMSEA = .077; CFI = .928; NNFI = .924), and all parameters estimated were statistically significant. Results indicated that each item saturated into corresponding scales. The fit of the single-factor model was poor ($\chi^2 = 2481.181$, $df = 1274$, $p < .01$; RMSEA = .123; CFI = .817; NNFI = .810). Summing up, the five-factor model showed better fit than the single-factor model.

Descriptive statistics for the study variables (mean, standard deviation), reliability estimates, and correlations are reported in Table 1. All variables showed acceptable to excellent reliability, ranging from Cronbach alphas of .71 to .97. In addition, main variables displayed significant and positive correlations ($p < .01$). See (Table 2).

3.2. Serial mediation model

The first hypothesis (H1) stated that empowering leadership predicts mindful organizing in the given sample of air traffic controllers. The following hypotheses suggested that upward critical communication predicts mindful organizing (H2), trust in leadership predicts critical upward communication (H3), and empowering leadership predicts trust in leadership (H4). Finally, our pre-last hypothesis (H5) postulated that the relationship between empowering leadership and mindful organizing is mediated first by an increase in trust in leadership that is followed by higher critical upward communication. See the obtained

Table 1
Descriptive statistics, reliability, and correlations for all study variables.

	Range	M	SD	1	2	3	4	5
Empowering Leadership	1–5	4.08	.88	(.97)				
1. Mindful Organizing	1–5	4.11	.71	.73**	(.96)			
2. Trust in leadership	1–5	4.07	.91	.78**	.69**	(.71)		
3. Promotion of participation	1–5	3.64	1.12	.68**	.75**	.79**	(.95)	
4. Critical upward communication	1–5	4.09	1.02	.79**	.65**	.75**	.66**	(.95)

Note: ** $p < .01$.

Table 2
Results of serial mediation analysis.

Mediator 1: Trust in leadership				
	B	SE	p	95 % CI
Empowering leadership	.81	.08	<.001	(.66,.97)
Constant	.76	.32	.02	(.11, 1.41)
R ² = .60				
F (1, 71) = 108.541, p < .001				
Mediator 2: Critical upward communication				
Empowering leadership	.61	.13	<.001	(.35,.87)
Trust in leadership	.38	.12	.003	(.14,.63)
Constant	.04	.35	.91	(−.66,.74)
R ² = .67				
F (2, 70) = 69.857, p < .001				
Outcome: Mindful organizing				
	B	SE	p	95 % CI
Empowering leadership	.37	.12	.002	(.13,.60)
Trust in leadership	.20	.10	.06	(−.01,.41)
Critical upward communication	.07	.09	.43	(−.11,.26)
Constant	1.50	.28	<.001	(.95, 2.06)
R ² = .57				
F (3, 69) = 31.007, p < .001				

results in Fig. 1.

According to the results obtained, a significant total effect ($b = .59$, $p < .001$) as well as a significant direct effect of empowering leadership on mindful organizing ($b = .37$, $p = .002$) supported our first hypothesis (H1). Empowering leadership does predict mindful organizing in this sample.

The indirect effect of empowering leadership on mindful organizing through trust in leadership and critical upward communication (H5) was not significant ($b = .03$, $SE = .04$, 95 % CI [−.04,.12]). Thus, the hypothesized serial mediation was not supported by the results of the analysis.

In addition, we found empowering leadership to be associated with trust in leadership ($b = .81$, $p < .001$), supporting the posed hypothesis (H4). Similarly, we found trust in leadership to predict critical upward communication ($b = .38$, $p = .003$), supporting the third hypothesis. Lastly, we did not find the association between critical upward communication and mindful organizing to be significant in our sample ($b = .07$, $p = .43$), which does not support our second hypothesis.

Apart from the aforementioned hypotheses, a positive relationship between empowering leadership and the second mediator of upward communication accounting for a B value of .61 at the $p < .001$ significance level was revealed as a result of the serial mediation analysis.

3.3. Moderated serial mediation analysis

In order to test the last hypothesis (H6), moderated serial mediation was performed. The output of the tested Model 83 in PROCESS Macro (Hayes, 2013) is depicted in Table 3.

