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Green Leadership as A Strategic Capability: Driving Green Performance Through Green Innovation and Middle Management Innovativeness

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Abstract

This study addresses a paradox in the literature on management accounting and entrepreneurship: the common assumption that management accounting practices in Micro, Small, and Medium Enterprises (MSMEs) directly contribute to improved performance, yet in practice, they do not always result in innovation or consistent business growth. Many MSMEs have adopted various forms of accounting practices, ranging from simple financial record-keeping to digital systems; however, their use is often limited to control functions and historical reporting rather than serving as a basis for strategic decision-making that drives innovation. This study aims to explain how management accounting information is translated by MSME owners into innovation strategies that ultimately influence entrepreneurial performance. This study employs a multiple-case study approach with abductive logic, examining a number of SMEs in Indonesia that vary in the level of formality of their accounting practices—ranging from fully formal systems to informal practices based on the owners' intuition and experience. The results indicate that management accounting practices do not have a direct impact on entrepreneurial performance but rather operate through a more complex process mechanism. Accounting information first creates visibility into the state of the business; it is then interpreted as business opportunities or problems, which in turn shape innovation strategies, followed by a process of experimentation, and ultimately determine the decision to scale up or discontinue the innovation. This mechanism explains that innovation strategies serve as the primary bridge that transforms accounting information into entrepreneurial outcomes. The main contribution of this study is the development of the concept of hybrid management accounting practices, which integrate formal and informal practices, as well as the accounting-to-innovation translation mechanism, which reconceptualizes mediation not as a statistical relationship but as a dynamic process that explains how accounting information is transformed into innovative actions and entrepreneurial performance.

Keywords: Hybrid management accounting practices; MSMEs; entrepreneurial performance; innovation strategy; accounting-to-innovation translation mechanism; multiple-case study; emerging economy

Introduction

The growing demand for environmental responsibility is fundamentally reshaping competitive dynamics and compelling organizations to embed sustainability within their core business strategies and operational architectures (Chen et al., 2020). Rather than being treated as a peripheral concern, sustainability has increasingly evolved into a strategic imperative that influences firm competitiveness, long-term resilience, and legitimacy in the eyes of stakeholders (Arici & Uysal, 2021). In this context, firms are required not only to comply with environmental regulations but also to proactively develop internal capabilities that enable the effective execution of sustainability-oriented strategies (Ahsan, 2025).

Although prior research has extensively explored the macro-level implications of sustainability transitions—particularly in relation to business models and industry transformation (Aagaard et al., 2021) —there remains a critical gap in understanding how internal organizational capabilities translate sustainability-oriented strategies into tangible green performance outcomes (Ma et al., 2025). Specifically, while green innovation has been widely recognized as a key driver of green performance and competitive advantage, firms often struggle to operationalize sustainability strategies due to limitations in leadership capabilities, organizational alignment, and resource mobilization (Ahsan, 2025).

Within this strategic context, green leadership can be conceptualized as a critical organizational capability that enables firms to align environmental objectives with strategic priorities and operational practices. Green leadership goes beyond symbolic commitment by embedding sustainability principles into decision-making processes, resource allocation, and organizational culture, thereby shaping the firm's ability to respond to environmental challenges and opportunities (Albort-Morant et al., 2017; Wang et al., 2022). However, despite its recognized importance, existing research provides limited insight into the mechanisms through which green leadership translates strategic sustainability intent into effective innovation outcomes and, ultimately, superior green performance (Shahzad et al., 2023).

To address this gap, it is essential to examine the internal processes and organizational conditions that enable the effective implementation of sustainability strategies. In particular, green innovation represents a key strategic pathway through which firms can transform environmental commitments into operational and technological advancements that enhance green performance (Araújo & Franco, 2021) (Ávila-Robinson et al., 2022). (Nevertheless, the successful development and implementation of green innovation are contingent upon the presence of supportive leadership and enabling organizational structures (Abdul et al., 2023).

