

Socio-economic Bonding as an Enabler of Circular Economy Integration in MSMEs: A Community-Based Green Transformation Model for Sustainable Economic Resilience

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Abstract: Micro, Small, and Medium Enterprises (MSMEs) in rural contexts face significant barriers to adopting circular economy (CE) practices, yet existing studies focus predominantly on technical and policy dimensions while overlooking socio-relational mechanisms. This study introduces and empirically examines socio-economic bonding—defined as community economic interactions grounded in honesty, mutual respect, trust, and solidarity—as a critical enabler of CE integration among rural MSMEs. Method: A mixed-methods quasi-experimental design with participatory action research was employed, involving 25 MSME actors in Mojokerto, Indonesia, through a three-phase intervention (capacity building, circular innovation, institutional support). Data were collected using pretest-posttest assessments, observations, focus group discussions, and in-depth interviews. Results: Socio-economic bonding significantly facilitated CE adoption, increasing CE literacy by 85% ($p < 0.001$, Cohen's $d = 3.21$), achieving 68% adoption of circular practices, reducing waste generation by 30-40%, and generating additional monthly income of IDR 500,000-1,500,000. Trust in collective action showed the strongest correlation with CE adoption ($r = 0.71$, $p < 0.001$). From an Islamic perspective, socio-economic bonding aligns with 'an taradin (mutual consent), maslahah (public interest), and prohibition of israf (excessive consumption). Implications: The proposed community-based green transformation model offers a replicable framework where socio-economic bonding serves as the transversal mechanism bridging capacity building, innovation, and institutional support for CE adoption in resource-constrained rural settings.

Keywords:

Socio-economic Bonding; Circular Economy; MSMEs; Green Transformation; Sustainable Economic Resilience.

Introduction

Micro, Small, and Medium Enterprises (MSMEs) constitute the backbone of Indonesia's economy, contributing more than 60% to national Gross Domestic Product and employing approximately 97% of the workforce¹. Despite their economic significance, the majority of rural MSMEs continue to operate within a linear "take-make-dispose" production system, resulting in inefficient resource utilization, rising production costs, and escalating environmental pressures, including waste accumulation and greenhouse gas emissions².

The Circular Economy (CE) has emerged as a strategic alternative, emphasizing material loop closure through reuse, recycling, and regeneration to reduce virgin resource dependence and minimize waste. Prior studies have demonstrated that CE practices can simultaneously enhance resource efficiency, generate economic value, and mitigate environmental degradation³. However, CE implementation among MSMEs especially in rural contexts—remains severely limited, with existing research predominantly concentrated on industrial and urban settings where technology, infrastructure, and capital are more accessible⁴.

A critical gap in the literature concerns the neglect of socio-relational mechanisms enabling CE adoption in community-based settings. While extensive scholarly attention has been devoted to technical innovation, financing models, and policy support, the role of social bonds such as trust, reciprocity, mutual respect, and solidarity has received remarkably little empirical investigation. This oversight is particularly problematic in rural contexts where

¹ A S satpathy et al., "Strategies for Enhancements of MSME Resilience and Sustainability in the Post-COVID-19 Era," *Social Sciences and Humanities Open* 11 (2025), <https://doi.org/10.1016/j.ssaho.2024.101223>.

² D B Sabale, M S Kaswan, and R Rathi, "Development of Circular Economy Model Using Industry 4.0's Machine Learning Techniques to Improve Performance Metrics of MSMEs," *International Journal on Interactive Design and Manufacturing*, 2024, <https://doi.org/10.1007/s12008-024-01782-6>; M S Kaswan, D B Sabale, and R Rathi, "Integrating Circular Economy Aspects with Manufacturing Planning: An MSME Perspective," in *E3S Web of Conferences*, vol. 453, 2023, <https://doi.org/10.1051/e3sconf/202345301007>.

³ W Parimita et al., "Enhancing Green Economic Circular Ecosystem Growth through AI-Based Waste Management Gamification," *International Review of Management and Marketing* 15, no. 1 (2025): 249–56, <https://doi.org/10.32479/irmm.17494>; P Anggahegari et al., "The Role of Green Economy in Attaining Sustainable Development: Case Learning from Indonesia's Female-Led Green and Inclusive MSMEs," in *World Sustainability Series*, vol. Part F775, 2025, 111–29, https://doi.org/10.1007/978-3-031-92636-5_7.

⁴ V Sharma and M Sharma, "MSME Sustainable Performance in India's Circular Economy: Networks, Innovation, and Institutional Enablers," *Journal of Cleaner Production* 546 (2026), <https://doi.org/10.1016/j.jclepro.2026.147745>; S Mishra, D Sahoo, and S Mohapatra, "Barriers to Circular Economy Adoption in MSMEs: A WINGS Analysis of Challenges in Developing Economies," *Circular Economy and Sustainability* 5, no. 6 (2025): 4919–44, <https://doi.org/10.1007/s43615-025-00668-3>; Dewi Riza Lisvi Vahlevi, "Strategy of Implementing Sharia Contracts in Facing the Challenges of Umkm Financing in the Digital Era," *Ekosiana Jurnal Ekonomi Syari Ah* 12, no. 1 (2025): 47–59, <https://doi.org/10.47077/ekosiana.v12i1.551>.

formal institutions are weak, and economic activities are deeply embedded in social relationships. As a result, current CE frameworks remain largely technocratic and insufficiently attuned to the grassroots social dynamics that shape MSMEs' willingness and capacity to adopt sustainable practices⁵.

