

From Waste to Value: A Human-Centred Eco-Innovation Approach for MSME Competitiveness and Income Diversification

1. INTRODUCTION

Micro, Small and Medium Enterprises (MSMEs) have been hailed as engines of economic growth globally, representing 90% of all businesses worldwide, employing between 60 and 70% of the global workforce and contributing roughly 50% of global GDP according to the International Labour Organisation. Yet MSMEs are also recognized as major contributors to global pollution accounting for roughly 70% of pollution and 64% of manufacturing air pollution.

Across sectors, from food service to retail, light manufacturing to hospitality; MSMEs generate substantial waste while operating on thin margins that could benefit from waste valorisation. Approximately 17.5% of prepared food in catering is discarded ("From plate to palate," 2024), and similar inefficiencies exist in textile offcuts, plastic packaging, and electronic components in other MSME sectors.

The significant increase in attention to MSME sustainability and green innovation, particularly in recent years, highlights the growing relevance of eco-innovation, circular economy practices, and sustainable supply chains in micro, small and medium enterprises. However despite the global emphasis on eco-innovation, many small businesses are still not well versed on eco-innovation and others perceive sustainability oriented practices as costly, complex and not connected to immediate commercial value. This creates a gap between sustainability theory and practice adoption in MSMEs. This paper aims to address that gap by discussing how eco-innovation when embedded within a human-centred and practice based training approach can serve as both a competitive strategy and a mechanism for income diversification.

This study focuses on innovation within operating MSMEs, specifically through the transformation of waste generated from ongoing business activities into value-added products. The study is grounded in an entrepreneurship training context where participants are guided to identify waste streams within their businesses and develop eco-innovative product prototypes. This provides a unique empirical setting to examine how sustainability can be operationalized as a business opportunity rather than a compliance requirement. The study

contributes to the literature in three ways. First, it advances theoretical understanding by integrating eco-innovation, human-centered entrepreneurship, and MSME competitiveness within a circular economy perspective. Second, it provides empirical evidence from an applied entrepreneurial training environment, demonstrating how innovation capabilities can be developed and translated into economic value. Third, it offers actionable insights for incubators, policymakers, and enterprise development practitioners on how to promote ecoinnovation amongst MSMEs through training and awareness.

2. LITERATURE REVIEW

The Circular Economy (CE) has emerged as a philosophy to transform industrial supply chains to become greener to combat climate change issues. Countries target of achieving Net Zero by 2050 will never be fulfilled unless 90% of businesses worldwide (MSMEs) are decarbonised along with larger organisations. While MSMEs contribute to the economies of countries, they also contribute to 70% of the global pollution. It is further observed that manufacturing SMEs contribute almost 64% of the air pollution, which is mostly due to limited compliance towards environmental management systems amongst other factors. It is clear that MSMEs need to rethink and redesign their business models to respond to and overcome emerging challenges. In such circumstances, the adoption of circular economy (CE) principles by MSMEs could be a strategy to overcome business challenges and ensure economic growth, competitiveness and income diversification.

The essential enabler for circular economy is eco-innovation because it provides the technological and organizational innovations needed to move from linear "take-make-waste" systems to closed-loop systems. While CE offers the structural framework focusing on resource efficiency and waste reduction, eco-innovation supplies the specific, sustainable solutions that make this transition actionable, such as new recycling technologies, eco-design, and circular business models.

Eco-innovation encompasses product, process, organisational, and marketing innovations that reduce environmental impact (Nirwal & Bhardwaj, 2025). Based on this definition eco-innovation has to do with responsible production processes and service innovations that are friendly and not harmful to the environment.

In this sense, eco-innovation is more a business opportunity than a burden. The main opportunity is in Waste Valorisation which entails repurposing or enhancement of waste into valuable products which create new income streams and can act as a competitive advantage for MSMEs.

MSMEs generate diverse waste: organic (food, green waste), plastics, paper/cardboard, metals, glass, textiles, e-waste, and used oil. Valorisation pathways vary by sector: upcycling for food/textiles, composting for organics, material recovery for plastics/metals, refurbishment for e-waste.

Low-to-mid tech valorisation options that convert waste to value include upcycling, biological conversion (composting, BSFL), mechanical recycling, and chemical conversion (grease-to-biodiesel).

Income diversification through new revenue models include selling upcycled products, compost, insect protein, and recycled materials. Cost reduction models lower disposal fees and material purchases. Service-based models offer “zero-waste” certification at a premium (Businessday NG, 2025). This is proof that eco innovation in MSME is feasible. Despite feasibility, adoption remains low due to awareness, operational constraints (space, labour), and economic uncertainty (Ouro-Salim et al., 2026).

Ouro-Salim et al. (2026) found that limited awareness and technical capacity are the primary obstacles to eco-innovation in MSMEs. Putri et al. (2025) add lack of upfront capital and perceived risk. What is needed is a change of perception amongst MSMEs, which can be accomplished through targeted trainings and awareness of the human centred approach to eco-innovation.

Human-centred design (HCD) is an approach to problem-solving that prioritises the needs, behaviours, and contexts of end-users throughout the design process (IDEO, 2015; Norman, 2013). In the context of eco-innovation, HCD shifts the focus from what is technologically possible or policy-mandated to what is usable, desirable, and feasible for the people who must adopt and sustain new practices in this case, MSME owners, managers, and frontline staff (Storm & Smith, 2022). The core principles of HCD – empathy, co-design, iteration, and contextual fit – are particularly relevant for MSMEs, where resource constraints, informal workflows, and high staff turnover make top-down or technology-only interventions prone to failure (Kigozi et al., 2024).

