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Research Article

A Multiple Case Study on the Environmental Sustainability Among Micro Enterprises in Cotabato City

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Abstract

Micro enterprises play a critical yet underexplored role in advancing environmental sustainability in developing and post-conflict contexts. This qualitative multiple case study investigates the environmental sustainability practices of micro enterprises in Cotabato City, Philippines, and examines how resource-constrained business owners reconcile ecological responsibility with economic survival. Guided by the Natural Resource-Based View (NRBV), the study draws on in-depth interviews with five micro-enterprise owners across diverse sectors and employs thematic and cross-case analysis. Findings reveal that micro enterprises actively implement low-cost sustainability practices, including waste segregation, eco-friendly packaging, energy conservation, and selective sustainable sourcing. However, these practices remain largely voluntary and uneven due to weak institutional support, inconsistent municipal services, limited supplier engagement, and cost constraints. While some enterprises leverage sustainability as a strategic branding and differentiation tool, others view it primarily as an operational or cost-saving measure, reflecting varied market responses and sectoral conditions. The study extends NRBV by demonstrating both its applicability and limits in informal, resource-scarce environments, emphasizing that environmental capabilities alone are insufficient without supportive institutional and market ecosystems. Policy implications underscore the need for culturally responsive government support, improved waste management infrastructure, and collaborative local partnerships to strengthen micro enterprises' contributions to environmental sustainability.

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1. Introduction

The environmental sustainability practices benefit from collaboration across disciplines, integrating insights from ecology, economics, and social sciences stated by Ellili (2023.). In today's society, environmental issues have become critical as it is recognized that the outcomes achieved in environmental management areas, such as waste management, will significantly impact the local community. The study of Durrani et. al. (2024) uncovers that lack of finance and education are significant barriers in recognizing and addressing environmental sustainability issues, along with the lack of government support and regulations to ensure compliance with safety laws, leading to low concern for sustainability practices among small and medium enterprises. Additionally, Wolniak et. Al., (2023), mentioned that implementing environmental sustainability offers numerous benefits for organizations. However, there are also potential disadvantages, such as initial costs, complex implementation, and resistance to change.

Moreover, Madrid-Guijarro & Durendez (2024) espoused that sustainable business models of SMEs reduce pollution, emission, energy consumption, as well as promote the development of sustainable products and facilities. Stoica (2024) also mentioned significant challenges in sustainable entrepreneurship, including regulatory inconsistencies, high initial costs, and consumer reluctance. It emphasizes the need for collaboration among policymakers, businesses, and investors to create an enabling environment for addressing these environmental sustainability issues. Moreover, Xu (2024) cited that SMEs in Guangdong, China faced challenges like resource allocation, awareness, supply chain management, and regulatory frameworks. It was further emphasized that there is a need for partnerships with environmentally responsible suppliers to enhance sustainability practices and overcome these issues effectively.

In the Philippines, a study conducted by Roxas & Chadee (2016) found that 241 manufacturing SMEs argue that resource-constrained SMEs rely on their relational capital to augment their capability to innovate in order to find better and environmentally sound ways of doing business. Another study conducted by Solina & Ocampo (2024), mentioned the urgency of addressing environmental degradation in the country issues like deforestation, pollution, and climate change impacts. Salvacion & Campos (2024) also highlighted problematic issues in the Philippines regarding environmental sustainability in business, including a lack of regulatory framework, insufficient standardization for effective implementation, and low awareness of circular economy practices.

Although there are several studies that have been conducted in line with environmental sustainability among micro business enterprises, the researcher has not come across a qualitative study in line with this topic. The researcher has felt the need to conduct this study that may assess the environmental sustainability of the micro business enterprise in Cotabato City. This study will address the pressing issue of environmental sustainability within Cotabato City. As micro enterprise, their environmental practices have a cumulative impact on the city's well-being. By exploring and analyzing how these businesses integrate or fail to integrate sustainable practices, this research contributes to a broader understanding of the challenges and opportunities in promoting green entrepreneurship in their businesses. The theory that will be used in this study is natural resource-based view (NRBV) which focuses on how environmentally sustainable practices can create competitive advantages for organizations.