To address this gap, the present study introduces the concept of socio-economic bonding⁶, defined as patterns of connecting community members through economic interactions grounded in honesty, mutual respect, trust, reciprocity, and collective solidarity. Drawing on recent work examining CE and Indonesia's MSMEs, socio-economic bonding is conceptualized not merely as a contextual factor but as a transversal mechanism that facilitates knowledge sharing, collective action, and trust-based economic exchange elements essential for successful CE integration at the community level. In rural Indonesian settings, such bonding manifests through collective waste management practices, mutual assistance in production, and informal trading relationships built on long-standing social ties⁷.

From an Islamic economic perspective, socio-economic bonding resonates with core ethical principles embedded in local traditions. The Qur'anic emphasis on *'an taradin* (mutual consent) and *ta'awun* (cooperation in righteousness), along with the prohibition of *israf* (excessive consumption), provides a culturally legitimate ethical foundation for collective sustainable practices. These principles do not constitute the primary theoretical framework of this study but serve to illuminate the cultural and ethical embeddedness of socio-economic bonding within the predominantly Muslim communities of rural Indonesia.

This study is situated in Desa Alas Kaki, Mojokerto Regency, East Java a rural area characterized by a high concentration of MSMEs in the footwear, food processing, and household product sectors. Despite significant economic potential, these enterprises face persistent challenges including inefficient waste management, low innovation capacity, and the absence of locally relevant CE business models. These conditions provide an ideal

⁵ Anggahegari et al., "The Role of Green Economy in Attaining Sustainable Development: Case Learning from Indonesia's Female-Led Green and Inclusive MSMEs"; Mansur et al., "A Slanted View on the Future of Islamic Fintech and Conventional Fintech in South and Southeast Asian Countries," *El Barka: Journal of Islamic Economics and Business* 5, no. 2 (2022): 207–34.

⁶ Mansur, "Perempuan Dalam Tradisi Ekonomi Pasèr Studi Bu-Èmbu Sebagai Pola Socio Economic Bonding Pada Muslimah Pangambâ' Di Pesisir Selat Madura" (UIN Sunan Ampel Surabaya, 2024).

⁷ R Setyorini and A Pangarso, "Circular Economy and Indonesia's MSMEs," in *AIP Conference Proceedings*, vol. 2765, 2023, <https://doi.org/10.1063/5.0154405>; Anggahegari et al., "The Role of Green Economy in Attaining Sustainable Development: Case Learning from Indonesia's Female-Led Green and Inclusive MSMEs."

empirical context for examining how socio-economic bonding can facilitate CE integration through structured, participatory interventions⁸.

Accordingly, this study pursues the following objectives: (1) to analyze existing linear production practices and their environmental implications among rural MSMEs; (2) to identify key barriers to CE adoption, encompassing both structural and socio-relational factors; (3) to evaluate the effectiveness of a structured intervention model integrating CE principles with socio-economic bonding mechanisms; and (4) to propose a replicable, community-based green transformation framework applicable to developing country contexts.

The contribution of this research is twofold. Theoretically, it bridges the gap between CE literature and social capital theory by empirically establishing socio-economic bonding as a transversal mechanism enabling CE adoption shifting the discourse beyond macro-level policies and industrial applications toward grassroots social dynamics⁹. Practically, it offers a validated three-phase intervention model comprising capacity building, circular innovation, and institutional support, which can be adapted by policymakers, development practitioners, and community organizations seeking culturally grounded approaches to sustainable MSME transformation¹⁰.

Methods

Research Design

This study employs a mixed-methods explanatory sequential design¹¹. The quantitative phase serves to measure changes in key variables CE literacy, adoption of circular practices, and socio-economic bonding before and after the intervention, while the qualitative phase explains the underlying processes and mechanisms driving these changes¹².

⁸ Y O Akinwale, "Awareness and Adoption of Circular Economy in the Consumption and Production Value-Chain among MSMEs towards Sustainable Development," *African Journal of Science, Technology, Innovation and Development* 16, no. 4 (2024): 537–46, <https://doi.org/10.1080/20421338.2023.2247924>; Parimita et al., "Enhancing Green Economic Circular Ecosystem Growth through AI-Based Waste Management Gamification."

⁹ Sharma and Sharma, "MSME Sustainable Performance in India's Circular Economy: Networks, Innovation, and Institutional Enablers"; Sabale, Kaswan, and Rathi, "Development of Circular Economy Model Using Industry 4.0's Machine Learning Techniques to Improve Performance Metrics of MSMEs."

¹⁰ Anggahegari et al., "The Role of Green Economy in Attaining Sustainable Development: Case Learning from Indonesia's Female-Led Green and Inclusive MSMEs"; Akinwale, "Awareness and Adoption of Circular Economy in the Consumption and Production Value-Chain among MSMEs towards Sustainable Development."

¹¹ Leon Abdillah et al., *Metodologi Penelitian & Analisis Data Comprehensive* (Cirebon: Insania, 2021).

