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ENVIRONMENTAL SUSTAINABILITY IN SMES: A STUDY OF EMERGING PATTERNS AND SECTORAL TRENDS

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ABSTRACT

Objective: This research explores the integration of environmental orientation in SMEs' innovation strategies and its impact on sustainable organizational innovation (SOI) and business competitiveness, by highlighting the drivers, barriers and strategic alignment of environmental sustainability in the innovation process.

Research Design & Methods: Companies that align environmental strategy with long-term business objectives are more likely to develop dynamic capabilities that strengthen adaptability to market and environmental changes. The reporting process followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, while methodological quality assessment was conducted using CASP (Critical Appraisal Skills Program) criteria. From 67 articles that passed the initial quality assessment, 42 articles that met all relevance and data completeness criteria were further analyzed thematically.

Findings: The findings show that the success of SOI in MSMEs depends on integrating environmental issues into core business strategies. MSMEs adopt an environmental orientation through internal and external factors and exhibit four main patterns: environmental responsiveness, learning-based adaptation, navigation of resource constraints, and alignment of strategies with sustainability goals. These aligned strategies drive long-term performance improvement and innovation.

Implications & Recommendations: This study advises MSMEs to proactively integrate sustainability in innovation and business strategy. Policymakers need to support through training, incentives and green innovation support. Future research should focus on sectoral strategies and the role of digital transformation in sustainable innovation.

Contribution & Value Added: This research broadens the horizon of sustainable entrepreneurship by demonstrating the strategic role of environmental orientation in driving MSME innovation and providing guidance for businesses and policy makers in building a green business ecosystem.

Keywords: Environmental orientation; sustainable innovation; MSMEs; strategic integration.

JEL codes: Q56, L26, O32.
Article type: research paper

INTRODUCTION

Environmental sustainability is a long-term commitment that aims to preserve ecosystems through responsible management of natural resources, reducing emissions and waste, and implementing environmentally friendly business models (Ahmadov et al., 2025). In the business

world, this materializes by adopting green innovations, energy efficiency, material recycling, and strengthening sustainable supply chains. Concepts such as green innovation, the transition to green business practices, and corporate social responsibility (CSR) are now essential elements in modern corporations' strategies to deal with global ecological challenges (Ashrafi et al., 2018; Gennari, 2023). While the main focus is often on large enterprises, the involvement of Micro, Small and Medium Enterprises (MSMEs) is gaining traction due to their significant role in the economy and their collective environmental impact (Gjergji et al., 2021). MSMEs account for more than 90% of total business units globally and play an important role in job creation and economic growth in many countries. However, MSMEs account for around 60-70% of the world's total industrial emissions and pollution, making them important actors in climate crisis mitigation efforts (Genc et al., 2019; Revell et al., 2010). Unlike large enterprises that have extensive access to clean technologies and financial resources, MSMEs often suffer from capital constraints, a lack of technical know-how, and a lack of adequate policy support in implementing sustainable business practices (Krupoderova & Portnov, 2020; Majid et al., 2023).

Environmental sustainability is no longer only a major concern for large corporations, but also increasingly important for Micro, Small and Medium Enterprises (MSMEs) due to their significant role and impact on ecological conditions (Vásquez et al., 2021). In Southeast Asia, MSMEs are an integral part of the economic structure and contribute significantly to production activities and employment (Endris & Kassegn, 2022). The large number of MSME players and the involvement of labor in the sector make them key actors in the green transition agenda. Also, the role of MSMEs in shaping national and regional business structures, including their contribution to gross domestic product, reinforces the urgency of their involvement in climate change mitigation strategies (Kusumawardhani et al., 2015). Therefore, attention to the environmental footprint of MSMEs and their ability to adapt to sustainability principles is becoming increasingly crucial within the regional sustainable development framework (Sari et al., 2024). To reinforce this urgency, it is important to understand how the dynamics of environmental sustainability in the context of MSMEs are reflected in quantitative data across countries. The following data provides a comparative picture of many Southeast Asian countries and the Global South in terms of the number of MSMEs, workforce engagement, estimated annual carbon emissions, green economy potential, and cost constraints in implementing sustainability practices. This presentation aims to show the sustainability burdens and opportunities MSMEs face more concretely and measurably.

Table 1 MSME Data and Environmental Emissions

Country	MSMEs (million units)	Workers (million people)	Estimated Emissions ($MtCO_2e$/year)	Green Economy (USD Billion)	Cost Barriers (%)
Indonesia	64,2	120,6	13,0	87,0	55
Vietnam	5,4	8,5	4,5	21,5	51
Thailand	3,1	12,3	3,8	19,5	50
Malaysia	1,2	7,3	2,2	13,8	49
Filipina	1,1	5,7	1,9	9,5	54
India	63,4	110,0	48,0	100,0	56
Kenya	7,4	15,0	2,1	7,8	59
Peru	2,7	7,0	1,6	6,5	52
Afrika Selatan	2,2	5,4	61,0	–	57

Source: Data compiled by the author from publicly available sources (World Bank, UNEP, ILO, WRI in Indonesia, etc.)

