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Driving Circular Supply Chains in Street Coffee SMEs: The Role of Bricolage Capability, Frugal Innovation, and Entrepreneurial Leadership

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Abstract

This study examines how bricolage capability shapes circular supply chain (CSC) among street coffee SMEs in the Special Region of Yogyakarta, Indonesia, with frugal innovation as a mediator and entrepreneurial leadership as a moderator. Evidence from resource-constrained street coffee SMEs remains scarce. Data were collected through a structured questionnaire from 143 street coffee business owners and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). Bricolage capability has a significant positive effect on frugal innovation but no significant direct effect on the CSC. Frugal innovation has a significant positive effect on the CSC and fully mediates the relationship between bricolage capability and the CSC, indicating indirect-only mediation. Entrepreneurial leadership significantly moderates both the path from bricolage capability to frugal innovation and the path from frugal innovation to the CSC. Theoretically, improvising with available resources does not strengthen the CSC by itself; it does so only after being converted into frugal innovation, the mechanism through which improvisation translates into circular outcomes. Entrepreneurial leadership acts as a boundary condition at both stages of this conversion. By revealing this two-stage conditional process in an emerging-market SME setting, the study refines understanding of how resource-constrained firms move toward circular supply chains.

Keywords: Bricolage capability, circular supply chain, frugal innovation, entrepreneurial leadership, street coffee SMEs.

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INTRODUCTION

Global supply chains have shifted from a primary focus on cost efficiency toward operational resilience, particularly following disruptions such as the COVID-19 pandemic and geopolitical conflicts (Amos et al., 2021). Firms are increasingly required to adapt to uncertainty through greater visibility and adaptive strategies (Russell & Taylor, 2019; Zheng & Brintrup, 2025). SMEs have been especially vulnerable to these shocks (Camur et al., 2024). In Indonesia, SMEs contribute approximately 61% of national GDP and up to 97% of employment (Ayuningtyas, 2024). Within the food and beverage sector, which comprised about 4.85 million business units and contributed 6.47% to national GDP in 2023 (Badan Pusat Statistik, 2024), coffee consumption has nearly doubled over the past decade to 1.8 kg per capita (Ardilles, 2026). Street coffee businesses have proliferated due to low capital requirements, yet they generate substantial volumes of difficult-to-recycle single-use plastic waste (Haryati, 2021). Circular economy approaches to coffee-related waste have been shown to increase value added by 38–45% while reducing negative externalities by approximately 65% (Djazuli & Tanjung, 2025), underscoring the relevance of circular supply chains (CSC) for this sector.

The core problem is that the businesses producing the greatest volume of this waste are also those with the least capacity to address it. Street coffee SMEs typically operate with limited capital and only a few workers, raising the critical question of how resource-constrained firms can develop circular supply chains. Given their large and growing numbers, the cumulative environmental impact is substantial, while their ability to adopt circular practices remains uncertain. Addressing this issue is therefore urgent, both to mitigate environmental harm and to support the long-term viability of the SMEs that dominate the local economy.

Existing research provides only partial guidance. Studies examining the relationships among bricolage capability, frugal innovation, entrepreneurial leadership, and CSC have predominantly focused on manufacturing or technology-oriented SMEs in contexts such as China, India, and Europe (Ur Rehman et al., 2024; Zhang, 2025). Empirical evidence on small-scale culinary businesses, particularly street coffee SMEs in Indonesia, remains limited. Conceptually, bricolage capability—the ability to improvise with resources at hand (Baker & Nelson, 2005)—may enable resource-constrained firms to develop frugal innovations (Prabhu, 2017), which in turn may support circular practices (Montag et al., 2021). Entrepreneurial leadership may further strengthen these relationships Rumaji & Ilhami (2024), Zhang (2025) provides the closest foundation by showing that bricolage promotes frugal innovation, which supports CSC implementation, with entrepreneurial leadership amplifying both links. However, two critical issues remain unresolved: whether improvisation leads to circularity directly or only through frugal innovation, and whether entrepreneurial leadership conditions both stages under extreme resource scarcity.

