



Factors influencing employees' eco-friendly innovation capabilities and behavior: the role of green culture and employees' motivations

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Abstract

Being a part of society, employees' behavior can't be ignored, and it must be encouraged to sustain nature for the upcoming generation. Following the resource-based view theory, this study aims to identify the factors influencing employees toward sustainable behavior. To meet the objectives, cross-sectional data were collected from employees of manufacturing companies, and structural equation modeling was used for the analysis. The study results show a positive effect of participative decision-making and employee motivation on employees' eco-friendly innovation capabilities and behavior. Additionally, this research reveals that employee motivation partially mediates the link between participative decision-making, eco-friendly innovation capabilities, and behavior. Furthermore, this research evidenced a positive moderation of green culture on the relationship between participative decision-making and eco-friendly innovation capabilities, evidencing that the relationship is stronger when the culture is high. This research contributes to the existing literature by providing a deeper understanding of the factors influencing employees' eco-friendly innovation capabilities and behavior. It highlights the significant roles of green culture as a moderator and employee motivation as a mediator, offering novel perspectives to both theory and practice.

Keywords Eco-friendly behavior · Eco-friendly innovation capabilities · Employee motivation · Green culture · Manufacturing sector · Participative decision-making

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1 Introduction

It is our collective responsibility to safeguard the environment and take proactive measures to mitigate its adverse impacts. This entails embracing and implementing green practices and promoting sustainable development to ensure the well-being of our planet. Climate change (i.e., an increase in greenhouse gases due to fossil fuels, energy, and wastes) caused by human activities is gradually intensifying and requires urgent control (Yoro & Daramola, 2020). Notably, the manufacturing sector, a significant source of pollution in China, accounted for 36% and 41% of detrimental effects on health and crop production, respectively (Gu et al., 2018). Thus, adopting sustainability and environmental protection practices is imperative for companies operating in China's manufacturing sector to sustain their competitiveness. Acknowledging China's status as the world's largest emitter of greenhouse gases (Larsen et al., 2021), the country has recognized the importance of transitioning towards a sustainable and environmentally friendly economy (Liu et al., 2022). Consequently, the government has implemented numerous initiatives to facilitate the adoption of green manufacturing practices, improve energy efficiency, and strengthen environmental protection efforts. For instance, the recent "China Central Financial and Economic Commission" highlights the importance of key industries, particularly the manufacturing sector, in adopting innovation, implementing pollution reduction practices, and promoting green manufacturing (Liu et al., 2022), thereby emphasizing the need to improve firms' eco-friendly innovation capabilities and sustainability behavior.

Despite the complex interplay between economic activities and the environment, firms are essential actors in the pursuit of sustainable development. By adopting sustainable practices, firms can benefit the society and contribute to sustainable development. Furthermore, they can gain multiple benefits from eco-friendly innovation, such as improving their performance, gaining a competitive advantage, and avoiding environmental risks (Amara & Chen, 2021). Eco-friendly innovation is the focus of this article. It refers to the transformation of knowledge and learning into new eco-friendly models, processes, products, and services that can benefit society.

The literature on eco-friendly innovation is growing steadily and generally stresses its effectiveness for mitigating the environmental impacts of corporations (Cheng et al., 2021; Shaheen et al., 2022; Zheng & Iatridis, 2022). The contributions in this field emphasize the need for a further analysis of the determinants of eco-friendly innovation capabilities (Adomako & Nguyen, 2023; Amara & Chen, 2021; Ceptureanu et al., 2020; Han & Chen, 2021; Sanni, 2018). As summarized by Sanni (2018), demand-pull factors, technology-push factors, and regulatory policies are vital determinants of eco-innovation, synergistically complementing the effects of firm-specific factors. Drawing upon a systematic literature review, Phan et al. (2019) underscored that a firm's characteristics and resources, including human resources, serve as catalysts for driving eco-innovation. Furthermore, the active engagement of human resources emerges as a pivotal organizational practice, fostering the development of a dynamic capacity to effectively align with the principles of sustainable development. In line with this, recent studies have explored the role of factors such as social legitimacy (Adomako & Nguyen, 2023) and green market orientation (Borah et al., 2023) in eco-innovation. Additionally, prior studies observed that purpose (van Tuin et al., 2020), environmental ethics, institutional environment, and managerial support (Junsheng et al., 2020) motivate employees. As part of an organization and society, the employees and firms play a critical role in sustaining the environment (Junsheng et al., 2020; Saleem et al., 2021). Overall, Bitencourt et al. (2020) suggest that a firm's capability

to implement eco-innovation depends on its capability to provide its employees with participation opportunities in transforming the business into a sustainable-oriented context. Phan et al. (2019) further support this idea, concluding that the key in eco-innovation lies in blending organizational support with employee engagement, acknowledging evidence that employee involvement as a crucial human resource management practice in eco-innovation. However, the link between participative decision-making and innovation capability is scarcely studied in the literature (Karbasi & Rahmanseresht, 2019; Su et al., 2022). Ul-Durar et al. (2023) also revealed a gap in eco-innovation literature, with most focus on capability rather than examining determinants in the micro-level eco-innovation. This article addresses the identified research gaps by studying the role of participative decision-making in the context of eco-innovation, considering its effects on employees' motivation, eco-friendly innovation capabilities, and eco-friendly behavior.