Table 1 succinctly illustrates how the dynamics of environmental sustainability in the context of MSMEs vary greatly between countries. Notable differences can be seen in the scale of business units, the number of workers involved, and the volume of carbon emissions generated. Countries like Indonesia and India stand out with a very large MSME base and a massive workforce, making their contribution to emissions more significant. On the other hand, despite having smaller economies of scale, countries like Kenya and Peru still face complex challenges in financing green transitions and strengthening institutional capacity (Gjergji et al., 2021; Pacheco et al., 2017). Such

diversity suggests that the sustainability challenges of MSMEs cannot be simplified through business size alone, but are also strongly influenced by regulatory readiness, institutional infrastructure and the national socioeconomic context (Onyeje et al., 2022). Therefore, policy approaches and intervention strategies applied in supporting MSME green transition need to consider sectoral and geographical characteristics more specifically, and avoid generic or one-size-fits-all approaches (Aldieri & Vinci, 2018; Sawang et al., 2024).

External pressures from consumers, investors, financing institutions and regulators are the main driving factors encouraging MSMEs to adopt environmentally friendly practices. However, the level of adoption of sustainability strategies is largely determined by the sectoral context and local conditions. For example, European organic farming practices are not necessarily relevant to the light manufacturing sector in Southeast Asia, which faces different regulatory and infrastructure challenges (Harsanto et al., 2022; Hossain et al., 2024). MSMEs' response to the sustainability agenda is also strongly influenced by internal factors, such as ownership structure, managerial leadership, and organizational cultural values, as well as by external factors such as global supply chain pressures and adaptive capacity to national regulations (Ong et al., 2025; Pacheco et al., 2017). Empirical evidence suggests that sectors such as textiles, mining and chemicals with a high carbon footprint tend to be under more pressure to comply with sustainability standards than services or digital technology sectors that are less environmentally impactful (Sawang et al., 2024). In many developing countries, weak support institutions and low sustainability literacy mean that most MSMEs are still stuck in short-term survival logic, an obstacle to sustainable green transformation (Aldieri & Vinci, 2018; Krupoderova & Portnov, 2020).

Most previous studies are still general and have not paid sufficient attention to the sectoral and contextual dimensions in MSME sustainability research (Baskaran et al., 2023; Parker et al., 2009). The findings of reinforce this and Ahmadov et al. (2025), who emphasized the need for a more differentiated approach in terms of industry sector, geographical region, and institutional capacity. Recent trends in the literature also show an increased interest in issues such as circular economy integration, sustainability innovation, and cross-actor collaboration in response to complex environmental and social challenges (Gennari, 2023; Gupta, 2017). Based on this urgency, this research is directed to investigate the dynamics of environmental sustainability in the context of MSMEs by highlighting emerging patterns and trends in the sector through a systematic approach to academic literature from 2018 to 2024. The research aims to identify the green strategies MSMEs adopt, the key factors influencing such adoption, and the implications for formulating more contextualized policies and business practices. The findings are expected to enrich the scientific discourse and provide practical contributions for MSMEs across sectors in building inclusive and adaptive sustainability capacity in the face of the global environmental crisis.

LITERATURE REVIEW

Research on environmental sustainability in the context of Micro, Small and Medium Enterprises (MSMEs) is growing in line with increasing global attention to the climate crisis and the role of businesses in mitigating it. Early studies have shown that while large corporations take center stage in the sustainability discourse, MSMEs play an important role as they dominate the economic structure in many countries, including Asia and the Global South (Johnson & Schaltegger, 2016). However, MSMEs often lag in implementing environmentally friendly practices due to limited resources, lack of incentives, and lack of sustainability literacy (Horbach et al., 2012). Internal factors such as organizational capacity, entrepreneurial orientation and managerial attitudes have been shown to influence the adoption of sustainability strategies among MSMEs (Akomea et al., 2023). Harsanto et al. (2022) stated that sustainability innovation cannot be separated from the understanding and commitment of business leaders, who often determine the direction and speed of the green transition. On the other hand, external factors such as environmental regulation, value chain pressure, and consumer demand also play an important role in driving changes in business behavior (Zhong & Um, 2025). MSMEs in the manufacturing sector that are part of the supply chain of multinational companies are more encouraged to adopt environmental practices due to strict compliance demands (Passaro et al., 2023).

