Mapping Green Innovation in SMEs: Internal-External Drivers, Performance Impacts, and Product Differences

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Abstract: Industrialization has accelerated global economic growth but has simultaneously intensified environmental degradation through resource depletion, pollution, and rising ecological pressures. In response, green innovation has emerged as a strategic pathway for firms particularly small and medium-sized enterprises (SMEs) to integrate environmental responsibility into their products, processes, and organizational practices. However, the adoption of green innovation within SMEs in developing economies remains limited due to constrained resources, institutional complexity, and inconsistent regulatory enforcement. This study conducts a systematic literature review (SLR) supported by bibliometric analysis using Scopus-indexed publications to examine three core issues: (1) the influence of internal and external factors on green innovation, (2) the impact of green innovation on SME performance, and (3) the distinctions between green and non-green products. A total of 122 relevant studies were analyzed through PRISMA-based screening, followed by keyword co-occurrence, citation mapping, and thematic clustering using VOSviewer. Findings reveal that internal capabilities such as green HRM, learning orientation, and dynamic capabilities interact with external pressures including regulation, stakeholder expectations, and technological turbulence to shape green innovation adoption. Moreover, green innovation significantly enhances SME competitiveness and sustainable performance. The study contributes by integrating determinants, impacts, and product-level distinctions into a unified framework relevant for SMEs in emerging markets.

Keywords: Green Innovation, Sustainable Performance, Small and Medium Enterprises (SMEs), Digital Transformation, Green Human Resource Management

Introduction

Industrialization has significantly boosted global economic prosperity by enhancing productivity, driving technological innovation, and expanding access to goods and services. However, this growth has also given rise to serious environmental challenges. As production demands escalate, so does the consumption of limited resources such as water, energy, and raw materials leading to resource depletion, pollution, and massive waste generation. These pressures strain ecological systems and undermine long-term industrial sustainability.

Proposed Solution

In response to these environmental threats, many firms especially small and medium-sized enterprises (SMEs) are embracing green innovation. Green innovation has emerged as a central mechanism by which businesses integrate ecological responsibility into their products, processes, and.

organizational practices. A study indicates that green innovation is driven by external environmental pressure and institutional demands, as well as by internal resource limitations such as knowledge and technological constraints (M. Li et al., 2022). While large corporations have widely implemented green innovation strategies, small and medium-sized enterprises (SMEs) in developing economies remain at an early stage of transition, despite their significant role in national economic growth In many emerging markets, the internal and external determinants that shape a firm's ability to adopt green innovation have become a major research focus. Internal factors such as organizational resources, leadership orientation, employee competencies, and green capabilities strongly influence a firm's readiness to integrate environmentally responsible practices (Alshammari, 2024; M. Li et al., 2022; Mirčetić et al., 2022; Shao et al., 2024; N. Wang et al., 2022). At the same time, external factors including government regulation, technological advancements, and stakeholder expectations play a vital role in encouraging or constraining green-oriented initiatives (Abro et al., 2024; Laradi et al., 2024; L. Wu et al., 2025). However, the interplay between internal and external forces remains insufficiently understood within the context of SMEs, especially in developing countries where resource limitations and institutional complexity often hinder sustainability adoption. This condition leads to the first research question regarding how internal and external factors influence green innovation.

Green innovation is recognized as a strategic driver of competitive advantage for SMEs, enabling them to enhance efficiency, reduce waste, strengthen market positioning, and comply with evolving environmental standards. Prior research indicates that SMEs engaging in green innovation tend to exhibit higher performance outcomes, improved customer perception, and stronger resilience in dynamic markets (Achmad & Wiratmadja, 2025). Yet, empirical evidence on the specific impact of green innovation within micro-level business environments particularly among small enterprises operating with limited capital and technological capabilities remains relatively scarce. Existing studies often focus on large firms, leaving a gap in understanding its implications for smaller businesses. This gap informs the second research question concerning the impact of green innovation on SME performance.

The distinction between green and non-green products has also become an important theme in sustainability research. Green products are generally characterized by reduced environmental impact across their lifecycle, including responsible material sourcing, lower carbon emissions, and improved recyclability (Chen et al., 2024; Janahi et al., 2021; Marco-Lajara et al., 2023). In contrast, non-green products typically focuses on economic gains or technical performance rather than environmental concerns (Meng & Imran, 2024; Rizaldy et al., 2025). Despite growing consumer awareness, the market penetration of green products remains uneven, influenced by factors such as price sensitivity, limited product knowledge, and inconsistent regulatory enforcement. Moreover, the academic literature still provides limited comparative analysis explaining how these differences affect business strategy, consumer behavior, and innovation pathways. This gap leads to the third research question regarding the differences between green and non-green products.

Urgency and research objective

Although existing literature acknowledges the relevance of sustainability-driven innovation, significant gaps remain. First, studies rarely integrate internal and external determinants into a unified framework to explain green innovation adoption among SMEs in emerging economies. Second, empirical findings on how green innovation affects SME performance are still fragmented and vary across sectors, suggesting the need for context-specific investigations. Third, comparative studies examining differences between green and non-green products often lack clarity in defining conceptual boundaries, operational indicators, and their implications for business practices. These gaps collectively justify the importance of examining internal factors, external pressures, and innovation outcomes in a single research model.

