Article

Upward Voice: Participative Decision Making, Trust in Leadership and Safety Climate Matter

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Abstract: A supportive upward voice environment is critical in nuclear power plants in order to provide energy in a sustainable manner. In high–reliability organizations, front–line employees' suggestions and concerns enable the early identification of potential problems that might have catastrophic consequences (e.g., a nuclear accident). Despite this, previous research has mostly focused on person–centered antecedents of upward voice and, to a lesser extent, the influence of the supervisor–subordinate relationship, while neglecting the importance of the organizational context. This study responds to the aforementioned research lacuna. It examined the relationship between participative decision making and upward voice, and the mediating role of trust in leadership in this relationship. Moreover, it further extends previous research by examining the role of safety climate, which is expected to moderate both the direct and the indirect effect of participative decision making on upward voice. The sample was composed of 495 workers from two nuclear power plants from the same organization. Findings supported the hypothesized moderated mediation model: the indirect effect of participative decision making (PDM) on upward voice via trust in leadership was contingent upon the level of the safety climate. The indirect effect became weaker as the safety climate increased. These findings support the relevance of the organizational context.

1. Introduction

Given the ubiquity of complex systems (e.g., aircraft companies as well as chemical, petrochemical or nuclear power plants), and the risks associated with them, maintaining safety and reliability has become a challenge for sustainable development. A migration of those complex systems to an unsafe zone would compromise environmental protection, economic growth and social welfare. An accident may cause enormous human, environmental and economic costs [1].

With respect to the nuclear industry, high safety standards have also become a necessary prerequisite to make a continuing contribution to sustainable development goals that support a carbon–constrained future [2]. Reducing the emissions of greenhouse gases that cause global warming and climate change is one of the major challenges of the 21st century; at the same time, electricity consumption worldwide is expected to grow by 45% by 2040 [3]. In this context, a recent interdisciplinary study of the Massachusetts Institute of Technology [3] analyzing the future prospects of nuclear energy concludes that "as of today and for decades to come, the main value of nuclear energy lies in its potential contribution to decarbonizing the power sector" (p. xvii) which is fundamental for mitigating climate change [4]. Along these lines, the OECD Nuclear Energy Agency [2] also acknowledges that

nuclear energy plays a relevant role alongside renewable technologies in the transition to a low-carbon energy future that matches the increasing global electricity demand over the coming decades.

However, only high safety standards can assure there is a positive nuclear energy contribution towards decarbonizing the power sector in a sustainable manner [5]. Despite accidents being rare in the nuclear industry, the accident at the Fukushima Daiichi nuclear power plant in 2011 showed that safety can never be taken for granted [1,6]. A proactive approach to safety that takes into account employees' contribution to safety and adopts a systemic approach is needed to provide energy in a sustainable manner.

Framed like this, upward voice becomes critical. Front–line employees' judgments, worries, suggestions or concerns might ease the early identification of problems before they cascade into an accident. Additionally, upward voice emphasizes employees' contribution to safety rather than human error [7] or unsafe behaviors [8,9].

Thus, this study attempts to shed light into how to build a supportive upward voice environment. Along these lines, several authors [10] claim that a systemic approach to safety which takes into account the organizational context [11] rather than only factors at the sharp end of system operation such as human errors or unsafe behaviors is necessary. Previous research on upward voice (see [12] for a literature review) has mostly focused on person–centered antecedents of employees' voice (e.g., emotions, personal dispositions, personality, and employees' attitudes) (e.g., [13]) or, in some cases, other factors such as leadership (e.g., [14–16]). Only a small number of studies have broadened their scope by incorporating the influence of the organizational context and they have mostly focused on facet–specific climates such as voice climate [17], procedural justice climate [18] or participative climate [19].

This study addresses how to build a supportive upward voice environment, which means taking into account both the supervisor–subordinate relationship and the organizational context in which this relationship takes place all together. Previous research adopting such a comprehensive approach is scarce [18]. This study postulates that nuclear safety climate will moderate both the direct effect of participative decision making (PDM) on upward voice and its indirect effect via trust in leadership (See Figure 1). Based on safety climate theory (e.g., [20,21]), this study advocates that safety climate provides an interpretation framework about valued and adaptive behaviors that influence the development of a supportive upward voice environment. To our knowledge, none of these relationships have been previously explored.
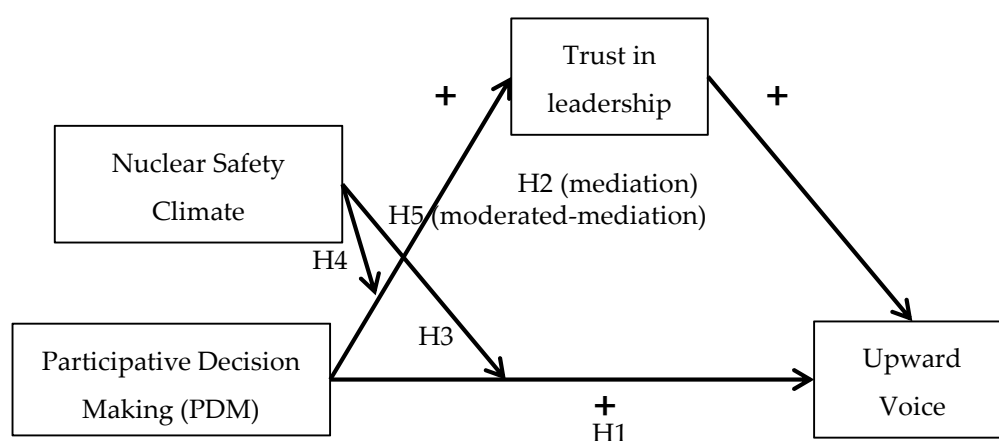

Figure 1. The proposed conceptual model.

