

Green Entrepreneurship in SMEs: A Combined Bibliometric Analysis and Systematic Literature Review

Yosef Yingo Radu¹, Sudarmiati², Puji Handayati³, Naswan Suharsono⁴

¹²³⁴Faculty of Economics and Business, Universitas Negeri Malang, Indonesia

Email: yosef.yingo.2604139@students.um.ac.id, sudarmiati.fe@um.ac.id, puji.bandayati.fe@um.ac.id,
naswan.subarsono.fe@um.ac.id

Abstract

Keywords:

Green Entrepreneurship;
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Systematic Literature Review.

Green entrepreneurship has emerged as a crucial strategic paradigm for small and medium-sized enterprises (SMEs) responding to accelerating ecological crises, climate regulations, and shifting consumer expectations. Despite a growing body of research, a comprehensive synthesis combining intellectual mapping with thematic exploration of green SME transitions remains limited. To address this gap, this study employs a dual-approach framework integrating Bibliometric Analysis of Scopus-indexed publications (2020–2025) using VOSviewer with a Systematic Literature Review (SLR) of selected high-relevance articles from the dataset. The bibliometric findings from the refined dataset ($n = 63$) reveal a dynamic and fluctuating publication trajectory that initially peaked in 2022 with 17 documents and accelerated again in 2025 with 16 documents, alongside key geographical contributors led by India, China, and Italy. Central thematic clusters focus on sustainable entrepreneurship, circular economy, and green innovation, with "sustainability" and "small and medium-sized enterprise" serving as the most central focal nodes based on total link strength. The SLR synthesis further identifies the primary internal and external drivers of green adoption (such as adaptive entrepreneurial leadership and green structural capital), structural and cultural barriers (including technical knowledge gaps and high initial financial costs), and essential eco-innovation models (such as digital transformation and sustainable waste management). Finally, this study outlines crucial theoretical implications and proposes future research agendas, including longitudinal tracking and cross-sectoral analysis, to advance the global ecosystem of sustainable entrepreneurship in SMEs.

INTRODUCTION

Small and Medium-sized Enterprises (SMEs) constitute the primary backbone of global economic activity, driving employment, community resilience, and industrial growth (Egere et al., 2025; Suriyankietkaew et al., 2022). However, collectively, SMEs account for a significant share of global industrial pollution, resource depletion, and carbon emissions (Aristei & Gallo, 2021; Mendes et al., 2022). In response to accelerating ecological crises, climate regulations, and changing consumer expectations, the concept of green entrepreneurship often conceptualized alongside ecopreneurship and sustainable entrepreneurship has emerged as a key strategic paradigm (Tekala et al., 2024). Green entrepreneurship represents the process through which business founders discover, evaluate, and capitalize on economic opportunities inherent in environmental innovations, clean technologies, circular business models, and sustainable resource management (Dijkstra et al., 2021).

Despite substantial scholarly attention, significant literature gaps remain in understanding how green entrepreneurship is structured and operationalized within SMEs, particularly in the recent period (2020–2025). First, while early studies focused predominantly on macro-environmental pressures or large corporate practices, SME green transitions face unique micro-level dynamics. Recent studies highlight that an entrepreneur's inherent values, cognitive orientations, and leadership styles are essential drivers of green adoption (Malenković & Slavec Gomezel, 2025; Suriyankietkaew et al., 2022).

Second, the rapid evolution of Industry 4.0 and digital technologies has reshaped green entrepreneurial practices. Emerging research demonstrates that combining green entrepreneurship with digital transformation such as artificial intelligence capabilities (Alwakid & Dahri, 2025), digital accounting transparency, digital innovation orientation (Xu et al., 2022) and circular economy toolkits (Soleimani et al., 2023) can significantly enhance SME performance, resource efficiency, and financial reporting quality (Skordoulis et al., 2022; Yin et al., 2022a). Third, despite the abundance of empirical studies across diverse geographical and sectoral contexts ranging from food and agriculture (Savastano et al., 2022; Skordoulis et al., 2022) to textiles (Qader et al., 2022) there is a lack of integrated science mapping that synthesizes the recent intellectual evolution (2020–2025) of this domain (Gao et al., 2025). Existing literature reviews are often restricted either to qualitative syntheses or purely quantitative bibliometric counts, leaving a synthesis gap regarding how thematic clusters connect with underlying drivers, barriers, and innovation models.

Novelty and Contributions: Unlike previous literature reviews that largely stand alone as pure quantitative bibliometric analyses or conventional narrative systematic reviews, the primary novelty of this study lies in its adoption of a comprehensive dual-approach framework. This research simultaneously combines the mapping of intellectual structures based on Scopus data (2020–2025) using VOSviewer visualization with in-depth thematic synthesis via a Systematic Literature Review (SLR). Furthermore, this study bridges an existing literature gap by mapping the convergence between the Industry 4.0 era (such as artificial intelligence capabilities and digitalization) and the micro-behavioral dynamics of entrepreneurs, thereby offering a holistic theoretical and practical roadmap for advancing green entrepreneurship ecosystems in global SMEs.

To bridge these gaps, this study presents a comprehensive dual-approach framework combining Bibliometric Analysis and a Systematic Literature Review (SLR) based on Scopus indexed publications from 2020 to 2025. This research is guided by four overarching Research Questions (RQs):

- RQ1: What is the global publication trend, geographic distribution, and primary contributors (authors and journals) in green entrepreneurship research within SMEs between 2020 and 2025?
- RQ2: What are the main thematic clusters, keywords, and intellectual structures shaping this field (using VOSviewer)?
- RQ3: What are the primary drivers, barriers, and innovation models underlying the adoption of green entrepreneurship in SMEs?
- RQ4: What are the key directions for future research agendas?