The result of this study will be disseminated through multiple channels, such as local business association, local government agencies and academic institutions and simplified versions with practical recommendations would

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be distributed directly to micro-entrepreneurs through community workshops and illustrated guides in local languages. Collaborating with LGUs can help translate research recommendations into actionable local policies, like integration of eco-friendly criteria into business permits and incentives.

And designing programs such as, training modules, or community-based sustainability campaigns that directly benefit micro enterprise. Also, Social media campaigns featuring best practices would broaden the awareness. Creating opportunities for knowledge exchange and collaborative initiatives that could strengthen environmental sustainability practices within Cotabato City.

The purpose of this qualitative multiple case study was to discover the environmental sustainability practices among micro business enterprises in Cotabato City, At this stage in the research, the environmental sustainability will

be generally defined as a strategic efforts to minimize ecological impact through resource-efficient practices, waste reduction, and green operational techniques while maintaining economic feasibility. These practices aim to help small businesses contribute to environmental conservation by adopting cost-effective strategies such as energy conservation, sustainable procurement, and implementing technologies that reduce carbon footprint and operational costs.

Research Questions

1. What are the environmental sustainable practices of Micro Enterprises in Cotabato City?
2. What are the challenges and opportunities resulting to these practices?
3. What explains the similarities and differences of each case?

2. Materials and Methods

2.1. Research Design

This study adopted a qualitative multiple case study design to explore environmental sustainability practices among micro enterprises in Cotabato City. A multiple case approach was selected to enable in-depth investigation of sustainability practices across diverse business contexts and to facilitate systematic comparison of similarities and differences among cases (Creswell, 2018; Ruslan, 2023).

Qualitative inquiry is appropriate for examining complex social phenomena by capturing participants' meanings, experiences, and decision-making processes rather than relying on quantifiable measures (Bearman, 2019; Maxwell & Chmiel, 2015). By examining five bounded cases, the design allowed for contextualized understanding while enhancing analytic robustness through cross-case comparison, which strengthens explanatory power and

transferability compared with single-case designs (Reddy, 2015).

2.2. Participants in the Case Units

The study involved five owners of micro enterprises operating in Cotabato City, selected using maximum variation sampling to capture diversity in business type, operational history, and sustainability practices (Patton, 2014). The cases represented distinct sectors—coffee shop, restaurant, gadget store, boutique, and printing shop—with years of operation ranging from approximately 3 to 14 years.

Participants were recruited through referrals and met inclusion criteria as registered micro enterprises with direct control over business operations and sustainability-related decisions. All participants were engaged in the study in their professional capacity as business owners and were not considered vulnerable, as

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participation posed minimal psychological, social, or economic risk.

2.3. Data Collection

Data were collected through semi-structured, in-depth interviews conducted over a three-month period following approval from the University of the Immaculate Conception Research Ethics Committee. Each participant completed one interview lasting approximately 30–45 minutes, focusing on sustainability practices, challenges, motivations, and perceived outcomes.

Interviews were audio-recorded with consent and conducted in settings chosen by participants to ensure comfort and openness. Informed consent was obtained prior to data collection, and participants were reminded of their right to decline questions or withdraw at any time. To enhance data accuracy, interview summaries were returned to participants for validation prior to analysis, consistent with qualitative best practices.

2.4. Data Analysis

Interview recordings were transcribed verbatim and analyzed using thematic analysis combined with cross-case analysis. Initial coding involved identifying recurring patterns, concepts, and meanings within each case, followed by clustering codes into broader themes related to environmental sustainability practices and contextual constraints (Braun & Clarke, 2021). Cross-case analysis was then conducted to compare how themes converged or diverged across business types, allowing identification of shared practices as well as case-specific strategies (Creswell, 2018). This two-stage

analytical process enabled both within-case depth and comparative synthesis, producing a nuanced understanding of sustainability practices among micro enterprises.