Rehman et al. (2023) stress that green culture should be considered when assessing employee attitudes toward eco-friendly practices. As the importance of employee motivation in environmental literature needs to be further explored (Junsheng et al., 2020; Salim et al., 2019), this study further considers existing literature devoted to culture, which offers significant insights into its importance and critical role in enhancing eco-friendly innovation capabilities (Tseng et al., 2019) and facilitating and promoting organizational effectiveness (Umranı et al., 2018). The systematic literature review conducted by Salim et al. (2019) highlighted that internal innovation capabilities would build a culture that could influence the employees' commitment and motivation. From this context, some studies evidenced the effect of culture on the adoption of eco-friendly innovation capabilities and called for further studies to test the causal mechanisms (García-Granero et al., 2020; Liao, 2018). This study aims to address a research gap by providing a better understanding of the effect of participative decision-making on eco-friendly innovation capabilities and employees' eco-friendly behavior.

This study has four objectives: (1) to explore the factors that influence eco-friendly innovation capabilities and (2) to examine the factors that enhance and strengthen eco-friendly innovation capabilities; (3) to explain the participative decision-making direct and indirect effect through the mediator (employees' motivation) on its outcome (eco-friendly innovation capabilities, and eco-friendly behavior); and (4) to assess green culture as a moderator on the path from participative decision-making to eco-friendly innovation capabilities and from participative decision-making–eco-friendly behavior.

This article offers several contributions to the eco-innovation literature. Firstly, it merges insights from the resource-based view theory with research focusing on corporate culture, thereby expanding upon prior investigations into the factors driving eco-friendly innovation. It introduces participative decision-making as a determinant to eco-friendly innovation capabilities and behavior, mediated by employees' motivation and moderated by green culture. This approach enables a more comprehensive understanding of the determinants of eco-friendly innovation capabilities, particularly within the context of the manufacturing sector, specifically in China. Secondly, this research complements studies that examine the factors (e.g., attitude, subjective norms, perceived behavior control, moral norms) influencing an individual's behavior towards environmental sustainability (Ansari et al., 2021; Jiang & Wu, 2022; Qalati et al., 2022a, 2022b). However, few studies have considered employees' intrinsic or extrinsic motivations to explain their behavior (Tian et al., 2020). Therefore, this study contributes to a more nuanced understanding of how employee motivation impacts eco-friendly innovation behavior, grounded in the resource-based view theory. Furthermore, several studies have tested the direct effect of participative decision-making and employees' motivation on eco-friendly innovation capabilities (Garcés-Ayerbe

et al., 2019; Sánchez et al., 2015; Tian & Zhai, 2019). Overall, this study provides new insights that can help achieve sustainability. It explores the interplay between socio-economic actors and the environment by demonstrating the significance of participative decision-making and the active role of employees in eco-innovation.

The rest of the article is organized as follows: The next section presents the study's theoretical background, focusing on the resource-based view theory. It provides a comprehensive review of contributions concerning the relationship between participative decision-making and eco-friendly innovation capabilities, eco-friendly behavior, and employees' motivation, combined with the literature on green culture, which facilitated the formulation of a set of research hypotheses. This is followed by a description of the methodology utilized in a quantitative study conducted with employees in China's manufacturing sector. Subsequently, the results are presented and discussed. The concluding section outlines the implications, limitations, and directions for future research.

2 Theoretical background and hypotheses development

2.1 Theoretical support

The resource-based view theory has been used to guide this research. This theory posits that organizations are striving to distinguish themselves from competitors to have a sustainable edge and superior performance (Wernerfelt, 1984). In this respect, prior studies postulate that internal resources (especially employees) can contribute to gaining a competitive advantage (Davis, 2017). In addition, strategic human resource management participation could improve the work environment and idea generation (Coff, 1997; Colbert, 2004). Using this theory, previous studies explored different concepts such as innovation capability (Al-Nuaimi et al., 2021), eco-friendly behavior (Hameed et al., 2021), and organizational culture (Freiling & Fichtner, 2010). Overall, eco-innovation revolves around improving resource efficiency, serving as a key element in this domain (UI-Durar et al., 2023). Drawing from the key contributions in eco-innovation literature and guided by the resource-based view theory, the following sections introduce the set of hypotheses formulated for this study.

2.2 Hypotheses development

2.2.1 Participative decision-making relationship with eco-friendly innovation capabilities, eco-friendly behavior, and employees' motivation

Participative decision-making refers to a shared influence and consensus on a particular issue, fostering collaboration between top managers and employees, thereby motivating employees to exert greater efforts in driving innovation (Da'as, 2019). This approach promotes information sharing, enabling both employees and managers to access crucial insights for the adoption of ecological innovation (Fernández-Mesa & Alegre, 2015). Furthermore, the imperative of environmental conservation underscores the significance of motivation and awareness, enhancing the green environmental knowledge of employees and managers (Amara & Chen, 2021). In this context, organizations should proactively engage environmentally conscious employees, encouraging their participation and support in embracing innovation-based practices (Al-Shboul & Alsmairat, 2023). Additionally,

participative decision-making minimizes barriers to eco-innovation, enhances employees' knowledge and skills, and motivates the organization to embrace ecological innovations (Sánchez et al., 2015).

Previous research has suggested that the implementation of participative decision-making within organizations enhances employee motivation to engage in eco-innovation practices (Garcés-Ayerbe et al., 2019; Tian & Zhai, 2019). Furthermore, while several scholars have examined the motivational factors driving individuals towards eco-friendly behavior in the household contexts (Fan et al., 2022; Qalati et al., 2022a, 2022b), motivations among employees still need further investigation (Junsheng et al., 2020).

Hence, this study considers that managerial support involving employees in meetings related to environmental sustainability, encouraging information sharing, and giving more rewards for adopting green practices also persuade them towards green behavior. Consequently, it is hypothesized that:

H1 Participative decision-making positively and significantly influences (a) eco-friendly innovation capabilities, (b) eco-friendly behavior, and (c) employees' motivation.