Based on these gaps, this study formulates the following research questions: (1) How do internal and external factors influence green innovation? (2) What is the impact of green innovation on SMEs? and (3) What are the differences between green and non-green products? Through addressing these questions, the study aims to provide a comprehensive and empirically grounded understanding of

sustainability-oriented innovation within the SME context.

The expected contribution of this study is twofold. Theoretically, it enriches sustainability and innovation literature by integrating internal capabilities, external institutional pressures, and green product conceptualization within a coherent analytical framework. Practically, the findings will help SMEs, policymakers, and industry stakeholders develop more effective strategies to adopt environmentally responsible innovation, enhance competitiveness, and encourage a broader shift toward sustainable production systems. By focusing on SMEs in a developing-country context, this research contributes novel insights into how resource-constrained firms can transition toward greener business models.

Methodology

This study employs a systematic literature review (SLR) combined with bibliometric analysis to examine research developments, material topics, and opportunities related to the implementation of green innovation in MSMEs. All data were sourced exclusively from the Scopus database due to its broad coverage of peer-reviewed publications in environmental management, innovation studies, and sustainability-oriented business practices. During the pre-search process, several challenges emerged, particularly the inconsistency of terminology used by authors when referring to green innovation. Many publications do not directly employ the term "green innovation," instead using related phrases such as "eco-innovation," "environmental innovation," or "sustainable technological innovation." Therefore, the search strategy was refined to incorporate broader variations of keywords to capture the full scope of relevant literature.

Data Analysis steps for SLR

Figure 1 presents the methodological framework applied in this study to conduct a systematic literature review (SLR) and bibliometric analysis on green innovation within MSMEs. This framework follows a structured process designed to map research trends, extract material topics, and identify both challenges and opportunities associated with implementing green innovation. Although the analytical structure was developed for the context of MSMEs, the framework is flexible and can be adapted to various industry sectors. The stages outlined in the figure summarize the sequential steps of the methodology, offering a comprehensive and scalable model for examining green innovation practices across different organizational settings.

Step 1: Research review paper selection

The search process began with the construction of a comprehensive keyword set: "green innovation" OR "eco-innovation" OR "environmental innovation" AND "SMEs" OR "MSMEs" AND "organizational performance". This combination ensured that the query covered innovations, environmental practices, and performance outcomes specifically in small and medium enterprises. The initial search generated 985 documents. Screening was conducted based on titles, abstracts, and subject areas, narrowing the dataset to 914 relevant records. Eligibility filtering was then applied using three criteria: Written in English, Published in peer-reviewed journals, Available in open-access format.

After this filtering stage, 122 documents were retained for in-depth assessment. The process followed the PRISMA structure identification, screening, eligibility, and inclusion to ensure transparency and reproducibility. A PRISMA flow diagram summarizing each stage of the selection process supports methodological clarity and aligns with standard SLR reporting practices.

Step 2: Bibliometric Analysis of Green Innovation Research Trends

The second stage involved mapping the intellectual structure and thematic development of green innovation using bibliometric techniques. VOSviewer was utilized to visualize and analyze: Citation networks of journals and authors, Keyword co-occurrence, Bibliographic coupling between publications. These analyses help reveal the dominant research themes, evolution of concepts, and interconnections among scholars. From the 122 selected papers, clusters of frequently co-occurring keywords and citation patterns emerged, forming the basis for the thematic classifications used in subsequent stages. The bibliometric maps also highlighted how green innovation research in MSMEs

has shifted from general environmental management toward more strategic discussions involving competitiveness, performance, and innovation capabilities.

Step 3: Identification Material Topics in Implementing Green Innovation

Based on the bibliometric clustering, the third stage focused on extracting material topics that frequently appear in the literature and are relevant for MSME-level implementation.

Step 4: Opportunities in Implementing Green Innovation

The final stage explored actionable insights derived from the literature. Opportunities were identified by comparing gaps in existing MSME practices with the research evidence extracted from earlier stages. Practical approaches include capacity-building for green skills, adoption of energy-efficient technologies, collaboration with local suppliers, utilizing eco-design principles, and leveraging government incentives for environmental innovation.