Importantly, the role of middle managers emerges as a critical yet underexplored factor in this process. Positioned between top management and operational employees, middle managers act as strategic intermediaries who translate high-level sustainability strategies into

actionable practices across organizational units (Molnar and Mulvihill, 2003; Sharma et al., 2021). Their capacity for innovativeness may significantly influence the effectiveness with which sustainability-oriented leadership is transformed into concrete innovation outcomes. Despite this, empirical evidence examining the boundary role of middle management innovativeness in strengthening the link between green leadership and green innovation remains scarce (Shajara et al., 2023; Clarke & Roome, 2010).

The present study aims to examine how green leadership influences green innovation and green performance and to investigate whether middle management innovativeness strengthens the translation of sustainability-oriented top leadership into operational green innovation practices. The exploration is anticipated to contribute significantly to the sustainability and organizational behavior literature by offering an integrated perspective connecting leadership with sustainability-oriented innovation pathways, and by elucidating how internal capabilities, employee engagement, and structural support foster green performance.

Drawing on the Job Demands–Resources (JD-R) theory (Bakker & Demerouti, 2017) and the Ability–Motivation–Opportunity (AMO) framework (Appelbaum et al., 2000), this study develops a multilevel perspective on how internal organizational capabilities support the execution of sustainability strategies. JD-R theory provides a foundation for understanding how leadership functions as a strategic resource that enhances employee engagement, knowledge sharing, and innovation capacity in response to sustainability pressures (Muisyo & Qin, 2021; Truong et al., 2023). Complementarily, AMO theory explains how firms build and leverage human capital capabilities to support strategic initiatives, including sustainability-oriented transformation (Albrecht et al., 2015).

Literature Review

JD-R theory explains how organizational resources encourage employee engagement and innovation (Cainelli et al., 2011). Accordingly, the theory outlines how firms respond to rising sustainability pressures by offering the psychological, social, and structural resources required for employees to participate effectively in green innovation initiatives (Muisyo & Qin, 2021). JD-R theory explains how leadership-generated resources such as support, autonomy, and transparency encourage employees to engage in innovation and align their behavior with environmental goals (Truong et al., 2023).

The theory further emphasizes that job resources play a central role in fostering communication, knowledge sharing, and proactive sustainability engagement across organizational levels (Obeng et al., 2024). Based on prior reports, firms that invest in resource-rich environments, particularly in settings where green transformation intersects with sustainability demands, are better equipped to navigate technological disruption, regulatory expectations, and innovation complexities (Thomas & Douglas, 2022).

Complementing JD-R, AMO Theory provides additional insight into how firms build and refine competencies to address evolving technological and environmental challenges (Appelbaum et al., 2000). AMO theory explains how organizational practices that build skills,

motivation, and opportunities support innovation and sustainability integration (Albrecht et al., 2015).

Green leadership and green performance

In the current sustainability-driven environment, organizations are increasingly required to cultivate green leadership to maintain competitiveness and improve environmental outcomes (Alzuman et al., 2025). This is primarily because green leadership functions as a strategic catalyst that integrates ecological values into organizational routines, enhances resource stewardship, and promotes environmentally responsible operational practices (Ahsan, 2025). As stated in a previous study, leaders who prioritize environmental concerns are essential in stimulating green innovation, fostering continuous learning, and promoting collaborative experimentation, thereby guiding respective organizations toward sustainability-oriented business models that elevate green performance (Albort-Morant et al., 2017).

In addition to improving internal operations, green leadership is in line with global sustainability agendas such as Sustainable Development Goal (SDG), including SDG 9 on innovation and SDG 12 on responsible and sustainable production (Wang et al., 2022). Through the advancement of green innovation and environmentally conscious behaviors, green leadership allows firms to meet regulatory requirements while contributing to wider ecological progress. Furthermore, by embedding sustainability considerations into strategic choices and organizational culture, the form of leadership would significantly enhance long-term resilience and environmental adaptability.

