CIRCULAR ECONOMY IN INDONESIAN MSMES: A QUALITATIVE STUDY ON THE ROLE OF ECO-INNOVATION AND SUSTAINABLE SUPPLY CHAINS

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Article history:
Received
12 September 2025

Revised
31 October 2025

Accepted
28 January 2026

Available online
31 January 2026

Abstract:

Background: Indonesia's transition toward a circular economy is increasingly urgent due to rising waste from urbanization and industrial growth. Although MSMEs contribute significantly to GDP, low resource efficiency and fragmented supply chains make them major waste contributors.
Purpose: This study examines how the synergy between ecological innovation (eco-innovation) and Sustainable Supply Chain Management (SSCM) enhances the effectiveness of circular economy implementation in Indonesian MSMEs.
Design/methodology/approach: An exploratory qualitative approach was employed through Focus Group Discussions (FGDs) involving MSMEs, associations, local governments, and experts in West Java and Bengkulu. Data were analyzed using NVivo 15 with thematic coding, heatmaps, and concept mapping.
Findings/Results: The findings indicate that circular economy implementation in MSMEs is driven by the synergy of eco-innovation and SSCM through collaboration, information sharing, training, and stakeholder engagement. However, it is constrained by limited green financing, human resources, and institutional support, with regional differences shaping economic and environmental outcomes.
Conclusion: MSMEs play a strategic role in advancing the circular economy but require localized policy support, digital innovation, and long-term partnerships.
Originality/value (State of the art): This study provides novel empirical evidence on the synergy of eco-innovation and SSCM at the MSME level in developing countries.

Keywords: circular economy, ecological innovation, MSMEs, green financing, sustainable supply chain

How to Cite:
Mekaniwati, A., Munawar, A., Rainanto, B. H., & Maulina, D. (2026). Circular economy in Indonesian MSMEs: A qualitative study on the role of eco-innovation and sustainable supply chains. Jurnal Aplikasi Bisnis dan Manajemen (JABM), 12(1). https://doi.org/10.17358/jabm.12.1.352

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INTRODUCTION

The transition to a circular economy (CE) in Indonesia has become an urgent need, given that waste volume is projected to reach 70.8 million tons by 2025. Although Micro, Small, and Medium Enterprises (MSMEs) contribute significantly to national GDP, accounting for 61% of the country's GDP, this sector paradoxically remains a substantial contributor to waste generation due to its low resource efficiency (EMF, 2021). The urgency of this paradigm shift is further emphasized by Indonesia's status as an upper-middle-income country with an ambitious vision to become a high-income country by 2045. National economic growth, driven by demographic dynamics, faces fundamental challenges in balancing expansion with environmental sustainability. Rapid urbanization and industrialization have exacerbated energy consumption and waste production, with the urban population increasing significantly to 53.12% (Central Bureau of Statistics, 2020). In particular, the dominance of organic waste (39.36%) and plastic (19.71%) reflects the inefficiency of the current recycling system. Consequently, a shift from the linear "take-make-dispose" model to a circular paradigm emphasizing the 3R principle (reduce, reuse, recycle) has become imperative in national waste management strategies (Euro Stat, 2024; Kadin, 2024). Without circular interventions at the MSME level, long-term development targets risk being hampered by ecological degradation (Khaksar et al. 2016; Namagembe et al. 2018), which directly impacts the volume of municipal solid waste in Indonesia. Empirical evidence indicates that municipal solid waste generation in Indonesia is predominantly household-based and strongly influenced by population growth and urbanization, with waste streams largely composed of organic waste, plastic, paper, metal, and emerging electronic waste (Khair et al. 2019; Qonitan et al. 2021; Septarini et al. 2021; Wibisono et al. 2020). When inadequately managed, the increasing volume and complexity of this waste significantly contribute to soil, water, and air degradation (Zoroufchi Benis et al. 2019; Yatoo et al. 2024;). Moreover, rising purchasing power and shifting consumption patterns have intensified waste heterogeneity such as textiles, cosmetics packaging, and polymer-based residues thereby increasing the challenges of municipal solid waste management in urban Indonesia (Bai et al. 2017; França et al. 2020).

Theoretically, the implementation of circular principles can be examined through the Resource-Based View (RBV) and Institutional Theory to map internal capabilities and external pressures (Barney, 1991; DiMaggio & Powell, 2000). However, these frameworks often encounter obstacles when applied to specific empirical contexts in developing countries (Phelan, 2023). Previous studies on CE in Indonesia have predominantly concentrated on the macro scale, such as government policies or municipal waste management (Baldé et al. 2024; Mckinsey, 2025). Conversely, the literature on Sustainable Supply Chain Management (SSCM) has predominantly focused on large corporations, while research addressing Micro, Small, and Medium Enterprises (MSMEs) remains fragmented and often concentrates on isolated practices such as partial eco-innovation rather than holistic supply chain integration (Panigrahi et al. 2018; Pandey et al. 2020; Bag et al. 2022). This creates a significant conceptual gap regarding how the synergy between eco-innovation and SSCM can strengthen comprehensive CE implementation at the MSME level. The novelty of this study lies in the integration of eco-innovation and sustainable supply chains within the unique context of Indonesian MSMEs where capital constraints often intersect with local wisdom in resource management. Unlike previous studies, this research proposes that the synergy between these aspects will significantly enhance operational efficiency and environmental performance compared to their isolated implementation.