2.2.2 Employees' motivation relationship with eco-friendly innovation capabilities and behavior

For enterprises of all types and sizes, employees constitute a central component and play a pivotal role in the successful implementation of green practices (Ren & Hussain, 2022). Their environmental orientation further encourages them towards adopting green behavior (Jiang & Wu, 2022). Organizations need to effectively manage motivational factors (Junsheng et al., 2020), since they aspire to foster innovation and drive process transformation. Encouraging employees is paramount, as they bear responsibility for the success or failure of strategy implementation (e.g., adoption of green practices). Demonstrating a strong commitment to the organization can influence employees to align their behavior with firm's goals, green initiatives, sustainability, and values (Temminck et al., 2015).

Previously, many studies have reported that organizations motivate employees to foster innovation, driven by their objective to gain a competitive advantage and enhance performance (Al-Nuaimi et al., 2021; Bermúdez-Edo et al., 2015). However, it has been argued that innovation, especially eco-innovation, is insufficient without capabilities serving as a source of competitive advantage (Amara & Chen, 2021). In this context, a few studies have provided evidence suggesting that employee motivation can enhance innovation capability, particularly when motivations are substantial (Wu & Sivalogathan, 2013). Furthermore, most studies have used the theory of planned behavior. They reported that individuals are motivated to demonstrate green behavior, such as buying organic food (Jiang & Wu, 2022) and saving energy (Qalati et al., 2022a, b). However, the employee perspective still requires further research. Therefore, it is hypothesized that:

H2 Employees' motivation positively and significantly influences (a) eco-friendly innovation capabilities and (b) eco-friendly behavior.

2.2.3 The mediating role of employees' motivation

Previously, many studies within the realm of human resource management literature have explored the mediating role of employee motivation. For instance, Guterres et al. (2020)

observed that work motivation significantly mediated the relationship between leadership style and employee performance. Similarly, Bastari et al. (2020) reported job motivation mediating the relationship between transformational leadership and job performance. Additionally, Alam et al. (2020) demonstrated the significant mediating effect of employee work performance between wage, welfare facilities, and employee productivity. Nevertheless, the existing literature from diverse contexts still requires further exploration of the mediation of employee motivation.

In this context, prior studies have demonstrated that participative decision-making motivates employees, thereby enhancing their engagement in generating ecological ideas and innovations (Amara & Chen, 2021), as well as fostering eco-friendly behavior (Junsheng et al., 2020). Some researchers have reported that individuals' (e.g., entrepreneurs) green motivations significantly impact ecological innovation practices (Singh et al., 2020). Consequently, both employees and entrepreneurs need to improve their motivation to develop eco-friendly innovation capabilities and behavior, ultimately contributing to firm performance improvement (Zheng & Iatridis, 2022). Entrepreneurs and managers play a crucial role in involving employees in decision-making processes and sharing power to stimulate motivation towards ecological innovation and eco-friendly behavior (Lu et al., 2022). This collective approach, driven by innovative practices and employees' eco-friendly behavior, yields opportunities not only to preserve the environment but also to enhance firm performance. Therefore, this study proposes that employees' motivation mediates the relationship between participative decision-making and eco-friendly innovation capabilities and behavior. Hence, it is hypothesized that:

H3 Employees' motivation positively and significantly mediates the relationship between (a) participative decision-making and eco-friendly innovation capabilities and (b) participative decision-making and eco-friendly behavior.

2.2.4 The moderating role of green culture

Organizational culture encompasses a company's norms, obligations, policies, and values (Merlin & Chen, 2022). Previous scholars have highlighted that the effect of culture on different constructs (i.e., eco-friendly innovation capabilities, eco-friendly behavior) is gaining growing attention in the realm of environmental studies and eco-innovation (Al-Swidi et al., 2021; Garcés-Ayerbe et al., 2019). Most studies have argued that culture underpins both eco-innovation and eco-friendly employee behavior (Al-Swidi et al., 2021; Liao, 2018; Reyes-Santiago et al. 2017). While prior research has evidenced the direct and indirect (mediating) effects of green culture on eco-innovation and eco-friendly employee behavior, there remains a need for empirical studies to elucidate the causal mechanism of culture within environmental literature (Merlin & Chen, 2022; Reyes-Santiago et al. 2017). In this context, few studies have examined the moderation effect of green culture on relationships such as customer pressure and green innovation (Chu et al., 2019), pro-environmental behavior and environmental sustainability (Khan & Terason, 2022), and green absorptive capacity and eco-innovation (Qu et al., 2022). In line with this, it is hypothesized that:

H4 Green culture moderates the (a) participative decision-making–eco-friendly innovation capabilities and (b) participative decision-making–eco-friendly behavior relationship.

3 Method

The literature review presented in the previous section led to the identification of five factors that help explain eco-friendly innovation capabilities and behavior, namely one independent variable (participative decision-making), two dependent variables (eco-friendly innovation capabilities and eco-friendly behavior), one mediator (employees' motivation), and one moderator (green culture). Figure 1 summarizes the research framework proposed for this study. In particular, black arrows show direct, blue arrows represent mediation effects, and orange arrows represent the moderation effects.

3.1 Materials

This study adopted measurement scales that had previously been developed and validated in extant literature, thereby confirming their strong alignment with the precise meanings of the constructs in the research model. The items were measured on a five-point Likert scale ranging from strongly disagree to strongly agree. Participative decision-making was measured using three items adapted from Amara and Chen (2021). Employees' motivation was assessed using five items adapted from Junsheng et al. (2020). Green culture was assessed using five items adapted from Marshall et al. (2015). Eco-friendly innovation capabilities was assessed using eight items adapted from Wang and Ahmed (2007). Finally, eco-friendly behavior was assessed using five items adapted from Junsheng et al. (2020). Full information on the items is presented in Table 1.