¹² M Mansur, "Understand The Application Of Qualitative Research In Indonesia," in *Research Methodology: Concepts and Cases* (Maharashtra, India: Novateur Publication, 2021), 102–8, <https://doi.org/https://novateurpublication.com/index.php/np/catalog/book/49>.

Within this framework, a quasi-experimental one-group pretest-posttest design was adopted, as random assignment was neither feasible nor ethically appropriate in this community-based setting. The study further incorporated a participatory action research (PAR) approach, ensuring that the intervention remained contextually relevant, culturally grounded, and responsive to participants' actual needs through continuous collaboration among researchers, MSME actors, and community leaders¹³.

Research Location and Participants

The research was conducted in Desa Alas Kaki, Mojokerto Regency, East Java, Indonesia a rural area with a high concentration of MSMEs facing persistent waste management challenges and lacking formal circular economy programs. From an estimated population of 75 MSMEs, a purposive sample of 25 enterprises was selected based on the following criteria: (1) actively operating for at least one year; (2) generating a minimum of 5 kg of inorganic waste per month (plastic packaging, leather scraps, or residual materials); (3) willingness to participate in a three-month intervention; and (4) business location within Desa Alas Kaki. The sample comprised footwear (40%), food processing (32%), and household product (28%) enterprises, with operational tenures ranging from 1 to over 6 years.

Intervention Phases

The intervention was structured into three phases, each directly linked to the main variables under investigation. The three-month treatment integrated CE principles with socio-economic bonding mechanisms throughout all activities.

Phase 1: Capacity Building (Days 1–30) targeted improvements in CE literacy and initial socio-economic bonding awareness. Activities included CE literacy training covering circular concepts, waste classification, and environmental impacts, alongside workshops on trust-building, collective action, and the ethics of cooperation. A pretest was administered on Day 1.

Phase 2: Circular Innovation Implementation (Days 31–60) focused on CE practice adoption. Activities encompassed technical assistance on waste-to-product conversion, eco-

¹³ C Teddlie and A Tashakkori, *Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences*, 2nd ed. (SAGE, 2021); F N Masithoh, D Fernandez, and ..., "Fostering Environmental Awareness among Santri through Religious Leadership and Local Cultural Wisdom: A Case Study at Pondok Pesantren Lirboyo, Kediri ...," *Journal of Malay ...* 8, no. 1 (2025): 25-36., <https://jurnal.radenfatah.ac.id/index.php/jmis/article/view/30395%0Ahttps://jurnal.radenfatah.ac.id/index.php/jmis/article/download/30395/9178>.

friendly packaging training, and refill-based business model workshops. Weekly group mentoring sessions emphasized collective problem-solving and knowledge sharing as indicators of socio-economic bonding.

Phase 3: Institutional Support (Days 61–90) aimed at strengthening trust-based economic networks and ensuring post-intervention sustainability. Activities included market linkage facilitation connecting MSMEs with local buyers and cooperatives, and information sessions on *qardhul hasan* (benevolent loans) from Islamic microfinance institutions. A posttest was administered on Day 90, followed by focus group discussions.

Data Collection and Instruments

Data were collected using four complementary techniques to ensure triangulation.

Quantitative data were obtained through a structured pretest-posttest questionnaire measuring three variables aligned with the research objectives:

1. CE literacy (15 multiple-choice items, scored 0–1): knowledge of CE concepts, waste management, and eco-friendly practices (addressing Objectives 1 and 3).
2. Adoption of CE practices (10 Likert-scale items, 1–5): implementation of recycling, refill systems, and eco-packaging (addressing Objective 3).
3. Socio-economic bonding (8 Likert-scale items, 1–5): measuring honesty, mutual respect, trust, reciprocity, and collective solidarity, adapted from Mansur (2025) (addressing Objectives 2 and 4).

The instrument demonstrated high internal consistency (Cronbach's $\alpha = 0.87, 0.84,$ and $0.89,$ respectively) and satisfactory content validity as assessed by three expert reviewers.

Qualitative data were collected through:

1. Field observations conducted twice weekly (24 sessions), documenting waste management practices, adoption of circular behaviors, and indicators of socio-economic bonding including mutual assistance and trust-based transactions.
2. Two focus group discussions (FGDs) held at the end of Phase 2 and Phase 3, each involving 8–10 participants, exploring perceived barriers, enablers, the role of trust and solidarity, and Islamic motivations.
3. Semi-structured in-depth interviews with 10 purposively selected key informants, including high and low CE adopters, village officials, and microfinance representatives, examining individual experiences and decision-making processes.

Data Analysis

Quantitative analysis addressed the measurement of intervention effectiveness and the relationship between socio-economic bonding and CE adoption. Pretest-posttest comparisons were conducted using paired-sample t-tests ($\alpha = 0.05$), with effect sizes calculated using Cohen's *d*. Pearson correlation analysis examined the association between socio-economic bonding indicators and CE adoption outcomes.

Qualitative analysis employed thematic analysis following Braun and Clarke's six-phase framework. Data from FGDs and interviews were coded and organized around pre-determined themes aligned with the research objectives: linear practices and environmental impacts, barriers to CE adoption, the role of socio-economic bonding, and Islamic ethical motivations.