To reinforce the strategic role of green leadership within sustainable transformation, AMO Theory provides an important complement to JD-R framework. AMO emphasizes how organizations can build employee competencies, strengthen motivation, and offer opportunities that support sustainability initiatives (Appelbaum et al., 2000). Based on these insights, the following hypothesis was proposed:

Hypothesis 1. Green leadership is positively related to green performance

Green leadership and innovation

Green leadership functions as a strategic catalyst for green innovation by embedding environmental principles into organizational decision-making and day-to-day operations (Aggarwal & Agarwala, 2023). As stated in a prior investigation, leaders with strong environmental vision guide firms toward adopting eco-friendly technologies and sustainability-oriented practices that enhance resource efficiency while mitigating ecological impact (Aggarwal & Agarwala, 2023). By embedding sustainability values into corporate strategies, green leaders foster a culture that promotes continuous learning, creative problem-solving, and proactive environmental initiatives, thereby increasing the organization capacity to respond effectively to novel ecological challenges.

A central contribution of green leadership to green innovation lies in its ability to promote knowledge sharing and foster environmentally focused collaboration across teams and departments (Khan et al., 2023). As observed, leaders who champion sustainability typically

empower employees to pursue eco-innovative solutions, enabling organizations to better manage regulatory pressures and environmental expectations (Huo et al., 2022; Qu et al., 2022). These leaders significantly increase organizational agility, allowing firms to implement green practices more effectively and remain competitive regardless of the rapidly evolving sustainability and market demands.

According to a previous study, green leaders further reinforce innovation by promoting evidence-based decision-making, as well as using green performance indicators to refine strategies and strengthen sustainability outcomes (Cooke et al., 2023). Another exploration reported that by nurturing a collaborative ecosystem comprising suppliers, customers, and regulatory stakeholders, green leadership enhanced the entire effectiveness of green innovation initiatives (Khassawneh et al., 2024). This ecosystem-based approach ensures that green-oriented technological and managerial developments are in line with long-term sustainability objectives.

Green innovation includes designing environmentally friendly products, services, and processes through cross-functional collaboration and ongoing learning (Araújo & Franco, 2021). As a valuable and hard-to-replicate capability, the concept has been observed to significantly support competitive advantage in a sustainability-focused economy (Ávila-Robinson et al., 2022). Accordingly, green leadership strengthens this capability by integrating environmental considerations into decision-making, resource planning, and development cycles, ensuring sustainability is embedded in organizational operations (Khan et al., 2023).

Strong organizational commitment to green innovation, particularly among senior leadership, has similarly been found to amplify the impact of green leadership. This is evidenced by the observation that when managers actively support sustainability initiatives, green innovation evolves into a core organizational competency rather than a peripheral activity (Ahsan, 2025). This correspondence significantly helps organizations achieve environmental goals and ensures long-term resilience in an economy increasingly shaped by sustainability priorities (Stanikzai & Mittal, 2025). Based on these insights, the following hypotheses were proposed:

Hypothesis 2. Green leadership is positively related to green innovation.

Hypothesis 3. Green Innovation mediates the relationship between green leadership and green performance.

The moderating role of middle management innovativeness

Middle management innovativeness reflects the proactive orientation of managers who support sustainability initiatives, encourage experimentation, and allocate resources to environmentally focused innovation (Sipe, 2024). Positioned between top leadership and operational teams, middle managers play a crucial role in translating strategic sustainability priorities into practical innovation activities across organizational units (Soewarno et al., 2019). In organizations where middle managers demonstrate strong innovative orientation, leadership-driven environmental priorities are more likely to be translated into actionable innovation practices. When middle managers demonstrate strong innovative capabilities, they reinforce

green leadership by creating environments that accelerate the adoption of green practices and integrate sustainability into strategic and operational decisions (Tang et al., 2018). This role becomes particularly important in green innovation initiatives, which often involve higher levels of uncertainty, regulatory pressure, and organizational resistance compared with conventional innovation activities.

Organizations with innovative middle managers are therefore better positioned to translate sustainability-oriented top leadership vision into operational innovation activities, enabling firms to implement environmentally friendly processes and practices more effectively (Oecon, 2016). They also support collaborative decision-making and the development of eco-friendly solutions that enhance organizational adaptability and competitiveness (Yang et al., 2023). Consequently, the effectiveness of green leadership in promoting green innovation may depend on the extent to which middle managers possess innovative capabilities that facilitate experimentation and resource mobilization within organizational units. Considering these insights, the following hypothesis was proposed:

Hypothesis 4. The level of middle management innovativeness positively moderates the relationship between green leadership and green innovation.