As presented in Fig. 2 and backed by Table 3, there is evidence of significant correlation between empowering leadership and trust in leadership as the primary mediator of the model ($b = .77$, $p < .001$). However, no evidence of promotion of participation moderating this link was revealed, resulting in a non-significant negative index of moderated mediation for the indirect effect reported in Table 3.

Thus, bringing the sixth hypothesis (H6) back, which stated that

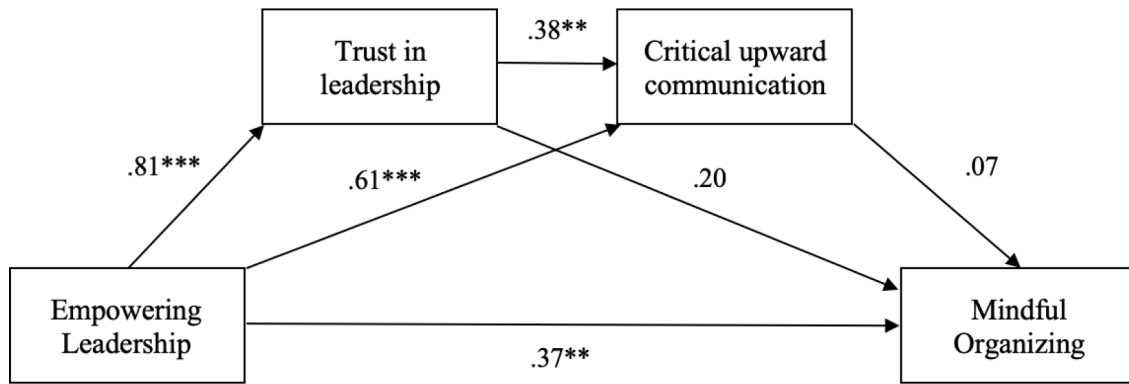


Fig. 1. Serial mediation model showing the direct and indirect paths between variables and unstandardized parameters. Note: **p < .01; ***p < .001.

Table 3
Results of moderated serial mediation analysis.

Mediator 1: Trust in leadership				
Effects	B	SE	p	95 % CI
Empowering leadership	.77	.19	<.001	(.40, 1.14)
Promotion of participation	.79	.23	.001	(.33, 1.26)
Empow. leadership* promotion of participation	-.10	.06	.07	(-.21,.01)
Constant	-.41	.68	.55	(-1.76,.94)
R ² = .74				
$F(3, 69) = 64.751, p < .001$				
Mediator 2: Critical upward communication				
Empowering leadership	.61	.13	<.001	(.35,.87)
Trust in leadership	.38	.12	.003	(.14,.63)
Constant	.04	.35	.91	(-.66,.74)
R ² = .67				
$F(2, 70) = 69.857, p < .001$				
Outcome: Mindful organizing				
Effects	B	SE	p	95 % CI
Trust in leadership	.20	.10	.06	(-.01,.41)
Critical upward communication	.07	.09	.43	(-.11,.26)
Empowering Leadership	.37	.12	.002	(.13,.60)
Index of moderated mediation for the indirect effect of empowering leadership to mindful organizing through mediators 1 & 2	-.003	.005		(-.01,.01)
R ² = .57				
$F(3, 69) = 31.007, p < .001$				

promotion of employee participation would positively moderate the link between empowering leadership and trust while trust and open communication would sequentially mediate the association between empowering leadership and mindful organizing, it becomes evident that the results of the moderated serial mediation analysis do not support it.

4. Discussion

This study tested a model to explore the mechanisms by means of which empowering leadership impacts on mindful organizing. To do that, we tested a serial mediation of the relationship between empowering leadership and mindful organizing through trust in leadership and upward communication. Additionally, we tested a moderated serial mediation model adding promotion of participation as moderator of the relationship between empowering leadership and trust in leadership. The results revealed a statistically significant relationship between empowering leadership and mindful organizing, empowering leadership and trust in leadership, trust in leadership and critical upward communication, and empowering leadership and critical upward communication. By contrast, the serial mediation path and the hypothesized moderated mediation were found non-significant.