2.5. Trustworthiness of the Study

Trustworthiness was established through credibility, dependability, confirmability, and transferability. Credibility was enhanced through prolonged engagement, triangulation of interview data, and member checking to verify the accuracy of interpretations (Patton, 2015).

Dependability and confirmability were supported by maintaining an audit trail and engaging in reflexive journaling to document analytic decisions and minimize researcher bias (Korstjens & Moser, 2018). Transferability was addressed by providing thick descriptions of the research context, cases, and procedures, allowing readers to assess the applicability of findings to similar settings (Vella, 2024; Nathan et al., 2025).

2.6. Role of the Researcher

In qualitative inquiry, the researcher serves as the primary instrument of data collection and interpretation. The researcher conducted all interviews, engaged in reflexive practice throughout the study, and remained attentive to positionality and potential bias during data analysis (Bearman, 2019). Reflexive journaling and peer consultation were employed to ensure analytical transparency and to preserve participants' voices. Ethical engagement was emphasized through culturally respectful interaction, informed consent, confidentiality, and anonymization, fostering trust and openness during the research process.

3. Results and Discussion

3.1. Cross-Case Analysis

This chapter emphasizes the practices of the micro business owners on environmental sustainability, whereas, the preceding Chapter 3-7 provided an in-depth analysis of the five

participants who met the criteria for participation in the study. Moreover, Table 1 provides a concise summary of the participants' pertinent profiles.

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Table 1. Profile of the Participants in the In-depth Interview

Profile	Paper Cup (Case A)	Banana Leaf (Case B)	Paper Bag (Case C)	Eco Bag (Case D)	Sticker Paper (Case E)
Municipality	Maguindanao Norte	Maguindanao Norte	Maguindanao Norte	Maguindanao Norte	Maguindanao Norte
No. of Informants	2	2	2	2	2
Age	32	38	37	34	28
Sex	Female	Female	Male	Male	Male
Marital Status	Married	Single	Single	Single	Married
Educational Level	College Graduate	College Graduate	College Graduate	College Graduate	College Graduate
Type of Business	Coffee Shop	Restaurant	Gadget Shop	Boutique	Printing Shop

As seen in Table 1, the in-depth interview included 5 participants Norte who operated various businesses, including a printing shop, restaurant, coffee shop, gadget shop, and boutique. The participants' ages ranged from 28 to 38 years old.

This allowed for various viewpoints to be expressed in the five case studies that featured various eco-friendly pseudonyms, including paper cups, banana leaves, paper bags, eco bags, and sticker paper. This diversity in demographics and business types provides a thorough basis for comprehending how various entrepreneurs view environmental sustainability in their businesses.

3.2. Similarities and Differences between Cases

Table 2 summarizes the similarities and differences in the environmental sustainability practices of the five microenterprises, grouped into (a) sustainable practices and (b) challenges and opportunities arising from these practices.

Environmental Sustainability Practices of Microenterprises

Across all five cases (A–E), waste management and recycling emerged as a shared baseline practice through waste segregation, reuse, and reduction. This convergence suggests that waste minimization is a low-barrier entry point for sustainability among microenterprises in Cotabato City, requiring minimal investment while yielding visible environmental benefits.

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Notably, these practices were largely voluntary, reflecting environmental awareness rather than regulatory enforcement.

All cases also adopted eco-friendly packaging, such as paper bags, paper cups, and reusable eco-bags, replacing conventional plastics. This uniform shift indicates that sustainable packaging has become accessible and affordable in the local context, allowing microenterprises with limited resources to align their operations with environmentally conscious expectations. The consistency across diverse businesses suggests that sustainability has transcended industry-specific norms and become a shared entrepreneurial value.

In terms of energy use and conservation, all enterprises relied on Cotabato Light as their sole electricity provider and implemented energy-saving measures. This uniformity reflects both structural constraints in energy supply and a pragmatic effort to reduce operational costs. The widespread adoption of energy conservation

practices highlights how sustainability initiatives that offer immediate financial benefits face minimal resistance among microenterprises.