3.2 Participants

The current study was conducted in China, making it a particularly relevant setting given its substantial pollution originating from the manufacturing sector (Gu et al., 2018), as well as the country's proactive initiatives in promoting green manufacturing practices (Liu

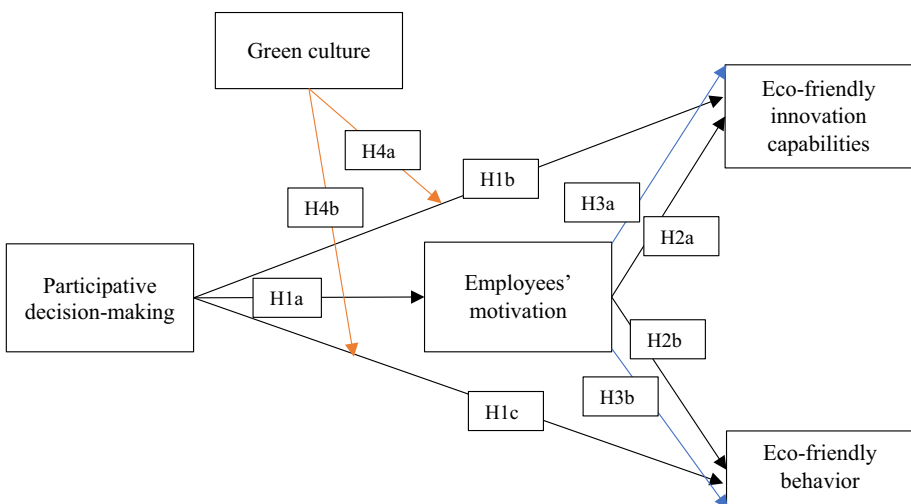


Fig. 1 Research framework

Table 1 Constructs

Construct	Code	Item	Adapted from
Participative decision-making (PDM)	PDM1	"Managers or entrepreneurs in this enterprise recurrently involve employees or workers in critical decisions to adopt eco-innovation practices and green behavior"	Amara and Chen (2021)
	PDM2	"Enterprise policies are considerably affected by the view of employees about eco-innovation and green behavior"	
	PDM3	"Employees or workers realize that they are involved in crucial enterprise decisions to adopt Eco-innovation practices and green behavior"	
Employees motivation (EM)	EM1	"Employees are encouraged by the top management to engage in environmental improvement"	Junsheng et al. (2020)
	EM2	"Incentives or rewards are given to encourage eco-innovation and green behavior"	
	EM3	"Engagement workshops or forums are provided for staff to improve their eco-innovation and green behavior"	
	EM4	"The company empowers employees to be involved in the improvement of the environment"	
	EM5	"Sufficient training is provided to employees so that they can participate in environmental improvement efforts"	
Green culture (GC)	GC1	"My organization provides information to all employees to understand the importance of environmental sustainability"	Marshall et al. (2015)
	GC2	"My organization promotes social sustainability as a major goal across all departments"	
	GC3	"My organization has a clear policy statement urging social sustainability in every area of operations"	
	GC4	"Social sustainability is a high-priority activity in my organization"	
	GC5	"Social sustainability is a central corporate value in my organization"	

Table 1 (continued)

Construct	Code	Item	Adapted from
Eco-friendly innovation capabilities (EIC)	EIC1	"In comparison with competitors, our enterprise is faster in bringing new products or services into the market"	Wang and Ahmed (2007)
	EIC2	"In comparison with competitors, our enterprise has introduced more innovative products and services during the past 5 years"	
	EIC3	"New products and services in our enterprise often put us up against new competitors"	
	EIC4	"Our new products and services are often perceived as innovative by customers"	
	EIC5	"Our company changes production methods at high speed in comparison with our competitors"	
	EIC6	"We are continually improving our business process"	
	EIC7	"The nature of the process in our enterprise is new compared with that of our primary competitors"	
Eco-friendly behavior (EB)	EB1	"The company effectively reduces its emission of hazardous substances or waste"	Junsheng et al. (2020)
	EB2	"The company reduces its consumption of water, electricity, coal, or oil"	
	EB3	"The company reduces its use of raw materials"	
	EB4	"The company recycles waste and emissions so that they can be treated and re-used"	
	EB5	"The company maintains the ISO 14001 standards and an environmental management system"	

et al., 2022). The study's population comprised manufacturing employees in China. Data was collected in Jiangsu province, by employing a convenient random sampling approach, which it is less costly, easy to administer, and a widely used in research. To mitigate common method bias issues, data was collected in different time frames, as suggested by Podsakoff et al. (2003). The first wave collected data related to the independent variable (participative decision-making) and dependent variables (eco-friendly innovation capabilities and eco-friendly behavior). The second wave collected data for the mediator (employees' motivation), and in the last wave, data was collected for the moderator (green culture). In the first time frame, the researchers shared an online link with 650 participants, resulting in 574 valid responses representing 88.3% response rate. In the second time frame, the 574 participants of the first wave were approached to fill out the second part of the questionnaire, and 437 valid responses were received, accounting for nearly 76.1%. Accordingly, only 328 valid responses were collected in the third time frame, representing a 75.05% response rate. The final sample size was considered appropriate for the complexity of the model, taking into account the number of latent (5) and observed variables (25) within the research model as well as the total number of hypotheses (7) to be tested (Hair et al., 2019). Furthermore, the number of responses exceeds the recommended threshold of 5 to 10 responses per item. Among the respondents, 207 (63.1%) were male, and 121 (36.9%) were female. In terms of age, 60 (18.3%) were between 18 and 25, 102 (31.1%) were between 26 and 30, 98 (29.9%) were between 35 and 40, and 68 (20.7%) were over 40.