1.1. The Positive Influence of Participative Decision Making on Upward Voice

Participative decision making (PDM) refers to leaders' encouragement and use of team members' input when making decisions [22]. Thus, PDM might encourage upward voice defined as a discretionary and informal form of upward communication that assess to what extent employees "voluntarily

communicate suggestions, concerns, information about problems, or work–related opinions to someone in a higher organizational position" [23] (p. 173).

In particular, this study focuses on PDM encouraged by immediate supervisors and informal upward voice targeted to immediate supervisors for several reasons. The normal chain–of–command structures provide for many interaction opportunities between employees and immediate supervisors [24]. Additionally, they have many chances for informal face–to–face interactions [25]. Thus, employees can engage in informal rather than formal voice on a regular basis. Finally, informal upward voice is a relevant outcome which has increasingly captured researchers' attention over the last years [23,26].

Several theoretical frameworks suggest that PDM will stimulate upward voice. First, Organizational Role Theory (ORT) [27,28] suggests that when supervisors actively seek subordinates' input through PDM, employees will then consider upward voice as an expected role behavior that allows the ones who occupy a given position to perform their duties effectively.

Second, the Group–Value Model [29] and Maslow [30] theory of human motivation suggest that PDM might elicit positive responses from employees. In particular, the Group–Value Model [29] suggests that people value membership within a group, and the way they are treated helps them to evaluate their group status. PDM can indicate how immediate supervisors value and respect employees' voices [31] and inform employees that they are valued group members.

Following Maslow theory of human motivation [30], PDM satisfies higher order needs, which emerge when the physiological and the safety ones (e.g., security, stability, protection, etc.) are satisfied. PDM fulfills the need for belonging and love by providing the feeling of belonging to a group that provides contact and affection, and prevents the development of feelings of alienation. PDM would also satisfy self–esteem needs showing recognition, attention, or appreciation; and the self–actualization needs providing opportunities for self–fulfillment. Consistently, several studies have acknowledged that PDM may satisfy personnel growth [32,33], support job enrichment and the need for self–expression [34,35] and enables subordinates to be fully aware of their role within their organization and its meaningfulness [33].

Finally, according to Social Exchange Theory [36], PDM can provide the basis for a social exchange that goes beyond the standard economic contract. Social exchanges arise when managers take care of their employees so that they feel an obligation to reciprocate this support. Social exchanges (vs. economic ones) entail unspecified obligations and engender feelings of gratitude and trust [37]. When managers and supervisors seek subordinates' input through PDM, they manifest their interest in cultivating a social exchange. PDM would fulfill employees' higher order needs and show respect and recognition for employees as valued members within their group. Thus, it can provide the basis for a social rather than an economic exchange and employees might feel grateful and reciprocate through engagement in upward voice.

Regarding empirical evidence, and to our knowledge, only two studies have explored the relationship between PDM and upward voice; the results of these studies are inconclusive. Tangirala and Ramanujam [38] found a positive relationship between managers' consultation and upward voice using a sample of nurses. These authors highlight that managers' consultation is a form of PDM which refers to the extent to which the manager solicits and listens to employees' suggestions or concerns on work issues [39].

However, unexpectedly, another study [40], with a sample of 500 travel agents from Egypt, found that PDM did not influence employees' upward voice, but that it did stimulate employees' voice with their colleagues. These authors [40] argued that unexpected results might be due to employees' fear of speaking up to their leaders despite the fact that they encourage PDM. Another potential explanation for these results could be that the authors failed to take into account the organizational context in which the supervisors–employees relationship is situated. Our model overcomes this limitation by incorporating the moderating role of the nuclear safety climate, which is a prominent feature of the organizational context in nuclear power plants.

Another contextual factor that may account for the inconclusive findings is the type of organization: while the second study [40] was based on a sample of travel agents, the first one used nurses [38]. It is likely that upward voice is not equally relevant in travel agencies than in high–reliability organizations (HROs) such as hospitals where safety is crucial. Upward voice is critical among nurses because they occupy a unique position to observe early signs of problems [38]. Our study is carried out in several nuclear power plants where upward voice is critical [41–43], as it is in hospitals.

To sum up, several theoretical arguments support the relationship between PDM and upward voice. However, empirical evidence of this relationship is scarce and inconclusive. This study attempts to fill this research gap.

Hypothesis 1. *PDM is positively related to upward voice.*

1.2. The Mediating Role of Trust in Leadership

Moreover, this study attempts to shed light into the mechanisms underlying the relationship between PDM and upward voice. Trust might mediate this association because it is a key social process in social exchanges [44,45].

Trust refers to "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another" [46] (p. 395). It involves the risk that the other party may not fulfill those expectations [47]. This study has focused on trust in organizational leadership, including both direct leaders and executive management as a target of trust. Indeed, direct leaders implement practices, policies and procedures that have been developed or encouraged by executive management; thus, PDM might cultivate trust at both of these levels. Consistently, a meta–analysis found that PDM predicts trust in both direct leaders and in executive management [48].

Several arguments support the mediating role of trust in leadership in the relationship between PDM and upward voice. First, theoretical and empirical studies support the positive influence of PDM on trust in leadership. The use of PDM would enhance trust in leadership because it provides clues on benevolence, goodwill and positive intentions [49]. PDM denotes that the immediate supervisor is trustworthy and he/she wants to provide support for their employees. Moreover, PDM demonstrates concern and interest for employees' wellbeing, as well as confidence in and respect for them [44,48,50]. PDM enables employees to voice their opinions and concerns, making them feel valued and appreciated [50]. Finally, PDM implies sharing power and responsibility [51,52] over decisions that affect employees [47]. Consistently, a meta–analysis [48] and other studies [34,53] have shown that PDM increases trust in leadership.