To address this gap, this study employs an exploratory qualitative approach through Focus Group Discussions (FGDs). The research focuses on West Java and Bengkulu due to their contrasting characteristics, which are representative of the Indonesian MSME ecosystem. West Java represents the national industrial hub facing high urbanization pressure, whereas Bengkulu represents the dynamics of MSMEs outside Java with potential in local resource utilization but limited infrastructure. The study specifically targets the food, textile, and packaging sectors, as these are major contributors to organic and plastic waste. Data analysis was conducted systematically using NVivo 15 software to code and map key themes.

Understanding the implementation of the circular economy in Micro, Small, and Medium Enterprises (MSMEs) requires an in-depth examination of how internal innovation capabilities interact with external supply chain structures. Previous studies have

highlighted eco-innovation and Sustainable Supply Chain Management (SSCM) as important enablers of circular practices; however, their integration at the MSME level, particularly in developing country contexts, remains insufficiently explored. This research is therefore important to address the existing conceptual gap by providing a holistic understanding of how these two dimensions jointly shape circular economy outcomes. By focusing on MSMEs, this study responds to the need for context-specific insights where resource constraints, institutional pressures, and local wisdom simultaneously influence business decisions. The articulation of clear research objectives is essential to ensure that the analysis not only contributes to theory development but also generates actionable implications for practitioners and policymakers. Accordingly, the objectives of this study are structured to capture both the process and the outcomes of circular economy implementation in Indonesian MSMEs. The primary objective of this study is to deeply understand the dynamics of circular economy implementation in Indonesian MSMEs by emphasizing the synergy between eco-innovation and SSCM. Specifically, the research aims to 1) analyze the integration of eco-innovation and SSCM aspects within MSMEs; 2) identify inhibiting factors, such as capital constraints, and driving factors in the adoption of circular practices; evaluate the impact of this integration on both economic and environmental performance; 4) identify a circular economy integration model tailored to MSMEs in developing nations and provide practical managerial guidelines for optimizing limited resources.

METHODS

This study employs an exploratory qualitative research design to examine phenomena that remain insufficiently explored and theoretically underdeveloped within the context of Micro, Small, and Medium Enterprises (MSMEs). This approach is particularly appropriate for addressing "how" and "why" questions related to complex and contextual dynamics of MSMEs, where rigid variables may limit the emergence of new insights (Creswell & Poth, 2018).

The primary data consist of qualitative data obtained directly from key stakeholders, including MSME actors, MSME associations, local government representatives, and subject-matter experts. These data capture participants' experiences, perceptions, and interpretations regarding eco-innovation, sustainable supply chain management (SSCM), access to financing, and policy effectiveness. Secondary data were also used to complement the analysis, including government reports, policy documents, and statistical data from official institutions.

West Java and Bengkulu provinces were selected through purposive sampling to represent contrasting regional characteristics. West Java represents Indonesia's largest MSME hub, contributing approximately 14.3% of the national total (BPS, 2023), reflecting a dense and competitive business ecosystem. In contrast, Bengkulu was selected to represent regions with growth potential but different infrastructural and institutional constraints.

The selection of three participants per category in each region was guided by the principle of data saturation in qualitative research. Previous studies indicate that core themes often emerge within six to twelve interviews; however, in relatively homogeneous groups with specialized knowledge, a smaller number of key informants can generate sufficient depth without excessive redundancy (Krueger & Casey, 2014; Guest et al. 2020).

Data were collected through Focus Group Discussions (FGDs) conducted in two separate sessions for each province, namely West Java and Bengkulu. Each FGD session lasted approximately 120–150 minutes and was carried out offline (face-to-face) to encourage natural interaction among participants, facilitate in-depth discussions, and enable researchers to observe non-verbal cues. The FGDs were guided by a semi-structured discussion framework, allowing flexibility in exploring emerging issues while remaining aligned with the research objectives (Krueger & Casey, 2014). The main discussion themes focused on obstacles to digital technology adoption, accessibility of formal financing, and the effectiveness of local government policies. Sample guiding questions included "How do current bureaucratic procedures affect the speed of your business adaptation to market changes?" and "To what extent has financial literacy support provided by relevant agencies generated direct benefits for your business?" This structured yet flexible approach ensured the relevance, depth, and richness of the qualitative data collected (Miles et al. 2014).

The qualitative data were analyzed using NVivo 15 software through three systematic stages. First, open coding was conducted to identify initial concepts and recurring patterns from the FGD transcripts. Second, axial coding was used to group related codes into broader thematic categories, including eco-innovation and SSCM synergy, enabling and inhibiting factors, and impacts on MSME performance and environmental outcomes. Finally, selective coding was applied to construct an integrative conceptual narrative explaining the interrelationships among the identified themes.

To strengthen analytical rigor, the study employed visual analytical tools, including heatmaps to illustrate the intensity of emerging issues and concept maps to depict relationships among themes. The credibility and validity of the findings were enhanced through source triangulation (MSMEs, associations, government officials, and experts) and method triangulation (FGDs, secondary document analysis, and visual mapping) (Miles et al. 2014).

In this exploratory qualitative study, formal statistical hypotheses are not employed as the issues are complex, contextual, and relatively new, making them difficult to explain quantitatively. Instead, the research is guided by the proposition that the effectiveness of circular economy implementation in MSMEs is fundamentally driven by the dynamic synergy between eco-innovation and SSCM. This premise serves as the qualitative foundation for exploring how actor interactions and various environmental factors influence organizational outcomes.