3.3 Data analysis procedures

Before analyzing the inner and outer models, it is recommended to assess the common method bias (CMB) as it is a serious concern to ensure the authenticity of the data. Many scholars have used Harman's single factor to measure CMB (Kim et al., 2019; Okumus et al., 2019; Qalati et al., 2022a), however, it has been criticized when using cross-sectional data (Pesämaa et al., 2021). Instead, for this study, the full collinearity approach-variance inflation factor (VIF) in PLS-SEM through SmartPLS was used (Hair et al., 2019). This study found VIF values below the standardized threshold of 3.3 (Fang et al., 2022; Hair et al., 2019) (see Table 2), indicating that this research data is free from bias issues.

To test the proposed hypotheses, this research used the PLS-SEM approach instead of the covariance-based structural equation modeling (CB-SEM) approach. PLS-SEM was preferred because it is easy to use, requires fewer restrictions, and is widely used for complex models comprising mediation and moderation (Hair et al., 2019). Additionally, compared to CB-SEM, PLS-SEM can be utilized for both prediction and explanation and can include both reflective and formative models (Dash & Paul, 2021). Given its flexibility and robustness, PLS-SEM was considered an adequate approach for this study.

4 Result analysis and discussion

4.1 Assessment of the outer model

To assess the adequacy of the used scales, this study employed Cronbach's Alpha (CA) and composite reliability (CR) to measure internal consistency reliability. Additionally, factor loadings and average variance extracted (AVE) were computed to assess convergent validity. The calculated values for CA ranged between 0.897 and 0.948, and CR values

Table 2 Measurement of the outer model

Construct	Items	Outer loadings	CA	CR	AVE	Inner VIF
Participative decision-making (PDM)	PDM1	0.886	0.898	0.900	0.831	2.776
	PDM2	0.929				
	PDM3	0.919				
Employees motivation (EM)	EM1	0.875	0.897	0.907	0.711	1.963
	EM2	0.885				
	EM3	0.723				
	EM4	0.840				
	EM5	0.883				
Green culture (GC)	GC1	0.912	0.948	0.950	0.828	2.638
	GC2	0.925				
	GC3	0.944				
	GC4	0.886				
	GC5	0.883				
Eco-friendly innovation capabilities	EIC1	0.886	0.946	0.948	0.778	
	EIC2	0.892				
	EIC3	0.827				
	EIC4	0.836				
	EIC5	0.928				
	EIC6	0.902				
	EIC7	0.900				
Eco-friendly behavior (EB)	EB1	0.937	0.942	0.945	0.834	
	EB2	0.867				
	EB3	0.927				
	EB4	0.908				
	EB5	0.925				

were in the range of 0.900 to 0.950, meeting the acceptable threshold of > 0.70 (Hair et al., 2019) (refer to Table 2). Regarding convergent validity, this study evidenced factor loadings ranging from 0.723 to 0.944, which align with the requirement of being > 0.70 and < 0.950 (Hair et al., 2019). Furthermore, AVE values ranged from 0.711 to 0.834, surpassing the acceptable limit of > 0.50 (Table 2). Lastly, to assess the discriminant validity, the Heterotrait-Monotrait (HTMT) ratio was used, with a criterion of $< HTMT_{0.85}$. In this research, HTMT values fell between $HTMT_{0.205-0.801}$, remaining below the acceptable threshold proposed by Hair et al. (2019) (see Table 3). Thus, it is concluded that this research exhibits a high level of high discriminant validity.

4.2 Assessment of the inner model

To assess the inner model and test the hypotheses, coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2) were employed. As shown in Table 4, all hypotheses were supported except for *H4b*: the moderating role of green culture on the relationship between participative decision-making and eco-friendly behavior ($p < 0.05$). R^2 is utilized to reveal the explanatory power of endogenous constructs. Table 4 indicates that participative decision-making accounted for a 46.1% variance in employees' motivation.

Table 3 Discriminant validity (HTMT ratio criterion)

Constructs	1	2	3	4	5
1. Eco-friendly innovation capabilities					
2. Eco-friendly behavior	0.689				
3. Employees' motivation	0.796	0.729			
4. Green culture	0.328	0.205	0.288		
5. Participative decision-making	0.801	0.726	0.744	0.444	

Moreover, the combined influence of participative decision-making and employee motivation explained 66.5% and 54.8% variance in eco-friendly innovation capabilities and eco-friendly behavior, respectively. R^2 values of 0.25, 0.50, and 0.75 denote weak, moderate, and substantial explanatory power, respectively (Hair et al., 2019). In this respect, employees' motivation [$R^2 = 0.461$], eco-friendly innovation capabilities [$R^2 = 0.665$], and eco-friendly behavior [$R^2 = 0.548$] exhibit moderate explanatory power (see Table 4). Furthermore, this research employed f^2 to assess the importance of independent constructs on the dependent ones. An f^2 value of 0.35, 0.15, and 0.02 corresponds to a large, medium, and weak effect size, respectively. Table 4 illustrates the individual effects of each construct, particularly highlighting that participative decision-making exerts a substantial impact on employees' motivation.

This research also used Q^2 to assess the out-of-sample predictive power. Q^2 values up to 0.25, > 0 , 0.25, and > 0.50 are categorized as small, medium, and large predictive relevance of the path model, respectively (Hair et al., 2019). Table 4 presents the predictive accuracy, indicating that employees' motivation [$Q^2 = 0.456$] and eco-friendly behavior [$Q^2 = 0.448$] have medium predictive relevance. At the same time, eco-friendly innovation capabilities [$Q^2 = 0.536$] have large predictive power.