Second, trust in leadership might facilitate upward voice. Trust allows employees to feel free to speak up honestly despite upward voice being inherently challenging [24] and the fact that it makes employees feel vulnerable [54]. It is common that employees feel afraid because upward voice might have negative consequences for the self (e.g., retaliation, punishment, etc.) or for one's relationship with superiors [23,34]. This is especially true when a hierarchical authority based relationship exists [24]. Trust in leadership enables employees to accept those risks based upon positive expectations of the behavior or intentions of their leaders. Consistently, a recent meta–analysis [12] has shown that trust in leadership is positively associated with employees' voice.

Finally, several theoretical arguments support the positive indirect effect of PDM on upward voice through trust in leadership. PDM denotes a willingness to enter into social exchange relationships [55] that operate on the basis of trust and reciprocity [48] and go beyond the standard economic contract. Hence, it might cultivate trust in leadership that, in turn, would lead employees to perform beyond their formal role obligations and engage in voice behaviors [56,57]. In addition, PDM engenders regular direct informal interaction with subordinates [24,51], which can lead to the development of trust and provides higher opportunities to speak up more often and openly with superiors [24,50].

Seemingly, previous research has shown that trust mediates the relationship between different forms of supportive leadership that engender high–quality exchange relationships and performance. Trust has arisen as a mediating variable in the relationship between participative [55,58], transformational [45,56,59,60] and shared leadership [52], and performance.

Despite several theoretical arguments and some empirical evidence supporting the mediating role of trust in leadership, to our knowledge, this relationship has not been previously tested. Thus, the following hypothesis was formulated:

Hypothesis 2. *Trust in leadership mediates the relationship between PDM and upward voice.*

1.3. The Moderating Role of Nuclear Safety Climate

Moreover, our theoretical model postulates that the nuclear safety climate moderates both the direct effect of PDM on upward voice and its indirect effect by affecting employees' trust in leadership. The strength of these relationships will depend on the nuclear safety climate.

The safety climate refers to policies, practices and procedures related to safety [21]; and their interrelationship with those related to other competing goals (e.g., productivity) that establish the relative priority of safety [61]. Safety climate has been conceptualized at the psychological and the group levels (team, unit or organization). Group–level safety climate denotes shared perceptions on safety policies, practices and procedures among group members. This study addresses psychological safety climate, that is, individuals' perceptions [62–65] of those policies, practices and procedures. We have focused on nuclear safety climate, which refers to radiation risks rather than generic safety climate following other studies [21] recommendations that acknowledge the need to take into account industry–specific targets of safety climate perceptions. Nuclear safety is crucial in nuclear power plants and refers to "the achievement of proper operating conditions, prevention of accidents and mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation risks" [66] (p.132).

The nuclear safety climate might moderate the relationship between PDM and upward voice. Indeed, the leader–subordinate relationship does not occur in a vacuum [67], and the context in which voice takes place is also crucial [17,34]. In nuclear power plants, nuclear safety climate is a relevant feature of the work environment and, as a result, it is also a potential moderating factor.

Several arguments suggest that when the safety climate is high, the positive effects of PDM on upward voice will be attenuated. First, a high nuclear safety climate would set high expectations on upward voice in such a way that the potential positive effects of PDM on upward voice would be mitigated. Notice that the nuclear safety climate provides an interpretation framework, guidance and cues about valued and adaptive behaviors [20,21]. The nuclear safety climate probably sets high expectations for upward voice because, in nuclear power plants where complex systems require continuous monitoring, any failure (e.g., involving people, equipment or procedures) can cascade very quickly into greater problems in unpredictable ways [68]. Therefore, it is important to note any small discrepancy or sign of degradation in the early stages [69,70], and communicate them to leaders who should be aware of any potential degradation of safety [71]. Along these lines, several international organisms [41,42] establish that the nuclear safety climate should set high expectations on upward voice; they highlight that front–line employees should identify early signs of potential safety problems.

Second, when the nuclear safety climate is high, then the effect of PDM would become less salient. Nuclear safety climate provides a more general framework than PDM does to judge whether upward voice is rewarded and can be provided without fear of reprisal. This is important because upward voice is usually accompanied by uncertainty about its potential risks and benefits (e.g., difficulties, disagreements or general concerns about superiors' reactions). Thus, individuals seek social cues in their immediate environment suggesting whether one can engage in upward voice without negative consequences for the self or for their relationships with superiors [17].

Finally, a safety climate can substitute for the positive effect of PDM because it signals to employees that their organization cares about them and attempts to keep them safe from harm. Thus, it cultivates social exchange relationships that prompt employees to reciprocate in a manner consistent with valued behaviors in the work environment [67]. Specifically, employees will reciprocate by engaging in upward voice, which is a valued and desired behavior in nuclear power plants with a positive safety climate.

Based on these arguments, our theoretical model advocates that the influence of PDM on upward voice would be weaker when the nuclear safety climate is high. Thus, hypothesis 3 reads as follows:

Hypothesis 3. *A nuclear safety climate moderates the relationship between PDM and upward voice such that the relationship is weaker when nuclear safety is high rather than low.*

A nuclear safety climate might also moderate the relationship between PDM and trust in leadership mitigating the influence of PDM. In the nuclear industry, where safety is of paramount importance, a nuclear safety climate would provide a more general framework than PDM does to help judge leaders' trustworthiness. Along these lines, when PDM is low, a nuclear safety climate would substitute for the positive effects of PDM on upward voice.