Findings of the present study contribute to the existing literature on mindful organizing in five ways. First, over the last few years, the amount of qualitative research on mindful organizing has increased, whereas quantitative research remains scarce. Few researchers have investigated mindful organizing processes in the aviation context given the fact that quantitative studies do not only present valuable advantages such as benchmarking, accumulation of knowledge and

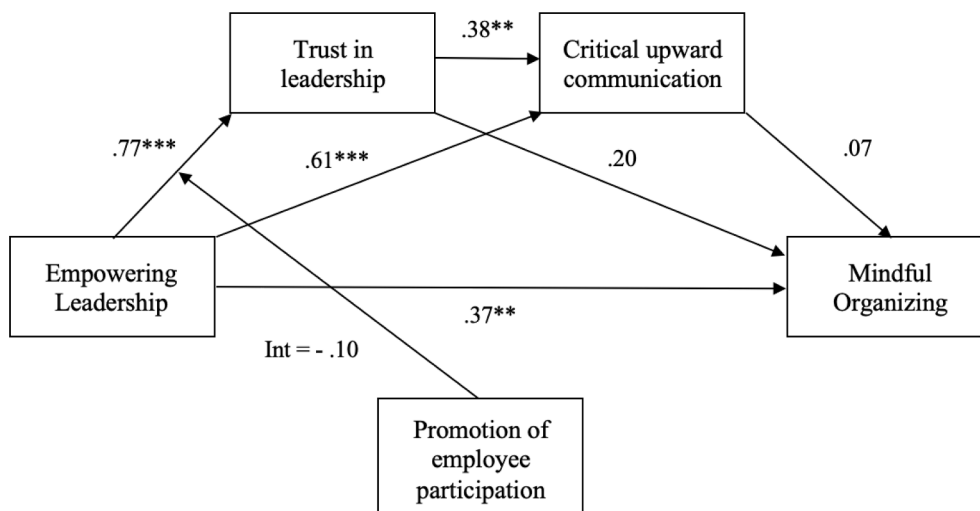


Fig. 2. Moderated serial mediation model showing the moderating role of promotion of employee participation. Note: **p < .01; ***p < .00.

comparison (Mezentseva et al., 2023), but also complements qualitative research and helps to build a stronger case for the implementation of mindful organizing practices. In this respect, the present study extends results by Callari et al. (2019) and suggests that an empowering leadership may help in creating a trust environment to foster clearer and more honest discussions and interactions guided by specific protocols and tools, which eventually elicit (according to Callari et al., 2019) some mindful organizing practices.

Secondly, given that research on mindful organizing has provided a limited understanding of its antecedents (Sutcliffe, 2018), this research presents a deeper insight on the matter. By testing the three possible predictors of mindful organizing, two of which were hypothesized in our model and one demonstrated its statistical significance, current study contributes to the building of a fuller picture of what it takes to create and sustain mindful organizing in high-reliability organizations such as air traffic control. Understanding that antecedents such as empowering leadership are robust across the studies, can inspire future research to focus on examining why this particular factor is influential, and whether its impact is consistent across different settings.

Thirdly, the study provides evidence that supports findings on the relationship between empowering leadership and mindful organizing in a new sector such as air traffic control. Our research adds to the existing literature by confirming the direct link between empowering leadership and mindful organizing found in the nuclear industry (Gracia et al., 2020). This research broadens the scope of this relationship (previously established in nuclear power plants) by exploring its mechanisms of influence. This advancement is important because it suggests that empowering leadership is universally crucial for promoting mindful organizing across diverse high-risk domains.

Fourthly, the study provides relevant insights for empowering leadership research in the safety arena. Our results identify empowering leadership as a key predictor of both trust in leadership and critical upward communication, pivotal elements for the safe functioning of HROs. These findings align with and expand upon previous research, demonstrating the influence of empowering leadership on organizational dynamics. For instance, Martínez-Córcoles et al.'s (2012) study with nuclear power plant workers showed how dialogue promotion and open communication partially mediate the effects of leadership on collaborative learning. Overall, this research contributes to the theoretical basis for integrating these concepts and offers a chance to extend the findings from the air traffic control sector to broader contexts.

Last but not least, some hypothesized associations were found to be non-significant, such as trust in leadership and mindful organizing, as well as upward communication and mindful organizing. These findings are crucial for existing literature as they might point to the criticality of some variables not tested in the current model for mindful organizing to occur. The hypothesis on the predictive power of upward communication over mindful organizing in our sample was based on an earlier study by Renecle et al. (2020a), where perceived safety for upward dissent significantly moderated the relationship between participation climate and mindful organizing. This hints to the necessity of including variables such as perceived safety for upward communication or psychological safety per se, as moderators or mediators, when testing the association between upward critical communication and mindful organizing. This can inspire future research to test new models including the above-mentioned variables. What's regarding the relationship between trust in leadership and mindful organizing, although not hypothesized in the present study, the non-significant result might hint to the necessity of other contextual factors to be in place for the mindful organizing to occur.