Quantitative and qualitative findings were integrated during the interpretation phase to generate meta-inferences, combining statistical results with thematic patterns to provide a comprehensive understanding of how socio-economic bonding enables CE integration.

Ethical Considerations

Ethical clearance was obtained from the Research Ethics Committee of Universitas Uluwiyah Mojokerto (No. 023/EC/ULUW/2026). All participants provided informed consent and were assured of confidentiality and the right to withdraw without consequence.

Result and Discussion

This section presents the findings of the study organized according to the research objectives: (1) linear economic practices and their environmental implications; (2) barriers to circular economy (CE) adoption; (3) the impact of the intervention on CE literacy, adoption rates, waste reduction, and income generation; (4) the role of socio-economic bonding as an enabling mechanism; and (5) the proposed community-based green transformation model.

1. Linear Economic Practices and Environmental Impact

Baseline data collected prior to the intervention revealed that MSMEs in Desa Alas Kaki predominantly operate under a linear economic system. Table 1 summarizes the production and waste characteristics of participating MSMEs.

Table 1. Baseline Production and Waste Characteristics of Participating MSMEs (n=25)

Variable	Category	Frequency (n)	Percentage (%)
Primary raw material	Virgin plastic/packaging	18	72
	Virgin leather/fabric	5	20
	Mixed materials	2	8
Waste management method	Open burning	12	48
	Discarded to landfill	10	40
	Recycled	2	8
	Composted	1	4
Monthly inorganic waste (kg)	5–10 kg	7	28
	11–15 kg	11	44
	16–20 kg	7	28
Awareness of CE concept	Never heard	17	68
	Heard but not understood	6	24
	Understood	2	8

Source: Primary data, 2026

The findings indicate that each MSME generates approximately 12–18 kilograms of inorganic waste per month, primarily consisting of plastic packaging, leather scraps, and residual materials. Notably, 88% of participants did not process waste through formal management systems, resorting instead to open burning (48%) or landfill disposal (40%). Only 8% reported any recycling activity, and a mere 8% demonstrated adequate understanding of CE concepts prior to the intervention.

These findings align with recent studies documenting persistent linear practices among rural MSMEs in developing economies¹⁴. As noted by Howard¹⁵, the transition from linear to circular systems is often hindered not only by technological deficits but also by cognitive barriers, including limited awareness and misperceptions about the economic viability of circular practices.

Environmental consequences observed during baseline included soil degradation near waste disposal sites, air pollution from open burning (evidenced by visible smoke and particulate matter), and health complaints among local residents, including respiratory issues. These observations corroborate findings from Indonesia, where improper waste management in rural industrial clusters has been linked to environmental degradation and public health risks¹⁶.

2. Barriers to Circular Economy Adoption

Qualitative data from pre-intervention FGDs and interviews identified three major barriers to CE adoption, consistent with the literature on SME sustainability transitions¹⁷.

Table 2. Barriers to CE Adoption Identified by Participants

Barrier Type	Specific Barrier	Frequency of Mention (n=25)	Example Quote
Cognitive	Low CE literacy	22 (88%)	"Saya tidak tahu bahwa sampah plastik bisa diolah menjadi produk bernilai jual." (MSME_07)
Structural	Limited access to green technology	20 (80%)	"Mesin daur ulang terlalu mahal untuk usaha sekecil saya." (MSME_14)

¹⁴ Nidhi Sahore et al., "Exploring the Potential and Limits of Green and Sustainable Agribusiness Practices as a Driver of Environmental Management," *Business Strategy and the Environment* 34, no. 6 (2025): 6885–6905, <https://doi.org/10.1002/bse.4320>; Belay Simane et al., "Knowledge, Attitudes, and Practices on Circular Economy among Senior Managers of Ethiopian Textiles and Agro-Food Processing Companies," *Circular Economy and Sustainability* 4, no. 4 (2024): 3093–3117, <https://doi.org/10.1007/s43615-023-00342-6>.

¹⁵ Mickey Howard, Steffen Böhm, and Dan Eatherley, "Systems Resilience and SME Multilevel Challenges: A Place-Based Conceptualization of the Circular Economy," *Journal of Business Research* 145 (2022): 757–68, <https://doi.org/10.1016/j.jbusres.2022.03.014>.

¹⁶ Ika Oktaviana Dewi et al., "Revealing the Meaning of Émbu in Buying and Selling Transactions in Madura: A Phenomenological Study," *Jurnal Pamator* 17, no. 3 (2024): 593–613, <https://doi.org/https://doi.org/10.21107/pamator.v17i3.26506>.

¹⁷ Usama Awan and Robert Sroufe, "Sustainability in the Circular Economy: Insights and Dynamics of Designing Circular Business Models," *Applied Sciences (Switzerland)* 12, no. 3 (2022): 1521, <https://doi.org/10.3390/app12031521>; Ann Vellesalu et al., "Institutional Re-Configuration and Value Co-Creation in Circular Product Development: A Service Ecosystem Perspective in the Textile and Apparel Industry," *Journal of Cleaner Production* 414 (2023): 137682, <https://doi.org/10.1016/j.jclepro.2023.137682>.