Consistently, several authors [50] argued that when an organizational climate is supportive, leaders will reciprocally receive trust and respect because they are likely to be perceived as the initiators of those policies. A safety climate might be considered to be highly supportive because it signals to employees that their organization takes care of them. Notice that a safety climate refers to policies, practices, and procedures related to safety [21] that provide assurance of proper operating conditions, prevent accidents and protect employees from any kind of risk and damage to their health. Consistently, previous literature suggests that safety climate facilitates trust in leadership [72–74] because it manifests benevolence and concern for employees' health and safety [73], and demonstrates that the organization can be trusted [72]. Based on the above–mentioned arguments, the following hypothesis was formulated:

Hypothesis 4. *A nuclear safety climate moderates the relationship between PDM and trust in leadership such that the relationship is weaker when a safety climate is high rather than low.*

In summary, as reasoned above, a work environment in which the process of upward voice takes place is crucial and a nuclear safety climate provides valuable contextual information in nuclear power plants. If a nuclear safety climate moderates the relationship between PDM and trust in leadership, then it follows that the indirect effect of PDM on upward voice (through trust in leadership) will be contingent on the nuclear safety climate. The current work attempts to integrate this boundary condition into the postulated mediating model.

The current work theorizes that the positive influence of PDM on upward voice through trust in leadership will be weaker when the nuclear safety climate is high. Yet, the positive indirect effect of PDM on upward voice will be stronger when the nuclear safety climate is low because under these circumstances, PDM becomes more salient. That is to say when the nuclear safety climate is low, then PDM arises as the main signal to judge leaders' trustworthiness and, in turn, indicates whether it is worthwhile to reciprocate by engaging in upward voice.

Hypothesis 5. *A nuclear safety climate moderates the positive indirect effect of PDM on upward voice through trust in leadership. Specifically, among employees who report a high nuclear safety climate, the indirect effect of PDM on upward voice via trust in leadership is weaker.*

2. Materials and Methods

2.1. Procedure and Sample

The sample consisted of 495 workers from two nuclear power plants from the same organization. All responsibility levels and functional areas in the nuclear facility were surveyed and the response rate was 65.1%. Most participants (78.9%) were older than 45 years, 17.6% were between 30 and 45 years of age, and 3.5% were less than 30 years old. Moreover, nearly half of the participants (47.3%) were university graduates.

Questionnaires were collected by means of group sessions during the employees' working time. Participation was voluntary and, in every group session, researchers explained the purpose of the project and assured anonymity and confidentiality. Additionally, researchers were available during the sessions to respond to any doubt or concern.

2.2. Measures

Participative Decision Making was assessed using three items adapted from Participative Decision Making subscale of "Empowering Leadership Questionnaire (ELQ)" [22]. This questionnaire has been widely used in previous literature (e.g., [58,75,76]), showing support for its five–factor model [75,76]. This study has focused on Participative Decision Making subscale following [58]. Participants were asked to assess the frequency in which their immediate supervisor shows behaviors such as: "encourages workgroup members to express ideas/suggestions", "listens to my work group's ideas and suggestions" and "uses my work group's suggestions to make decisions that affect us". A 5–point Likert response scale, with a range between 1 (Never or almost never) and 5 (Always or almost always), was used.

Trust in leadership was measured using two items developed by our research team based on previous research [48,50]. The scale items were "I trust my immediate supervisor" and "I trust the management team". The response scale ranged from "Completely disagree" (1) to "Completely agree" (5).

Upward voice was assessed using a three–item measure developed by our research team based on previous literature [25,54]. It assesses to what extent employees feel free to communicate to their superiors their concerns or any challenging information as an attempt to provide relevant insights. The items read as follows: "I can tell my supervisor when things are not going well", "I can freely express any disagreements I have with my boss" and "I feel free to talk to my boss about any problems and difficulties I have in my job without any fear at all". Responses scale ranged from 1 (Completely disagree) to 5 (Completely agree).

Nuclear safety climate was assessed using fifteen items from the Group Nuclear Safety Climate questionnaire [77]. This questionnaire has been validated and it is an adapted version of the "Group Safety Climate (ZGSC)" scale [78] and it refers to nuclear safety rather than general safety. The questionnaire includes the following heading "Below we present a series of statements about NUCLEAR SAFETY. Please indicate to what extent you agree with each of them with regard to your WORK UNIT". This questionnaire has been previously used in other studies (e.g., [79]), displaying good reliability and validity results. Some sample items were "There is a frequent check on whether the safety norms and procedures are being followed", "We make sure we have everything we need to do the job in a safe way", "The safety parameters are emphasized when we are working under pressure" and "The inherent risks in our work are often referred to". A 5–point Likert scale ranging from 1 "Strongly disagree" to 5 "Completely agree" was used.

2.3. Data Analyses

In order to test the hypotheses, first, a simple mediation (Hypotheses 1 and 2) and a simple moderation model (Hypothesis 3 and 4) were examined. Second, we examined the overall proposed

model that incorporates the moderated mediation hypothesis (Hypothesis 5). We used PROCESS macro for SPSS [80] to perform these analyses.

3. Results

Descriptive statistics, bivariate correlations and Cronbach's alphas for all the variables are presented in Table 1. PDM was positively and significantly correlated with trust in leadership ($r = 0.67$; $p < 0.01$). Trust in leadership also displayed a positive and statistically significant relationship with upward voice ($r = 0.58$; $p < 0.01$).

Table 1. Descriptive statistics, alpha coefficients and correlations.