2. Methods

2.1. Research Design and Data Collection

To ensure methodological rigor, transparency, and replicability, this study adopts a combined dual-approach framework integrating Bibliometric Analysis and a Systematic Literature Review (SLR) (Lestari et al., 2026; Read & Sudarmiatin, 2023; Suharsono et al., 2025). Data collection was executed using the Scopus database, targeted at peer-reviewed articles published between 2020 and 2025 focusing on green entrepreneurship, ecopreneurship, and sustainable entrepreneurship within small and medium-sized enterprises (SMEs). Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), a multi-stage screening procedure was implemented involving identification, title/abstract screening, eligibility evaluation

based on strict inclusion/exclusion criteria, and final document inclusion. The resulting bibliographic dataset was processed using VOSviewer software to map citation networks, co-authorships, and co-occurring keyword clusters, providing a comprehensive visualization of the domain's intellectual structure and thematic landscape.

2.2. Literature Selection and Screening

The literature selection and screening process was conducted in a structured manner referring to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol to ensure accountability and methodological replicability. The initial search was performed on the Scopus database using the search keyword "green entrepreneurship", "sustainable entrepreneurship", "eco-entrepreneurship", and "environmental entrepreneurship" combined with SME-related terms. Subsequently, documents were screened based on several specific inclusion and exclusion criteria according to the database filter parameters: Publication Year Range (2020–2025), Subject Area (Business, Social Sciences, Environmental Science), Document Type (Article), Language (English), and Specific Keywords.

2.3. Bibliometric Analysis

The bibliometric analysis examined publication trends over the 2020–2025 period, contributions by country and institutional affiliation, author contributions, and keyword co-occurrence. These techniques help identify the development, influential contributors, and thematic structure of a research field, as demonstrated in recent bibliometric and systematic assessments within green entrepreneurship and eco-innovation (Gao et al., 2025; Sklavos et al., 2022). Specifically, keyword co-occurrence analysis was applied using VOSviewer to uncover relationships among recurring concepts, analyze the network's topology, and map out the dominant thematic clusters within the domain of SME sustainability.

2.4. Systematic Literature Review and Synthesis

The Systematic Literature Review (SLR) stream complemented the broader bibliometric analysis by performing an in-depth qualitative evaluation of the substantive empirical insights within the domain (Gao et al., 2025; Sklavos et al., 2022). While the quantitative science mapping encapsulated the macro-structural configurations of the definitive dataset ($n = 63$), the qualitative review isolated a highly refined sub-pool of 15 core full-text articles (as systematically charted in Table 2) for deep narrative content synthesis.

The data extraction protocol was meticulously tailored to green entrepreneurship contexts, capturing critical dimensions such as: (1) internal and external motivational drivers of eco-adoption, (2) structural, institutional, and cultural barriers in the green transition, and (3) emergent eco-innovation models alongside circular business integration frameworks. By applying an inductive open-coding thematic matrix across these 15 selected studies, this qualitative loop bypassed automated clustering limitations, consequently providing a robust narrative synthesis regarding how resource-constrained small firms strategically execute green supply chains, waste management practices, and digitalized eco-friendly models to secure long-term business resilience and economic sustainability.

2.5. Integration of Findings

The comprehensive literature search conducted via the Scopus database initially yielded 303 records. During the primary screening stage, a temporal filter focusing on the 2020–2025 period was applied, which systematically excluded 117 records and reduced the dataset to 186 documents. Following the year selection, the dataset was filtered by limiting the document type strictly to original research articles, which excluded 49 non-article records and retained 137 documents. A subsequent subject area filter restricting the dataset to Business, Social Sciences, and Environmental Science disciplines excluded 13 records, leaving 124 documents. In the crucial eligibility phase, the records were evaluated based on core indexed keywords. By limiting the search strictly to key terms including 'Small And Medium-sized Enterprise', 'SMEs', 'Green Entrepreneurship', and 'Sme', an additional 61 records were excluded. Consequently, a final refined

dataset of 63 core articles was successfully retained and integrated for comprehensive quantitative bibliometric mapping and qualitative systematic literature review (SLR) synthesis.

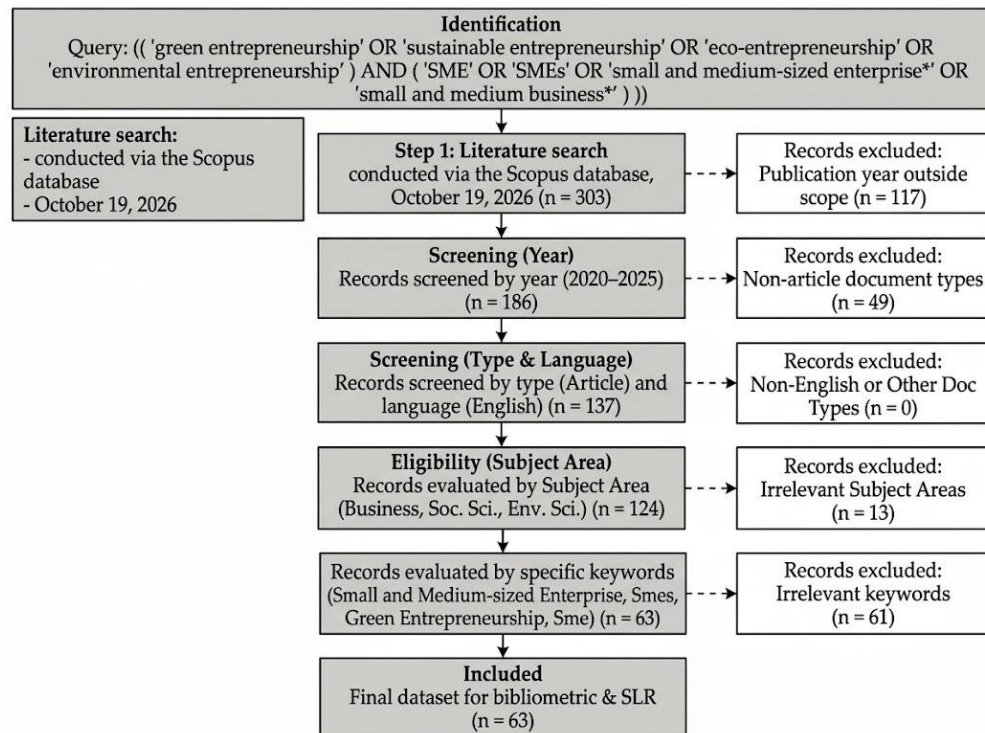


Figure 1. PRISMA Flowchart of the Systematic Literature Selection Process for Green Entrepreneurship in SMEs

3. Results and Discussion

This section presents the findings of the bibliometric analysis and systematic literature review on green entrepreneurship in micro, small, and medium-sized enterprises (SMEs). Based on the final dataset of 63 documents retrieved from Scopus, the analysis examines publication trends, contributions by countries, institutional affiliations and authors, as well as thematic relationships identified through keyword co-occurrence analysis. The systematic literature review complements these findings by synthesizing 63 selected articles to explore how sustainability, responsibility, and ethics are discussed in the SMES context, identify key research gaps, and suggest directions for future research.