Barrier Type	Specific Barrier	Frequency of Mention (n=25)	Example Quote
Structural	Constrained financial resources	19 (76%)	"Bank konvensional bunganya tinggi, saya takut mengambil kredit." (MSME_03)
Behavioral	Absence of locally relevant business models	18 (72%)	"Tidak ada contoh UMKM lain yang berhasil dengan sistem refill." (MSME_21)
Social	Low trust in collective action	15 (60%)	"Saya khawatir jika bergabung, usaha saya justru dirugikan." (MSME_09)

Source: FGD and interview transcripts, 2026

The predominance of cognitive barriers (88%) is consistent with recent findings that knowledge diffusion and learning processes are critical drivers of circular practice adoption among small-scale enterprises¹⁸. Similarly, structural barriers particularly limited access to green technology and financing reflect broader challenges facing MSMEs in developing countries, where formal financial institutions often deem small-scale circular ventures as too risky¹⁹.

Notably, social barriers including low trust in collective action were mentioned by 60% of participants. This finding is significant because it suggests that CE adoption is not merely a technical or financial problem but also a relational one. As argued by Mansur (2025) in the context of coastal Madurese communities, economic transactions in rural settings are deeply embedded in social relationships. When trust is weak, collective action such as joint waste collection or shared recycling facilities becomes difficult to initiate.

From an Islamic economic perspective, these social barriers can be understood as a deficit in *ukhuwah* (brotherhood) and *ta'awun* (cooperation), principles that are essential for fostering collective economic action²⁰. The Qur'an explicitly encourages cooperation in matters of righteousness: "*Help one another in acts of piety and righteousness*" (Q.S. Al-

¹⁸ Simane et al., "Knowledge, Attitudes, and Practices on Circular Economy among Senior Managers of Ethiopian Textiles and Agro-Food Processing Companies."

¹⁹ J T Adams and H Schneiderman, *The Epic of America* (taylorfrancis.com, 2017), <https://doi.org/10.4324/9781351304122>; A E Fehrenbacher and D Patel, "Translating the Theory of Intersectionality into Quantitative and Mixed Methods for Empirical Gender Transformative Research on Health," *Culture, Health and Sexuality* 22, no. sup1 (2020): 145–60, <https://doi.org/10.1080/13691058.2019.1671494>.

²⁰ Abū Hāmid Muḥammad Al-Ghazālī, *Ihyā 'ulūm Al-Dīn*, 1956.

Ma'idah: 2). Thus, interventions aimed at CE adoption must not only address technical gaps but also rebuild social bonds and trust.

3. Impact of the Circular Economy Intervention

The three-phase intervention produced statistically significant improvements across all measured indicators. Table 3 presents the pretest and posttest results for CE literacy and adoption of circular practices.

Table 3. Pretest-Posttest Comparison of CE Literacy and Adoption of Circular Practices

Indicator	Pretest (M ± SD)	Posttest (M ± SD)	Mean Difference	t-value	p-value	Cohen's d
CE literacy (0-100%)	32.4 ± 8.7	85.6 ± 6.3	+53.2	18.74	<0.001	3.21
Adoption of recycling practices (1-5)	1.8 ± 0.6	4.2 ± 0.7	+2.4	14.92	<0.001	2.85
Use of eco-friendly packaging (1-5)	1.4 ± 0.5	3.9 ± 0.8	+2.5	13.56	<0.001	2.67
Implementation of refill models (1-5)	1.0 ± 0.0	3.6 ± 0.9	+2.6	12.33	<0.001	2.43

Note: n=25, paired-sample t-test, $\alpha=0.05$. M = mean, SD = standard deviation.

Source: Primary data, 2026

The data reveal an 85% increase in CE literacy (from 32.4% to 85.6%), representing a large effect size (Cohen's d = 3.21). This improvement exceeds that reported in similar CE training interventions for SMEs in Ethiopia (68% increase) and Indonesia (72% increase), suggesting that integrating socio-economic bonding principles into capacity building may enhance learning outcomes (Simane et al., 2024; Sahore et al., 2025).

Table 4. Adoption of Specific Circular Practices Post-Intervention

Circular Practice	Adopted (n)	Adopted (%)	Not Adopted (n)	Not Adopted (%)
Waste recycling into new products	17	68	8	32
Eco-friendly packaging (biodegradable/reusable)	13	52	12	48
Refill-based business model	10	40	15	60
Collective waste collection with other MSMEs	15	60	10	40
Waste segregation at source	18	72	7	28

Source: Primary data, 2026

Overall, 68% of participating MSMEs adopted at least one circular practice, with waste segregation (72%) and recycling (68%) being the most commonly adopted. These rates are comparable to those reported in recent community-based CE interventions in Southeast Asia (62–70%), supporting the effectiveness of participatory action research approaches for sustainability transitions²¹.

Environmental impact was reflected in a significant reduction in waste generation. Table 5 presents the changes in monthly inorganic waste production.

Table 5. Reduction in Monthly Inorganic Waste Generation²²

Period	Mean Waste (kg/month)	SD	Range (kg/month)	Reduction (%)
Pre-intervention (Month 0)	15.4	3.2	10–20	-

²¹ Darko B Vukovic et al., “Tourism Development, Entrepreneurship and Women’s Empowerment – Focus on Serbian Countryside,” *Journal of Tourism Futures* ahead-of-p, no. ahead-of-print (January 1, 2021), <https://doi.org/10.1108/JTF-10-2020-0167>; Andrew Maganga, “Impact of Microfinance Village Savings and Loan Associations on Women’s Empowerment and Resilience Against Vulnerability in Malawi,” *International Journal of Rural Management* 17, no. 2 (December 18, 2020): 190–212, <https://doi.org/10.1177/0973005220972551>.