Regarding sustainable sourcing of materials, all cases applied multi-criteria decision-making that balanced quality, functionality, customer needs, environmental considerations, and cost. This approach demonstrates a mature understanding of sustainability as a balancing act rather than a rigid “green versus non-green” choice. The consistency across cases underscores the importance of flexible sustainability models that align with the operational realities of microenterprises.

Finally, customer and community engagement was evident in all cases, indicating a shared recognition that sustainability extends beyond internal operations. Micro-entrepreneurs viewed environmental responsibility as a collective effort that strengthens customer relationships, community ties, and social capital, reinforcing both environmental and business outcomes.

Table 2. *Similarities and Differences of Environmental Sustainability Practices of Micro Enterprises and Challenges and Opportunities Resulting to these Practices*

Case Unit		Remarks
Similar	Different	
Practices		
Waste Management and Recycling	A, B, C, D, E	All practice waste reduction in some form (segregation, reuse, recycling)
Packaging Practices	A, B, C, D, E	All use eco-friendly packaging such as paper cups, paper bags, and eco-bags
Energy Use and Conservation	A, B, C, D, E	All rely solely on Cotabato Light and practice energy conservation

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Sustainable Sourcing of Materials	A, B, C, D, E		· All consider material selection based on specific criteria, quality, functionality, customer need, environmental impact or cost)
Customer and Community Engagement	A, B, C, D, E		· All engage customers/communities in sustainability initiatives
Challenges and Opportunities			
Operational Realities of Environmental Practice:	A, B, D,		· The 3 owners experience higher costs or logistical adjustments in implementing eco-friendly practices
		C	· Do not face much difficulty
		E	· Do not experience significant challenges in managing the wastes.
Institutional and Policy Environment	A, B, E		· The 3 owners observed to no government or supplier support.
		C, D	· recalled LGU once distributed segregation posters but no follow-through
Perceived Outcomes of Sustainability Efforts	A, B		· A and B observed that customers value product quality over eco-friendly packaging
		C	· Saw paper bags as added value.
		D	· Branded bags became a draw.
		E	· High-quality materials reduced rework and built trust.
Customer and Supplier Engagement	A, C		· A and C dealt with mixed or inconsistent customer responses to packaging changes
		B	· Positive reception to banana leaf packaging;
		D	· Suppliers neutral, leaving businesses to decide

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		E	customers accepted waiting during energy-saving adjustments
Sustainability as Business Positioning	B, D, E		The 3 owners used sustainability to enhance branding and reputation.
		A	Framed sustainability primarily as cost savings
		C	Believed product quality mattered more than packaging

3.3. Challenges and Opportunities Resulting from These Practices

Despite shared commitments, operational realities varied. Cases A, B, and D reported higher costs and logistical challenges in implementing eco-friendly practices, particularly due to expensive materials and limited supplier options. In contrast, Cases C and E experienced minimal difficulty, suggesting that implementation burdens are uneven and shaped by organizational capacity, resource availability, and the specific sustainability practices adopted. The institutional and policy environment emerged as a major constraint. Cases A, B, and E noted the absence of government or supplier support, forcing businesses to navigate sustainability independently. While Cases C and D recalled receiving segregation posters from the LGU, this support lacked continuity and material backing. Collectively, the cases reveal a policy vacuum in which sustainability-oriented microenterprises operate with minimal institutional guidance or incentives.

Perceived outcomes of sustainability efforts differed across cases. Cases A and B observed that customers prioritized product quality over eco-friendly packaging, questioning the market value of some sustainability investments. Conversely, Case C viewed paper bags as added

value, Case D leveraged branded packaging as a market draw, and Case E emphasized quality improvements that reduced rework and strengthened customer trust. These findings highlight that customer responses to sustainability initiatives are highly context-specific and influenced by business type, customer expectations, and branding strategies.