A supportive institutional ecosystem also accelerates the green transformation of MSMEs. MSME involvement in industry associations, green incubators, and partnerships with research institutions can strengthen access to green knowledge and technologies (Goyal et al., 2017). However, in many developing countries, challenges such as weak institutions, policy uncertainty and lack of fiscal incentives make this transition uneven. Training programs and green funding schemes often do not reach MSMEs outside industrial centers or in the informal sector (Anu et al., 2023). Recent literature has also highlighted the issue of ecological justice as an important dimension of MSME sustainability. Sustainability approaches fail to consider the socio-economic vulnerabilities inherent in MSMEs, especially in marginalized areas (Klewitz & Hansen, 2018). Therefore, sustainability strategies should not only be oriented towards efficiency or profitability but also prioritize dimensions of inclusiveness and social justice. In this context, community-based and collaborative approaches are increasingly being scrutinized as more adaptive alternatives and responsive to local realities.

Along with technological development, digital transformation is also key in driving MSME sustainability. Technologies such as the Internet of Things (IoT), blockchain for supply chain transparency, and carbon monitoring tools can improve MSMEs' efficiency and environmental accountability (Sarkis, 2020). However, the digital divide remains a significant barrier, especially in rural areas or countries with weak digital infrastructure. Inclusive digital transformation should be part of sustainability strategies, so as not to create new gaps in achieving environmental targets (Bag et al., 2022). The research approach to MSME sustainability has also evolved in terms of methodology. Previously dominated by quantitative surveys, many studies now adopt qualitative and mixed methods approaches to deeply understand the social and organizational dynamics behind green decisions in MSMEs. Case studies, narrative interviews and participatory observation have become important tools in exploring the actual practice of sustainability and how small businesses interpret and negotiate environmental values.

The literature also shows a shift from traditional sustainability concepts towards circular economy models. The circular economy provides a more systemic framework for reducing waste and optimizing product lifecycle (Sandoval et al., 2022). While this concept is promising for the MSME sector, implementation has many challenges. Lack of understanding, supporting infrastructure and incentives are the main barriers. However, some studies show the successful implementation of circular economy principles on a small scale, especially when combined with local values and community-based business models. This literature review shows that MSME sustainability is an evolving and increasingly complex field. A cross-sector, cross-discipline and cross-policy level approach is needed to create an ecosystem that enables MSMEs to actively transition to a low-carbon economy. Therefore, future research must explore more sectoral dynamics, geographical differences and local practices to shape contextualized and adaptive sustainability policy and practice frameworks.

METHODS

This research uses a systematic literature review (SLR) approach to examine emerging patterns and sectoral trends in implementing environmental sustainability in Micro, Small and Medium Enterprises (MSMEs). This approach was chosen because it is considered effective in identifying knowledge development in a comprehensive and structured manner through synthesizing the results of relevant previous studies. The literature search was conducted on three reputable international academic databases, namely Scopus, Web of Science, and ScienceDirect. The keywords used included a combination of terms such as "SMEs", "environmental sustainability", "green innovation", "sustainable business practices", "eco-innovation", "sectoral trends", and "developing countries", organized using Boolean operators. Selected articles were limited to scientific journals published between 2018 and 2024, indexed Q1 to Q3 in the Scimago Journal Ranking, written in English, and explicitly addressing environmental sustainability practices in the context of MSMEs. Studies that focused only on large corporations, were conceptual without empirical data, or only addressed social and economic aspects without environmental dimensions, were eliminated from the selection process. From 1,346 articles obtained at the initial stage, 215 were screened based on title and abstract. After an in-depth evaluation of the full text and

methodological quality testing using the CASP (Critical Appraisal Skills Programme) framework, 67 articles were selected for further analysis.

The analysis process was conducted through thematic synthesis, starting with extracting key data such as publication year, geographical location, industry sector, methodological approach, type of sustainability strategy, and drivers and barriers. The data was then coded and categorized based on sectoral patterns, geographical variations and strategic focus. Comparative analysis was used to identify common patterns and gaps that have not been widely discussed in the literature, especially about high-emission sectors and developing country contexts. Internal validity was maintained through transparent documentation of search and selection procedures and possible replication. In contrast, external validity was strengthened by comparing the findings of this study with previous meta-analyses such as those conducted by Baskaran et al. (2023), Parker et al. (2009) and Johnson & Schaltegger (2016). To minimize interpretation bias, the analysis results were also reviewed by two independent researchers. This approach is expected to provide a solid and contextualized academic contribution in understanding environmental sustainability dynamics in MSMEs across sectors and regions.