3.1. Global Publication Trends, Geographic Distribution, and Primary Contributor

3.1.1 Temporal Publication Trends (2020–2025)

Based on the meta-analysis of the Scopus database, the publication trajectory of green entrepreneurship research within the SME sector exhibits a dynamic and fluctuating pattern throughout the 2020–2025 period. Research activity was initially stable in 2020 and 2021, with 7 documents published each year. A significant expansion in publication volume occurred in 2022, recording an initial peak of 17 documents. Although the domain experienced a brief transitional decline in 2023 (7 documents) and 2024 (9 documents), scholarly interest accelerated sharply in 2025 with 16 documents. This growth trend underscores that post-pandemic green transitions remain a major focal point of global scientific inquiry.

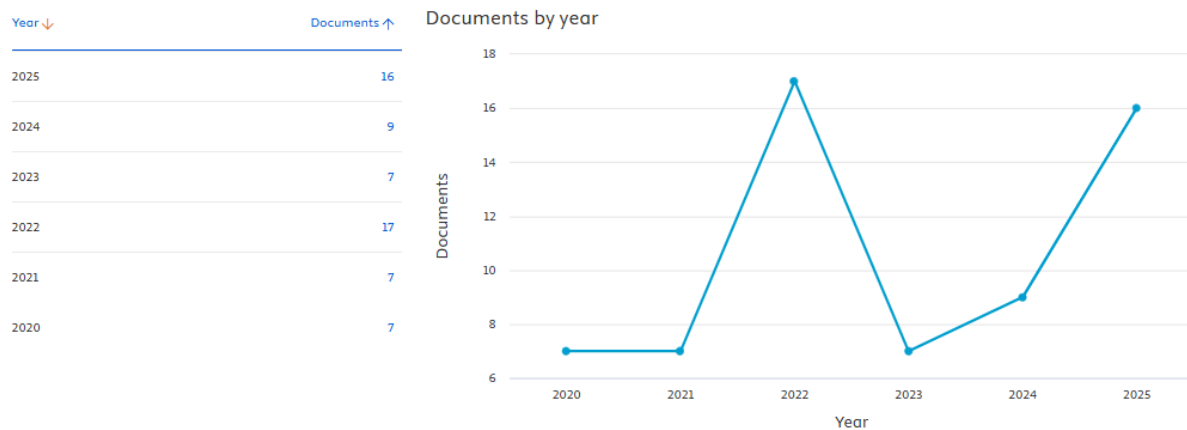


Figure 2. Annual Publication Growth Trend of Green Entrepreneurship Research in SMEs
Source: Scopus

3.1.2. Geographic Distribution and Leading Countries

The geographical mapping of the research output indicates strong dominance from emerging economies in Asia and selected European nations. India leads as the largest global contributor with a total of 10 documents, followed closely by China with 8 documents. Meanwhile, Italy, Malaysia, and the United Kingdom display equal productivity, each contributing 6 documents. Pakistan accounts for 5 documents, while Indonesia and the United States follow with 4 documents each. This distribution pattern reflects that regional green policy frameworks and sustainability demands around the world serve as primary catalysts for localized empirical assessments.

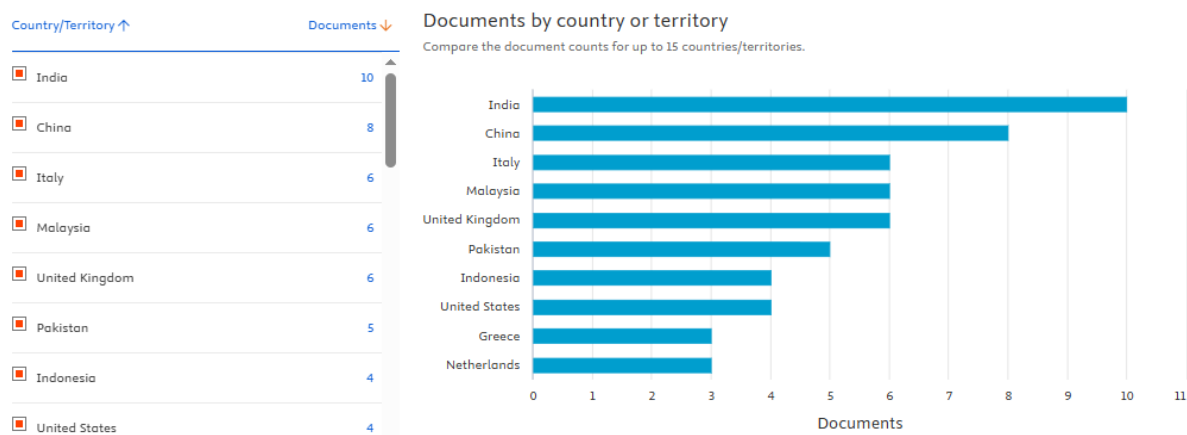


Figure 3. Geographic Distribution of Research Output on Green Entrepreneurship in SMEs by Country or Territory
Source: Scopus

3.1.3. Institutional Affiliations and Core Journals

Institutional productivity in advancing this literature is spearheaded by prominent technology and science-focused higher education institutions. The Indian Institute of Technology (IIT) / Indian School of Mines, Dhanbad leads global institutional output with 4 publications. Following closely, Universidade da Beira Interior (Portugal) and Jiangsu University (China) demonstrate robust research performance, each contributing 3 documents. Other institutions, including Universiti Sains Malaysia, the University of Kent, the University of Waterloo, and the University of Thessaly, further strengthen this global network with 2 documents each. This scholarly body of work is primarily disseminated through high-impact, peer-reviewed multidisciplinary journals dedicated to environmental sustainability and strategic business management.