Figure 1 presents the conceptual model of this study, reflecting the relationships among green leadership, green innovation, and green performance, as well as the moderating role of middle management innovativeness. The model shows that green leadership directly influences green innovation, which subsequently enhances green performance, signifying a mediating effect of green innovation. The model also emphasizes that middle management innovativeness strengthens the relationship between green leadership and green innovation. This is evidenced by the report that middle managers who promote creativity and experimentation helped integrate sustainability practices into daily operations, thereby amplifying the indirect effect of green leadership on green performance (Yang et al., 2023).

Research Method

Population and sample

The study population consists of employees working in solar panel firms in Indonesia. This sector was selected primarily because it provides a relevant institutional setting where sustainability-focused leadership and innovation capabilities are increasingly important due to national governance reforms, environmental regulations, and growing demands for organizational transparency. Furthermore, the solar panel industry in developing economies such as Indonesia is progressively embedding green practices into operational processes, making the setting appropriate for examining the influence of green leadership, green innovation, and middle management innovativeness on green performance. Previous explorations have emphasized the role of leadership and managerial competencies in driving sustainability-oriented changes in organizational contexts (Zada et al., 2025).

To address common method bias (CMB) and strengthen causal interpretation, this study adopted the use of a three-wave time-lagged data collection procedure. Introducing time gaps between the measurements of each variable helped establish clearer temporal ordering, thereby reducing endogeneity concerns and increasing the reliability of the results (Dhir et al., 2024). Time-lagged approaches have been widely recognized in green leadership and sustainability studies primarily because of how effective the approaches are in capturing genuine causal relationships rather than responses influenced by single-time perceptions or respondent bias (Egeland et al., 2023).

During the course of this investigation, 420 employees were invited to serve as the study population, out of which 350 provided consent. The data utilized, all of which were collected from respondents, were gathered across three separate waves, each spaced 4 weeks apart to allow the variables to unfold in sequence. During the first wave, demographic information was collected along with assessments of green leadership and middle management innovativeness, resulting in 320 valid responses (91.43%). Four weeks later, wave 2 was carried out with a focus on green innovation and was completed by 298 participants (85.14%). The final wave captured green performance, with 276 employees responding (78.86%). This staggered data collection approach significantly strengthened internal validity by tracing changes over time rather than relying on a single cross-sectional measurement.

The present study controlled for demographic variables such as age, gender, educational background, and work experience. Respondents included 58% male and 42% female, all of whom were aged between 22 and 45 years. The demographics were drawn from a variety of roles in solar panel firm, including technical and production staff (35%), project coordinators and supervisors (25%), quality and maintenance personnel (20%), as well as managerial or executive positions (20%). By incorporating insights from employees across operational and strategic levels, this investigation provides a comprehensive understanding of how green leadership and managerial innovativeness shape green innovation and sustainability practices in Indonesian solar panel firms.

Measures

The present study adopted the use of previously established multi-item measurement scales, applying a five-point Likert format from 1 (strongly disagree) to 5 (strongly agree) across all variables. Green leadership was measured using 6 items adapted from Ilyas et al. (2020). An example of these items includes, "our top managers show a positive attitude towards green practices." Subsequently, green innovation, functioning as the mediating variable, was assessed through 9 items adopted from Padilla-lozano et al. (2023). An example of these items includes, “my organization implements specific measures to prevent environmental pollution.” Middle management innovativeness, acting as the moderating variable, was evaluated using 9 items adapted from (Khalili, 2017), one of which includes, “our managers search continuously for opportunities to make change or improve the organization.” Lastly, green performance, the dependent variable, was examined using 9 items refined from Wang (2019). An example of these items includes, “Our firm conforms with the requirements of community relations.”

Analysis data

The relationship between green leadership, green innovation, middle management innovativeness, and green performance was investigated in this study by applying Structural Equation Modeling (SEM) through AMOS 24.0, in line with analytical approaches commonly applied in prior sustainability studies. Before performing the analysis, data were screened to ensure normal distribution and multicollinearity diagnostics confirmed all VIF values were below 5. The validity of the measurement model was subsequently examined through Confirmatory Factor Analysis (CFA), which demonstrated satisfactory model fit based on the Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). Mediation effects were also tested using a bootstrapping approach with 5,000 resamples, while moderation effects were assessed through interaction terms and interpreted with simple slope procedures.