RESULT

This research analyzes various studies exploring the application of sustainability-oriented innovation (SOI) in the MSME sector internationally. The findings suggest that the success of MSMEs in adopting sustainability innovations is strongly influenced by organizational strategy, environmental orientation, technological readiness, and external collaboration. In addition, each study contributes a different perspective on how innovation can be a catalyst in improving the environmental, social and economic performance of MSMEs. The main findings of these studies suggest that the successful implementation of sustainability-oriented innovations in MSMEs is highly dependent on policy support, technological adaptability, understanding of sustainability processes, and knowledge transfer.

Table 2: Synthesis of Research Related to Sustainability-Oriented Innovation in MSMEs

No	Author	Region	Sector	Sustainability Focus	Findings
1	Gamero & Azorín, (2016)	Spain	Industry	Environmental Management	Proactive environmental practices improve financial performance & reputation. Internal resource-based strategies strengthen long-term sustainability.
2	Bakos et al. (2020)	United States	Manufacturing (SMEs)	Supply Chain Sustainability	The lean-green approach positively impacts the sustainability and efficiency of SME business processes; technology integration aids in green decision-making.
3	Jaiswal (2014)	India	Multisector SMEs	Triple Bottom Line (TBL) & Sustainability Strategies	TBL (environment, social, economy) strategies help SMEs improve competitiveness, innovation, and social responsibility.
4	Onu & Mbohwa, (2021)	Africa (regional focus)	Manufacturing	Industry 4.0 & Technology Sustainability	Technology 4.0 (IoT, CPS, Big Data) opens up sustainable production opportunities for SMEs. A national strategy is needed to reduce the technology gap and improve global competitiveness.

5	Rodríguez et al., (2016)	Denmark	Manufacturing (SMEs)	Environmental Initiatives & Strategies	Environmental initiatives are linked to cost advantage & differentiation. Corporate strategy plays more of a role than managerial attitude. SME size does not significantly affect competitive advantage.
6	Salim et al., (2018)	Global (Europe, US, China dominant)	Multisector	ISO 14001 & Environmental Management Systems	Bibliometric review of 509 articles. Dominant theme: social-ecological. Minimal participation of developing countries. Cross-country collaboration & local needs-based approach recommended.
7	Akomea et al., (2023)	Ghana	Multisector SMEs	Entrepreneurial Orientation & Sustainability	Sustainability practices mediate the EO-performance relationship. Competition weakens the EO-SP relationship, but strengthens the EO → SP → Performance.
8	Maniu et al. (2021)	Romania	General MSMEs	Environmental Practices & Manager Characteristics	Identify five types of pro-environmental behavior. There is a gap between managers' pro-environmental attitudes and actual implementation in companies.
9	Malik & Biliczak, (2018)	Poland (EU economies)	Regional SMEs	Innovation as a sustainability process	Innovation is not a result, but a process. Knowledge transfer is important to improve MSME sustainability practices.
10	Yacob et al. (2019)	Malaysia	MSME manufacturing	Green Initiatives & Environmental Performance	Green initiatives such as energy efficiency and waste management have been proven to improve business and environmental performance. Regulatory and external support are important.
11	Harsanto et al. (2022)	Indonesia	Social enterprises (incl. social-based MSMEs)	Sustainability-oriented innovation in social organizations	Process/organizational innovations, such as business model transformation and stakeholder management, are commonly applied by social enterprises. SOIs are more social than environmental. Challenges include limited long-term funding and high competition.
12	Hossain et al., (2024)	Malaysia	Manufacturing	Green Innovation Performance	Green smart technology adoption, green ambidextrous leadership, and green innovation behavior significantly contribute to improving the green innovation performance of manufacturing enterprises. Green leadership plays an important moderating role in adopting technology and innovative behavior.
13	Pacheco et al. (2017)	India	Light manufacturing	Technological Barriers & Costs	Twenty-three key factors of eco-innovation in manufacturing