Variable	M	SD	1	2	3	4
1. Participative decision making (PDM)	3.73	1.02	(0.93)			
2. Nuclear safety climate	4	0.71	0.52 **	(0.95)		
3. Trust in leadership	4.01	0.88	0.67 **	0.55 **	(0.72)	
4. Upward Voice	4	0.94	0.59 **	0.53 **	0.58 **	(0.93)

Note: ** $p < 0.01$. Reliabilities (coefficient alpha) are given in parentheses.

As hypothesized (Hypothesis 1), the direct effect of PDM on upward voice was significantly different from zero ($c' = 0.34$). In regards to Hypothesis 2, PDM was positively associated with trust in leadership ($a = 0.59$), and trust in leadership was positively related with upward voice when controlling for PDM ($b = 0.35$) (See Table 2). These relationships were statistically significant. A bias–corrected bootstrap confidence interval for the indirect effect ($ab = 0.21$) based on 5000 bootstrap samples was entirely above zero (95% confidence interval = 0.14–0.28). To sum up, our findings supported Hypothesis 2.

Table 2. Regression results for the mediation model.

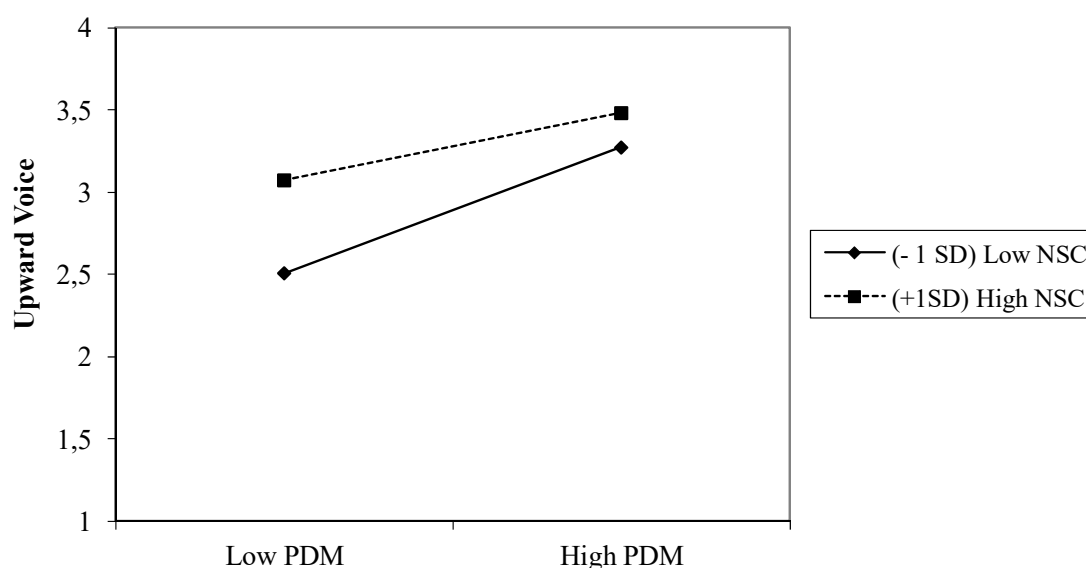| Predictor	Trust in Leadership			Upward Voice		
	β	SE	p	β	SE	p
Constant	1.83	0.11	<0.001	1.31	0.16	<0.001
PDM	0.59	0.03	<0.001	0.34	0.04	<0.001
Trust in leadership	–	–	–	0.35	0.05	<0.001
	$R^2 = 0.456$			$R^2 = 0.408$		
	$F_{(1,492)} = 412.324$, $p < 0.001$			$F_{(2,491)} = 169.250$, $p < 0.001$		

In agreement with Hypothesis 3, the cross–product term PDMxNuclear safety climate was related to upward voice ($B = -0.12$, $t = -3.241$, $p = 0.001$) (See Table 3). Moreover, the increase in explained variance when the interaction term was introduced in the model was statistically significant (R–square–change = 0.012, $F_{(1,484)} = 10.51$, $p = 0.001$). Trust in leadership was introduced as control variable and displayed a positive and statistically significant relationship with upward voice ($B = 0.24$, $t = 4.663$, $p < 0.001$).

Table 3. Regression results for the conditional process model.

Predictor	Trust in Leadership			Upward Voice		
	β	*SE*	*p*	β	*SE*	*p*
Constant	4.05	0.03	<0.001	3.08	0.21	<0.001
PDM	0.45	0.03	<0.001	0.29	0.04	<0.001
Trust in leadership	—	—	—	0.24	0.05	<0.001
Nuclear safety climate (NSC)	0.29	0.05	<0.001	0.27	0.06	<0.001
PDM × NSC	−0.11	0.03	0.001	−0.12	0.04	0.001
	$R^2 = 0.517$			$R^2 = 0.464$		
	$F_{(3, 485)} = 173.317, p < 0.001$			$F_{(4, 484)} = 104.604, p < 0.001$		

Nuclear safety climate (NSC)	Conditional indirect effect at range of values of NSC	95% Bias-Corrected Bootstrap CI
−1SD (0.711)	0.13	0.07–0.19
M (0)	0.11	0.06–0.17
+1SD (0.711)	0.09	0.05–0.15

In particular, the conditional effect of PDM on upward voice at low (−1 SD: one standard deviation below the mean) ($\Theta_{(X \rightarrow Y)|M=-1SD} = 0.38$, $p < 0.001$, 95% confidence interval = 0.28–0.48), moderate ($\Theta_{(X \rightarrow Y)|M=MEAN} = 0.29$, $p < 0.001$, 95% confidence interval = 0.20–0.37), and high levels of nuclear safety climate (+1 SD: one standard deviation above the mean) ($\Theta_{(X \rightarrow Y)|M=+1SD} = 0.20$, $p < 0.001$, 95% confidence interval = 0.100–0.301) was positive and statistically significant. However, the conditional effect was greater at low rather than high levels of nuclear safety climate. All the confidence intervals were above zero. There were no statistical significance transition points within the observed range of the moderator found using the Johnson–Neyman method.