Result

Table 1 presents the correlation matrix among the studied variables, reflecting several significant relationships. The obtained results showed how green leadership had a positive and statistically significant association with green performance ($r = 0.279$, $p < 0.01$) and green innovation ($r = 0.331$, $p < 0.01$), signifying that environmentally oriented leadership behaviors contributed directly to enhanced sustainability outcomes and innovative green initiatives. Middle management innovativeness was also found to be strongly related to green leadership ($r = 0.352$, $p < 0.01$), green performance ($r = 0.355$, $p < 0.01$), and green innovation ($r = 0.468$, $p < 0.01$). These results significantly emphasize the essential role of innovative middle managers in driving environmental improvement and strengthening the diffusion of sustainability-oriented innovations in organizations. Furthermore, the observed correlation between green innovation and green performance ($r = 0.122$, $p < 0.01$) reinforces the perception that innovation serves as a contributing mechanism for achieving enhanced green performance. All variables reflected Cronbach's alpha coefficients above the acceptable threshold of 0.70, supporting their respective internal reliability and psychometric robustness.

Measurement model

Measurement model was evaluated to ensure the adequacy of convergent and discriminant validity, as well as to confirm the robustness of the variables used in this study. Convergent validity was examined through standardized factor loadings, average variance extracted (AVE), and composite reliability (CR). As presented in Table 2, all items showed satisfactory standardized factor loadings ranging from 0.69 to 0.96, exceeding the recommended threshold of 0.60. AVE values range between 0.60 and 0.69, surpassing the minimum criterion of 0.50, which signifies that each latent variable adequately explains the variance of its observed indicators.

All the observed variables further showed strong internal reliability. This is evidenced by the obtained Cronbach's alpha values for each variable, all of which were above the acceptable

limit of 0.70, supporting reliability and internal consistency. Composite reliability values also fell in 0.92 to 0.96, well above the recommended benchmark of 0.70, confirming that the measurement scales were precise and stable in capturing respective variables. These results collectively validate that measurement properties are statistically sound, thereby supporting the appropriateness of the variables for further structural model testing.

Structural model

The results of structural model provide strong empirical support for the proposed hypotheses. SEM was adopted to conduct a path analysis and assess the hypothesized relationships (see Figure 2). The fit indices, alongside their recommended thresholds (Hair et al., 2019), including a chi-square to degrees-of-freedom ratio below three ($\chi 2/df < 3$), CFI, Incremental Fit Index (IFI), and TLI values of at least zero point nine (0.91; 0.93; 0.96), as well as RMSEA value lower than zero point zero-eight (< 0.06), showed that the model possessed an acceptable level of fit. Hypothesis 1 was accepted, as green leadership was observed to positively and significantly influence green performance ($\beta = 0.318$; $p = 0.007$). This result signified that when leaders show strong environmental commitment and direction, organizations become more capable of achieving improved sustainability outcomes. Hypothesis 2 was also supported, reflecting that green leadership similarly had a positive effect on green innovation ($\beta = 0.451$; $p = 0.021$). This suggests that environmentally focused leadership significantly promotes the development and implementation of green innovation, thereby enhancing long-term ecological and strategic capabilities. The mediating role of green innovation proposed in Hypothesis 3 was also confirmed. Based on the observation made, the indirect pathway from green leadership to green performance through green innovation was statistically significant ($\beta = 0.126$, SE = 0.029, LLCI-ULCI = 0.071–0.194, $p = 0.001$). These results invariably reflected that green innovation served as a mediating mechanism in the relationship between green leadership and green performance. Collectively, the findings emphasize the significance of fostering green leadership practices and advancing innovation initiatives to strengthen green performance.

Moderating role analysis

To examine the moderating role of middle management innovativeness, PROCESS Macro Model 1 (Osei et al., 2019) was adopted. The results obtained from the analysis confirmed that middle management innovativeness acted as a significant moderator, leading to the acceptance of Hypothesis 4. Specifically, the conditional effects of green leadership on green performance differ depending on the level of middle management innovativeness.