In terms of customer and supplier engagement, reactions ranged from mixed acceptance (Cases A and C) to positive responses rooted in cultural relevance, as seen in Case B's banana leaf packaging. Case D reported neutral supplier involvement, placing full responsibility on the business, while Case E noted customer patience during energy-saving adjustments when explanations were clearly communicated. These variations underscore the importance of communication and cultural alignment in fostering stakeholder support.

Lastly, sustainability as business positioning distinguished the cases. Cases B, D, and E strategically integrated sustainability into their branding and reputation, transforming environmental responsibility into a competitive advantage. In contrast, Case A framed sustainability mainly as a cost-saving measure, while Case C prioritized product quality over

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environmental messaging. These differing orientations demonstrate that while sustainability is widely acknowledged, its

3.4. Environmental Sustainability Practices of Microenterprises

Waste management and recycling practices among microenterprises in Cotabato City reflect both innovation and structural constraints. Across all five cases, enterprises engaged in waste segregation and creative reuse, including repurposing used oil, recycling plastics, and utilizing banana leaves as biodegradable alternatives. These practices indicate genuine environmental concern; however, reliance on inconsistent municipal waste collection systems frequently undermined proper segregation efforts. This finding underscores that sustained waste management practices among microenterprises remain contingent on stronger municipal infrastructure and support.

These challenges align with Derhab and Elkhwesky (2023), who found that MSMEs face significant barriers in waste management due to limited financial resources, technical knowledge, and government training support. Infrastructure limitations further exacerbate these challenges, particularly in areas with inadequate road networks and service access (Ezeudu & Bristow, 2025). Similarly, Xiao et al. (2023) identified dependence on external waste collection systems as a major vulnerability, with intermittent services disrupting firms' waste sorting practices.

Packaging practices across the cases further illustrate the tension between sustainability goals and economic realities. While all enterprises recognized packaging as central to their environmental commitment, many continued to rely on plastic due to its affordability, durability, and consumer familiarity. This balancing act between environmental ideals and financial survival is consistent with Chakraborty et al. (2025), who argue that high upfront investment costs discourage SMEs from adopting sustainable packaging despite potential

strategic role varies based on business goals and market perceptions.

long-term benefits. Comparable findings in the Philippine context were reported by Cayan et al. (2025), while Gustavo et al. (2018) noted that supply chain constraints and cost premiums often limit small firms' ability to transition to sustainable materials.

Energy use and conservation practices among the microenterprises demonstrated pragmatic environmental engagement shaped by financial and infrastructural constraints. All cases implemented energy-saving behaviors, such as regulating appliance use and adjusting operations based on customer flow, despite limited access to renewable energy technologies. These findings support Fresner et al. (2025), who observed that small businesses in developing contexts exhibit adaptive environmental behaviors even when capital-intensive solutions are inaccessible. Vasconcelos et al. (2024) similarly emphasized the importance of cost-efficient energy management strategies, while Behera et al. (2025) highlighted that micro-entrepreneurs often adopt gradual conservation practices rather than technological investments.

Sustainable material sourcing decisions further revealed how environmental preferences are tempered by functionality, supplier control, and operational constraints. While some businesses prioritized paper-based or durable materials to minimize waste and rework, plastic remained indispensable for certain applications due to functional requirements and supplier-determined packaging. These compromises reflect Liu et al.'s (2023) finding that reducing non-essential plastic use can yield environmental benefits, even when complete elimination is impractical. However, as Kannan and Gambetta (2025) and Kot (2018) note, green procurement places significant burdens on SMEs, particularly those with limited bargaining power and access to sustainable supply chains.

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Microenterprises also actively engaged customers and communities in sustainability efforts, viewing environmental responsibility as both a business and social endeavor. These practices align with Tilbury's (2017) assertion that sustainability-oriented business operations contribute to environmental learning and customer loyalty. Engagement strategies varied, ranging from encouraging customers to bring reusable containers to organizing clean-up activities and environmental awareness campaigns. Incentive-based approaches, as observed in some cases, support Verma and Chandra's (2018) findings on consumer behavior change. Resource constraints, however, limited the depth of business-LGU collaboration, reflecting Prieto-Sandoval et al.'s (2018) argument that scarcity can foster creativity but also restrict systemic impact.