4.3 Mediation analysis

The variance accounted for (VAF) test proposed by Hair et al. (2019) was adopted to assess the mediating role of employees' motivation in the research model. The VAF values of < 20 , 20–80, and $> 80\%$ are considered no, partial, and full mediation (Hair et al., 2019).

$$\text{VAF} = \text{Indirect effect} / \text{total effect}.$$

where total effect = direct effect + indirect effect.

$$\text{VAF}_{\text{Eco-friendly innovation capabilities}} = 0.317 / (0.369 + 0.317) = 0.462.$$

$$\text{VAF}_{\text{Eco-friendly behavior}} = 0.280 / (0.418 + 0.280) = 0.401.$$

The findings revealed that employees' motivation partially mediated the relationship between participative decision-making and eco-friendly innovation capabilities, with a VAF of 46.2% falling within the established threshold of 20–80%. A similar conclusion was drawn concerning the relationship between participative decision-making and eco-friendly behavior because the obtained VAF value of 40.1% also falls within the 20–80% range (Hair et al., 2019).

Table 4 Hypotheses testing and strength of the model

Hypothesis	Relationship	β	SD	t-value	Decision	f ²
<i>Direct effect</i>						
H1a	Participative decision-making → Employees' motivation	0.679	0.029	23.523***	Supported	0.855
H1b	Participative decision-making → Eco-friendly innovation capabilities	0.369	0.058	6.350***	Supported	0.146
H1c	Participative decision-making → Eco-friendly behavior	0.418	0.063	6.612***	Supported	0.139
H2a	Employees' motivation → Eco-friendly innovation capabilities	0.466	0.047	9.953***	Supported	0.331
H2b	Employees' motivation → Eco-friendly behavior	0.413	0.056	7.357***	Supported	0.192
<i>Indirect effect</i>						
H3a	Participative decision-making → Employees' motivation → Eco-friendly innovation capabilities	0.317	0.034	9.393***	Supported	
H3b	Participative decision-making → Employees' motivation → Eco-friendly behavior	0.280	0.036	7.830***	Supported	
<i>Moderation effect</i>						
H4a	Participative decision-making × Green culture → Eco-friendly innovation capabilities	0.150	0.062	2.418**	Supported	
H4b	Participative decision-making × Green culture → Eco-friendly behavior	0.035	0.059	0.594	Not Supported	

Critical values, one-tailed, where *($p < 0.05$); **($p < 0.01$); ***($p < 0.001$)
 R^2 (Employees motivation) = 0.461; R^2 (Eco-friendly innovation capabilities) = 0.665; R^2 (Eco-friendly behavior) = 0.548
 Q^2 (Employees motivation) = 0.456; Q^2 (Eco-friendly innovation capabilities) = 0.536; Q^2 (Eco-friendly behavior) = 0.448
 Model fit: SRMR = 0.051; d_ULS = 0.848; d_G = 0.824; Chi-square = 1501.472; NFI = 0.837

4.4 Moderation analysis

Regarding the moderating role of green culture, this research used a formula proposed by Cohen (1988), widely used in environmental-based studies (Merlin & Chen, 2022). The f^2 values of 0.35, 0.15, and 0.02 indicate strong, moderate, and weak effects, respectively.

$$f^2 = (R_{\text{included}}^2 - R_{\text{excluded}}^2) / (1 - R_{\text{included}}^2) = (0.665 - 0.657) / (1 - 0.665) = 0.023.$$

This study revealed a value of 0.023, which falls within the range of > 0.02 and < 0.15 , indicating a weak effect of green culture. Figure 2 illustrates the slope depicting the moderation of green culture, demonstrating that the relationship between participative decision-making and eco-friendly innovation capabilities is stronger when green culture is high compared to when it is low.

4.5 Results discussion

This study highlights the importance of employees' motivation in the context of environmental sustainability in China's manufacturing sector. This study formulated several hypotheses to empirically demonstrate the relationship between participative decision-making, employee motivation, eco-friendly innovation capabilities, eco-friendly behavior, and green culture. This research found that participative decision-making positively and significantly influences employee's motivation ($\beta = 0.679$, $t = 23.523$, $p = 0.000$), eco-friendly innovation capabilities ($\beta = 0.369$, $t = 6.350$, $p = 0.000$), and eco-friendly behavior ($\beta = 0.418$, $t = 6.612$, $p = 0.000$); thus, hypotheses *H1a-c* were supported. There results are consistent with the findings of other studies (Amara & Chen, 2021; Fan et al., 2022; Garcés-Ayerbe et al., 2019; Junsheng et al., 2020), suggesting that when employees are actively involved in meetings and decision-making processes regarding the adoption and implementation of green practices for environmental protection, their motivation, innovation, and behavior are stimulated. Moreover, these findings emphasize that the distribution