The graphical representation of the interaction effects showed that the relationship between PDM and upward voice was stronger when nuclear safety climate was low rather than high (See Figure 2). Moreover, those that reported low PDM and low nuclear safety climate showed the lowest levels of upward voice. In summary, our findings supported Hypothesis 3.

Figure 2. Plot of interaction between participative decision making (PDM) and nuclear safety climate (NSC) in predicting upward voice.

As predicted in Hypothesis 4, the interaction term PDMxNuclear safety climate predicted trust in leadership ($B = -0.11$, t = −3.23, $p = 0.001$) (See Table 3), and it increased the explained variance

when it was introduced in the model (R–square–change = 0.01, F (1,485) = 10.458, *p* = 0.001). Moreover, the conditional effect of PDM on trust in leadership at low (–1 SD) ($\Theta_{(X\to Y)|M=-1SD}$) = 0.53, *p* < 0.001, 95% confidence interval = 0.46–0.61), moderate ($\Theta_{(X\to Y)|M=MEAN}$) = 0.45, *p* < 0.001, 95% confidence interval = 0.39–0.52), and high levels of nuclear safety climate (+1 SD) ($\Theta_{(X\to Y)|M=+1SD}$) = 0.38, *p* < 0.001, 95% confidence interval = 0.30–0.46) was positive and statistically significant. All the confidence intervals were above zero. It is noteworthy that the conditional effect of PDM on trust in leadership is greater when nuclear safety climate is low rather than high. There were no statistical significance transition points within the observed range of the moderator found using the Johnson–Neyman method.

The plot of the interaction between PDM and nuclear safety climate (Figure 3) showed that the association between PDM and trust in leadership is stronger when nuclear safety climate is low rather than high. In addition, trust in leadership was lowest when both PDM and nuclear safety climate were low. Therefore, our findings supported Hypothesis 4 and suggest that it is plausible that the strength of the hypothesized indirect effect (Hypothesis 2) is conditional on the value of the moderator, or what has been termed conditional indirect effects (Hypothesis 5: moderated mediation).
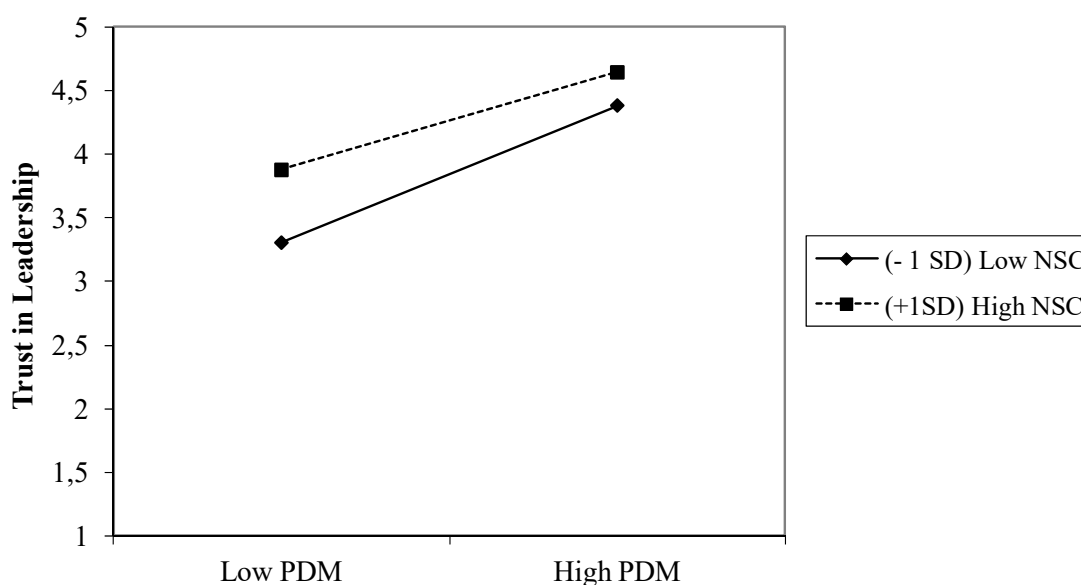

Figure 3. Plot of interaction between participative decision making (PDM) and nuclear safety climate (NSC) in predicting trust in leadership.