3.4. Challenges and Opportunities Resulting from These Practices

Operational challenges consistently emerged as a key barrier to sustaining environmental practices. Cost pressures, logistical constraints, and inconsistent waste collection made long-term implementation difficult, echoing Kannan and Gambetta's (2025) observation that SMEs often lack the financial and human resources needed for sustained sustainability efforts. The price gap between conventional and eco-friendly materials further constrained adoption, supporting Hillary's (2017) assertion that cost differentials significantly affect small firms' operating margins.

Institutional and policy support for sustainability in Cotabato City was generally weak. While information campaigns existed, implementation lacked continuity and enforcement. This finding mirrors Darnall et al.'s (2010) conclusion that firm-level environmental performance depends heavily on supportive institutional frameworks. The absence of enforcement mechanisms resulted in sustainability practices relying largely on individual entrepreneurial initiative, consistent with Madrid-Guijarro and Durendez (2024) and Durrani et al. (2024), who noted that

weak regulatory environments limit sustainability compliance among small enterprises.

Perceived business outcomes of sustainability efforts varied considerably. Some owners reported minimal impact on sales or loyalty, as customers prioritized product quality over environmental attributes, aligning with Magnier and Schoormans (2015). Others observed that durable, eco-friendly packaging enhanced customer trust and reduced waste, consistent with Steenis et al. (2017) and Jansson et al. (2017), who found that consumer responses to sustainability are highly heterogeneous and context-dependent.

Customer and supplier engagement further revealed unpredictability in sustainability demand. This inconsistency supports Johnstone and Tan's (2015) argument that fluctuating environmental concern complicates firms' sustainability investments. Visible incentives, such as reusable container discounts, were more positively received, reinforcing White et al.'s (2019) finding that concrete sustainability cues influence consumer behavior. Supplier neutrality, however, left many microenterprises bearing sustainability costs alone, consistent with Chen et al. (2017).

3.5. Sustainability, Business Positioning, and Theory Confirmation

Sustainability served varied strategic roles across the cases. Some enterprises successfully leveraged eco-friendly practices for branding and differentiation, while others viewed sustainability as secondary to product quality or cost efficiency. These mixed outcomes align with Magnier et al. (2016) and Barbosa et al. (2020), who emphasized that sustainability enhances competitiveness only when aligned with functional quality and market expectations. Arslan and Can (2025) further highlight the tension between long-term competitive advantage and short-term cost pressures in highly competitive markets.

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Overall, the findings strongly support Hart's Natural Resource-Based View (NRBV) by demonstrating that environmental constraints can foster strategic capabilities even among resource-limited microenterprises. Waste management, eco-friendly packaging, and energy conservation practices contributed to trust, reputation, and customer satisfaction, validating NRBV's value-creation premise. However, the study also reveals the theory's limits: without institutional support, enforcement, and consistent stakeholder engagement, the competitive potential of sustainability remains uneven and highly contingent on market and contextual factors.

3.6. Implication for Practices

Based on the environmental practices implemented by micro enterprises in Cotabato City, several important implications emerge for local business communities. These grassroots sustainability efforts demonstrate that even

resource-constrained micro enterprises can meaningfully contribute to environmental protection through practical, cost-effective measures such as waste segregation, innovative reuse of materials, and energy conservation practices. However, the findings also reveal significant barriers that prevent deeper sustainability integration, including inconsistent municipal waste collection systems, cost limitations that force continued reliance on plastic packaging, and insufficient access to renewable energy infrastructure due to rental and financial constraints. Moving forward, these businesses may benefit from enhanced support systems including more reliable waste management services, affordable eco-friendly packaging alternatives, accessible renewable energy options, and strengthened community partnerships that could amplify their individual efforts into collective environmental impact across Cotabato City.