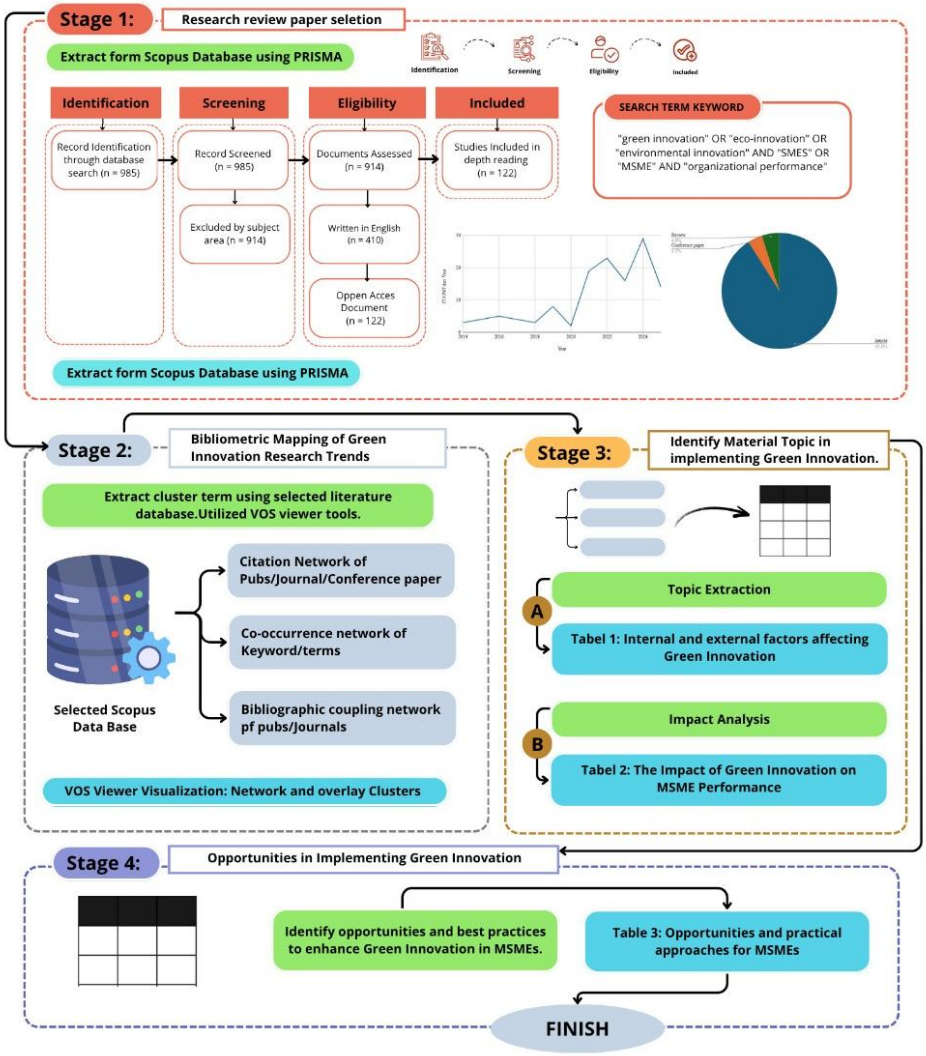

Figure 1. Data Analysis flow-chart for Systematic Literature Review and Bibliometric Analysis Framework

Results

Stage 1: Research review paper selection

The review process began with the extraction of articles from the Scopus database using predefined keywords related to green innovation, eco-innovation, environmental innovation, MSMEs, and organizational performance. The identification, screening, and eligibility assessments followed the PRISMA flow structure as used in the template. A total of 985 documents were initially identified. After

removing unrelated subject areas (n = 914), non-English documents, and non–open-access studies, a final set of 122 studies met the inclusion criteria for in-depth analysis.

Stage 2: Bibliometric Analysis of Green Innovation Research Trends

Figure 2 and 3 provides a comprehensive visualization of thematic patterns derived from the bibliometric analysis, illustrating how research on green innovation, sustainability, and SME performance has evolved over time. The mapping highlights the intellectual structure of the field, showing how key concepts are interconnected and how research priorities have shifted in recent years.

In Figure 2 the network cluster visualization depicts several thematic clusters formed based on keyword co-occurrence. The cluster representing green innovation appears centrally positioned, linking closely with terms such as sustainability, innovation capabilities, environmental innovation, digital transformation, and SMEs. This central position indicates that green innovation serves as a bridging concept across multiple research domains, including environmental management, sustainable performance, organizational resilience, and digital technology adoption. The diversity of clusters reflects the multidisciplinary nature of green innovation research, especially within the context of micro, small, and medium enterprises.

Figure 3, the overlay visualization, illustrates the temporal progression of research themes from earlier foundational topics to more recent emerging concepts. Keywords shaded in darker tones represent earlier studies, typically focusing on innovation, sustainability, and SME performance. In contrast, newer topics appear in yellow-green tones, highlighting current directions in the literature, such as digital transformation, green human capital, environmental dynamism, and knowledge sharing. These emerging keywords suggest a growing scholarly emphasis on how SMEs adopt green innovation in response to technological change, environmental uncertainty, and evolving competitive pressures.

Overall, the bibliometric results reveal a clear upward trend in research on green innovation among SMEs, reflecting increasing global attention to sustainable development and environmental responsibility. The clustering and temporal analyses demonstrate that green innovation has become a critical component in discussions on organizational performance, resilience, and competitive advantage particularly for SMEs operating in rapidly changing economic and ecological environments.