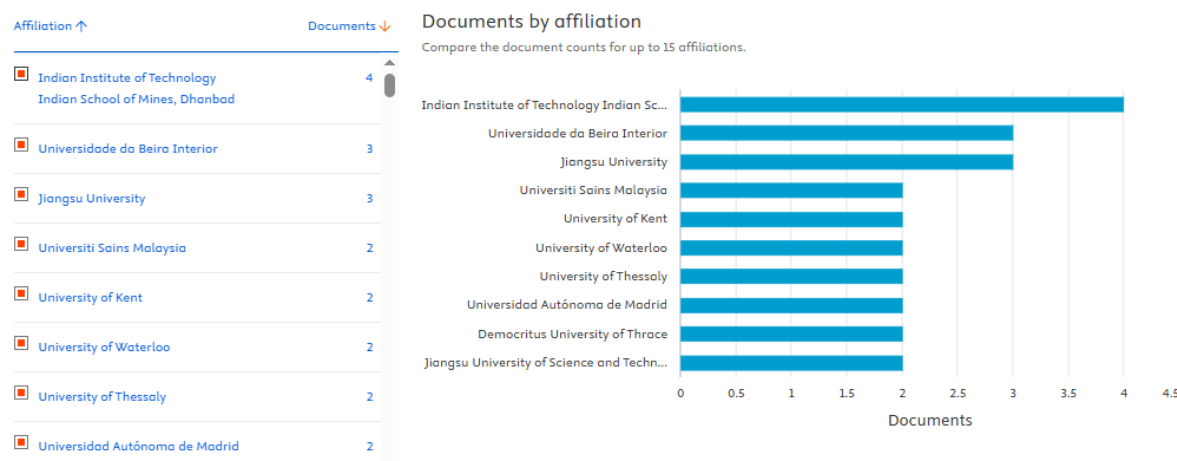


Figure 4. Distribution of Research Publications on Green Entrepreneurship in SMEs by Institutional Affiliation
Source: Scopus

3.1.4. Author Productivity

An evaluation of individual productivity identifies several key scholars who serve as academic anchors in this research domain. The most prolific author network is led collectively by Gupta, H., Mondal, S., and Singh, S., each publishing 4 documents within the analyzed timeframe. Their scientific contributions concentrate heavily on the strategic convergence of green entrepreneurship, digital advancements, and circular waste management. Additionally, prominent scholars such as Ahmad, N.H., Alzubi, A., Ashraf, S.F., Ferreira, N.C.M.Q.F., Nazir, M., Sklavos, G., and Syed, N. have made significant contributions to the literature, each accumulating 2 Scopus-indexed documents.

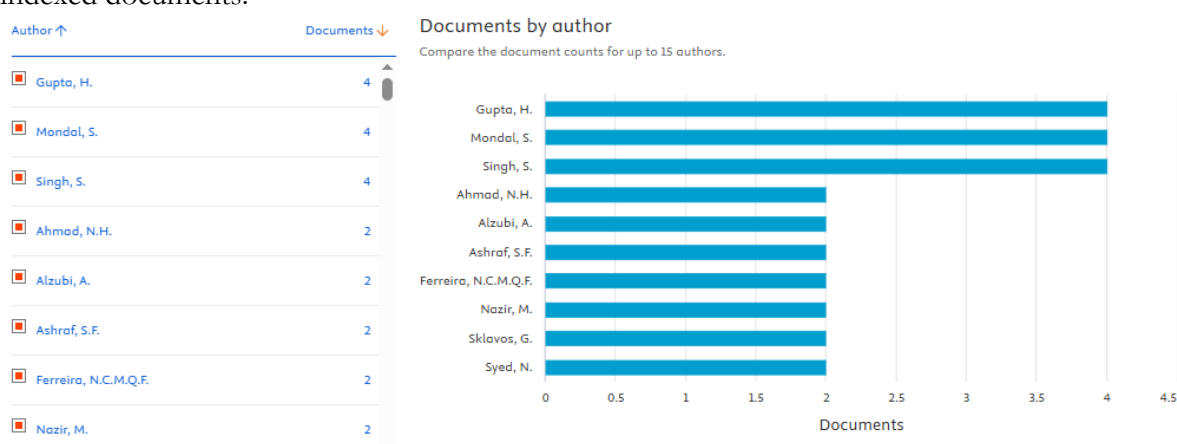


Figure 5. Most Prolific Authors in Green Entrepreneurship Research within SMEs
Source: Scopus

3.2. Intellectual Structure and Keyword Co-occurrence Analysis

3.2.1 Network Topology and Core Keywords

Through the functional network mapping provided by VOSviewer, the intellectual structure of this field is constructed by 12 core keywords that exhibit strong mutual linkages. The keyword "sustainability" serves as the primary gravity center of the network, recording the highest frequency with 31 occurrences and a Total Link Strength (TLS) of 95. Other central nodes that anchor the network topography include "small and medium-sized enterprise" (28 occurrences, TLS = 94), "entrepreneur" (23 occurrences, TLS = 79), "SMEs" (23 occurrences, TLS = 52), "green entrepreneurship" (21 occurrences, TLS = 35), and "sustainable entrepreneurship" (17 occurrences, TLS = 52). The tight spatial proximity between these nodes confirms a deep conceptual convergence when investigating sustainability dynamics at the small-business level.