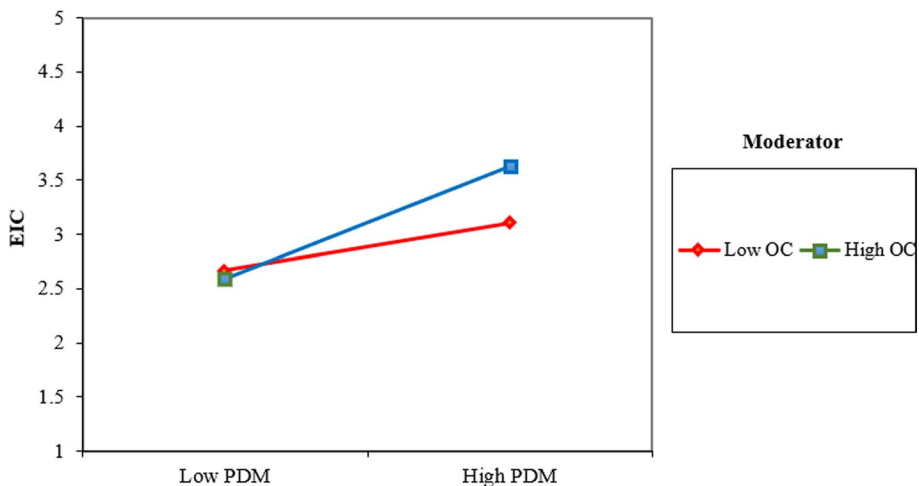


Fig. 2 Moderation effect of green culture

of decision-making and power between employees and managers holds a pivotal role in magnifying the influence of motivation. Thus, participative decision-making could be cultivated as a strategic tool to stimulate the generation of ideas and innovations. Additionally, these results highlight that a one unit change in participative decision-making leads to a 67.9%, 36.9%, and 41.8% increase in employees' motivation, eco-friendly innovation capabilities, and eco-friendly behavior, respectively.

Moreover, this research provides evidence that employees' motivation has a positive and significant influence on eco-friendly innovation capabilities ($\beta = 0.466, t = 9.953, p = 0.000$) and eco-friendly behavior ($\beta = 0.413, t = 7.357, p = 0.000$), thereby supporting hypotheses *H2a–b*. These results consistent with previous research (Al-Nuaimi et al., 2021; Qalati et al., 2022b; Temminck et al., 2015; Wu & Sivalogathan, 2013), which underscores the importance of motivation and provides empirical support for its positive influence on innovation capabilities and green behavior. Consequently, organizations should prioritize the enhancement of motivation levels to strengthen eco-friendly innovation capabilities and foster desirable employee conduct. The results of this study suggest that when employees are offered additional incentives, salary increments, and opportunities to engage in workshops and training programs focused on environmental sustainability, their dedication towards generating innovative ideas and effectively implementing environmentally conscious initiatives is amplified. Additionally, these results indicate that heightened employee motivation leads to greater opportunities and capabilities for achieving environmental protection, driving eco-innovation, and ultimately enhancing performance. Hence, it is confirmed that employees' motivations are interconnected with eco-friendly innovation capabilities, aligning with firms' goals to reduce costs, minimize waste, and save energy.

Furthermore, findings unveil that one unit increase in employee motivation leads to a 46.6% and a 41.3% change in eco-friendly innovation capabilities and behavior, respectively.

Moreover, regarding the mediating role of employees' motivation, this research provides evidence that employees' motivation exerts a positive and significant indirect influence on the relationship between participative decision-making and eco-friendly innovation capabilities ($\beta = 0.317, t = 9.393, p = 0.000$), as well as between participative decision-making and eco-friendly behavior ($\beta = 0.413, t = 7.357, p = 0.000$), thereby confirming hypotheses *H3a–b*. These results are consistent with prior studies of Amara and Chen (2021) and Junsheng et al. (2020).

The mediating role of employees' motivation suggests that when employees are motivated by their assigned tasks, participation in decision-making, and incentives provided for environmental tasks, it leads to improvements in innovation and behavior. Conversely, if motivation is lacking, it diminishes the magnitude of the total effect on eco-friendly innovation capabilities and behavior. The current study analyzed employees' motivation as a mediator and confirmed that decision-making not only has a direct effect on eco-friendly innovation capabilities and eco-friendly behavior but also an indirect effect through employees' motivation.

Consequently, the integration of employees' motivation within the participative decision-making process becomes crucial to strengthen eco-friendly innovation capabilities and foster eco-friendly behavior. Finally, regarding the moderation effect by culture, this research observed a positive and significant moderating effect of green culture on the relationship between participative decision-making and eco-friendly innovation capabilities ($\beta = 0.150, t = 2.418, p = 0.016$). However, the moderation effect was found to be insignificant between participative decision-making and eco-friendly behavior ($\beta = 0.035, t = 0.594 < 1.96, p = 0.552 < 0.05$); hence, *H4a* was supported while *H4b* was not

supported. This result suggests that the relationship between participative decision-making and eco-friendly innovation capabilities is more pronounced when green culture is high compared to when it is low. These findings are consistent with prior research (Chu et al., 2019; Khan & Terason, 2022).

5 Conclusion

Using the resource-based-view theory, this study aimed to explore the factors influencing eco-friendly innovation capabilities and behavior in the context of the manufacturing sector. A closed-ended online survey was used for cross-sectional data collection from a convenient random sample of 328 employees working in Chinese companies. SmartPLS 4 software helped estimate the set of research hypotheses by applying PLS-SEM techniques.

The study extended our knowledge on the factors that exert influence over eco-friendly innovation capabilities and behavior, bridging gaps in existing knowledge. It revealed the interplay of factors shaping these outcomes, spanning participative decision-making, employee motivation, and green culture within organizations. This exploration provided a holistic understanding of eco-friendly innovation dynamics in the manufacturing sector. The findings elucidated that participative decision-making fosters employee motivation, which in turn significantly augments eco-friendly innovation capabilities and eco-friendly behavior. It also clarified how participative decision-making directly and indirectly influences these outcomes. Notably, the research underscored green culture's moderating role, highlighting its amplification of participative decision-making's impact on innovation capabilities. Overall, the article not only addressed gaps but also presented a nuanced framework for comprehending the intricate connections among participative decision-making, motivation, green culture, and eco-friendly innovation dynamics. These insights bear significant implications for advancing sustainable practices within organizations.