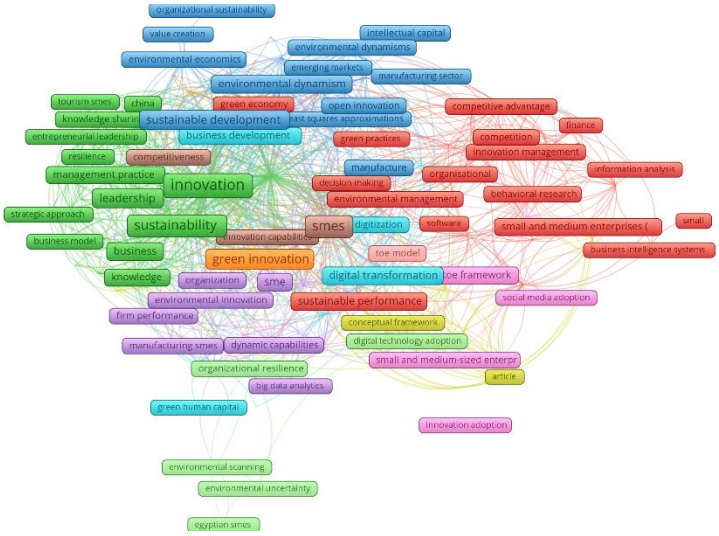

Figure 2. Network Cluster, the structure of networks device arrangement, data flows, and dependencies

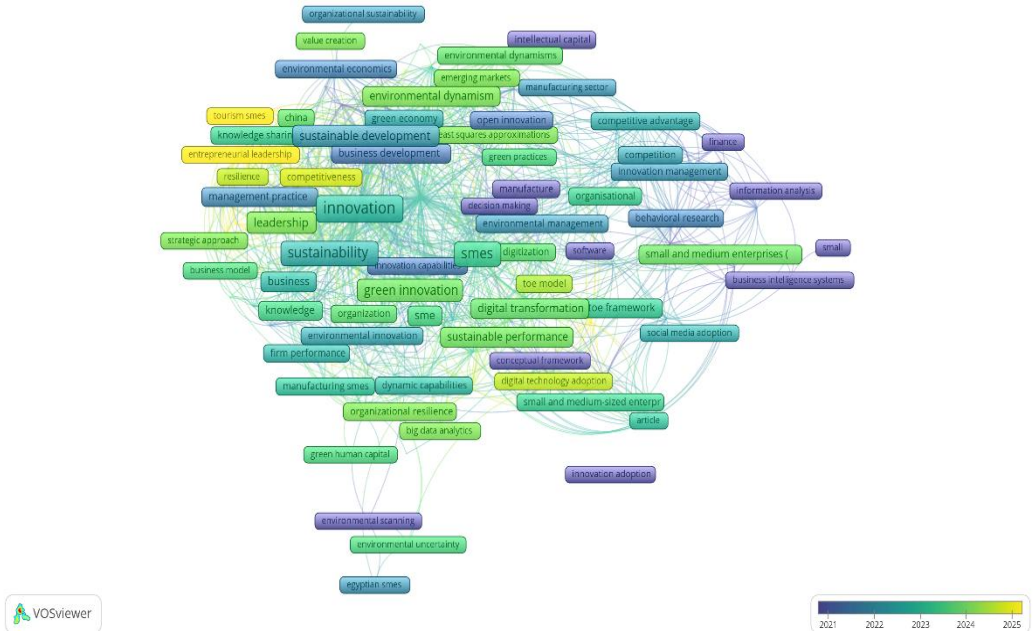

Figure 3. Overlay Visualization, type of network visualization that uses color to differentiate items

Stage 3A: Identification Material Topics in Implementing Green Innovation

Recent bibliometric trends and keyword clusters in the field of green innovation demonstrate a clear movement toward sustainability-oriented and digitally supported business practices among SMEs as shown in Table 1, emerging themes such as digital transformation, environmental innovation, and sustainable performance are becoming central material topics that shape the current research landscape. These topics highlight not only the primary challenges faced by SMEs such as environmental uncertainty, capability development, and competitive pressure, but also the strategic areas where intervention is most needed.

Table 1. Research Trends in Green Inovation

Cluster Color	Cluster	Older Terms	Newest Terms (2023-2025)	Insights	Area of Interest / Material Topics
Green	Sustainability & Green Innovation	sustainability, business model, knowledge, leadership, environmental innovation	green human capital, environmental scanning, environmental uncertainty	Research has evolved from general sustainability concepts toward human-capital-based sustainability, environmental uncertainty, and capability building.	ESG, green innovation, sustainability strategy, environmental capability
Teal / Blue	Innovation & Business Development	innovation, open innovation, environmental dynamism, sustainable development	innovation capability, green practices, value creation	Research is shifting from broad innovation constructs toward capability-based innovation and value creation in dynamic environments.	Innovation management, sustainable innovation, strategic innovation

Cluster Color	Cluster	Older Terms	Newest Terms (2023-2025)	Insights	Area of Interest / Material Topics
Light Blue / Cyan	SMEs & Digitalization	SMEs, digitization, digital transformation	digital technology adoption, organisational resilience, manufacturing SMEs	The focus is moving from basic digital adoption to organizational resilience, digital capability, and sector-specific (manufacturing) digital transformation.	Digital transformation, SME competitiveness, Industry 4.0, resilience
Red	Competitive Advantage & Performance	competitive advantage, innovation management, finance	business intelligence systems, behavioural research, information analysis	Research expands from traditional competitive strategies toward analytics-driven and behavioral decision-making approaches.	Competitive strategy, business intelligence, performance analytics
Pink	Digital Adoption & Social Media	social media adoption, adoption, SME adoption	digital framework, conceptual framework	Recent studies focus on developing conceptual and digital adoption frameworks to improve SME digital performance.	Social media strategy, digital adoption model, SME digital capability
Purple	Environmental Management & Capabilities	environmental management, firm performance	dynamic capabilities, big data analytics	Research combines environmental management with advanced analytical capabilities and digital data-driven approaches.	Environmental analytics, sustainable performance, capability development