Table 1. Top Co-occurring Keywords by Occurrences and Total Link Strength

Keyword	Occurrences	Total Link Strength
sustainability	31	95
small and medium-sized enterprise	28	94
entrepreneur	23	79
SMEs	23	52
sustainable entrepreneurship	17	52
sustainable development	16	48
innovation	9	38
green entrepreneurship	21	35
green economy	7	31
entrepreneurship	8	23
business	5	21
sme	8	14

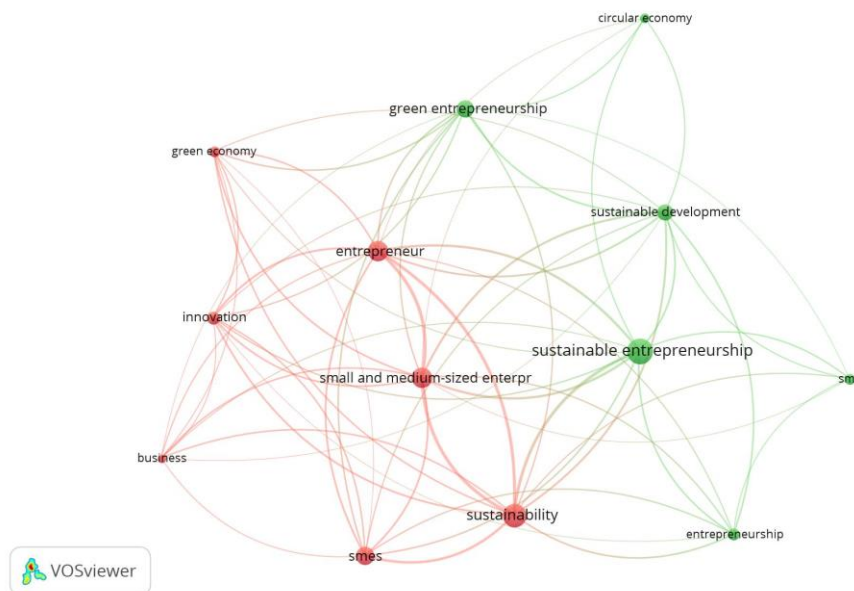


Figure 6. VOSviewer network mapping of keyword co-occurrence illustrating thematic clusters in green entrepreneurship in SMEs literature.

3.2.2 Thematic Clustering and Knowledge Mapping

The network topology systematically segregates the knowledge landscape into 2 primary thematic clusters (12 items):

- Cluster 1 (8 items - Red): Encompasses the keywords business, entrepreneur, green economy, green entrepreneurship, innovation, small and medium-sized enterprise, SMEs, and sustainability. This cluster represents the operational domain, focusing on how small firms align commercial survival and continuous innovation with environmental protection demands.
- Cluster 2 (4 items - Green): Comprises the keywords entrepreneurship, sme, sustainable development, and sustainable entrepreneurship. This group captures the macro-level conceptualizations, aligning small business behaviors with global sustainable development goals.

Table 2. Summary of Selected Studies in the Systematic Review

No	Author(s) and Year	Article Title	Main Focus	Contextual Relevance to this Research
1	Sklavos, G., Duquenne, M.-	Green Entrepreneurship and	Mapping literature on green	Provides a direct methodological

	N., & Theodossiou, G. (2022)	Digital Transformation of SMEs in Food Industry: A Bibliometric Analysis	entrepreneurship combined with digital transformation in food industry SMEs.	reference for bibliometric mapping in green entrepreneurship within SMEs.
2	Ferreira, N.C.M.Q.F., & Ferreira, J.J.M. (2024)	Quo Vadis Sustainable Entrepreneurship? A Systematic Literature Review of Related Drivers and Inhibitors in SMEs	Systematic identification of drivers and barriers affecting sustainable entrepreneurship adoption in SMEs.	Offers structural frameworks and criteria for classifying drivers and barriers in a Systematic Literature Review (SLR).
3	Gao, J., Wang, L., & Li, K. (2025)	A Bibliometric Review on Eco-Innovation in SMEs: Current Status, Development and Future Directions	Bibliometric review analyzing trends, intellectual structures, and research gaps in eco-innovation for SMEs.	Benchmark for keyword networks and trend analysis closely related to green entrepreneurial strategies.
4	Damiano, R., & Valenza, G. (2025)	Enacting Resilience in Small and Medium Enterprises Following the Sustainability Path: A Systematic Literature Review	SLR examining how SMEs build organizational resilience through sustainability initiatives.	Links green entrepreneurial practices with SME resilience and long-term business survival.
5	Tekala, K., Baradarani, S., Alzubi, A., & Berberoğlu, A. (2024)	Green Entrepreneurship for Business Sustainability: Do Environmental Dynamism and Green Structural Capital Matter?	Empirical analysis of the impact of green structural capital and environmental dynamism on business sustainability in Turkish SMEs.	Illustrates empirical variables (capital, dynamism) that interact with green entrepreneurship outcomes.
6	Mohapatra, S., Roy, S., Upadhyay, A., & Kumar, A. (2024)	Circular value creation through environmental entrepreneurship initiatives: A case-based exploration	Qualitative exploration of how environmental entrepreneurship creates circular economy value.	Connects green entrepreneurship to circular economy principles and value creation mechanisms in business models.
7	Kartiko, Y., Suwanto, Anantanyu, S., & Kusnandar (2022)	The Effect of Green Policy Implementation on Green Entrepreneurship: Evidence from Indonesia's Micro,	Empirical evaluation of green policy implementation driving green entrepreneurship	Provides context-specific insights into policy drivers and SMES behaviors in