					SMEs were identified and grouped into seven categories. Key factors include: government policy support, resource availability, strategic perception, network partnerships, and technology assistance. The study also developed a model to understand the relationship between factors and solutions to barriers to green innovation.
14	Sawang et al., (2024)	United Arab Emirates (UAE)	Diverse MSME sectors	Stakeholder influence on environmental practices	Customers, suppliers and regulators have significant influence on MSMEs' adoption of environmental practices; customer pressure and regulatory policies are the main drivers.
15	Bocken et al., (2019)	Netherlands	Multisector	Circular Economy & Recycling	Circular business models are gaining ground; support systems are needed.
16	Aldieri & Vinci (2018)	Global	R&D-intensive firms	Green economy & employment	Green investments hurt job creation as replacement effects outweigh compensation; policies are needed to support job creation in a sustainable transition.
17	Gjergji et al., (2021)	Spain	Multisector	Regulation & Stakeholder Demands	SMEs tend to comply with green practices if there is pressure from external stakeholders.
18	Gennari (2023)	Chile & Peru	Agriculture	Collaboration Across Actors	Local ecosystems are critical in driving SME green innovation.
19	Krupoderova & Portnov, (2020)	Germany	Heavy industry	Adoption of Environmental Innovations	Access to technology and regulatory pressure are key factors for green innovation.
20	Ong et al., (2025)	Malaysia	MSMEs)	ESG (Environmental, Social, and Governance)	Ethical leadership is important in driving ESG adoption in MSMEs in Malaysia. Leaders' ethical values influence organizational culture and motivate employee engagement in sustainability initiatives.
21	Al-Shami, (2023)	Malaysia	Halal food MSMEs	Eco-innovation in halal SMEs	Technological, organizational, environmental and individual factors significantly influence eco-innovation performance in halal food MSMEs. The Islamic perspective becomes the normative framework for value orientation and practice.
22	Rehman et al. (2022)	Malaysia	Construction & Manufacturing (SMEs)	Environmental sustainability orientation, CSR and green capability mediation	ESO directly improves environmental performance, while CSR affects environmental performance indirectly through green capability, which acts as a key mediator.
23	Brenya et al., (2023)	Emerging & developing economies	Agribusiness	Barriers to agribusiness sustainability	Key barriers include: weak policies, limited access to finance, lack of technology,

	(environmental, economic, social)	social resistance, and climate change challenges.

The analysis of the main studies shows that the implementation pattern of environmental sustainability in the SMEs sector is very diverse, but forms a significant trend sectorally and geographically. In general, the successful implementation of sustainable innovation in the SME sector is determined by technological aspects and public policy factors, organizational readiness, and the integration of sustainability strategies in the existing business model. In Spain highlights the importance of structured environmental management strategies in improving the environmental performance of service and manufacturing MSMEs. The research shows how the service sector has been positively impacted by the sustainability orientation that was previously more prevalent in manufacturing.

From the sectoral side, the manufacturing sector is the dominant focus in various studies reviewed, as seen in India, which confirms that green management practices significantly contribute to the competitive advantage of MSMEs. A similar point was also raised by Onu & Mbohwa (2021) in Africa, which showed that implementing Industry 4.0 technology in the manufacturing industry brings great opportunities for implementing sustainable production. This research specifically highlights the importance of technological readiness and policy support for this digital transformation to impact the sustainability of MSMEs. In other sectors such as agribusiness and retail, findings from v retail sector. Meanwhile, a study in Malaysia by Al-Shami, (2023) showed that the integration of digital technology and innovative capabilities play a crucial role in improving the sustainability of halal-based MSMEs and agro-industries. This research emphasizes the importance of digital empowerment, e-commerce adoption, and entrepreneurial ecosystem support to sustainably strengthen the competitiveness and added value of the sector.

From the perspective of cross-regional trends, studies in Eastern Europe such as by Gherghina & Vintila, (2016) in Poland emphasize the need for digital literacy and integration between digitalization and environmentally friendly practices so that the sustainability process is not only symbolic, but can reduce emissions and increase energy efficiency. In this context, the utilization of technologies such as IoT, Big Data, and renewable energy is a pattern that is starting to be widely applied and shows a positive impact on the sustainability performance of MSMEs. A study in Malaysia by Rehman et al., (2022) emphasizes the importance of environmental sustainability orientation and corporate social responsibility (CSR) in improving the environmental performance of MSMEs. This study found that although CSR does not directly impact environmental performance, it plays an important role in building green capability as a strong mediating mechanism. This finding indicates that in the MSME sector, the success of sustainability strategies depends not only on strategic intentions, but also on the organization's ability to internalize green values into operational practices. Green capabilities are an important bridge linking corporate social and environmental commitments to tangible performance outcomes, particularly relevant in emerging economies driving sustainable green growth. The manufacturing sector dominates with trends in technology adoption and energy efficiency, while services emphasize green management strategies and operational processes. The agribusiness and retail sectors tend to emphasize integrating sustainability values in products and consumer relationships. This shows that MSME sustainability patterns are not generic, but are strongly influenced by sectoral characteristics and region-specific challenges.