Stage 3B: The Impact of Green Innovation

The mapping of key material topics reveals that green innovation is shaped by the interaction between internal organizational capabilities and external environmental pressures. Internally, factors such as green HRM, green competencies, organizational learning, and dynamic capabilities play a central role in strengthening sustainability-driven innovation, while leadership and control systems ensure consistent alignment with environmental goals, as shown in Table 2. Externally, regulatory forces, market expectations, technological turbulence, and stakeholder pressure accelerate the need for green transformation across industries. Across areas like digital competitiveness, sustainable innovation, business intelligence, and environmental analytics, the evidence shows that firms advance when they successfully integrate internal green capabilities with external demands highlighting that sustainability is no longer optional but structurally embedded in competitive strategy.

Table 2. Key Internal and External Factors Shaping Green Innovation

Material topics	**Faktor Internal**	**Faktor Eksternal**
Green innovation & sustainability strategy	Organizational Environmental Culture, Green HRM, Green competencies (Al Doghan et al., 2022; Gazi et al., 2025; Lin et al., 2024; Mirčetić et al., 2022) Organizational Green Learning, Green dynamic capability (Frare et al., 2022; N. Wang et al., 2022) Pro-green leadership & organizational support (Alshammari, 2024; Tuan & Canh, 2022)	Regulatory pressure, stakeholder expectations (Alam et al., 2025) Green technological turbulence (GTT) / market & tech shocks (N. Wang et al., 2022) Institutional pressure, GSCM, institutional pressures (Lee & Choi, 2021; Wen et al., 2023)
Innovation management & sustainable innovation	Absorptive capacity / Organizational Green Learning/ knowledge acquisition (Awan et al., 2021; Song et al., 2021; N. Wang et al., 2022) Green dynamic capabilities & resource integration (Frare et al., 2022) Leadership & managerial capability (Laradi et al., 2024; Zhao & Huang, 2022) Internal governance, formal & social control, relational capability (PICHLAK, 2021; Zhang et al., 2021)	Technological/market turbulence & institutional pressure (N. Wang et al., 2022; Wen et al., 2023) Stakeholder expectations & ESG mandates (Alam et al., 2025; Chen et al., 2024; L. Wu et al., 2025)
Digital transformation & SME competitiveness	IT-enabled transformation / digital readiness / AI / IR4.0 (Demirel et al., 2025; S. Li et al., 2025; Sun & Chu, 2022; Y. Wu et al., 2025) Learning capability & digital skills; intellectual capital (human, relational, and organizational capital)(Achmad & Wiratmadja, 2025; Frare et al., 2022)	Fintech / green finance / green innovations and financial development (Lăzăroiu et al., 2023) Social media (Ahmed & Streimikiene, 2021) Post-COVID acceleration & external factor (Alraja et al., 2022; Sun & Chu, 2022)
Competitive strategy & business intelligence	Green strategic intent & green intellectual capital (Achmad & Wiratmadja, 2025; Jirakraisiri et al., 2021) Organizational learning, BI/data readiness, process innovation (Ahmed et al., 2023; Frare et al., 2022) CEO identity / leadership shaping strategy (Lu et al., 2025; Ren et al., 2021)	Market complexity, institutional ownership (Ren et al., 2021) Competitive pressure & stakeholder pressure (Bintara et al., 2023; F. A. Khan et al., 2024)
Social media strategy & digital adoption framework	CSR integration with digital strategy; marketing capability (Ahmed & Streimikiene, 2021; Hang et al., 2022) Organizational digital readiness & green learning orientation (C. Wang et al., 2022; N. Wang et al., 2022)	Social media platforms & cultural advertising driving adoption (Ahmed & Streimikiene, 2021; Raza et al., 2021) Stakeholder expectations for transparent sustainability communication (Abro et al., 2024; Alam et al., 2025)
Environmental analytics & sustainable performance	GSCM practices, PMS / measurement & dashboards for sustainability (Wen et al., 2023; Zhu, 2024)	Regulatory requirements, circular economy policies, fiscal incentives (Dzwigo et al., 2021; Janahi et al., 2021)