In the context of air traffic control, where external factors like seasonality, geopolitical events, and fluctuating oil prices intensify operational pressures, empowering leaders provide controllers with autonomy, encourages diverse perspectives in decision-making, and leverages expertise regardless of hierarchy. These empowering behaviors increase the controllers' ability to anticipate and/or contain unexpected

events (i.e. mindful organizing). Moreover, empowering leadership also plays a pivotal role in fostering key safety practices in this industry. For instance, safety reporting plays a crucial role in accident prevention, as exemplified by Regulation (EU) No 376/2014. This regulation aims to improve aviation safety by ensuring that relevant safety information is reported, collected, stored, protected, exchanged, disseminated and analyzed. To achieve this, the regulation establishes guidelines for maintaining the confidentiality of information, ensuring its appropriate utilization, and enhancing the protection of individuals mentioned in occurrence reports. Despite the existence of regulations and policies promoting a "just culture," operational practices may still exhibit characteristics of a "blame culture." Therefore, it is crucial for social dynamics and interactions to align with established procedures and policies to facilitate their effective implementation. This study highlights the significance of empowering behaviors in encouraging controllers to voice concerns and report critical information by enhancing trust.

The current study's findings also suggest the importance of integrating empowering leadership in broader management practices. For instance, by selecting or promoting controllers to positions of responsibility based on their interpersonal and leadership abilities (not only on their experience or technical skills), or by leadership training programs based on an empowering approach. These insights could guide agencies like the International Federation of Air Traffic Controllers' Associations (IFATCA) or the Air Traffic Control Association (ATCA) in developing sector-specific management practices. Furthermore, the rising air traffic volumes, as forecasted, underscore the importance of such leadership approaches in maintaining safety and efficiency in increasingly busy airspaces. This study's implications for safety management stress the need for proactive strategies in identifying and addressing potential risks, thereby contributing to the overall safety and reliability of air traffic operations in challenging contexts. Incorporating the forecasted increase in air traffic, the practical implications of our research become even more pertinent. Airbus' Global Market Forecast predicts a 3.6 % annual growth in passenger traffic until 2042 (Airbus, 2023), and IATA projects overall traveler numbers to surpass pre-COVID-19 levels by 2024 (International Air Transport Association, 2022). This expected surge in air traffic volumes emphasizes the necessity of mindful organizing in air traffic control operations. Empowering leadership, trust in leadership, effective communication, and employee participation are crucial for maintaining safety and efficiency in increasingly busy airspaces. Our study provides essential insights and tools for professionals and agencies in the air traffic control sector to adapt to these changes and ensure reliable operations.

Nevertheless, although much can be learned from the results of the present study, there are a number of limitations to this work. First, all scales are self-report measures which might have influenced the truthfulness of the reported scores since safety is reinforced as a crucial practice in air traffic control on a day-to-day basis. g. Furthermore, while efforts were made to address potential common method bias through statistical techniques such as CFAs, the possibility of residual bias cannot be entirely ruled out, which may have impacted the observed relationships between variables. Future research could use objective measures or observational data sources, such as performance metrics or supervisor ratings, to mitigate potential biases associated with self-report measures and enhance the validity of findings. Second, a small sample size, characteristic to the population of air traffic controllers in general, might have decreased the statistical power of the analyses and impacted the outputs obtained (Rosnow & Rosenthal, 2013). Thus, further studies on the link between empowering leadership and mindful organizing can benefit significantly by enlarging their sample size; testing the model while incorporating related constructs like psychological safety and perceived safety for upward communication; and introducing a multi-level approach (e.g., looking at the interactions between every dimension of the dependent and independent variable). More newly construed variables like promotion of

participation can be looked at in depth, as overlapping of items with other concepts like participation climate or participative decision-making is not uncommon. This can cause further issues with construct validity and the theoretical differentiation between the constructs.

CRedit authorship contribution statement

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

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.

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