Finally, in order to examine Hypothesis 5 (See Figure 4), the conditional indirect effect of PDM on upward voice (through trust in leadership) was assessed at three values of nuclear safety climate: the mean, and one standard deviation below and above the mean. Results indicated that the conditional indirect effect of PDM on upward voice was consistently positive and became stronger as the nuclear safety climate decreased (see the lower half of Table 3). The conditional indirect effect was statistically different from zero at low, moderate and high nuclear safety climate levels based on a 95% bootstrap confidence interval. Moreover, the index of moderated mediation that tests the difference between conditional indirect effects was significantly different from zero with an estimate of –0.03 (boot SE = 0.01; 95% confidence interval = −0.05 to −0.01). This result indicates that overall the conditional indirect effects estimated at multiple levels of nuclear safety climate were significantly different from each other. Thus, Hypothesis 5 was supported, such that the indirect and positive effect of PDM on upward voice through trust in leadership was observed when levels of nuclear safety climate were low to high. However, the conditional indirect effect became weaker as the nuclear safety climate increased.
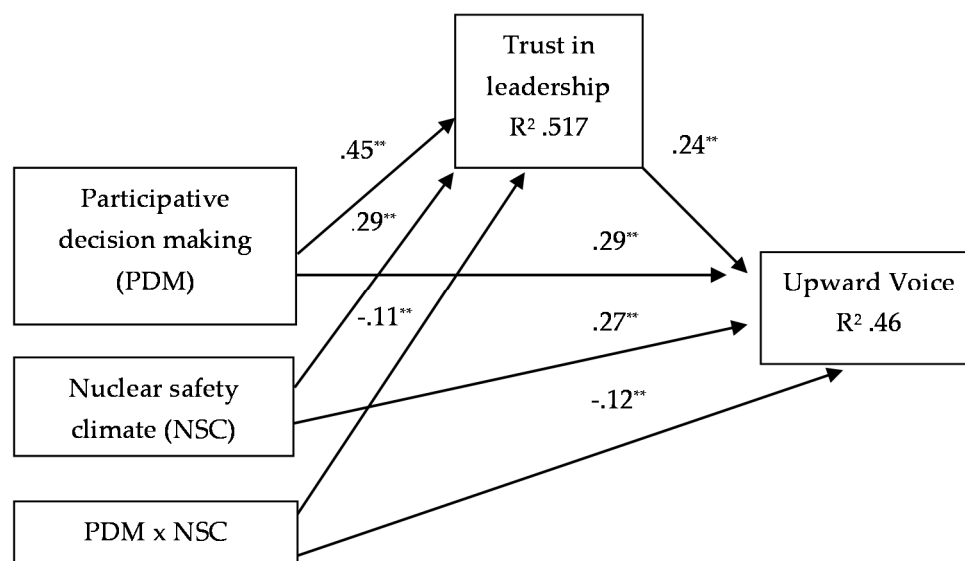
Figure 4. Moderated mediation model.

4. Discussion

This study developed and tested a model that examined why and when PDM would encourage upward voice. As expected, results showed that PDM influences upward voice both directly and indirectly through trust in leadership. Additionally, nuclear safety climate attenuated the positive influence of PDM on upward voice, which was weaker for employees that reported high rather than low nuclear safety climate. Those employees that reported a low nuclear safety climate and low PDM displayed the lowest levels of upward voice. Seemingly, the nuclear safety climate also moderated the relationship between PDM and trust in leadership, which was also weaker when the nuclear safety climate was high. Finally, the magnitude of the indirect effect of PDM on upward voice via trust in leadership was contingent upon the level of nuclear safety climate: the indirect effect became weaker as nuclear safety climate increased. In conclusion, we obtained support for our model.

4.1. Theoretical Implications

Our theoretical model provides insight into how to build a supportive upward voice environment by means of examining the antecedents, mechanisms and boundary conditions that explain upward voice. To date, research on the influence of PDM on upward voice has been almost nonexistent and inconclusive [38,40]. This study showed that PDM elicits upward voice and suggests that several theoretical frameworks (Organizational Role Theory, Maslow theory of human motivation, the Group Value model, and the Social Exchange Theory) can explain this positive association.

Moreover, this study extends previous research suggesting that trust in leadership enables employees to accept those risks associated with upward voice (e.g., negative consequences for one's relationship with superiors) (e.g., [34]). Standing on the social exchange theory [36], our theoretical model advocates that PDM would engender social exchange relationships which would cultivate trust in leadership and, in turn, encourage employees to perform beyond their formal role obligations. Consistently, previous research have shown that trust mediates the relationship between supporting leadership styles (e.g., participative, transformational or shared leadership), that cultivate social exchange relationships, and performance (e.g., [45,55]). Our study extends previous research showing that trust in leadership partially mediates the relationship between PDM and upward voice.

Additionally, the current study moves away from a person–centered approach to develop a more comprehensive interactionist model that takes into account both the nature of the relationship between leaders and employees, and the organizational context in which voice takes place. Only [18] has

previously adopted this approach, but she focuses on the moderating role of procedural justice climate in the relationship between leader–member exchange relationship and voice.

Furthermore, our theoretical model stands on Social Exchange Theory [36] and safety climate literature to provide theoretical arguments that might explain the postulated moderated mediation model. Nuclear safety climate would provide an interpretation framework that allows assessing upward voice as a valued and rewarded behavior and to judge leaders as trustworthy. Nuclear safety climate would cultivate social exchange relationships so that high levels of nuclear safety climate would substitute for the positive effects of PDM, the influence of which would be weaker under these circumstances.

This model also attempts to be insightful for system safety approach developments (e.g., [70,71]) which acknowledge that front–line employees' suggestions, ideas, worries, and concerns are crucial to prevent safety degradation in HROs. Paradoxically, they do not incorporate voice literature (e.g., [23,24,34,81]) in their theoretical developments. Indeed, only a few studies have addressed voice behavior in HROs and they have been primarily conducted in the healthcare sector (e.g., [12,16,82]).

Finally, this study suggests that when a facet–specific climate is salient in a given context (e.g., nuclear safety climate in nuclear power plants), its influence is not limited to the specific outcome referent associated with it (e.g., nuclear safety). The nuclear safety climate has a broader influence on the workplace and it favors other outcomes that are also relevant in high–reliability organizations such as upward voice.