Material topics	Faktor Internal	Faktor Eksternal
Green innovation & sustainability strategy	Organizational Environmental Culture, Green HRM, Green competencies (Al Doghan et al., 2022; Gazi et al., 2025; Lin et al., 2024; Mirčetić et al., 2022) Organizational Green Learning, Green dynamic capability (Frare et al., 2022; N. Wang et al., 2022) Pro-green leadership & organizational support (Alshammari, 2024; Tuan & Canh, 2022)	Regulatory pressure, stakeholder expectations (Alam et al., 2025) Green technological turbulence (GTT) / market & tech shocks (N. Wang et al., 2022) Institutional pressure, GSCM, institutional pressures (Lee & Choi, 2021; Wen et al., 2023)
Innovation management & sustainable innovation	Absorptive capacity / Organizational Green Learning/ knowledge acquisition (Awan et al., 2021; Song et al., 2021; N. Wang et al., 2022) Green dynamic capabilities & resource integration (Frare et al., 2022) Leadership & managerial capability (Laradi et al., 2024; Zhao & Huang, 2022) Internal governance, formal & social control, relational capability (PICHLAK, 2021; Zhang et al., 2021)	Technological/market turbulence & institutional pressure (N. Wang et al., 2022; Wen et al., 2023) Stakeholder expectations & ESG mandates (Alam et al., 2025; Chen et al., 2024; L. Wu et al., 2025)
Digital transformation & SME competitiveness	IT-enabled transformation / digital readiness / AI / IR4.0 (Demirel et al., 2025; S. Li et al., 2025; Sun & Chu, 2022; Y. Wu et al., 2025) Learning capability & digital skills; intellectual capital (human, relational, and organizational capital)(Achmad & Wiratmadja, 2025; Frare et al., 2022)	Fintech / green finance / green innovations and financial development (Lăzăroiu et al., 2023) Social media (Ahmed & Streimikiene, 2021) Post-COVID acceleration & external factor (Alraja et al., 2022; Sun & Chu, 2022)
Competitive strategy & business intelligence	Green strategic intent & green intellectual capital (Achmad & Wiratmadja, 2025; Jirakraisiri et al., 2021) Organizational learning, BI/data readiness, process innovation (Ahmed et al., 2023; Frare et al., 2022) CEO identity / leadership shaping strategy (Lu et al., 2025; Ren et al., 2021)	Market complexity, institutional ownership (Ren et al., 2021) Competitive pressure & stakeholder pressure (Bintara et al., 2023; F. A. Khan et al., 2024)
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	Green HRM, employee engagement & green psychological climate (Lin et al., 2024, 2024; Meng & Imran, 2024)	Buyer/supplier environmental collaboration & supply chain governance (Lee & Choi, 2021) External shocks (pandemic) forcing

Material topics	**Faktor Internal**	**Faktor Eksternal**
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		analytics & waste/operational changes (Bahmani et al., 2023; Sun & Chu, 2022)

The synthesis of internal and external determinants shows that internal capabilities such as green knowledge, competencies, HRM practices, learning orientation, and leadership significantly enhance green innovation capability, environmental performance, and organizational competitiveness. These capacities also promote employee green behavior and strengthen sustainable performance, particularly within SMEs. Externally, regulatory pressure, stakeholder expectations, digital transformation, and institutional environments act as catalysts that accelerate green innovation adoption. Support mechanisms such as government incentives and supply chain pressure further reinforce sustainability outcomes, although institutional constraints may either strengthen or hinder environmental performance depending on firms' adaptive strategies. As shown in Table 3.

Table 3. Impacts of Internal and External Factors on Green Innovation and Sustainability Performance

Factor	Impact	Evidence
Internal	Enhances Green Innovation Capability	Internal factors such as green culture, green competencies, green HRM, green knowledge, learning capability, and leadership strengthen a firm's green innovation capability (Alshammari, 2024; Enbaia et al., 2024; Gazi et al., 2025; Lin et al., 2024; Mirčetić et al., 2022; Shao et al., 2024; N. Wang et al., 2022; Zhao & Huang, 2022)
	Improves Environmental Performance	Green competencies, green leadership, service innovation competence, employee green behavior, and organizational support enhance environmental performance (Alshammari, 2024; F. A. Khan et al., 2024; Najib et al., 2022; Shao et al., 2024; Zhao & Huang, 2022)
	Strengthens Knowledge Sharing & Organizational Learning	Internal knowledge, green human capital, innovation capability, knowledge sharing, and regenerative unlearning improve a company's ability to generate innovation (Alam et al., 2025; Anshima et al., 2025; Cegarra-Navarro et al., 2025; Mirčetić et al., 2022)
	Improves Organizational Performance & Competitiveness	Green competencies, corporate social responsibility, employee innovation behavior, and green marketing orientation contribute to organizational performance and competitive advantage (F. A. Khan et al., 2024; Mirčetić et al., 2022; Zahrani, 2024)
	Enhances Employee Green Behavior	Leadership, green HRM, organizational commitment, shared vision, and green culture reinforce employees' green behavior (Alshammari, 2024; Anshima et al., 2025; Enbaia et al., 2024; Gazi et al., 2025)
	Improves SMEs' Sustainable Performance	Internal capabilities such as green core competence, CSR, service innovation competence, and green talent management significantly influence sustainability performance (Shao et al., 2024)
External	Regulatory Pressure Increases Green Innovation & Environmental Performance	Regulatory pressures, government standards, and external regulations compel firms to enhance green innovation and ESG performance (Alam et al., 2025; Lu et al., 2025; X. Wang & Gualberto, 2024)
	Digital Transformation Drive Sustainability Performance	Technological turbulence and digital transformation influence green innovation and sustainability performance (S. Li et al., 2025; Ma et al., 2023; N. Wang et al., 2022)
	Government Subsidies, Incentives & Public Attention Promote Green Innovation	Government subsidies, public environmental attention, and institutional support strengthen firms' green innovation capability (Mu et al., 2025; Rizaldy et al., 2025)
	Institutional Constraints Weaken or Strengthen Environmental Performance	Economic conditions, corporate policies, and institutional environments may either strengthen or undermine green innovation depending on firms' adaptive strategies (S. Li et al., 2025; Lu et al., 2025; Meng & Imran, 2024; Mu et al., 2025)