Research framework (Figure 1) illustrates that the effectiveness of implementing a circular economy in MSMEs is influenced by the synergy between eco-innovation and SSCM. This synergy is dynamic, formed through interactions between actors and influenced by both inhibiting and enabling factors, ultimately creating economic, social, and environmental impacts for MSMEs.

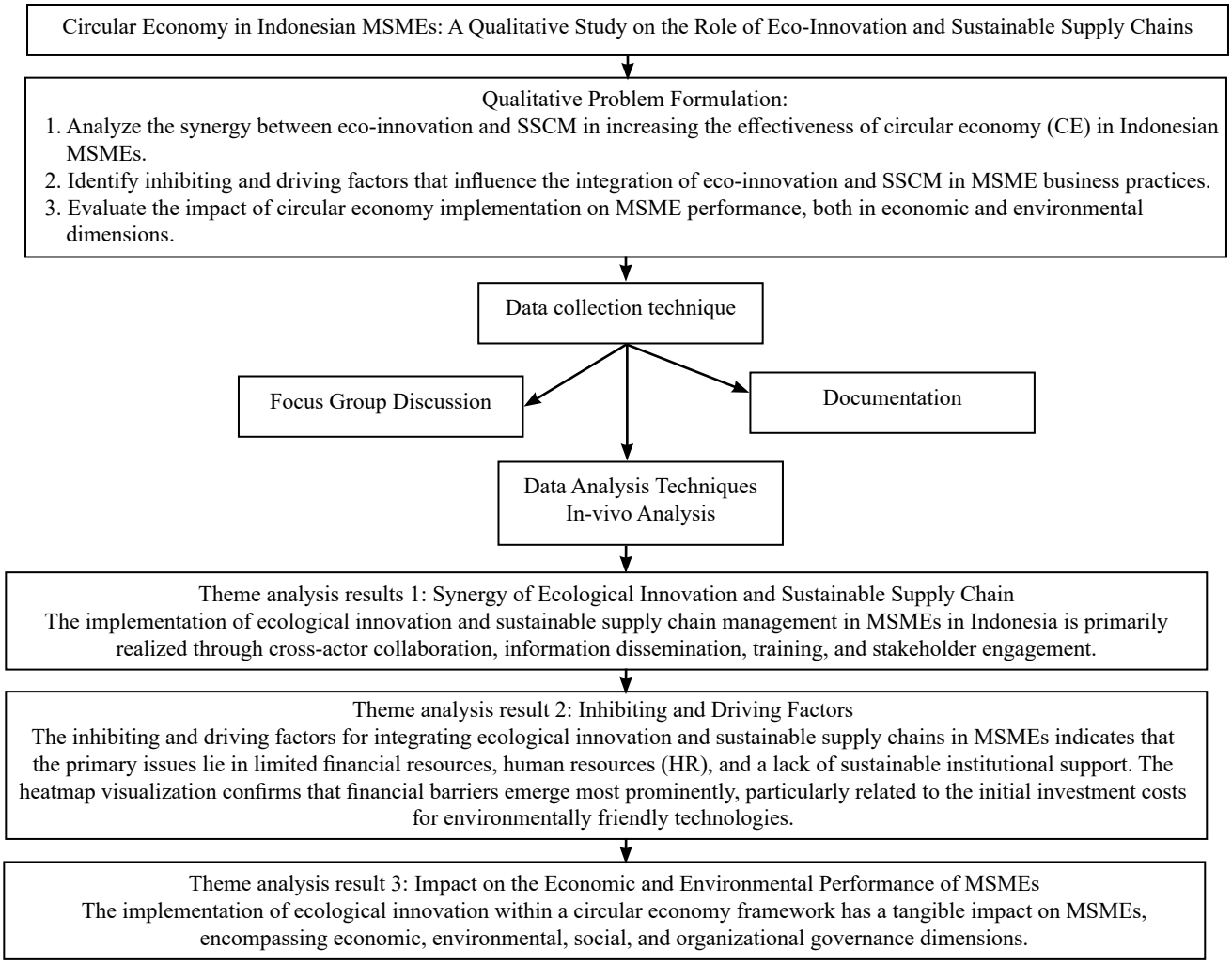

Figure 1. Conceptual framework of circular economy implementation in indonesian MSMEs through the synergy of eco-innovation and sustainable supply chain management

RESULTS

Building upon the thematic analysis of FGD transcripts, a primary finding emerges regarding the structural interaction between the two main pillars of the study. The Focus Group Discussion (FGD) results indicate that the implementation of a circular economy within Indonesian MSMEs is not a fragmented process; rather, it relies on a robust synergistic relationship between eco-innovation and Sustainable Supply Chain Management (SSCM). Eco-innovation, particularly in product design and production processes, serves as a fundamental catalyst that enhances the efficacy of SSCM. When MSMEs adopt eco-innovation by utilizing biodegradable materials or energy-efficient machinery, it directly streamlines the sustainable supply chain by reducing the complexity of waste management and facilitating more effective reverse logistics.