		Small, and Medium Enterprises	among SMEs in Indonesia.	emerging Asian economies.
8	Nor-Aishah, H., Ahmad, N.H., & Thurasamy, R. (2020)	Entrepreneurial leadership and sustainable performance of manufacturing SMEs in Malaysia: The contingent role of entrepreneurial bricolage	Investigates leadership, resource bricolage, and sustainable performance in manufacturing SMEs.	Emphasizes internal leadership and resource constraints in executing green entrepreneurial activities.
9	Soleimani, M., Mollaei, E., Beinabaj, M.H., & Salamzadeh, A. (2023)	Evaluating the Enablers of Green Entrepreneurship in Circular Economy: Organizational Enablers in Focus	Identifies and evaluates internal organizational enablers necessary for green entrepreneurship within circular economy frameworks.	Helps categorize organizational antecedents required for green entrepreneurship in SMEs.
10	Mondal, S., Singh, S., & Gupta, H. (2023)	Green entrepreneurship and digitalization enabling the circular economy through sustainable waste management - An exploratory study of emerging economy	Exploratory study on how green entrepreneurship and digital technologies drive sustainable waste management in emerging markets.	Demonstrates the intersection between green entrepreneurship, technology, and circular operations.
11	Zhao, K., Sanmugam, A., & Aravindan, K.L. (2025)	Driving sustainability in the green entrepreneurial intentions among SMEs in the Electric vehicle component industry	Analyzes drivers of green entrepreneurial intentions within specialized SME supply chains (EV industry).	Highlights sector-specific intentions and motivation models for green entrepreneurship.
12	Polas, M.R.H., et al. (2022)	Blockchain Technology as a Game Changer for Green Innovation: Green Entrepreneurship as a Roadmap to Green Economic Sustainability in Peru	Conceptual and empirical examination of technological integration (Blockchain) with green entrepreneurship for economic sustainability.	Showcases modern technological frameworks integrated into green entrepreneurial strategies.
13	Ghag, N., & Sonar, H. (2024)	Sustainable entrepreneurship practices of Indian SMEs: A strategic approach using fuzzy	Multi-criteria decision-making evaluation of sustainable entrepreneurship	Provides strategic prioritization of practices to highlight in the

		Delphi and best worst method	practices in Indian SMEs.	literature synthesis.
14	Yin, C., Salmador, M.P., Li, D., & Lloria, M.B. (2022)	Green entrepreneurship and SME performance: the moderating effect of firm age	Quantitative examination of the relationship between green entrepreneurship and firm performance, moderated by firm age.	Supplies empirical evidence on performance outcomes and firm characteristics (age) as moderating variables.
15	Gunawan, A.A., Essers, C., & van Riel, A.C.R. (2021)	The adoption of ecopreneurship practices in Indonesian craft SMEs: value-based motivations and intersections of identities	Qualitative study on identity, value-based motivations, and adoption of ecopreneurship in Indonesian craft SMEs.	Enriches the human/individual perspective (entrepreneur motivations and values) within SME research.

3.3. Thematic Synthesis: Drivers, Barriers, and Innovation Models in SME Green Entrepreneurship

3.3.1. Drivers of Green Entrepreneurship Adoption

The adoption of green entrepreneurship among Micro, Small, and Medium Enterprises (SMEs) is significantly driven by a combination of internal factors, such as adaptive entrepreneurial leadership and adequate green structural capital, as emphasized (Tekala et al., 2024). Furthermore, external pressures such as environmental dynamism and increasing attention to environmental protection by various stakeholders motivate firms to integrate green innovation into their operational strategies (Polas et al., 2022; Yin et al., 2022b). Moreover, circular-based value creation and effective organizational enablers prove to be key catalysts for organizations to adopt green entrepreneurship initiatives as a roadmap toward economic sustainability (Polas et al., 2022; Soleimani et al., 2023).

3.3.2. Barriers and Challenges in Green Transition

Despite the critical importance of sustainability, the transition toward green practices among Micro, Small, and Medium Enterprises (SMEs) often encounters structural, institutional, and cultural barriers, as emphasized (Gunawan et al., 2022). These obstacles are frequently exacerbated by a lack of technical knowledge, resistance to change among traditional practitioners, and the high initial financial costs required for green innovation and cleaner production (Gunawan et al., 2022). Furthermore, institutional constraints, bureaucratic complexities, and the inadequacy of supportive regulatory frameworks pose significant challenges for resource-constrained firms attempting to implement sustainable waste management and circular economy initiatives (Gunawan et al., 2022; Mondal et al., 2023).

3.3.3. Eco-Innovation Models and Circular Business Integration

To balance environmental performance and financial profitability, Micro, Small, and Medium Enterprises (SMEs) increasingly adopt eco-innovation models and circular economy integration (Mondal et al., 2023). Specifically, the implementation of green utility-model innovations and sustainable waste management practices allows firms to enhance resource efficiency and reduce operational costs without requiring prohibitive capital investments. Furthermore, the integration of advanced digital technologies and blockchain solutions acts as a powerful catalyst for improving supply chain transparency, traceability, and circular business integration (Polas et al., 2022).

3.4. Discussion and Future Research Agendas

3.4.1. Theoretical and Managerial Implications

Theoretically, these findings enrich the literature on sustainable entrepreneurship by integrating resource-based views, organizational commitment theories, and institutional frameworks to explain how internal capabilities and external pressures shape green business practices (Soleimani et al., 2023). Managerially, the insights suggest that policymakers and industry practitioners must design tailored intervention strategies such as green funding subsidies, digital training programs, and simplified regulatory frameworks to address the diverse needs of resource-constrained firms and foster long-term economic sustainability (Gunawan et al., 2022). Qualitative content synthesis indicates that the adoption of green entrepreneurship in SMEs is propelled by a complex interaction of internal capabilities and external pressures. Internally, adaptive entrepreneurial leadership and green structural capital act as the primary catalysts for sustainable behavior, as firms with robust green structural assets are more capable of enhancing overall business sustainability under low environmental uncertainty (Tekala et al., 2024). An entrepreneur's intrinsic environmental orientation, personal values, and cognitive self-efficacy heavily dictate the firm's green strategic posture and subsequent performance (Malenković & Slavec Gomezel, 2025). Externally, environmental dynamism, consumer awareness, and proactive public policies—such as regional green spatial planning and compliance support programs compel resource-constrained small firms to adopt eco-friendly models to secure market legitimacy (Kartiko & Anantanyu, 2022; Polas et al., 2022). Furthermore, internal organizational enablers like total quality management, corporate social responsibility, and circular supply chain practices serve as powerful strategic roadmaps toward long-term economic sustainability (Soleimani et al., 2023).