DISCUSSION

Sectoral Trends in Environmental Sustainability Practices

The findings on sectoral variations in adopting environmental sustainability by MSMEs show that sustainability practices are not universal, but are strongly influenced by industry context, technological readiness, and institutional pressures. In the manufacturing sector, for example, adopting Industry 4.0 technologies including IoT, smart automation, and physical cyber systems enables more systematic integration of sustainability into the production process. This is consistent with the eco-efficiency and resource-based approach, which states that technological capabilities are strategic assets in enhancing environmental competitive advantage (Onu & Mbohwa, 2021;

Tabaa et al., 2020). These technologies enable energy optimization, real-time emissions monitoring, and production process efficiency, significantly supporting long-term sustainability targets (Kamble et al., 2020; Onu & Mbohwa, 2021). The finding that lean manufacturing and green innovation play an important role in improving the environmental performance of manufacturing MSMEs supports the argument that sustainability is not only a response to external pressures, but also part of an internal efficiency strategy. The importance of integrating lean manufacturing and green innovation as an adaptive strategy for small and medium scale manufacturing industries in India (Kamble et al., 2020). On the other hand, the agribusiness sector shows different dynamics. Sustainability is more geared towards responding to market and regulatory pressures that encourage innovation based on local practices such as agroecology and irrigation efficiency. This finding confirms the relevance of DiMaggio et al., (1983) institutional pressure theory in explaining how MSMEs in the agribusiness sector adopt green practices as a form of legitimization as well as adaptation to structural changes, including the climate crisis and the need for food security (Brenya et al., 2023; Jaiswal, 2014).

The service and technology sectors show that sustainability has evolved from mere social responsibility to strategic differentiation and focuses on operational efficiency and digitalization of environmental management systems (Chen et al., 2020; Shao et al., 2024). The use of digitalization in supply chains and the implementation of green HRM reinforce the dynamic capabilities theory, where organizations that can proactively absorb and leverage sustainability trends will gain superior performance both financially and ecologically (Ojo et al., 2022). In the service and technology sectors, sustainability is not only a corporate social responsibility, but has also transformed into a strategic competitive advantage (Bakos et al., 2020; Ojo et al., 2022). The integration of operational efficiency and environmental value in this sector proves that sustainability can be a value creation logic in the digital era. Overall, this discussion shows that MSME sustainability strategies are contingent, depending on sectoral factors such as product type, technology, regulation, and market pressure. However, the emerging pattern leads to a convergence between resource efficiency, green innovation and commitment to the environment as the foundation of adaptive and strategic sustainability. This confirms the global literature that emphasizes the importance of a cross-sectoral approach in understanding the environmental capabilities of MSMEs (Gamero & Azorín, 2016; Syahza et al., 2025).

Emerging Patterns in Sustainable Innovation

From various cross-country studies, sustainable-oriented innovation (SOI) has become the dominant framework for MSMEs to strategically adopt sustainability (Bossle et al., 2016; Harsanto et al., 2022; Khurana et al., 2021). SOI involves not only product and process innovation, but also organizational structure and strategic management focusing on resource efficiency and reduced environmental impact (Gamero & Azorín, 2016). MSMEs that implement SOI tend to improve environmental performance, operational efficiency, and sustainable value-based competitive advantage (Morant et al., 2018; García et al., 2025; Hojnik & Ruzzier, 2016). In countries such as Poland and Malaysia, there has been a significant shift from cost-efficiency motivations towards value-driven innovation, with MSMEs placing more emphasis on process innovations oriented towards circular economy principles, such as the utilization of environmentally friendly raw materials, energy optimization, and emission reduction (Chen et al., 2024; Wysocki, 2021). In manufacturing MSMEs, this practice is often realized through a lean-green approach that integrates lean production principles with environmental goals (Dangelico, 2016; Garbie, 2014).

Another strengthening trend is cross-actor collaboration-including strategic partnerships between MSMEs, government, academia and large industries-that serve as enablers in the process of sustainable innovation (Adomako, 2020; Bocken et al., 2014). This collaboration creates an open innovation system that enables knowledge diffusion, technology access, and the acquisition of policy incentives that accelerate the transformation towards green business (Mubarak et al., 2021; Porter & Kramer, 2019). Integrating lean-green principles in manufacturing MSMEs underscores the simultaneous effort between improving operational efficiency and achieving sustainability goals (Dangelico, 2016; Garbie, 2014). However, these initiatives cannot be separated from the support of a collaborative innovation ecosystem. This finding emphasizes the importance of cross-actor

collaboration as an institutional mechanism to address the limited internal resources of MSMEs. Through the open innovation model (Mubarak et al., 2021), partnerships between MSMEs, government, academia, and large corporations act as enabling structures that expand access to technology, knowledge, and financing needed for green transition (Adomako, 2020; Bocken et al., 2014). Green incubation initiatives in several developing countries have been shown to bridge the innovation gap and reduce financial risk in adopting green technologies (Pacheco et al., 2017; Rizos et al., 2016). Green incubation developed in developing countries is a concrete example of institutional engineering that can fill the innovation capability gap of MSMEs (Pacheco et al., 2017; Rizos et al., 2016). This approach reflects a shift from the traditional incubation model towards a new role as a hub in sustainable innovation ecosystems. This supports the narrative that institutions create constraints and provide structural opportunities that enable new norms and practices that support green innovation.