This synergistic mechanism is empirically evidenced by the NVivo analysis results. Figure 2 shows the Heatmap of the Synergy Topic of Ecological Innovation and Sustainable Supply Chains, illustrating the distribution of key themes that drive this integration:

The NVivo analysis in Figure 2 reveals that the implementation of ecological innovation and SSCM in Indonesian MSMEs is primarily realized through four operational dimensions: cross-actor collaboration, information dissemination, training, and stakeholder engagement. Strategic partnerships emerge as a prominent aspect, encompassing collaborations with recycling partners, the hospitality industry, financial institutions, and universities. This evidence aligns with literature emphasizing that external partnerships are vital in strengthening circular economy practices. For instance, a waste bank manager in Bogor highlighted the role of cross-sectoral synergy: *"...we collaborate with hotels, restaurants, and even with Pegadaian through gold savings... which makes people more enthusiastic"*.

In contrast to the urban-industrial collaboration in Bogor, MSMEs in Bengkulu demonstrate that universities and local associations play a more dominant role in bridging the innovation gap. An entrepreneur revealed that: *"...campuses often help through community service programs (KKN)... to process plastic waste into valuable products"*. Such findings are consistent with the academic contribution to MSME capacity building through knowledge-based innovation.

Furthermore, the synergy extends into the socio-cultural realm through tailored information dissemination. While the Bogor Environmental Agency (DLH) utilizes digital channels, Bengkulu relies on community-based communication such as the "PKK" women's group, confirming that communication effectiveness is highly dependent on socio-cultural suitability. This is complemented by technical training supported by global organizations like WWF in Bogor to enhance business professionalism and creative awareness programs in Bengkulu, such as school competitions. At the micro level, individual and family awareness remain the foundational pillars of this sustainable ecosystem.

The adoption of circular economy practices among Indonesian MSMEs is influenced by a complex interplay of internal and external factors. However, these determinants do not affect MSMEs uniformly; instead, they exert specific influences on different dimensions of eco-innovation and Sustainable Supply Chain Management (SSCM). This differentiated impact is illustrated in Figure 3, which presents a heatmap of key drivers and barriers identified through NVivo-based thematic coding of FGD transcripts. Market-driven factors, such as increasing consumer demand for "green" products in urban areas like Bogor, act as a primary driver of product eco-innovation, forcing MSMEs to redesign their offerings to remain competitive. Conversely, regulatory drivers and institutional pressures are more influential in shaping SSCM practices, as firms implement sustainable procurement and waste management practices to comply with emerging environmental standards. As stated by an informant from the Bogor Environmental Agency, "…we provide the regulatory framework, and companies that comply with waste management standards receive easier permit processing." On the structural side, financial constraints particularly the lack of accessible green credit critically hamper process eco-innovation. This barrier limits firms' ability to invest in cleaner production technologies or energy-efficient machinery, as expressed by a textile MSME owner: "…the intention to use more eco-friendly machines is there, but the upfront cost is beyond our current capital reach" (Informant B). These findings demonstrate that while some barriers primarily stall internal innovation, others disrupt the external integration of sustainable supply chains (Moktadir et al. 2018).

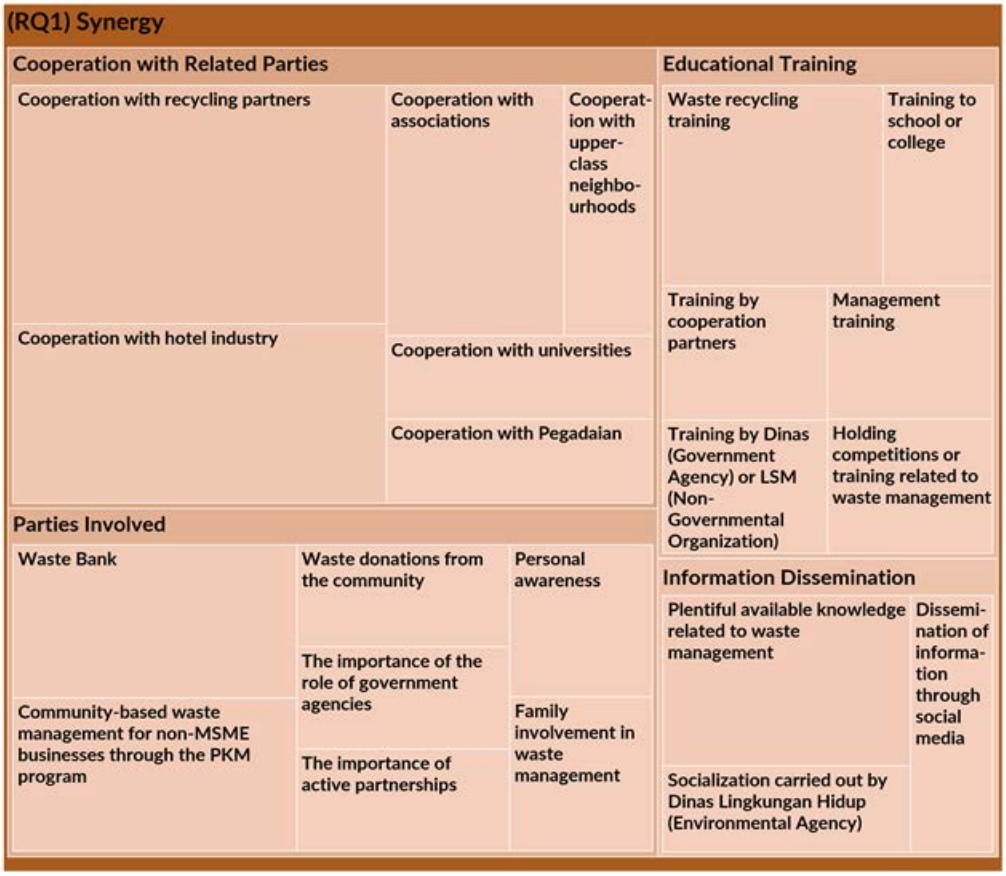

Figure 2. Heatmap of thematic synergy between eco-innovation and sustainable supply chain management in Indonesian MSMEs