The evolution of product-related sustainability shows a clear shift from process-oriented

improvements to more strategic and capability-driven green innovation. Earlier studies mostly positioned green products as outcomes of improved manufacturing efficiency such as reduced emissions and resource optimization rather than as consumer-oriented eco-designed offerings. In contrast, non-green products were consistently described as conventional items optimized for cost, function, and operational efficiency, often embedded in linear production models. Recent literature highlights a more advanced stage where green products are intentionally designed through eco-materials, life-cycle thinking, and organizational capabilities such as green HRM, competencies, and dynamic capabilities. Meanwhile, non-green products increasingly appear as less sustainable alternatives, associated with short-termism, regulatory risks, and reputational drawbacks as markets demand stronger sustainability commitments. As shown in Table 4.

Table 3. Comparative Characteristics of Green and Non-Green Products

Category	Green Product	Non-Green Product
New	Produced through environmentally friendly and resource-efficient processes (Chen et al., 2024; Lăzăroiu et al., 2023; Pratikno et al., 2023)	Focuses on economic gains or technical performance rather than environmental concerns (Lăzăroiu et al., 2023; Meng & Imran, 2024; Rizaldy et al., 2025)
	Linked to internal strategies such as green HRM, digital transformation, and pro-environmental practices (Demirel et al., 2025; Gazi et al., 2025)	Not influenced by green organizational practices, eco-innovation, or ESG initiatives (Enbaia et al., 2024; X. Wang & Gualberto, 2024)
	Reduces pollution and waste impacts (da Silva et al., 2023; He et al., 2023)	Does not support sustainability (Gazi et al., 2025; Ni & Abdullah, 2025; Wen et al., 2023)
	Sustainability-oriented (Bintara et al., 2023; Fazal-e-Hasan et al., 2023; Good et al., 2023; Marco-Lajara et al., 2023)	Does not consider ecological impacts (Bahmani et al., 2023; Bintara et al., 2023; He et al., 2023)
	Provides additional social and environmental value through CSR (Abro et al., 2024; Padilla-Lozano & Collazzo, 2022)	Does not offer additional reputation or ESG-related benefits (Al-Hakimi et al., 2022; Pérez et al., 2024; Y. Wu et al., 2025)
	Developed to meet stakeholder demands or environmental regulations (Lu et al., 2025; Wahyudi et al., 2023; L. Wu et al., 2025)	Does not adapt to stakeholder demands or environmental regulations (Lu et al., 2025)
		Does not necessarily require technological adoption for sustainability (Laradi et al., 2024)
Old	Focused on energy efficiency, eco-friendly materials, and reduction of waste and pollution (R. K. Singh et al., 2022; Sun & Chu, 2022)	Conventional products prioritize profit and overlook environmental impact (T. Singh & Sachdeva, 2024; Sun & Chu, 2022; C. Wang et al., 2022)
	Sustainability-oriented (Al-Hakimi et al., 2022; Sun & Chu, 2022)	Pays little attention to internal capacity and collaboration (Santos et al., 2021; Song et al., 2021; N. Wang et al., 2022)
	Emphasizes sustainability in processes, outcomes, and socio-environmental performance (Awan et al., 2021; Ngo, 2022; C. Wang et al., 2022; Zhang et al., 2021)	Lacks governance mechanisms for sustainability (Lee & Choi, 2021)
	Encourages eco-innovation, recyclable design, and integration of green technologies (Dzwigo et al., 2021; Janahi et al., 2021; N. Wang et al., 2022)	Does not emphasize CSR or green marketing (Ahmed & Streimikiene, 2021; Zhao & Huang, 2022)
	Influenced by green culture, employee competencies, and internal–external collaboration (Imran et al., 2021; P. A. Khan et al., 2021; Song et al., 2021)	
	Utilizes CSR and social responsibility initiatives (Ahmed & Streimikiene, 2021; Zhao & Huang, 2022)	

Impact as Benefits and Opportunities of Green Innovation in MSMEs

Green innovation provides transformative opportunities for small and medium-sized enterprises (SMEs) by enabling them to integrate environmentally responsible practices into products, processes, and organizational capabilities. By adopting green innovation, SMEs can reduce resource consumption, minimize waste, and optimize operational efficiency while complying with regulatory standards and responding to stakeholder expectations. This not only lowers production costs through energy efficiency and sustainable sourcing but also creates new market opportunities for eco-friendly products.

Beyond environmental benefits, green innovation strengthens organizational competitiveness, fosters knowledge sharing, and promotes employee green behavior. Firms implementing green HRM, green competencies, and dynamic capabilities tend to enhance performance outcomes, improve customer perception, and achieve sustainable business growth. Moreover, green innovation encourages SMEs to adopt digital technologies, improve supply chain sustainability, and respond effectively to market pressures, positioning them as proactive actors in sustainability-driven markets.