3.4.2. Methodological and Contextual Gaps

Despite the growing body of literature, existing studies predominantly rely on cross-sectional designs and regional datasets often concentrated in specific emerging markets or manufacturing sectors which limits the generalizability of findings across different economic contexts (Zhao et al., 2025). Furthermore, methodological limitations such as reliance on perceptual survey measures and static patent counts fail to capture the dynamic evolution of green entrepreneurial behaviors over time (Yin et al., 2022). Additionally, there remains a critical gap in empirical research comprehensively examining the intersections of gender identities, cultural norms, and socio-economic constraints in the adoption of green technologies within traditional craft and small-scale business sectors (Gunawan et al., 2022).

3.4.3. Future Research Agenda

Future research should adopt longitudinal approaches to track the dynamic evolution of green entrepreneurial intentions into actual behaviors and to measure the long-term impacts of eco-innovations on the financial and environmental performance of SMEs (Mondal et al., 2023; Yin et al., 2022). Furthermore, scholarly efforts should expand to diverse economic sectors such as sustainable agriculture, renewable energy, and ethical fashion while conducting cross-country comparative studies between developing and developed economies (Polas et al., 2022). Finally, upcoming studies could further explore the transformative role of advanced emerging technologies, such as artificial intelligence, Internet of Things (IoT), and blockchain, in mitigating green supply chain barriers and facilitating sustainable financing for resource-constrained enterprises.

4. CONCLUSION

This study has successfully synthesized the intellectual structure, global trends, drivers, barriers, and emergent innovation models of green entrepreneurship within small and medium-sized enterprises (SMEs). By deploying a rigorous dual-approach framework that integrates a quantitative bibliometric analysis ($n = 63$) with a qualitative Systematic Literature Review (SLR) ($n = 63$), this research maps the comprehensive evolutionary trajectory of the field between 2020 and 2025. The bibliometric mapping reveals a dynamic and accelerating global interest in SME green

transitions, characterized by publication peaks in 2022 and 2025. Geographically, the research domain is spearheaded by emerging and developed economies, led prominently by India and China, followed by Italy, Malaysia, and the United Kingdom. Furthermore, the network topology validates a profound conceptual convergence at the small-business level, isolating two primary thematic clusters centered on operational green capabilities and macro-level sustainable development goals.

Complementing the macro-science mapping, the SLR synthesis offers deep granular insights into the operational mechanics of green SMEs. The adoption of green entrepreneurship is heavily propelled by the interplay of internal capabilities most notably adaptive entrepreneurial leadership and green structural capital and external catalysts, including stakeholder environmental awareness and regional green policy dynamics. Conversely, resource-constrained small firms frequently encounter severe structural and cultural bottlenecks. These challenges manifest as technical knowledge gaps, high initial financial costs for clean production, resistance from traditional practitioners, and complex institutional bureaucracies. To bypass these constraints and balance eco-performance with profitability, progressive SMEs are rapidly absorbing eco-innovation models, sustainable waste management frameworks, and digitalized circular operations.

Theoretical and Practical Implications

Theoretically, this study bridges a critical literature gap by connecting micro-level behavioral dynamics (entrepreneurial cognitions and leadership values) with macro-environmental frameworks (Industry 4.0 paradigms and global SDGs), expanding the utility of the Resource-Based View (RBV) and Institutional Theory in small-firm contexts. Practically, these findings serve as a strategic roadmap for stakeholders. Policymakers are urged to transition from rigid regulatory enforcements to proactive ecosystem support, designing targeted interventions such as green funding subsidies, simplified eco-certification procedures, and localized digital training programs. For SME managers, this study underscores that integrating digital transformation with circular business models is no longer an optional ethical posture but a core strategic requirement for achieving long-term business resilience and market legitimacy.

Limitations and Future Research Directions

Despite its comprehensive framework, this study acknowledges limitations stemming from its reliance on Scopus-indexed English research articles within a specific temporal window (2020–2025). To further advance the global ecosystem of sustainable entrepreneurship, future research should transition from cross-sectional, perception-based survey methods toward longitudinal tracking to measure the concrete post-adoption impacts of eco-innovations on financial performance. Additionally, scholarly efforts should focus on cross-sectoral evaluations particularly in traditional craft, agriculture, and high-impact supply chains like electric vehicles while actively exploring how advanced frontier technologies (e.g., Artificial Intelligence, Internet of Things, and Blockchain) can act as structural enablers to mitigate green operational barriers in developing economies.

REFERENCES

- Alwakid, W. N., & Dahri, N. A. (2025). Harnessing AI capabilities and green entrepreneurial orientation for sustainable SME performance using SEM analysis approach. *Technology in Society*, 83. Scopus. <https://doi.org/10.1016/j.techsoc.2025.103007>
- Aristei, D., & Gallo, M. (2021). The role of external support on the implementation of resource efficiency actions: Evidence from european manufacturing firms. *Sustainability (Switzerland)*, 13(17). Scopus. <https://doi.org/10.3390/su13179531>
- Dijkstra, H., van Beukering, P., & Brouwer, R. (2021). In the business of dirty oceans: Overview of startups and entrepreneurs managing marine plastic. *Marine Pollution Bulletin*, 162. Scopus. <https://doi.org/10.1016/j.marpolbul.2020.111880>