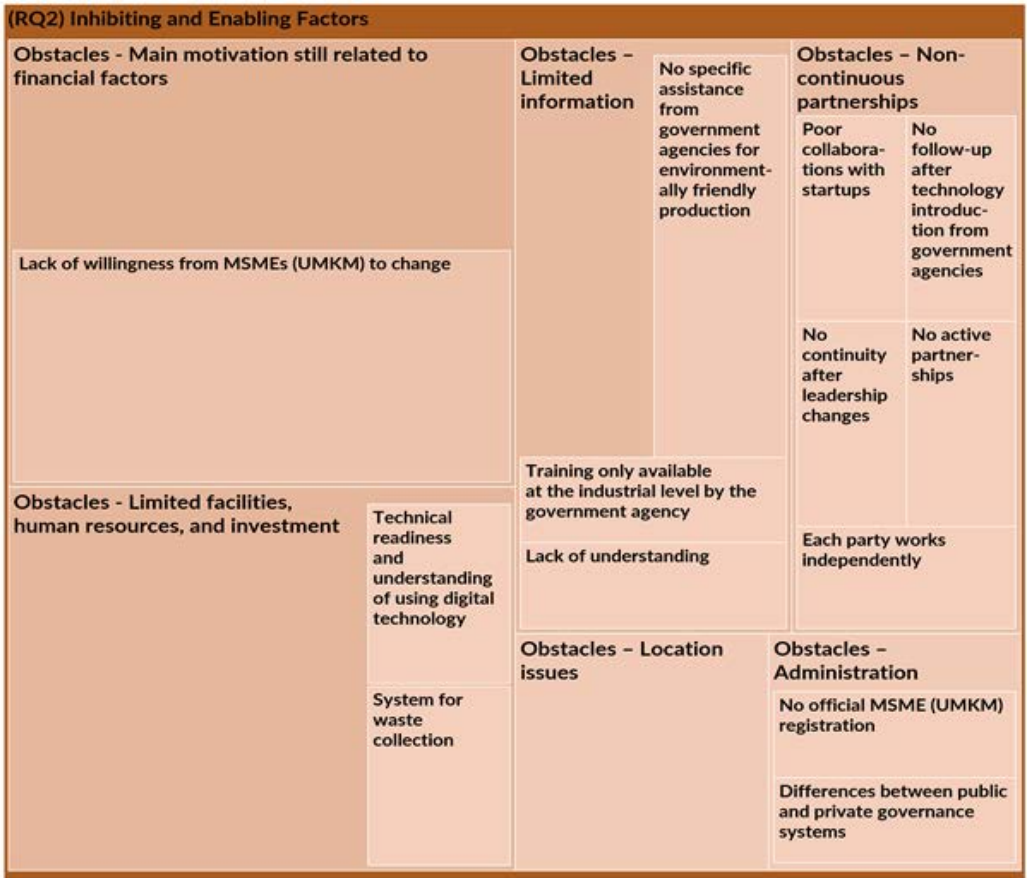

Figure 3. Heatmap of key drivers and barriers affecting circular economy adoption in Indonesian MSMEs

Furthermore, the study identifies significant regional variation in the circular economy landscape. In West Java, MSMEs face more intense competitive barriers, where pressure to maintain low prices often conflicts with the higher costs of eco-innovative materials. However, the regional drivers in West Java remain relatively strong, supported by better access to green technology providers and a more sophisticated recycling infrastructure. In contrast, MSMEs in Bengkulu are predominantly constrained by geographic and infrastructural barriers, including limited access to sustainable suppliers and high logistics costs for waste collection. Nevertheless, the drivers in Bengkulu tend to be more community-centric, with local wisdom and social capital playing a crucial role in collective resource sharing. As one MSME entrepreneur in Bengkulu explained, "…we don't have large recycling factories here, so we rely on local community groups to collect and process our waste together." This regional contrast highlights the necessity for localized policy interventions rather than a "one-size-fits-all" approach to circular economy implementation (Mura et al. 2020).

Impact on the Economic and Environmental Performance of MSMEs

The study establishes a clear causal link between specific drivers and the resulting effectiveness of circular economy implementation among Indonesian MSMEs. Based on the thematic synthesis of the qualitative data, it is evident that internal environmental orientation (the cause) triggers the adoption of eco-innovation processes (the effect), which subsequently leads to a significant reduction in material intensity. This causal pathway suggests that for a circular economy to be effective, practitioners must prioritize the reduction of "resource loops" through innovation, which in turn optimizes the entire supply chain's environmental and economic performance.

Furthermore, when external institutional pressure is combined with supply chain collaboration, it results in a more effective closed-loop system. The findings demonstrate that MSMEs driven by strategic long-term profitability tend to achieve higher circularity rates than those driven merely by reactive regulatory compliance. This relationship is reflected in the holistic impact of these practices across multiple dimensions:

1. Economic and Environmental Impact: MSMEs have successfully transformed waste into added economic value, producing recycled products such as ecobricks and charcoal stoves. This transformation not only increases competitiveness but also significantly reduces the volume of waste entering landfills.
2. Social and Governance Transformation: Beyond technical aspects, the transition to a circular economy involves fundamental changes in social behavior and organizational governance. For example, the integration of digital systems in Bogor has increased transparency in waste management, while community-centric approaches in Bengkulu have fostered collective ecological awareness.