Street coffee SMEs in the Special Region of Yogyakarta offer a theoretically important boundary condition for examining these unresolved issues. These micro-scale businesses typically employ one to five workers, rely heavily on local resources, and concentrate decision-making in the owner-manager. Under such conditions, bricolage functions as a daily necessity rather than a deliberate strategic choice, and circular practices must be achieved without formal

systems or significant investment capacity. Testing the proposed relationships in this setting allows the study to determine whether mechanisms observed in better-resourced firms hold under more severe constraints.

Accordingly, this study examines the interplay of bricolage capability, frugal innovation, and entrepreneurial leadership in driving circular supply chains among street coffee SMEs. Specifically, it investigates the effect of bricolage capability on frugal innovation, the direct and indirect effects of bricolage capability on CSC, the effect of frugal innovation on CSC, and the moderating role of entrepreneurial leadership in both the bricolage–frugal innovation and frugal innovation–CSC relationships. The main challenge lies in capturing these mechanisms in micro-scale firms that lack formal systems and operate under severe resource constraints.

This study offers three theoretical contributions. First, it clarifies the role of frugal innovation as the conversion mechanism through which bricolage capability translates into circular supply chain outcomes. Second, it positions entrepreneurial leadership as a boundary condition operating along the entire pathway from improvisation to circularity. Third, by testing these relationships among micro-scale firms with minimal capital and formal systems, it extends bricolage and frugal innovation theory from explaining how resource-constrained firms cope toward explaining how they achieve circular supply chain outcomes (Zhang, 2025). Practically, the findings suggest that street coffee owners cannot rely on improvisation alone; it must be deliberately channeled into simple, low-cost innovations and reinforced by entrepreneurial leadership to manage resource constraints while advancing sustainability-oriented supply chain practices (Rumaji & Ilhami, 2024; Ur Rehman et al., 2024).

METHOD

This study employed a cross-sectional quantitative survey design to test a moderated mediation model in which bricolage capability (BC) predicts the circular supply chain (CSC) both directly and indirectly through frugal innovation (FI), while entrepreneurial leadership (EL) moderates the BC → FI and FI → CSC paths. The unit of analysis was the street coffee business, represented by the owner or primary manager responsible for operational and strategic decisions. The target population consisted of street coffee businesses (mobile carts, booths, and tents) operating across the five administrative areas of the Special Region of Yogyakarta. Because no official register of these businesses exists, a sampling frame could not be constructed and probability sampling was not feasible (Etikan, 2016). Purposive sampling was therefore applied to reach respondents who met predefined eligibility criteria relevant to the study objectives.

Data were collected from 17 May 2026 to 28 June 2026 through direct field visits (using a QR code linked to the online questionnaire), social media platforms, and WhatsApp groups. Eligibility was verified through screening questions requiring respondents to be the owner or primary manager of a street coffee MSME, to maintain relationships with raw-material suppliers, and to have experience with operational adjustments, efficiency or customer-oriented changes, and waste-management or environmentally friendly practices. Only respondents who satisfied all criteria and confirmed their willingness to participate were retained. The final sample comprised 143 complete responses, distributed across Sleman (n = 48), Yogyakarta City (n = 43), Bantul (n = 24), Gunungkidul (n = 15), and Kulon Progo (n = 13). All constructs were measured

using multi-item reflective scales on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), adapted from previously validated instruments. Bricolage capability was measured with eight items (An et al., 2018; Huang et al., 2022), frugal innovation with eight items (Perera & Badir, 2025), circular supply chain with six items (AL - khatib & Ramayah, 2025), and entrepreneurial leadership with eight items (Nor-Aishah et al., 2020). The online questionnaire (Google Forms) presented each construct in a separate section and reminded respondents that there were no right or wrong answers in order to minimize common-method bias.

The hypothesized model was estimated using partial least squares structural equation modeling (PLS-SEM) in SmartPLS 4, an approach appropriate for models that combine mediation and moderation with moderate sample sizes (Hair et al., 2021). All constructs were specified as reflective. The measurement model was assessed through outer loadings, average variance extracted (AVE), composite reliability, Cronbach's alpha, and discriminant validity using both the Heterotrait-Monotrait (HTMT) ratio and the Fornell-Larcker criterion. Multicollinearity and common-method bias were evaluated via inner and full-collinearity variance inflation factor (VIF) values. The structural model was examined using path coefficients, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and standardized root mean square residual (SRMR). Statistical significance was determined through bootstrapping with 5,000 resamples. Mediation was assessed based on the significance of indirect and direct effects, while the interaction terms (EL × BC and EL × FI) were created using the two-stage approach.