4. Conclusion

This study highlights the adaptive capacity of micro enterprises in Cotabato City as they navigate environmental sustainability within conditions of resource scarcity and institutional limitation. The findings demonstrate that micro enterprises actively engage in pragmatic, low-cost sustainability practices driven by personal commitment, operational efficiency, and selective market incentives rather than regulatory enforcement. While some enterprises successfully translate sustainability initiatives into branding and reputational advantages, others perceive limited market returns, underscoring the context-specific nature of sustainability as a competitive strategy. By applying the Natural Resource-Based View in an informal and developing-economy context, the

study extends the theory by illustrating both its explanatory power and its constraints in environments lacking coordinated institutional and stakeholder support. Strengthening municipal waste systems, enhancing access to affordable sustainable inputs, and fostering collaborative partnerships between local government units, suppliers, and micro enterprises are essential to scaling environmental sustainability beyond individual initiatives. Ultimately, meaningful progress toward environmental sustainability in micro-enterprise sectors requires not only entrepreneurial commitment but also enabling ecosystems that align economic viability with ecological responsibility.

5. Recommendations

Based on the complex realities revealed in this study of micro enterprises in Cotabato City, future research should explore how policy

interventions and institutional support mechanisms can be strengthened to bridge the gap between environmental awareness and

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sustainable practice implementation among resource-constrained businesses that requires a multifaceted research approach that begins with understanding the specific barriers these businesses face. Additionally, investigating the development of collaborative models that connect micro enterprises with suppliers, customers, and local government units should employ participatory action research methodologies that engage all stakeholders in co-designing context-appropriate solutions for Cotabato City's unique socio-economic and cultural environment that could provide valuable insights into creating enabling ecosystems that make sustainability more economically viable and operationally feasible.

Research examining the long-term business outcomes of different sustainability positioning strategies requires a carefully designed longitudinal research that tracks cohorts of small-scale entrepreneurs using mixed-methods to capture both quantitative performance metrics

and qualitative insights into the mechanisms through which environmental practices generate or fail to generate competitive advantages that would help clarify the actual competitive advantages and market benefits that environmental practices generate for small-scale entrepreneurs in developing contexts.

Finally, studies focusing on scalable, low-cost sustainable solutions should be pursued by conducting systematic research that identifies, tests, validates, and disseminates affordable environmental interventions that generate measurable benefits without requiring substantial capital investment, advanced technical expertise, or significant operational disruption as these interventions specifically designed for the financial and infrastructural limitations of micro enterprises could offer practical pathways for broader adoption of environmental practices while maintaining business viability.

Supplementary Details

Author Contributions:

This paper was collaboratively authored by two researchers, each contributing according to their expertise: Ma. Rosario A. Casibang led the development of the introduction, interpretation of results, and discussion of findings; Dr. Bilog was responsible for the comprehensive review, ensured the rigor of the study through validation of the methodology and results critical refinement of the manuscript.

Institutional Review Board Statement:

This research endeavor was submitted for ethical review. It received full-board approval from the University of the Immaculate Conception Research Ethics Committee (UIC-REC) to ensure compliance with ethical standards during the conduct of this research. The approved protocol code was GS-ER-06-25-0315

Informed Consent Statement:

Informed consent was obtained from all subjects involved in the study. All research participants were informed of the purpose and procedure of the study, potential risks and discomforts, benefits, data privacy and confidentiality and their rights as research participants.

Conflicts of Interest:

The authors declare no conflict of interest.

Disclosure Statement:

In the course of writing the research, the following AI tools were employed, along with their specific applications, such as; SciSpace and Claud.ai – assisted in locating relevant peer-reviewed articles. ChatGPT – assisted in drafting, refining and improving the structure and wording of the sections of the manuscript. Grammarly – provided grammar checking,

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clarity enhancement, and paraphrasing of cited articles for coherence and readability. I have reviewed and verified all outputs generated with

the assistance of the above-mentioned AI tools, ensuring their accuracy, relevance, and alignment with the requirements of my work.

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