The multidimensional effectiveness of circular economy implementation is further evidenced by the diverse range of impacts generated through the synergy of eco-innovation and SSCM. As visually detailed in Figure 4 (Impact Topic Heatmap), these effects encompass economic, environmental, social, and organizational governance dimensions.

At the economic level, as shown in the heatmap, MSMEs have successfully transformed waste into value-added products such as ecobricks and recycled paper. One MSME owner in Bogor confirmed this by stating that handicraft bags made from plastic waste can increase the income of local housewives.

The NVivo analysis in Figure 4 reveals that the most prominent impact is the transformation of waste into economic value. In Bogor, MSMEs have successfully commercialized recycled products such as ecobricks and charcoal stoves, which has not only increased competitiveness but also created new revenue streams. One waste bank manager noted: *"...waste is no longer a burden; it has become a resource that can be traded for gold savings, providing a direct financial incentive for the community"* (Waste Bank Manager, Bogor).

In Bengkulu, the impact is more pronounced in the social and collective awareness dimension. The implementation of circular practices has fostered a culture of sustainability at the household level. An entrepreneur in Bengkulu emphasized: *"...the real impact is seeing children and families now instinctively sorting their waste. It's a change in mindset that will last for generations"* (MSME Entrepreneur, Bengkulu). From an environmental perspective, the reduction of

material intensity and landfill waste is a significant outcome across both regions. Moreover, the integration of digital technology such as the use of social media for education in Bogor has enhanced organizational governance by increasing transparency and community engagement. These holistic impacts confirm that when eco-innovation and SSCM are integrated effectively, the benefits extend beyond mere profit, contributing to a broader systemic transition toward sustainability.

The systemic interconnectedness of these impacts, alongside the previously discussed synergies and constraints, is summarized in Figure 5, the Concept Map, which provides a final synthesis of the circular economy ecosystem in Indonesian MSMEs. At the economic level, as shown in the heatmap, MSMEs have successfully transformed waste into value-added products such as ecobricks and recycled paper. One MSME owner in Bogor confirmed this by stating that handicraft bags made from plastic waste can increase the income of local housewives.

The concept map presented in Figure 5 illustrates the systemic interconnectedness between the elements that shape the circular economy in MSMEs. At its core, the circular economy is influenced by two main pathways: synergy and constraints. Synergy is created through the interaction of various actors, where cross-stakeholder collaboration, information dissemination, training, and stakeholder engagement are crucial drivers of MSMEs' adaptive capacity. This pathway demonstrates that the success of a circular economy is not solely the result of internal efforts but rather the result of active collaboration that strengthens technical, managerial, and institutional capacity.

Meanwhile, the emerging obstacles are multifaceted, ranging from predominantly financial motivations, limited facilities and human resources, to administrative and locational constraints. These obstacles highlight critical points that must be addressed to ensure the transition to a circular economy is not hampered. These obstacles also emphasize the need for interventions targeting the internal capacity of MSMEs and ongoing external support.