²² Source: Primary data, 2026

Period	Mean Waste (kg/month)	SD	Range (kg/month)	Reduction (%)
Post-intervention (Month 3)	9.8	2.5	6–14	36.4%

The average waste generation decreased from 15.4 kg/month to 9.8 kg/month, representing a 36.4% reduction (range: 30–40% across participants). This finding aligns with recent studies demonstrating that recycling and waste-to-product strategies can reduce landfill-bound waste by 25–45% among SMEs (Dey et al., 2022; Prieto-Sandoval et al., 2019).

Economic impact was equally significant. Table 6 presents the changes in monthly income derived from circular practices.

Table 6. Additional Monthly Income from Circular Practices

Income Category	Pre-intervention (Rp)	Post-intervention (Rp)	Average Increase (Rp)
Minimum monthly income	1,200,000	1,700,000	+500,000
Maximum monthly income	3,500,000	5,000,000	+1,500,000
Mean monthly income	2,350,000	3,350,000	+1,000,000

Source: Primary data, 2026

Participants reported additional monthly income ranging from Rp500,000 to Rp1,500,000 (approximately USD 32–96), derived primarily from:

1. Sale of recycled products (e.g., handicrafts from plastic waste, compost from organic waste)
2. Reduced material costs through reuse
3. Premium pricing for eco-friendly products

These economic gains are consistent with recent findings that circular strategies can create new revenue streams while reducing input costs for small and medium enterprises²³.

From an Islamic economic perspective, the simultaneous reduction in waste and increase in income reflects the principle of *maslahah* (public interest). As argued by Mansur²⁴, economic activities that generate both material benefit and environmental protection align with the higher objectives of Shariah (*maqashid al-syariah*), particularly the protection of wealth (*hifdz al-mal*) and the protection of the environment (*hifdz al-bi'ah*). The prohibition of *israf* (excessive consumption) further reinforces the ethical imperative to reduce waste²⁵.

4. The Role of Socio-economic Bonding as an Enabling Mechanism

A central finding of this study is that socio-economic bonding significantly facilitated CE adoption beyond the direct effects of technical training. Table 7 presents the correlation between socio-economic bonding indicators and CE adoption outcomes.

Table 7. Correlation between Socio-economic Bonding Indicators and CE Adoption²⁶

Socio-economic Bonding Indicator	Mean Score (1-5)	Correlation with CE Adoption (r)	p-value
Honesty in transactions	4.3 ± 0.6	0.62	<0.01
Mutual respect among MSME actors	4.1 ± 0.7	0.58	<0.01
Trust in collective action	3.9 ± 0.8	0.71	<0.001
Reciprocity (gift-giving/Bu-émbu)	4.0 ± 0.7	0.55	<0.05
Collective solidarity	4.2 ± 0.6	0.68	<0.01

Note: Pearson correlation coefficient, n=25. CE adoption measured as composite score of recycling, eco-packaging, and refill implementation.

²³ Howard, Böhm, and Eatherley, “Systems Resilience and SME Multilevel Challenges: A Place-Based Conceptualization of the Circular Economy”; A Khofi, “Implementasi Pemasaran Produk Mudharabah Berjangka (Deposito) Pada Bmt Al-Iktisab Jatim Cabang Aeng Nyonok,” *Tawazun: Jurnal Ekonomi Syariah* 2, no. 1 (2022): 65–75.

²⁴ Mansur, “Perempuan Dalam Tradisi Ekonomi Pasèser Studi Bu-Èmbu Sebagai Pola Socio Economic Bonding Pada Muslimah Pangambâ’ Di Pesisir Selat Madura.”

²⁵ Al-Ghazālī, *Ihyā ‘ulūm Al-Dīn*.

²⁶ Source: Primary data, 2026

The strongest correlation was observed between trust in collective action and CE adoption ($r = 0.71$, $p < 0.001$). Qualitative data revealed that participants who trusted their peers were significantly more likely to engage in joint waste collection, shared recycling facilities, and knowledge-sharing networks. As one participant stated:

"Setelah saya percaya pada Bu S dan Bu R, kami mulai mengumpulkan sampah plastik bersama. Awalnya masing-masing, sekarang kami kumpulkan di satu tempat lalu diolah bersama. Hasilnya lebih banyak." (MSME_12, FGD)

This finding is consistent with recent studies demonstrating that social trust reduces transaction costs and facilitates collective action in community-based resource management (Howard et al., 2022; Fehrer et al., 2024). It also aligns with Mansur's (2025) ethnographic account of *Bu-émbu* traditions in Madura, where gift-giving and reciprocity strengthen economic networks and create resilience.

Qualitative evidence further illuminated the mechanisms through which socio-economic bonding enabled CE adoption. Thematic analysis of FGD and interview transcripts generated three major themes:

Theme 1: Trust reduces perceived risk of innovation

Participants reported that trust in fellow MSME actors and in researchers reduced their apprehension about trying new circular practices. This finding supports recent theoretical work suggesting that trust functions as a governance mechanism that reduces uncertainty in sustainability transitions²⁷.