RESULTS AND DISCUSSION

Street Coffee Business Profile

Before examining the relationships among the research constructs, it is important to first describe the characteristics of the businesses included in the survey. A total of 143 street coffee businesses met the screening criteria and provided complete, eligible responses, and all subsequent analyses are based on these 143 respondents.

Table 1 summarizes the 143 analyzed businesses by location, operating duration, and respondent role. These characteristics are relevant because street coffee businesses are small-scale, and owners or primary managers are usually directly involved in operational and strategic decisions.

Table 1. Street Coffee Business Profile (N = 143)

Characteristic	Category	Frequency	Percentage
Business Location	Kota Yogyakarta	43	30.10%
	Sleman	48	33.60%
	Bantul	24	16.80%
	Kulon Progo	13	9.10%
	Gunungkidul	15	10.50%
	Total	143	100.00%
Business Duration	< 1 year	44	30.80%
	1-3 years	57	39.90%
	3-5 years	32	22.40%
	> 5 years	10	7.00%

		Total	143	100.00%
Owner/Primary Manager	Yes		143	100%
		Total	143	100.00%

Source: Primary data, processed (2026)

As Table 1 shows, the analyzed businesses were spread across all five administrative areas of the Special Region of Yogyakarta, with Sleman the largest share (33.6%), followed by Kota Yogyakarta (30.1%) and Bantul (16.8%). Most businesses had operated for 1–3 years (39.9%), and 30.8% for less than one year, while only 7.0% had operated for more than five years, indicating a sample of relatively young businesses. All 143 respondents were owners or primary managers, so the informants had direct involvement in business decision-making and were suitable for assessing the practices examined in this study. Because all analyzed respondents met the screening criteria on operational adjustment, efficiency improvement, and waste-management or eco-friendly practices, the sample reflects businesses with prior experience of the practices examined in the model.

Measurement Model Assessment

The measurement model was assessed prior to structural model testing to verify construct validity and reliability. Outer loadings, average variance extracted (AVE), composite reliability, and Cronbach's alpha were examined for all four constructs, with results summarized in Table 2.

Table 2. Measurement Model Results

Construct	Item	Outer loading	t-value	Cronbach's alpha	CR (ρa)	CR (ρc)	AVE
Bricolage capability (BC)	BC1	0.818	31.153	0.928	0.928	0.94	0.664
	BC2	0.816	25.559				
	BC3	0.824	31.853				
	BC4	0.807	23.877				
	BC5	0.785	22.671				
	BC6	0.802	25.184				
	BC7	0.824	27.263				
	BC8	0.841	26.049				
Frugal innovation (FI)	FI1	0.802	19.542	0.926	0.926	0.939	0.658
	FI2	0.815	24.86				
	FI3	0.853	32.818				
	FI4	0.791	21.098				
	FI5	0.806	22.529				
	FI6	0.784	21.345				
	FI7	0.824	25.023				
	FI8	0.814	22.898				
Circular supply chain (CSC)	CSC1	0.809	23.327	0.905	0.908	0.927	0.678
	CSC2	0.815	27.258				

	CSC3	0.841	29.29				
	CSC4	0.82	24.841				
	CSC5	0.819	23.415				
	CSC6	0.836	32.668				
Entrepreneurial leadership (EL)	EL1	0.815	27.505	0.922	0.923	0.936	0.647
	EL2	0.770	18.063				
	EL3	0.814	24.182				
	EL4	0.799	25.594				
	EL5	0.792	19.391				
	EL6	0.809	24.324				
	EL7	0.837	26.031				
	EL8	0.799	19.712				

Note: All loadings are significant at $p < 0.001$ (5,000 bootstrap resamples). CR = composite reliability; AVE = average variance extracted. Source: Processed data from SmartPLS 4.1.1.8, 2026.