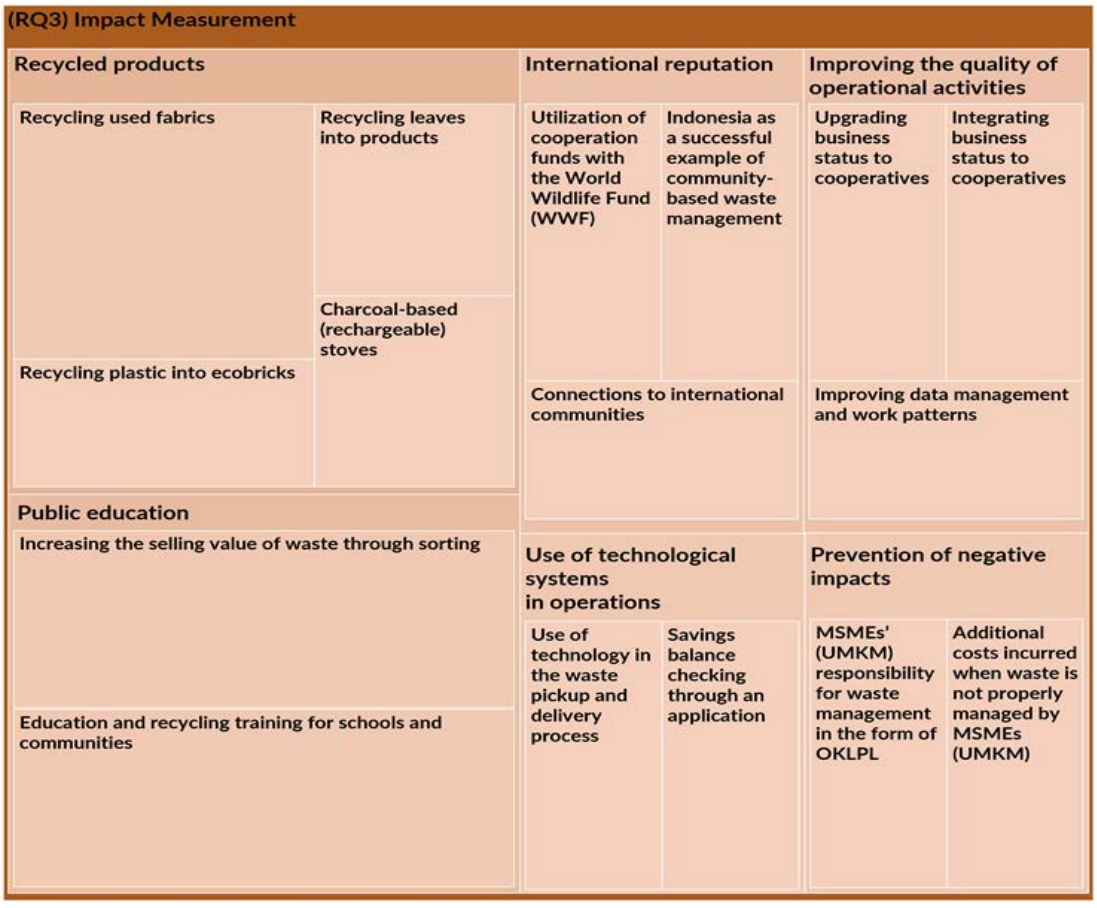

Figure 4. Heatmap of economic, environmental, social, and governance impacts of circular economy practices in Indonesian MSMEs

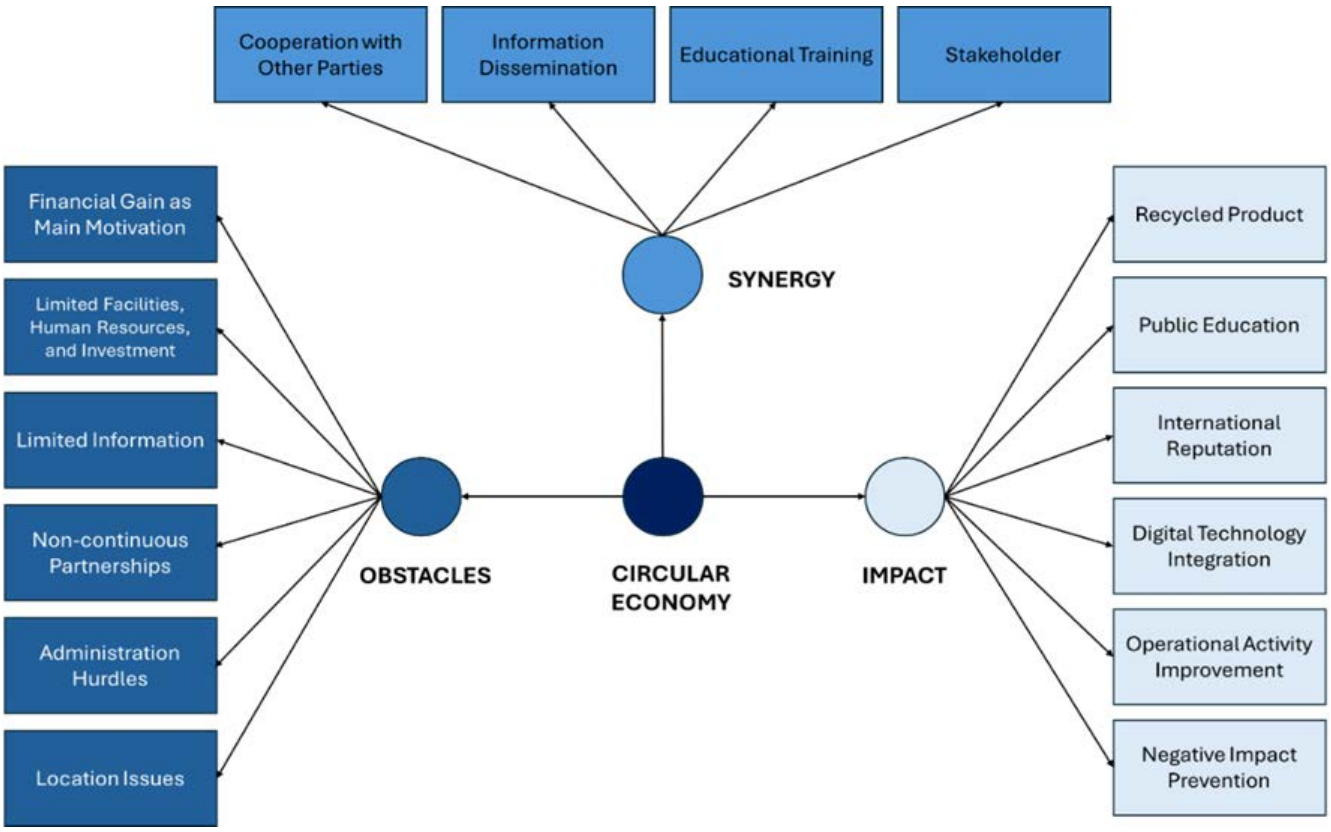

Figure 5. Concept map of circular economy ecosystem in Indonesian MSMEs: synergies, constraints, and multidimensional impacts

The impacts arising from the interaction between synergies and constraints span multiple dimensions, from increased economic value through recycled products, social empowerment through education and collective awareness, enhanced international reputation, and operational efficiency through digital technology integration. These impacts confirm that implementing a circular economy provides holistic benefits for MSMEs, both internally and externally.