The adoption of digitalization-including IoT, blockchain, and big data-is identified as a trigger for accelerating green innovation, as it enables real-time monitoring, energy consumption prediction, and supply chain transparency (Bonilla et al., 2018; Sarkis et al., 2020). The ability to adopt these technologies is strongly influenced by the institutional readiness and digital literacy capacity of MSMEs. In this context, the institutional framework plays a dual role: first, as a facilitator in building an inclusive digital infrastructure, and second, as a normative director to ensure that the use of technology remains in line with sustainability principles. Thus, patterns of sustainable innovation in MSMEs are not only reactive to regulatory or market pressures, but increasingly show proactive, strategic and collaborative characteristics that support the transformation of resilient and environmentally friendly business systems (Daddi et al., 2016; Harsanto et al., 2022). In addition, the role of digital technologies such as IoT, blockchain, and big data were identified as transformational instruments that strengthen green innovation processes (Bonilla et al., 2018; Sarkis et al., 2020). Overall, however, this discussion confirms that the adoption of sustainable innovations by MSMEs does not take place in a vacuum, but is heavily influenced by the surrounding institutional structures and dynamics. When institutional pressure is accompanied by strategic support mechanisms such as incentives, collaboration and digital transformation, MSMEs can transform from passive actors to agents of change in the green economy system. This is in line with Harsanto et al., (2022) that SOI in MSMEs is an evolutive process that demands a balance between external pressure and internal capabilities enriched through institutional interactions.

Institutional and Contextual Influences on Environmental Sustainability of MSMEs

Institutional and contextual influences in driving environmental sustainability in MSMEs suggest that external dynamics play an important role in shaping the behavior of small and medium-sized organizations towards green business practices (Mondal et al., 2024). P The influence of environmental regulation, consumer pressure, fiscal incentives, and social norms serve as drivers of adoption and shapers of long-term sustainability strategies. This reinforces the neo-institutional theory approach which emphasizes that pressures from an organization's external environment can create conformity to socially and legally expected practices (DiMaggio et al., 1983). In this context, governments in countries such as Spain, India and Malaysia have played a fairly active role by implementing supportive environmental policies, including the provision of fiscal incentives and green financing. As noted by Gamero & Azorín, (2016) where the success of such regulations is inseparable from the alignment between national policies and the specific needs of the MSME sector. This is in line with the findings of Testa et al., (2018) that financial incentives can encourage the adoption of green innovations if combined with adequate counseling and supervision. Institutional pressure does not only come from formal policies. The sustainability discourse is also shaped by changing social values, as consumers, trading partners and industry associations begin to demand more environmentally responsible business practices (Río et al., 2010). In many cases, this pressure has led to a convergence of values between MSME actors and society, creating new social norms that place sustainability as a standard of business legitimacy (Haack & Rasche, 2021). Therefore, the success of MSMEs in adopting green principles is not only determined by regulatory pressures, but also by normative and mimetic pressures emanating from their external networks.

However, it is important to note that the effectiveness of such institutional pressures is highly dependent on the internal capacity of MSMEs. Many small businesses still face barriers in the form of limited digital literacy, strategic leadership and technical capabilities to implement green practices across the board (Harsanto et al., 2022; Salaheldeen et al., 2024). In developing countries, these challenges are exacerbated by inequalities in technological infrastructure, limited financing, and weak local institutional support (Rizos et al., 2016). Therefore, external pressures need to be supported by internal capacity building in order to be able to produce a substantive, rather than merely symbolic, sustainability transformation.

Table 3 Institutional Impacts on Environmental Sustainability in SMEs

Institutional Factor	Description	Relevant Articles
Environmental Regulation	Government regulations that require emission reduction, energy efficiency, and the use of environmentally friendly materials.	Gamero & Azorín, (2016); Testa et al., (2018)
Market & Consumer Pressure	Pressure from consumers and trading partners demanding green products and processes.	Haack & Rasche (2021); Río et al., (2010)
Financial Incentives	Subsidies, fiscal incentives or special funding to encourage the adoption of green technologies.	(Jaiswal, 2014)
Social Norms & Peer Effects	Social expectations to conduct ethical and sustainable business, influenced by communities and associations.	Morant et al., (2018); Salaheldeen et al., (2024)
Capacity Constraints	Internal limitations such as digital literacy, capital and technical skills.	Harsanto et al., (2022)
Technological Gaps	Gaps in access to technology and infrastructure to support green innovation.	Rizos et al., (2016) Salaheldeen et al., (2024)