Table 2 reports the outer loading of every item together with the reliability and convergent validity of each construct. All 30 items loaded above the 0.70 threshold and were statistically significant ($p < 0.001$). Loadings ranged from 0.785 to 0.841 for BC (lowest BC5, highest BC8), 0.784 to 0.853 for FI (FI6 to FI3), 0.809 to 0.841 for CSC (CSC1 to CSC3), and 0.770 to 0.837 for EL (EL2 to EL7). AVE values (0.647–0.678) exceeded 0.50, and Cronbach's alpha (0.905–0.928), ρa (0.908–0.928), and composite reliability ρc (0.927–0.940) were all above 0.70, so the measurement model satisfies the criteria for convergent validity and internal consistency (Hair et al., 2021). Because all items met the criteria, none was removed.

Table 3. Heterotrait-Monotrait (HTMT)

	BC	CSC	EL	FI
BC				
CSC	0.574			
EL	0.309	0.633		
FI	0.851	0.702	0.469	

Source: Processed Data from SmartPLS 4.1.1.8, 2026

As presented in Table 3, all inter-construct HTMT values remained below the 0.90 threshold, specifically BC–FI = 0.851, FI–CSC = 0.702, and EL–CSC = 0.633, providing evidence that the constructs are empirically distinct (Henseler et al., 2015). Overall model fit was supported by an SRMR of 0.058, which falls within the acceptable range of 0.08 or below (Hu & Bentler, 1999).

Descriptive Statistics

Street coffee business perceptions of all four constructs were measured on a five-point Likert scale. Mean scores were BC = 3.82, FI = 3.75, EL = 3.80, and CSC = 3.60, all in the "High" category (interval 3.40–4.19). These results indicate that street coffee businesses perceive themselves as relatively capable in resource improvisation and frugal innovation and are led by entrepreneurially oriented leaders, but CSC adoption remains the lowest among the four constructs, suggesting room for further improvement.

Hypothesis Testing

Hypothesis testing was conducted via PLS-SEM bootstrapping with 5,000 resamples. Results are presented across four tables covering direct effects, mediation, moderation, and model quality criteria.

Table 4. Direct Effects (H_1, H_2, H_3)

Hypothesis	Relationship	Path Coefficient (β)	T-Stat	p-value	Decision
H_1	BC → FI	0.733	16.085	<0.001	**Supported**
H_2	BC → CSC	0.106	0.762	0.446	**Not Supported**
H_3	FI → CSC	0.372	2.508	0.012	**Supported**

Source: Processed Data from SmartPLS 4.1.1.8, 2026

Table 4 displays the direct effects among the three primary pathways examined in this study. For H_1, bricolage capability exerted a strong and statistically significant positive effect on frugal innovation ($\beta = 0.733$, $T = 16.085$, $p < 0.001$), with a large effect size ($f^2 = 1.602$), indicating that the capacity to improvise with available resources is a powerful predictor of frugal innovation among street coffee businesses. For H_2, bricolage capability showed a positive but statistically non-significant direct effect on the circular supply chain ($\beta = 0.106$, $T = 0.762$, $p = 0.446$); therefore, H_2 was not supported. This result indicates that the study did not obtain sufficient statistical evidence for a direct relationship, and it should not be taken as proof that such a relationship is absent. One plausible explanation is that resource improvisation alone may not be enough to establish circular supply chain practices, since bricolage mainly helps firms cope with resource limitations, whereas a circular supply chain requires these adaptations to be turned into structured and sustainable operational practices. The significant indirect pathway through frugal innovation suggests that bricolage capability is linked to circular supply chain adoption mainly when available resources are converted into innovative, low-cost, and sustainability-oriented solutions. For H_3, frugal innovation exerted a significant positive effect on circular supply chain adoption ($\beta = 0.372$, $T = 2.508$, $p = 0.012$), demonstrating that low-cost, resourceful innovations serve as a meaningful and statistically robust driver of circular supply chain among street coffee businesses in the Special Region of Yogyakarta.