As shown in Table 3, the moderating interaction between green leadership and middle management innovativeness on green innovation is both positive and significant ($\beta = 0.1125$, SE = 0.0513, 95% CI = 0.0172–0.2281). These results emphasize the strategic contribution of middle management innovativeness in translating leadership commitment into tangible environmental outcomes. Essentially, the observations made reinforce the theoretical proposition that middle management innovativeness acts as an essential catalyst in maximizing the effectiveness of green leadership on green innovation. This implies that organizations aiming to enhance respective green innovation should not only develop green leadership but

also foster a culture of managerial innovation to ensure stronger and more consistent environmental achievements.

Discussion

The findings of this study provide important insights into how firms can effectively translate sustainability-oriented strategies into tangible green performanceoutcomes through the development and orchestration of internal capabilities. Specifically, the results demonstrate that green leadership functions not merely as a behavioral or cultural attribute but as a strategic organizational capability that enables firms to align sustainability objectives with operational and innovation processes. From a strategic perspective, the positive relationship between green leadership and green performance indicates that firms embedding environmental considerations into leadership practices are better positioned to enhance sustainability outcomes and strengthen long-term organizational resilience. This finding suggests a shift from compliance-driven environmental management toward capability-driven sustainability strategies, where leadership plays a central role in shaping firm-level environmental competitiveness (Ávila-Robinson et al., 2022).

Furthermore, the mediating role of green innovation highlights its function as a critical strategic mechanism through which sustainability-oriented leadership is operationalized. Rather than exerting a direct effect alone, green leadership enables firms to develop innovation capabilities that support environmentally friendly products, processes, and practices, thereby enhancing green performance (Albort-Morant et al., 2017). This aligns with prior research emphasizing that innovation serves as a key pathway through which sustainability strategies are translated into competitive advantage and performance outcomes (Ávila-Robinson et al., 2022).

Importantly, this study extends existing knowledge by demonstrating that the effectiveness of green leadership is contingent upon internal organizational conditions, particularly middle management innovativeness. The moderating effect suggests that middle managers play a pivotal role in bridging the gap between strategic intent and operational execution. When middle managers exhibit strong innovative orientation, they facilitate the transformation of sustainability strategies into actionable initiatives, thereby amplifying the impact of green leadership on green innovation and performance (Yang et al., 2023). Conversely, limited innovativeness at the middle management level may constrain the firm's ability to fully leverage leadership-driven sustainability initiatives (Wang, 2019).

These findings reinforce the importance of internal alignment and capability integration in sustainability strategy execution. Firms that successfully combine strategic leadership commitment with innovation-oriented managerial capabilities are more likely to achieve consistent and scalable green performance improvements. In this regard, sustainability is not only a strategic intention but also a function of how effectively internal actors mobilize resources, knowledge, and innovation processes across organizational levels (Zada et al., 2025).

This study contributes to a more nuanced understanding of sustainability strategy implementation by illustrating that green performance outcomes depend on the interplay between leadership, innovation, and managerial capabilities. It underscores the need for firms to move beyond symbolic sustainability commitments and focus on building internal mechanisms that enable the effective execution of environmental strategies across hierarchical levels (Akinwalere et al., 2025; Jayashree et al., 2022; Asiaei et al., 2021).

Theoretical implications

The present study advances the investigation of sustainability-oriented leadership in private-sector organizations by emphasizing several key contributions. First, this study reconceptualizes green leadership as a strategic organizational capability rather than solely a behavioral or ethical construct. By demonstrating its direct and indirect effects on green performance, the findings extend existing sustainability research by positioning leadership as a key driver of firm-level environmental competitiveness and long-term value creation (Obgapeng et al., 2024; Acharya & Jena, 2016). This perspective aligns with the growing emphasis on internal capabilities as foundational elements of sustainability-oriented competitive advantage.