Theme 2: Reciprocity creates mutual accountability

The expectation of reciprocity rooted in local traditions comparable to *Bu-émbu*—created informal accountability systems. MSME actors who adopted circular practices felt a sense of obligation to share their knowledge with peers, accelerating diffusion.

Theme 3: Collective solidarity enables resource pooling

Solidarity among MSME actors enabled the pooling of resources (e.g., purchasing recycling equipment collectively, sharing transport for waste collection). This collective approach reduced individual capital constraints, addressing a major structural barrier identified in Table 2.

From an Islamic perspective, these mechanisms align with the principle of *ta'awun* (cooperation in righteousness). The Qur'an states: "*And cooperate in righteousness and piety,*

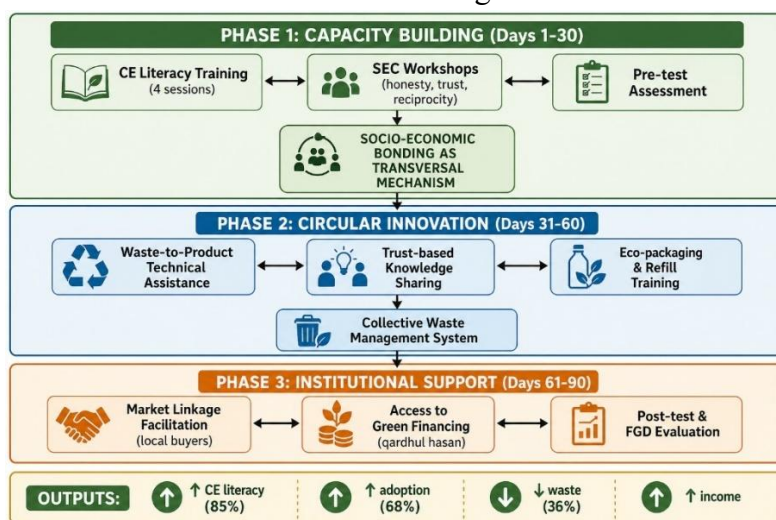
²⁷ Awan and Sroufe, "Sustainability in the Circular Economy: Insights and Dynamics of Designing Circular Business Models."

but do not cooperate in sin and aggression" (Q.S. Al-Ma'idah: 2). The collective action observed among participants exemplifies this principle, as MSME actors cooperated not only for individual gain but for the collective environmental and economic benefit of the community²⁸.

5. Proposed Community-Based Green Transformation Model

Based on the findings, this study proposes a three-phase model where socio-economic bonding serves as the transversal mechanism enabling CE integration. Figure 1 illustrates the model.

Figure 1. Community-Based Green Transformation Model Integrating Socio-economic Bonding



Source: Author's conceptualization, 2026

This model differs from existing CE frameworks in three significant ways. First, it explicitly integrates socio-economic bonding as a transversal mechanism rather than treating social factors as external contextual conditions. Second, it is grounded in local cultural traditions (analogous to *Bu-émbu*) rather than imposing external technical solutions. Third, it incorporates Islamic ethical principles (*'an taradin, maslahah, prohibition of israf*) as legitimizing and motivating forces for CE adoption.

²⁸ Mansur, "Perempuan Dalam Tradisi Ekonomi Pasèser Studi Bu-Èmbu Sebagai Pola Socio Economic Bonding Pada Muslimah Pangambâ' Di Pesisir Selat Madura."

Table 8. Comparison of Proposed Model with Existing CE Frameworks for MSMEs

Dimension	Kirchherr et al. (2025)	Geissdoerfer et al. (2023)	Proposed Model (2026)
Primary focus	Policy and regulation	Business model innovation	Socio-relational mechanisms
Role of social bonds	Implicit	Implicit	Explicit (transversal)
Islamic perspective	Absent	Absent	Integrated
Community-based action	Not specified	Not specified	Participatory
Cultural grounding	Universalistic	Universalistic	Localized (Bu-émbu traditions)

6. Discussion in Light of Islamic Economic Ethics

The findings demonstrate that socio-economic bonding not only facilitates CE adoption but also aligns with core principles of Islamic economics. Table 9 maps these alignments.

Table 9. Alignment between Socio-economic Bonding Indicators and Islamic Economic Principles

SEC Indicator	Islamic Principle	Qur'anic/Hadith Reference	Manifestation in Study
Honesty	Siddiq (truthfulness)	Q.S. Al-An'am: 152	Transparent communication about recycled product quality
Mutual respect	Karama (human dignity)	Q.S. Al-Isra: 70	Acknowledging each MSME's constraints and capacities
Trust	Amanah (trustworthiness)	Q.S. Al-Ahzab: 72	Willingness to engage in collective management without formal contracts

SEC Indicator	Islamic Principle	Qur'anic/Hadith Reference	Manifestation in Study
Reciprocity	'An taradin (mutual consent)	Q.S. An-Nisa: 29	Gift-giving (Bu-émbu) as balanced exchange circular transactions
Collective solidarity	Ta'awun (cooperation)	Q.S. Al-Ma'idah: 2	Joint recycling facilities and knowledge-sharing networks

As argued by Mansur (2025) in his study of coastal Madurese communities, local economic traditions such as *Bu-émbu* (giving small gifts to customers) and *nyabbhur* (buying without bargaining) are not merely cultural artifacts but embody deep Islamic ethical commitments. These traditions create socio-economic bonding that reduces transaction costs, builds trust, and enables collective action precisely the mechanisms needed for successful CE adoption in resource-constrained settings.