Table 5. Mediation Analysis (H_4)

Hypothesis	Relationship	Path Coefficient (β)	T-Stat	p-value	CI 95%	Decision
H_4	BC → FI → CSC	0.273	2.347	0.019	[0.062, 0.512]	**Supported**

Source: Processed Data from SmartPLS 4.1.1.8, 2026

Table 5 presents the mediation analysis result for H_4. The indirect effect of bricolage capability on circular supply chain through frugal innovation was statistically significant ($\beta = 0.273$, $T = 2.347$, $p = 0.019$), with a 95% confidence interval of [0.062, 0.512] that does not encompass zero, confirming the significance of the mediation effect. Because the corresponding

direct path (BC → CSC) was not statistically significant (β = 0.106, p = 0.446), this pattern is consistent with full mediation (Hair et al., 2021), suggesting that, in this sample, the influence of bricolage capability on the circular supply chain is transmitted through frugal innovation, with no significant direct effect detected. The confidence interval further reinforces the robustness of this indirect effect, as the lower bound of 0.062 confirms a meaningful positive indirect pathway even under the most conservative estimation conditions.

Table 6. Moderation Analysis (H_5, H_6)

Hypothesis	Relationship	Path Coefficient (β)	T-Stat	p-value	Decision
H_5	EL × BC → FI	0.122	4.201	<0.001	**Supported**
H_6	EL × FI → CSC	0.129	2.382	0.017	**Supported**

Source: Processed Data from SmartPLS 4.1.1.8, 2026

Table 6 presents the moderation analysis results for H_5 and H_6. For H_5, the interaction term between entrepreneurial leadership and bricolage capability produced a significant positive moderating effect on frugal innovation (β = 0.122, T = 4.201, p < 0.001). Conditional slope analysis further demonstrates the practical significance of this moderation: the BC-to-FI path coefficient strengthens from β = 0.611 under low entrepreneurial leadership (−1 SD) to β = 0.855 under high entrepreneurial leadership (+1 SD), a difference of 0.244 that underscores the decisive role of leadership quality in amplifying how effectively resource improvisation converts into frugal innovation output. For H6, the interaction term between entrepreneurial leadership and frugal innovation produced a significant positive moderating effect on circular supply chain (β = 0.129, T = 2.382, p = 0.017). Conditional effect analysis reveals that the effect of frugal innovation on circular supply chain is significant at high entrepreneurial leadership (+1 SD: β = 0.501, p < 0.001) and at mean levels (β = 0.372, p = 0.012), but becomes statistically insignificant when entrepreneurial leadership is low (−1 SD: β = 0.244, p = 0.161), identifying entrepreneurial leadership as a critical boundary condition that determines whether frugal innovation effectively translates into circular supply chain adoption.

Table 7. Model Quality Criteria

Construct	R^2	R^2 Adjusted
Frugal Innovation (FI)	0.692	0.686
Circular Supply Chain (CSC)	0.554	0.541

Source: Processed Data from SmartPLS 4.1.1.8, 2026

Table 7 presents the model quality criteria for the two endogenous constructs. The R^2 value for frugal innovation reached 0.692 (adjusted R^2 = 0.686), indicating that the predictor variables in the model collectively account for 69.2% of the variance in frugal innovation, a moderate level (Hair et al., 2021). The R^2 value for circular supply chain was 0.554 (adjusted R^2 = 0.541), meaning that 55.4% of the variance in circular supply chain adoption is explained by the model. The minimal discrepancy between R^2 and adjusted R^2 values for both constructs confirms that the model does not suffer from overfitting, and the overall explanatory power affirms the adequacy of the structural model in capturing the dynamics among bricolage capability, frugal innovation, entrepreneurial leadership, and circular supply chain among street coffee SMEs in Yogyakarta.

Discussion

Bricolage Capability and Frugal Innovation

Bricolage capability had a strong positive effect on frugal innovation ($\beta = 0.733$, $p < 0.001$), and the model explained 69.2% of the variance in frugal innovation. This agrees with the foundational argument that bricolage turns scarce resources into workable solutions Baker & Nelson (2005) and with recent evidence that creative use of scarce resources improves innovation in SMEs (Abid et al., 2023; Magobe et al., 2024). Magobe et al., (2024) is particularly relevant because it studies food and drink SMEs and shows that financial and market constraints push innovative firms toward bricolage, which is in turn linked to higher innovation. Dost et al., (2025) report that entrepreneurial bricolage encourages frugal innovation in Malaysian firms, and Zhang (2025) and Iqbal et al., (2025) reach the same conclusion for Chinese SMEs and for frugal innovation research respectively. Flaminiano (2024) also reports that bricolage supports innovation in small firms in a developing economy.