Second, the study contributes to theory by identifying green innovation as a central mediating mechanism that links sustainability-oriented leadership with green performance outcomes. While prior research has acknowledged the importance of green innovation, this study provides empirical evidence of its role as a capability through which strategic intent is transformed into measurable environmental outcomes. This reinforces the view that innovation capabilities are essential for firms seeking to operationalize sustainability strategies effectively (Albrecht et al., 2015).

Third, the integration of JD–R and AMO frameworks extends their application into the domain of strategic sustainability. The findings suggest that leadership-driven resources (JD-R) and capability-building mechanisms (AMO) jointly enable firms to develop and deploy sustainability-oriented innovation capabilities. This multi-theoretical integration provides a more comprehensive explanation of how internal organizational processes support environmental strategy execution, thereby enriching both frameworks within the context of sustainability research (Appelbaum et al., 2000).

Fourth, this study highlights the critical boundary role of middle management innovativeness, thereby advancing understanding of multilevel dynamics in sustainability strategy implementation. By demonstrating that middle managers influence the strength of the relationship between leadership and innovation, the study underscores the importance of internal alignment across hierarchical levels. This finding contributes to the emerging literature emphasizing that the effectiveness of sustainability strategies depends not only on top-level commitment but also on the capabilities of intermediate actors responsible for implementation (Obgapeng et al., 2024)

Practical implications

The current investigation provides actionable insights for private-sector leaders, HR specialists, and policymakers aiming to enhance sustainability outcomes. First, the strong influence of green leadership on innovation and green performance emphasizes the importance of integrating sustainability-oriented capabilities into managerial development. Accordingly, training initiatives should cultivate environmental awareness, responsible decision-making, and the capacity to articulate sustainability goals effectively, while recruitment and promotion processes can be structured to reinforce and reward green leadership behaviors. Second, the mediating role of green innovation stresses the need to cultivate organizational environments that promote experimentation, problem-solving, and cross-unit collaboration. In this context, initiatives such as innovation task forces or recognition systems can institutionalize continuous eco-friendly improvements. Third, enhancing middle management innovativeness is essential, as it amplifies green leadership effectiveness. Developing the skills, motivation, and capacity of mid-level managers to champion green initiatives ensures sustainability objectives are meaningfully translated into daily operations. Strategic alignment, clear communication, adequate resources, and delegated decision-making further strengthen organization-wide sustainability transformation.

Conclusion

In conclusion, this study examined the relationship between green leadership, green innovation, middle management innovativeness, and green performance in Indonesian solar panel industry. Drawing on JD–R framework and AMO perspective, the obtained results showed the essential role of sustainability-oriented leadership and capability-enhancing mechanisms in driving environmental outcomes in private-sector organizations. Based on the analysis conducted, green leadership was found to foster employee behaviors, learning, and commitment toward ecological goals, with its impact on green performance partially mediated by green innovation. Following green leadership, middle management innovativeness was observed to further strengthen the relationship, reflecting that mid-level managerial creativity and experimentation are essential in translating leadership directives into tangible sustainability results.

For private-sector leaders, the study results emphasize the importance of developing leadership competencies, promoting innovation-supportive structures, and enhancing managerial capacity to accelerate sustainability initiatives and reinforce organizational accountability.

Future Research

Regardless of the fact that this study significantly contributes to the understanding of sustainability-oriented leadership in the private sector, several limitations should be addressed. First, data were collected solely from Indonesian solar panel firms, which may limit generalizability to other industries or administrative contexts. To address the stated limitation, comparative studies could consider including several other sectors or regions, as this will

invariably strengthen external validity. Second, reliance on self-reported surveys introduces potential CMB despite precautions. In this context, future explorations could adopt multi-source, mixed-method, or longitudinal designs to enhance measurement accuracy and causal inference. Third, the framework focuses on four variables, namely green leadership, green innovation, middle management innovativeness, and green performance. Incorporating additional organizational factors, such as green culture or employee resilience, may provide a more comprehensive view of sustainability outcomes. Finally, exploring alternative boundary conditions, complex moderated mediation models, or private comparisons could further refine the theoretical model and deepen understanding of how sustainability-oriented leadership drives performance.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this research. The authors have no financial, personal, or professional relationships that could influence the research process, data analysis, or interpretation of the results.

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