From a maqashid al-syariah perspective (higher objectives of Islamic law), the proposed model contributes to five essential protections:

Protection (<i>Hifdz</i>)	How CE + SEC Contributes
Religion (<i>al-din</i>)	CE as stewardship (<i>khalifah</i>) of the earth
Life (<i>al-nafs</i>)	Reduced pollution and health risks
Intellect (<i>al-'aql</i>)	Enhanced CE literacy and innovation capacity
Lineage (<i>al-nasl</i>)	Sustainable environment for future generations
Wealth (<i>al-mal</i>)	Increased income and resource efficiency

This multi-dimensional contribution distinguishes the proposed model from secular CE frameworks, which typically focus on economic and environmental outcomes without explicit attention to spiritual and ethical dimensions.

7. Summary of Key Findings

Research Question	Key Finding	Evidence
What are existing linear practices?	MSMEs generate 12-18 kg/month waste; 88% no formal waste management	Table 1
What are barriers to CE adoption?	Cognitive (88%), structural (76-80%), social (60%)	Table 2
Did the intervention improve outcomes?	CE literacy +85%, adoption 68%, waste -36%, income +Rp1M	Tables 3-6
Does SEC enable CE adoption?	Strong correlation ($r=0.71$ for trust)	Table 7
What model is proposed?	3-phase model with SEC as transversal mechanism	Figure 1, Table 8
How does this align with Islamic economics?	SEC embodies siddiq, amanah, ta'awun, 'an taradin	Table 9

Transition to Conclusion

The findings reported above provide robust empirical evidence that socio-economic bonding serves as a critical enabler of circular economy integration among rural MSMEs. The significant improvements in CE literacy, adoption rates, waste reduction, and income generation coupled with the strong correlations between SEC indicators and adoption outcomes support the proposed model's validity. The following section presents the conclusion, policy implications, limitations, and directions for future research.

Conclusion

This study demonstrates that socio-economic bonding defined as connecting community members through economic interactions grounded in honesty, mutual respect, trust, reciprocity, and collective solidarity serves as a critical enabler of circular economy (CE) integration among rural MSMEs.

First, baseline data confirmed that MSMEs in Desa Alas Kaki operate under a linear system, generating 12–18 kg of inorganic waste monthly, with 88% lacking formal waste management and only 8% demonstrating adequate CE literacy. Second, three major barriers to CE adoption were identified: cognitive (88% low CE literacy), structural (76–80% limited

access to technology and financing), and social (60% low trust in collective action). This confirms that CE adoption is not merely technical but also relational. Third, the three-phase intervention (capacity building, circular innovation, institutional support) produced significant improvements: CE literacy increased by 85% ($p < 0.001$, Cohen's $d = 3.21$), adoption of circular practices reached 68%, waste generation decreased by 36.4%, and additional monthly income ranged from IDR 500,000 to 1,500,000. Fourth, socio-economic bonding significantly facilitated CE adoption, with trust in collective action showing the strongest correlation ($r = 0.71$, $p < 0.001$). Qualitative data revealed that trust reduced innovation risk, reciprocity created mutual accountability, and collective solidarity enabled resource pooling.

From an Islamic economic perspective, socio-economic bonding aligns with *siddiq* (honesty), *amanah* (trustworthiness), *ta'awun* (cooperation), *'an taradin* (mutual consent), and prohibition of *israf* (excessive consumption). The proposed three-phase model contributes to all five protections of *maqashid al-syariah*. For policymakers: Integrate socio-economic bonding into green transformation programs and facilitate trust-building platforms among MSMEs. For MSME practitioners: Leverage local traditions of reciprocity as entry points for circular practices and form collective waste management groups.

For Islamic financial institutions: Develop *mudharabah* and *qardhul hasan* products specifically for CE ventures. This study has limitations: quasi-experimental design without a control group limits causal inference; small sample size ($n=25$) from a single village limits generalizability; three-month intervention captures only short-term outcomes; self-reported data may introduce social desirability bias. Future research should conduct longitudinal studies to assess long-term sustainability, comparative studies across different regions and sectors, experimental designs with control groups to strengthen causal claims, and digitalization studies exploring how fintech might extend trust-based networks. Additionally, comparative studies of indigenous CE traditions across Islamic communities in Southeast Asia and integration of socio-economic bonding into zakat, waqf, and qardhul hasan frameworks are warranted.

This study demonstrates that CE adoption in resource-constrained rural MSMEs is socially constructed through community engagement, trust, and shared values. Socio-economic bonding rooted in local traditions and Islamic ethical principles—enables green transformation by reducing transaction costs, facilitating knowledge sharing, and enabling

collective action. The proposed three-phase model offers a practical, scalable, and culturally grounded framework for designing socially inclusive CE interventions at the village level.

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