The street coffee setting explains why the link is strong. Owners operate with little capital and few workers, so substituting inputs, repurposing equipment, and simplifying service are daily practices, and these are the same moves that produce affordable, functional solutions (Hindocha et al., 2021; Prabhu, 2017). The finding also fits the broader mapping of frugal innovation as a multidisciplinary field that links resource constraints to affordable solutions (Dabić et al., 2022). From the dynamic capabilities view, bricolage is the reconfiguring capability and frugal innovation is where it is embedded in products and routines (Teece, 2007). The result extends bricolage theory from manufacturing and technology-based firms (Mateus & Sarkar, 2024) to micro-scale culinary businesses.

Bricolage Capability and Circular Supply Chain

Bricolage capability did not show a statistically significant direct effect on the circular supply chain ($\beta = 0.106$, $p = 0.446$; 95% CI [−0.170, 0.374]), so H_2 was not supported. This indicates that the study did not obtain sufficient statistical evidence for a direct relationship, and it does not show that such a relationship is absent. The confidence interval is wide, and post-hoc power for this path was low (0.35 at $\alpha = 0.05$), so a small direct effect cannot be ruled out. The result differs from Wu et al., (2024), who found a direct positive effect of entrepreneurial bricolage on entrepreneurial performance, and from studies showing that bricolage supports business model renewal and SME performance (Shirokova et al., 2025; Wang et al., 2025). A plausible reason is that these studies examined performance or business-model outcomes, whereas a circular supply chain requires coordinated changes in materials, suppliers, and waste handling.

Research on circular economy adoption in small firms helps explain this gap. Chakraborty et al., (2023) find that SMEs' adoption is shaped by budget limits, customer awareness, and business process clarity, and Bowen et al., (2024) show that UK hospitality SMEs want resource-efficient practices but are often held back by rising costs. Circular supply chain management also depends on integrating circular logic into supply chain operations Carissimi et al., (2023), Garcia - Buendia et al., (2024), Taddei et al., (2022) show that circular practices must be embedded in supply chains

to produce gains. Improvisation may therefore help owners cope with constraints without, by itself, producing the structured practices a circular supply chain involves.

Frugal Innovation and Circular Supply Chain

Frugal innovation had a significant positive effect on the circular supply chain ($\beta = 0.372$, $p = 0.012$), and the model explained 55.4% of its variance. This supports Montag et al., (2021) and AL-khatib & Ramayah, (2025) , who position frugal innovation as a facilitator of circular practices, and it agrees with Perera & Badir (2025) , who find that frugal innovation links innovation sources to circular economy principles in SMEs in emerging economies. Yousaf et al., (2022) similarly report that frugal innovation partly mediates the relationship between innovation networks and organizational innovativeness in the circular economy, and Dost et al., (2025) link frugal innovation to circular economy adoption in Malaysia. A systematic review also shows that frugal innovations oriented toward simplicity and functionality tend to align with circular economy principles (Stober et al., 2022).

The mechanism is easy to see in the street coffee setting. Reusable cups, simpler packaging, and reorganized waste handling are low-cost changes owners can make without formal systems, and they feed circular practices such as reuse and supplier cooperation. The effect is small to medium ($f^2 = 0.099$), so frugal innovation is an important but not the only driver, which fits the substantial direct effect of entrepreneurial leadership on the circular supply chain ($\beta = 0.411$).

The Mediating Role of Frugal Innovation

The indirect effect of bricolage capability on the circular supply chain through frugal innovation was significant ($\beta = 0.273$, 95% CI [0.062, 0.512]), while the direct effect was not. This pattern corresponds to indirect-only mediation (Hair et al., 2021) and it suggests that, in this sample, the influence of bricolage on the circular supply chain is transmitted through frugal innovation, with no significant direct effect detected. It agrees with (Dost et al., 2025), who report that frugal innovation mediates the link between entrepreneurial bricolage and circular economy adoption, and with Perera & Badir (2025) and Iqbal et al., (2025) on the mediating role of frugal innovation. It differs from Zhang (2025) , who found that bricolage retained a direct effect in Chinese SMEs. A plausible reason is the much smaller scale and informality of the businesses studied here, although this explanation was not tested.