The findings discussed in Table 3 show that responses to institutional pressures result in various sustainability innovation strategies among MSMEs. One of the most striking patterns is the dominance of process innovation as an adaptive response to regulations and market demands. These innovations include energy efficiency, digitization of production processes and waste reduction, reflecting a shift in orientation from mere cost efficiency towards sustainable value creation (Chen et al., 2024; Wysocki, 2021). The collaborative approach between MSMEs and external actors such as academia, financing institutions, and non-governmental organizations shows that the innovation ecosystem contributes to successfully adopting green practices. This collaboration enables knowledge transfer, access to green technologies, and the design of inclusive financing schemes (Adomako, 2020). Interestingly, some MSMEs in the digital sector have gone beyond technical innovation to business model innovation based on circular economy and sharing economy, expanding the scope of sustainability from operational aspects to value model aspects (Geissdoerfer et al., 2017). The implications of these findings suggest that approaches to MSME sustainability should be holistic, encompassing interventions at the level of public policy, social norms, technological infrastructure and internal capacity building. When these dimensions work synergistically, sustainability innovation can be a proactive strategy for MSMEs to build long-term competitiveness, rather than a reactive response to environmental pressures. Sustainability-oriented innovation is no longer optional but a strategic foundation for MSME business continuity in the green economy era.

Integration of Business Strategy and Environmental Orientation

The integration of business strategy and environmental orientation is now a decisive factor in achieving sustainable competitive advantage in the MSME sector. When sustainability practices are no longer just a response to external pressures-such as regulations or market demands-but are internalized into a company's vision and strategic direction, it creates synergies between economic goals and mutually reinforcing ecological goals (Bakos et al., 2020; Bossle et al., 2016). Pendekatan ini menandai pergeseran paradigma dari compliance-based sustainability ke arah strategic sustainability orientation, di mana keberlanjutan menjadi bagian integral dari penciptaan nilai bisnis (Freudenreich et al., 2020). This approach marks a paradigm shift from compliance-based sustainability towards strategic sustainability orientation, where sustainability becomes integral to

business value creation (Amui et al., 2017). This is particularly relevant for MSMEs, which generally have flexible organizational structures but are vulnerable to external volatility. By adopting green strategies as part of corporate planning, MSMEs can build strategic resilience and strengthen their bargaining position in supply chains that increasingly demand environmental transparency and accountability (Dangelico et al., 2017).

Furthermore, this integration is also reflected in the design of business models that support circular economy principles, resource efficiency, and proactive management of environmental risks (Bocken et al., 2014; Freund, 2020). In practice, MSMEs that adopt green-oriented business models tend to innovate at the product and process level and in the value structure, such as redefining value propositions and relationships with stakeholders (Mondal et al., 2024). This creates unique market differentiation opportunities that are difficult to replicate by competitors that have not integrated sustainability aspects systemically. In addition, the role of strategic leadership is critical in driving this integration. MSME owners or managers with green leadership orientation tend to consistently align operational decisions with long-term sustainability goals, including investments in clean technology, human resource training, and cross-sector collaboration (Brenya et al., 2023; Niazi et al., 2023). Structural supports such as government policy incentives and access to green incubation programs also strengthen MSMEs' internal capabilities to implement environmentally sustainable strategies (Pacheco et al., 2017; Rizos et al., 2016). Integrating business strategy and environmental orientation is no longer an optional choice, but a strategic necessity in facing global challenges such as climate change, resource crises, and transforming consumer preferences. MSMEs that can internalize sustainability at the heart of their business strategy not only strengthen their short-term competitiveness, but also create long-term value that is resilient and inclusive (Friedman, 2011; Porter & Kramer, 2019).

CONCLUSION

This study confirms that the holistic and integrated integration of institutional structure, business strategy, and environmental orientation strongly influences the success of sustainability efforts in the MSME sector. The synthesis shows that top-down approaches such as government regulations and fiscal incentives do play an important role as initial drivers, but are insufficient if the intrinsic motivation and internal adaptive capabilities of the MSMEs themselves do not match them. In this context, sustainable-oriented innovation (SOI) becomes the intersection of external demands and internal strategies, enabling MSMEs to survive economically and actively contribute to the global environmental agenda.

Collaborative practices across actors-between MSMEs, the public sector, research institutions and large industrial players-have proven to be an institutional mechanism that strengthens innovative capacity and accelerates the adoption of green technologies. Furthermore, integrating digitalization and circular economy principles opens up space for resource efficiency, increased transparency, and sustainable value creation. These findings emphasize that sustainability cannot be positioned solely as a response to external pressures, but rather as a long-term strategy embedded in the core business model. As such, the transformation of MSMEs towards sustainability demands not only supportive policy reforms, but also a managerial paradigm shift that prioritizes innovation, collaboration and strategic integration. The practical implications of this study suggest that institutional empowerment, green incubation, and investment in digital and innovation capabilities should be a priority on the agenda for designing a resilient and environmentally-friendly MSME ecosystem in the future.

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