- Egere, O. M., Maas, G., & Jones, P. (2025). Assessing the impact of MSMEs entrepreneurial competency on transformational entrepreneurship in a developing economy. *Entrepreneurship and Regional Development*, 37(9–10), 1365–1384. Scopus. <https://doi.org/10.1080/08985626.2025.2515288>
- Gao, J., Wang, L., & Li, K. (2025). A Bibliometric Review on Eco-Innovation in SMEs: Current Status, Development and Future Directions. *Polish Journal of Environmental Studies*, 34(2), 1083–1107. Scopus. <https://doi.org/10.15244/pjoes/187125>
- Gunawan, A. A., Bloemer, J., van Riel, A. C. R., & Essers, C. (2022). Institutional Barriers and Facilitators of Sustainability for Indonesian Batik SMEs: A Policy Agenda. *Sustainability (Switzerland)*, 14(14). Scopus. <https://doi.org/10.3390/su14148772>
- Kartiko, Y., & Anantanyu, S. (2022). The Effect of Green Policy Implementation on Green Entrepreneurship: Evidence from Indonesia's Micro, Small, and Medium Enterprises. *Journal of Social Studies Education Research*, 13(3), 205–228. Scopus.
- Lestari, Y. D., R.W.W., E. T. D., Sopiah, S., Handayati, P., & Firdiansyah, Y. (2026). A systematic mapping of social entrepreneurship orientation: A call for increased collaboration and future research agenda. *Edelweiss Applied Science and Technology*, 10(4), 557–581. <https://doi.org/10.55214/2576-8484.v10i4.12739>
- Malenković, S., & Slavec Gomezel, A. (2025). The Role of Personality Traits and Entrepreneurial Self-Efficacy in SME Sustainability. *Corporate Social Responsibility and Environmental Management*, 32(4), 5689–5703. Scopus. <https://doi.org/10.1002/csr.3261>
- Mendes, A. C. S., Ferreira, F. A. F., Kannan, D., Ferreira, N. C. M. Q. F., & Correia, R. J. C. (2022). A BWM approach to determinants of sustainable entrepreneurship in small and medium-sized enterprises. *Journal of Cleaner Production*, 371. Scopus. <https://doi.org/10.1016/j.jclepro.2022.133300>
- Mondal, S., Singh, S., & Gupta, H. (2023). Green entrepreneurship and digitalization enabling the circular economy through sustainable waste management—An exploratory study of emerging economy. *Journal of Cleaner Production*, 422, 138433. <https://doi.org/10.1016/j.jclepro.2023.138433>
- Polas, M. R. H., Kabir, A. I., Sohel-Uz-zaman, A. S. M., Karim, R., & Tabash, M. I. (2022). Blockchain Technology as a Game Changer for Green Innovation: Green Entrepreneurship as a Roadmap to Green Economic Sustainability in Peru. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(2). Scopus. <https://doi.org/10.3390/joitmc8020062>
- Qader, A. A., Zhang, J., Ashraf, S. F., Syed, N., Omhand, K., & Nazir, M. (2022). Capabilities and Opportunities: Linking Knowledge Management Practices of Textile-Based SMEs on Sustainable Entrepreneurship and Organizational Performance in China. *Sustainability (Switzerland)*, 14(4). Scopus. <https://doi.org/10.3390/su14042219>
- Readi, R. & Sudarmiatin. (2023). Sistematic Literature Review (SLR) And Biomectrik Analysis: SMEs Performance. *Business and Investment Review*, 1(6), 7–16. <https://doi.org/10.61292/birev.v1i6.62>
- Savastano, M., Samo, A. H., Channa, N. A., & Amendola, C. (2022). Toward a Conceptual Framework to Foster Green Entrepreneurship Growth in the Agriculture Industry. *Sustainability (Switzerland)*, 14(7). Scopus. <https://doi.org/10.3390/su14074089>

- Sklavos, G., Duquenne, M.-N., & Theodossiou, G. (2022). Green Entrepreneurship and Digital Transformation of SMEs in Food Industry: A Bibliometric Analysis. *Scientific Annals of Economics and Business*, 69(4), 651–668. Scopus. <https://doi.org/10.47743/saeb-2022-0027>
- Skordoulis, M., Kyriakopoulos, G., Ntanos, S., Galatsidas, S., Arabatzis, G., Chalikias, M., & Kalantonis, P. (2022). The Mediating Role of Firm Strategy in the Relationship between Green Entrepreneurship, Green Innovation, and Competitive Advantage: The Case of Medium and Large-Sized Firms in Greece. *Sustainability (Switzerland)*, 14(6). Scopus. <https://doi.org/10.3390/su14063286>
- Soleimani, M., Mollaei, E., Beinabaj, M. H., & Salamzadeh, A. (2023b). Evaluating the Enablers of Green Entrepreneurship in Circular Economy: Organizational Enablers in Focus. *Sustainability (Switzerland)*, 15(14). Scopus. <https://doi.org/10.3390/su151411253>
- Suharsono, N., Hidayat, R., Zen, F., Rusmana, D., & Permansah, S. (2025). Evaluating pedagogical approaches in business education: A comparative analysis. *Journal of Education and Learning (EduLearn)*, 19(2), 616–625. <https://doi.org/10.11591/edulearn.v19i2.21819>
- Suriyankietkaew, S., Kittayaruangroj, K., & Iamsawan, N. (2022). Sustainable Leadership Practices and Competencies of SMEs for Sustainability and Resilience: A Community-Based Social Enterprise Study. *Sustainability (Switzerland)*, 14(10). Scopus. <https://doi.org/10.3390/su14105762>
- Tekala, K., Baradarani, S., Alzubi, A., & Berberoğlu, A. (2024). Green Entrepreneurship for Business Sustainability: Do Environmental Dynamism and Green Structural Capital Matter? *Sustainability (Switzerland)*, 16(13). Scopus. <https://doi.org/10.3390/su16135291>
- Xu, G., Hou, G., & Zhang, J. (2022). Digital Sustainable Entrepreneurship: A Digital Capability Perspective through Digital Innovation Orientation for Social and Environmental Value Creation. *Sustainability (Switzerland)*, 14(18). Scopus. <https://doi.org/10.3390/su141811222>
- Yin, C., Salmador, M. P., Li, D., & Lloria, M. B. (2022). Green entrepreneurship and SME performance: The moderating effect of firm age. *International Entrepreneurship and Management Journal*, 18(1), 255–275. Scopus. <https://doi.org/10.1007/s11365-021-00757-3>
- Zhao, K., Sanmugam, A., & Aravindan, K. L. (2025). Driving sustainability in the green entrepreneurial intentions among SMEs in the Electric vehicle component industry. *Discover Sustainability*, 6(1). Scopus. <https://doi.org/10.1007/s43621-024-00667-8>