4.2. Practical Implications

Our theoretical model has relevant practical implications for nuclear power plants, which are required to provide energy in a sustainable manner. The accident at the Fukushima Daiichi nuclear power plant in 2011 has proved the need to cultivate supportive upward voice environments in an industry where accidents are rare, but the consequences of accidents could be catastrophic causing enormous human, environmental and economic costs [6]. For instance, the IAEA [6] pointed out that overconfidence on the robustness of the technology contributed to Fukushima accident. A supportive upward voice environment would contribute to challenge such assumptions and enables managers to be aware of safety challenges. Research in this field is valuable because it provides assurance for safer operations, which is a prerequisite to support nuclear power's contribution to a carbon–constrained future.

Moreover, our results contribute to the development of policies and practices that promote upward voice because it provides a bigger picture of its antecedents, the mechanisms that cultivate it and its boundary conditions. This is especially relevant in HROs such as nuclear power plants [41,42]. Upward voice provides the basis for a proactive approach to safety. It allows leaders and key decision makers to be aware of any potential migration of the system outside the boundaries of safe performance in its early stages [71]. Upward voice also facilitates the detection of any early sign of safety degradation that may trigger a near–incident or an accident that could have catastrophic consequences and compromise nuclear energy sustainability. Our theoretical model is not only useful for programs that stimulate voice in HROs (e.g., Nuclear Power Plant Personnel – Employee Concerns Program developed by [83]); it is also insightful for other organizational initiatives that rest on suggestions and concerns provided by front–line employees.

In particular, our findings showed that promoting PDM benefits engagement in upward voice. PDM increases voice directly but also does so by increasing trust in leadership. However, our findings suggest that the policies and practices that attempt to promote upward voice should not only rest on leaders' behaviors because the organizational context also plays a relevant role. For instance, when direct supervisors do not encourage PDM, a nuclear safety climate may substitute for its positive effects.

4.3. Potential Limitations and Future Research Directions

This is a cross–sectional study, which means that causal relationships cannot be assumed. The relationship between PDM and upward voice might be reciprocal: upward voice might provide valuable insights to supervisors, which may then lead to supervisors to further encourage PDM. Despite this, previous research supports the idea of a positive influence of PDM on upward voice [15,84].

Moreover, one may argue that this study is based on self–reported measures, which may lead to common method bias. However, several authors [85] claim that relationships between self–reported measures are not necessarily upwardly biased. This is an extended misconception.

In addition, note that self–reported measures are appropriate for measuring the variables included in this study. Safety climate has traditionally been informed through individuals' perceptions. Seemingly, trust in leadership and the immediate supervisor–employee relationship are inherently a personal experience which can only be self–reported. Employees' perceptions rather than objective measures of PDM encouraged by immediate supervisors can explain informal upward voice on a daily basis.

Moreover, in order to reduce potential common method bias, respondents' anonymity was assured to avoid social desirability, and different anchor labels were used to measure the different constructs under study [86].

Another potential limitation is the fact that the current study has been carried out in two nuclear power plants pertaining to the same organization. Thus, results should be interpreted cautiously and further research is needed to support the generalizability of the results. Despite this, our findings are valuable for other HROs (e.g., aircraft companies, or either chemical or petrochemical plants) because they share common characteristics that make upward voice fundamental for their sustainable development. For instance, HROs require continuous monitoring and upward voice to allow decision-makers to have an adequate picture of the organizational state of their operations, to prevent migration of the system to an unsafe zone and to identify "weak cases" or "early warning signs" of safety degradation (e.g., [87]). Along these lines, [88] have acknowledged that "HROs know that odd things can occur and want their people to be on the lookout for these odd or unusual things instead of assuming that they don't matter or are not important" (p.72). These authors illustrates trhough examples from intensive care units, airplane companies or nuclear power plants, how important it is that front-line employees are able to recognize anomalies or situations that may be getting out of control and report them to prevent accidents. In their words, HROs aggressively seek to know what they do not know.

Therefore, our results should stimulate further research on how to build a supportive upward voice environment. Several studies carried out in other HROs also point in that direction; however, empirical evidence is scarce and it mainly focuses on leadership related variables neglecting other relevant factors in the organizational context such as safety climate. In particular, in the airline industry, a study carried out in Taiwanese international airlines showed that a benevolent and a morality leadership positively influence upward safety communication [14]. In the health sector, several empirical studies based on the simulation of medical emergencies suggest that inclusive leader language [16] and hierarchy beliefs in multi–professional teams [15] influence voice behavior which is critical for anesthesia teams. These studies were also carried out in a single organization (a hospital's simulation center and a university hospital, respectively). Thus, further research on how to build a supportive upward voice environment that takes organizational context into account is necessary and would allow accumulation of knowledge and empirical evidence that is generalizable to different HROs.

Future research should adopt a longitudinal and multilevel approach to voice that would enrich our understanding of how to build a voice supportive work environment sustainable over time. Longitudinal studies enable us to conceptualize upward voice as a process that evolves over time and takes into account responses experienced by the voicer [34]. These responses (e.g., to what degree concerns or issues are resolved, co–workers' and supervisors' reactions ...) will generate different dynamics over time and may escalate or inhibit upward voice. Moreover, upward voice engagement

might neither always be good or be better as more is provided. Over time, it might increase work overload or become ineffective and cultivate frustration if the organization is not able to respond to all employees' inputs.

In addition, a multilevel approach would allow researchers to identify group–level features that cultivate a voice–supportive context. This study has examined the role of individuals' perception of nuclear safety climate in the relationship between PDM and upward voice. However, the influence of shared nuclear safety climate operationalized at the group–level remains unexplored.

Finally, future studies should explore the role of other facet–specific climates that may become especially salient depending on the kind of industry under study. In industries where innovation is required, an innovation climate might signal to a company's employees that upward voice is valuable because it would help it to adapt to a changing environment.

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