Theoretically, this refines the dynamic capabilities view: reconfiguring resources matters for sustainability outcomes mainly when it is converted into new solutions, consistent with the argument that capabilities create value through how they are deployed (Teece, 2007). Because the data are cross-sectional, the mediation reflects statistical association and should not be read as established causal ordering.

The Moderating Role of Entrepreneurial Leadership

Entrepreneurial leadership strengthened both conversion stages: the link between bricolage capability and frugal innovation (interaction $\beta = 0.122$, $p < 0.001$) and the link between frugal innovation and circular supply chain (interaction $\beta = 0.129$, $p = 0.017$). Simple slope analysis shows that the effect of frugal innovation on the circular supply chain was $\beta = 0.501$ ($p < 0.001$)

when entrepreneurial leadership was one standard deviation above the mean, but $\beta = 0.244$ ($p = 0.161$) when it was one standard deviation below, where it was no longer significant. The effect of bricolage capability on frugal innovation was positive at both levels ($\beta = 0.611$ at −1 SD; $\beta = 0.855$ at +1 SD).

This agrees with studies in which leadership shapes the use of bricolage and innovation outcomes, Shirokova et al., (2025) find that entrepreneurial leadership mitigates the negative indirect effect of bricolage on SME performance through ambidexterity, and Owoseni et al., (2025) link leadership to circular economy practices in SMEs. Entrepreneurial leadership has also been linked to creativity and innovative behavior Mehmood et al., (2021), Rumaji & Ilhami (2024), to open innovation through supportive leadership Wiroonrath et al., (2024), and, in its green form, to firm performance and green product innovation (Asad et al., 2024). Sustainable leadership orientation has been identified as a precondition for frugal innovation in SMEs Ur Rehman et al., (2024), and Iqbal et al., (2025) connect leadership to frugal innovation and sustainable development. In micro-scale firms the owner decides on resource allocation and supplier choice, so leadership shapes whether improvised solutions are consolidated into routines and carried into supply chain practice (Yasmeen et al., 2025).

Two cautions apply. Both interaction effects are small ($f^2 = 0.062$ and 0.038) and the bootstrap confidence intervals are wide, so the magnitude of moderation should not be overstated. Entrepreneurial leadership also had a significant direct effect on the circular supply chain, so it acts both as an independent driver and as a boundary condition.

CONCLUSION

This study provides empirical clarity on how street coffee SMEs in Yogyakarta can progress toward circular supply chains under severe resource constraints. The findings show that bricolage capability does not exert a significant direct effect on circular supply chain outcomes; its influence operates fully through frugal innovation as a conversion mechanism. This full mediation result is theoretically significant, indicating that resource improvisation must first be transformed into deliberate, low-cost innovations before sustainable supply chain practices can emerge. Entrepreneurial leadership further functions as a critical boundary condition that strengthens both the translation of bricolage into frugal innovation and the subsequent effect of frugal innovation on circular supply chain adoption. Practically, these results suggest that street coffee owners should deliberately channel improvisation into simple, affordable innovations such as reusable or biodegradable packaging, coffee-waste reuse, and supplier collaboration on circular materials, while simultaneously developing entrepreneurial leadership competencies. Local government and business development agencies can support this transition by combining access to sustainable inputs and circular packaging incentives with targeted entrepreneurial leadership training rather than relying solely on capital assistance.

Several limitations should be acknowledged. The use of purposive sampling restricted to businesses with prior sustainability-related experience, the cross-sectional design, and reliance on single-respondent self-reports limit causal inference and generalizability. Future research should employ longitudinal or multi-wave designs, incorporate multi-source or objective indicators of circular practices, and test the model with larger, more diverse samples of micro-

enterprises across different informal food and beverage sectors and emerging economies to examine the robustness of the indirect-only mediation pattern and the boundary role of entrepreneurial leadership.

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