5.1 Theoretical contributions

In the logic of the resource-based view theory, differentiation is an essential strategy for companies to achieve sustainable advantages and superior performance (Wernerfelt, 1984), leading some studies to highlight the role of employees as a source of competitive advantage (Davis, 2017), namely regarding innovation capability (Al-Nuaimi et al., 2021), eco-friendly behavior (Hameed et al., 2021), and organizational culture (Freiling & Fichtner, 2010). This study demonstrates that participative decision-making is essential to understanding eco-friendly innovation capabilities and behavior. By unraveling the complex dynamics between participative decision-making, employees' motivation, green culture, and eco-friendly innovation capabilities and behavior, the study provides a holistic framework that contributes significantly to the advancement of knowledge in the realm of sustainable development within organizational contexts. Indeed, one important contribution by this article is the extension of the resource-based view theory, by combining it with contributions of the employee motivation literature and of green culture literature. This enabled to provide a more comprehensive framework to explain eco-innovation capabilities and behavior, by underscoring a combination of mediation and moderation effects. This contribution, and the developed research framework, can be adopted by future research to study eco-innovation and related phenomena.

This approach can also be relevant to further understand individual's behavior toward environmental sustainability. Besides filling a research gap by exploring the factors that influence eco-friendly innovation capabilities specifically within the manufacturing sector in China, this article goes beyond the common focus on variables from the theory of planned behavior, such as attitude, subjective norms, and perceived behavior control, and further analyzes the essential role of motivations. Additionally, this study reveals the mediation mechanism performed by employees' motivations, providing a deeper understanding of how participative decision-making influences innovation capabilities. Furthermore, the study demonstrates the moderating role of culture in the relationships between participative decision-making and both eco-friendly innovation capabilities and eco-friendly behavior, providing additional evidence in line with previous literature (García-Granero et al., 2020; Liao, 2018). The strong explaining power of the proposed framework is particularly inspiring for future applications in other contexts (e.g., other geographical settings, other industries) and domains (e.g., other sustainability practices, specific domains of innovation).

Therefore, this study contributes to a more nuanced understanding of how employee motivation impacts eco-friendly innovation behavior, grounded in the resource-based view theory. Furthermore, several studies have tested the direct effect of participative decision-making and employees' motivation on eco-friendly innovation capabilities (Garcés-Ayerbe et al., 2019; Sánchez et al., 2015; Tian & Zhai, 2019). Overall, this study provides new insights that can help achieve sustainability. It explores the interplay between socio-economic actors and the environment by demonstrating the significance of participative decision-making and the active role of employees in eco-innovation.

5.2 Practical implications

The findings of this study provide organizations with actionable strategies to cultivate eco-friendly innovation capabilities and behavior. Firstly, the study underscores the vital role of participative decision-making in this context, as it significantly enhances employee motivation, eco-friendly innovation capabilities, and eco-friendly behavior. It is advisable for managers to develop and implement strategies that promote increased employee participation. Entrepreneurs and managers can support employee involvement in decision-making, offer incentives, arrange workshops, and design training programs to effectively implement environmentally conscious practices and safeguard the environment. Encouraging employee engagement in decision-making stimulates idea generation, contributing to competitive advantage and overall firm performance.

Moreover, manufacturing managers should prioritize nurturing employee motivation towards sustainability by fostering a supportive work environment. The research establishes a positive correlation between employee motivation and both eco-friendly innovation capabilities and behavior. Recognizing and rewarding employees for their sustainable efforts can further heighten their motivation and dedication to environmental initiatives. Organizations should concentrate on establishing a supportive work atmosphere and providing incentives to bolster motivation, thereby nurturing innovation and eco-friendly conduct.

The study's results also advocate for the cultivation of a green culture within organizations, particularly in the manufacturing sector. It is evident that the positive influence of participative decision-making on eco-friendly innovation capabilities is more pronounced in organizations with a higher level of green culture. Therefore, manufacturing entities should harness a green culture that champions sustainable practices. Enhancing the green

culture within an organization magnifies the constructive impact of participative decision-making on sustainable behavior.

The results of this study also offer valuable insights for policymakers. While the study's focus is primarily on firms, the findings underscore the proactive engagement of employees as key contributors to sustainable development, both in their roles as citizens and as integral members of their respective organizations. Government bodies can apply these insights to their own institutional settings, while policymakers may consider developing strategies, including training and communication approaches, aimed at encouraging businesses to enhance employee involvement, especially in the realm of eco-innovation.

5.3 Limitations and future research directions

Despite the interesting contributions and insights, this study is not without limitations. Firstly, it uses a convenience sample of the manufacturing sector in China. In order to further validate the findings, it is recommended that future studies replicate this model in other countries. In addition, this research used cross-sectional data collected via a shared link. This procedure was mainly determined by the limited personal contacts that were allowed during the pandemic. To overcome this limitation, future studies could use longitudinal data and mixed methods to collect data. Finally, several constructs that may be relevant to understand eco-friendly innovation capabilities and behavior were beyond the scope of this study and could be included in future research, namely as moderators and as determinants of the dependent variables. This study considers the moderation of green culture on the link between participative decision-making, eco-friendly innovation capabilities, and behavior. However, other moderation relationships can be tested by future research. Other constructs could be included in the model, guided by the resource-based view theory or other relevant theories and models explaining employees' capabilities and behaviors.

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Data availability Data will be made available upon request from the authors.

Declarations

Conflict of interest The authors declare no conflict of interest.

Ethical approval The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Liaocheng University, China.

Informed consent Informed consent was obtained from all subjects involved in the study.

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