Overall, the concept map emphasizes the character of the circular economy as a dynamic ecosystem: the success of MSMEs depends on the balance between mitigating constraints and leveraging synergies, thus creating a sustainable positive impact on various aspects.

The findings of this study provide a comprehensive understanding of how Indonesian MSMEs navigate the transition toward a circular economy by integrating eco-innovation and Sustainable Supply Chain Management (SSCM). This discussion evaluates the theoretical and practical implications of these synergies, the role of regional dynamics, and the causal pathways leading to implementation effectiveness.

The results confirm that the circular economy in MSMEs is not a series of isolated green activities but a synergistic system where eco-innovation acts as a technical catalyst for SSCM. This finding aligns with the Natural Resource-Based View (NRBV), which suggests that firm-level environmental capabilities can lead to competitive advantage. In this study, product eco-innovation (e.g., using biodegradable materials) directly simplifies waste management complexities within the supply chain, facilitating more efficient reverse logistics.

Furthermore, the synergy between these two pillars ensures that sustainability shifts from a mere administrative burden to a core operational strategy. Without integrating innovation into the production process, SSCM practices tend to remain superficial, focusing only on supplier selection rather than achieving the resource efficiency required for a true circular loop. This reinforces the view that technological advancement and supply chain collaboration are mutually reinforcing feedback loops.

A significant contribution of this study is the identification of distinct regional landscapes in circular economy adoption. While MSMEs in West Java are

driven by industrial competition and access to advanced green technology, MSMEs in Bengkulu rely heavily on community-centric drivers and social capital.

The dominance of universities and local associations in Bengkulu in bridging the innovation gap suggests that in regions with limited industrial infrastructure, "knowledge-based innovation" facilitated by academic institutions becomes the primary driver for MSME capacity building. This finding expands upon the work of Mura et al. (2020) by emphasizing that socio-cultural suitability is just as critical as technological availability in the Indonesian context. Consequently, the "PKK" women's groups or community-based waste banks are not merely social entities but are vital operational nodes in the regional circular ecosystem.

The causal mapping in this research reveals that internal environmental orientation is the fundamental trigger for adoption. When this orientation is present, MSMEs are more likely to invest in process eco-innovation, which leads to a significant reduction in material intensity. This study finds that MSMEs driven by long-term strategic profitability achieve higher circularity than those reacting solely to regulatory pressure.

The integration of digital technology, particularly in urban areas like Bogor, has proven to enhance organizational governance by increasing transparency in waste tracking and stakeholder engagement. This confirms that the transition to a circular economy is as much a social and governance transformation as it is a technical one. By transforming waste into economic value such as the "gold savings" initiative MSMEs effectively mitigate the financial barriers that typically stall green investments.

Managerial Implications

Interventions in industrial hubs (West Java) should focus on lowering the cost of eco-innovative materials and providing green credit. In contrast, in regions like Bengkulu, support should be directed toward strengthening community-based logistics and academic-MSME partnerships. Success depends on the balance between leveraging external synergies (partnerships) and mitigating internal constraints (financial/human resources). Managers should prioritize "resource loops" to optimize both environmental performance and economic resilience

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This study concludes that the transition toward a circular economy among Indonesian MSMEs is heavily contingent upon the synergistic integration of Eco-Innovation and Sustainable Supply Chain Management (SSCM). Eco-innovation serves as a technical catalyst that enables more efficient and sustainable supply chain operations. A key contribution of this research is the identification of distinct regional dynamics: MSMEs in industrial hubs (West Java) are primarily driven by market competition and technological access, whereas those in developing regions (Bengkulu) rely significantly on social capital and community-based collaboration.

Overall, the effectiveness of circular economy implementation is determined by a strong internal environmental orientation, which triggers a causal shift from material efficiency toward the creation of multidimensional economic and social value. These findings demonstrate that the circular economy is not merely about waste management but represents a fundamental transformation of business governance capable of enhancing MSME competitiveness amidst resource constraints.

There is a need for localized policy interventions. In industrial clusters, the government should focus on providing fiscal incentives and green credit. In contrast, in regions like Bengkulu, support should be directed toward strengthening community-based logistics infrastructure and academic-MSME partnerships. Environmental product standards and certifications should be streamlined to help MSMEs access broader international markets.

Recommendations

MSMEs should prioritize the adoption of digital technologies to enhance supply chain transparency and the marketing effectiveness of circular products. Strengthening external collaborations (with waste banks, universities, and industrial associations) is essential to overcome internal capital and human resource limitations. This study is limited to a qualitative approach in two specific regions. Future researchers are encouraged to conduct large-scale quantitative studies to test the generalizability of the relationship between

eco-innovation and circular economy performance across Indonesia. Future studies should also explore the specific role of Green Fintech in mitigating the financial barriers identified in this research.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to the Directorate of Research and Community Service, Directorate General of Research and Development, Ministry of Higher Education, Science, and Technology of the Republic of Indonesia for providing funding support for this research. The authors also acknowledge the Unitary Business and Informatics Institute for the facilities and institutional support that enabled the successful completion of this study.

FUNDING STATEMENT: This research was funded by the Directorate of Research and Community Service, Directorate General of Research and Development, Ministry of Higher Education, Science, and Technology of the Republic of Indonesia.

CONFLICTS OF INTEREST: The authors declare no conflict of interest.

DECLARATION OF GENERATIVE AI STATEMENT: During the preparation of this work, the authors used ChatGPT to assist in checking grammar, improving language clarity, and polishing the academic writing. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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