Discussion

The findings of this systematic literature review and bibliometric analysis highlight that green innovation within SMEs is primarily shaped by the interplay between internal organizational capabilities and external institutional pressures. Internal determinants including green HRM, learning orientation, dynamic capabilities, and leadership commitment serve as foundational enablers that strengthen a firm's capacity to adopt sustainability-oriented practices. These internal resources determine whether SMEs can mobilize skills, knowledge, and routines needed for eco-friendly product and process innovation. The bibliometric clusters further show that recent studies increasingly emphasize human capital and capability development, indicating a shift from general sustainability discussions toward employee-driven and learning-based innovation models.

Externally, regulatory pressure, stakeholder expectations, technological turbulence, and market competition emerge as dominant forces prompting SMEs to adopt green innovation. The overlay visualization suggests that the role of digital transformation, environmental uncertainty, and institutional demands has become more prominent in the 2023–2025 research landscape. This indicates that SMEs are now required not only to comply with environmental regulations but also to adapt to rapid technological change and evolving consumer preferences. Such pressures accelerate the need for green-oriented strategies, making sustainability integration a structural not optional component of competitive advantage.

Furthermore, the results show that green innovation positively influences SME performance across multiple dimensions, including operational efficiency, market competitiveness, customer perception, and long-term resilience. SMEs with stronger green capabilities are better positioned to reduce waste, optimize resources, and differentiate their products in environmentally conscious markets. This reinforces the view that green innovation is not merely a compliance-driven activity but a strategic pathway toward superior performance.

Finally, the analysis of product-level distinctions reveals clear differences between green and non-green products in terms of lifecycle impact, resource use, and sustainability value. Green products emphasize environmental responsibility, recyclability, and emissions reduction, while non-green alternatives tend to prioritize short-term economic gains or technical attributes. However, limited consumer awareness, higher production costs, and inconsistent regulation continue to hinder wider adoption of green products highlighting a persistent gap between sustainability expectations and market readiness.

Overall, this study integrates determinants, impacts, and product-level differences into a cohesive framework, underscoring that SMEs' successful transition toward green innovation requires simultaneous strengthening of internal capabilities and alignment with external environmental pressures. The results also affirm that strategic adoption of green practices not only enhances sustainability performance but also contributes to long-term competitive advantage in emerging economies.

Future research direction

To maximize the potential of green innovation in SMEs, future research may explore several critical directions. First, investigations should examine scalable models for integrating internal capabilities (e.g., green competencies, organizational learning) with external pressures (e.g., regulatory frameworks, stakeholder demands, market turbulence) to enhance innovation adoption. Second, empirical studies could conduct cost-benefit analyses of green practices to assess financial, social, and environmental returns, particularly in resource-constrained SMEs.

Third, cross-sector and cross-regional comparisons may reveal contextual factors influencing green innovation adoption in emerging economies. Advanced modeling approaches, such as Agent-Based Modeling (ABM) or System Dynamics (SD), can simulate interactions between organizational resources, environmental uncertainty, and policy interventions, providing actionable insights into sustainable strategies. Finally, longitudinal studies assessing long-term environmental and social impacts are crucial to understand the durability and effectiveness of green innovation in SME performance and market competitiveness.

Limitations

This study is limited by its reliance on secondary data from the Scopus database, which may exclude recent practices, gray literature, or local SME initiatives not indexed in international journals. The dataset period (2020-2025) may overlook foundational studies prior to 2020 that could provide additional historical insights. Moreover, terminological inconsistencies such as the use of "eco-innovation," "environmental innovation," or "sustainable technological innovation" may have led to partial coverage of relevant research. These limitations suggest the need for future empirical studies to validate findings within specific industry contexts and geographic settings.

Conclusions

The landscape of small and medium-sized enterprises (SMEs) is increasingly shaped by the imperative to integrate sustainable practices, with green innovation emerging as a central strategy. Research trends indicate a shift from conventional operational improvements toward strategic and capability-driven sustainability initiatives. Material topics, including green HRM, organizational green competencies, digital transformation, and sustainable performance, have been identified as critical areas for advancing green innovation in SMEs. Effective adoption requires the alignment of internal organizational capabilities with external pressures, such as regulatory requirements, stakeholder expectations, and technological turbulence. Collaboration with industry partners, government agencies, and financial institutions is essential to support knowledge sharing, resource efficiency, and sustainable business practices.

The benefits of green innovation extend across economic, environmental, and social dimensions. Economically, SMEs gain competitive advantage, reduce operational costs, and create new market opportunities through eco-designed products and sustainable processes. Environmentally, green innovation minimizes waste generation, lowers emissions, and promotes resource efficiency, contributing to broader sustainability goals. Socially, the adoption of green practices enhances employee engagement, promotes green behavior, and strengthens corporate responsibility within communities.

Green innovation provides a powerful framework for SMEs to achieve sustainability while maintaining competitiveness in dynamic markets. By integrating organizational capabilities, digital tools, and external support mechanisms, SMEs can transform environmental challenges into strategic opportunities. The widespread implementation of green innovation has the potential to reshape small enterprise practices, foster resilient and sustainable business models, and contribute to the global transition toward environmentally responsible economies. As SMEs navigate the pressures of resource limitations, regulatory compliance, and market competition, green innovation emerges not only as a practical solution but also as a guiding principle for sustainable growth, value creation, and long-term resilience.

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