Eco-innovation adoption in MSMEs is not primarily a technical challenge. As Ouro-Salim et al. (2026) demonstrated, the most frequently cited barriers are lack of awareness, limited technical skills, and perceived operational disruption, all of which are human and organisational, not technological. Similarly, Putri et al. (2025) found that even when low-cost eco-innovations are available, MSMEs fail to adopt them because the innovations do not fit existing workflows or because staff are not adequately engaged.

HCD addresses these barriers directly. By starting with understanding what staff say, think, do, and feel about current waste handling. HCD reveals hidden pain points (e.g., a bin placed too far from a workstation) and motivational drivers (e.g., pride in reducing waste). Through co-design, staff become active participants in designing new processes, which increases ownership and reduces resistance to change (Storm & Smith, 2022). Iterative prototyping allows MSMEs to test small changes (e.g., moving a bin, adding a sign) before committing resources, lowering perceived risk.

3. METHODOLOGY

The analysis focuses on three key dimensions: (1) the identification and reinterpretation of waste within MSME operations, (2) the role of human-centered thinking in ensuring that eco-innovations are contextually relevant and marketable, and (3) the importance of prototyping in bridging the gap between idea generation and commercial application.

This study adopts a practice-based, exploratory design to examine how MSMEs apply eco-innovation within existing business operations. A mixed-methods approach was used, combining quantitative survey data with qualitative evidence from participant-developed prototypes.

The study focused on MSMEs that had previously participated in an Empretec training programme, which included an eco-innovation module requiring participants to develop prototypes from waste generated in their businesses. An online survey was distributed to 50 MSMEs, with 70% response rate. The sample included businesses from sectors such as retail, agro-processing, and textiles.

Data was collected through a structured online survey, capturing: awareness of eco-innovation before and after training, waste utilisation practices before and after the training, and development and application of eco-innovative products.

In addition, prototype case examples were used to provide practical evidence of eco-innovation in action.

Three illustrative cases demonstrate the waste-to-value process: A **spaza shop** transformed plastic packaging waste into moulded plastic bowls for resale; An **agro-business** produced compost from food waste and eggshells for agricultural use; A **textile business** converted fabric offcuts into cushions and pillows

4. FINDINGS AND DISCUSSION

Findings indicate that: **87.5%** of respondents had no prior knowledge of eco-innovation before training and **62.5%** now actively repurpose waste into income-generating products

The findings indicate that eco-innovation, when grounded in existing business realities and supported through hands-on prototyping, produces multiple value creation outcomes. These include cost efficiencies through waste reduction, product differentiation through sustainable offerings, and income diversification through the introduction of new product lines. The case vignettes further illustrate how entrepreneurs are able to translate waste into viable business opportunities, reinforcing the practical applicability of the framework. The survey results validate that the main barrier to eco-innovation in MSMEs is not technology cost or complexity, but lack of awareness and practical know-how.

5. CONCLUSION

Empirical findings demonstrates that a low-cost, training first approach can rapidly accelerate circular economy adoption. The paper concludes that human-centred, waste-based eco-innovation represents a scalable and contextually relevant pathway for MSMEs to achieve resilience, competitiveness, and diversified income streams. Embedding such approaches within entrepreneurship training and incubation programmes can play a critical role in advancing both local economic development and achieving global sustainable development goals.

REFERENCES:

- African Development Bank. (2025). Enabling African MSMEs to realize circular economy's potential. *AfDB Blogs*.
- Businessday NG. (2025). Circular economy strategies for Nigeria's supply chain through SMEs' empowerment. *Businessday Nigeria*.
- Circular Economy in Small and Medium-Sized Enterprises—Current Trends, Practical Challenges and Future Research Agenda
- Ayon Chakraborty 1,* , Debashree De 2and Prasanta Kumar Dey
- Development Alternatives. (n.d.). Green MSMEs – Enabling transition to a green economy. devalt.org.
- “From plate to palate: Sustainable solutions for upcycling food waste in restaurants and catering.” (2024). *ScienceDirect*.
- Kigozi, J., Kalyango, M., Baidhe, E., et al. (2024). Human-centered design in the development of innovative technology for food processing MSMEs in Uganda. *Journal of Engineering Research*.
- Mohd Saman, N. R., Mahmud, N., et al. (2025). Green innovation and SMEs' sustainability performance: A comprehensive review. *PaperASIA*.
- Nirwal, P., & Bhardwaj, A. (2025). Mapping the nexus of green innovation and sustainability in MSMEs: A bibliometric perspective. *Wiley Online Library*.
- Ouro-Salim, O., Ramos, H. R., & Fanho, A. D. (2026). Upcycling as a circular strategy for food waste valorization in developing countries: A systematic review and the upgrade strategic framework. *Wiley Online Library*.
- Putri, A. N. A., Hermawan, P., et al. (2025). Exploring green growth in SMEs: Global trends, challenges, and future directions. *Foresight and STI Governance*.
- Storm, J., & Smith, A. (2022). Empathize with whom? Adopting a design thinking mind-set to stimulate sustainability initiatives in Chinese SMEs. *Sustainability (MDPI)*.
- UNESCAP. (2026). MSMEs at the heart of the green transition. *United Nations*.

- Wijayanti, E., Abdulah, B., & Sandopart, D. P. Y. A. L. (2025). Green entrepreneurial orientation in MSMEs: A systematic review. *Jurnal Manajemen Bisnis*.