Economics, Business, Accounting & Society Review
Volume 5, Nomor 1, p. 27 - 36
ISSN 2810-0115

Frugal Innovation as a Mediating Mechanism between Strategic Flexibility, Sustainability Orientation, and Operational Performance

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ARTICLE INFO
Article history:
Received 28 December 2025
Revised 14 January 2026
Accepted 05 February 2026
Available Online 16 February 2026

Keywords:
Frugal Innovation
Strategic Flexibility
Sustainability Orientation
Operational Performance
F&B SMEs

Cite as:
Labanie, A., & Pusparini, E. S. (2026). Frugal Innovation as a Mediating Mechanism between Strategic Flexibility, Sustainability Orientation, and Operational Performance. Economics, Business, Accounting & Society Review, 5(1). https://doi.org/10.55980/ebasr.v5i1.312

ABSTRACT
Recent studies recognize innovation as a critical pathway for strengthening SME competitiveness and resilience. This study investigates how food and beverage SMEs improve operational performance by transforming strategic flexibility and sustainability orientation into practical, cost-efficient innovation practices. In highly competitive and resource-constrained environments, SMEs must balance efficiency, adaptability, and increasing sustainability expectations. The research focuses on frugal innovation as a pragmatic approach that emphasizes simplicity, affordability, and optimal resource utilization in daily operations. A quantitative research design was employed using survey data collected from owners and operational managers of food and beverage SMEs in the Jabodetabek region. The constructs were measured using established Likert-scale instruments adapted from prior studies. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), which enables simultaneous assessment of measurement reliability and structural relationships among variables. This approach allows for examining both direct and indirect effects within a mediation framework. The findings indicate that strategic flexibility and sustainability orientation contribute to the development of frugal innovation practices. In turn, frugal innovation significantly enhances operational performance by improving efficiency, reducing operational waste, and strengthening process effectiveness. The results confirm that performance improvements emerge when strategic intentions are translated into concrete, resource-aware innovations. This study contributes by providing empirical evidence that frugal innovation serves as a practical mechanism linking strategic orientation to superior operational outcomes in resource-constrained SMEs.

1. Introduction

Small and Medium Enterprises (SMEs) play a central role in the Indonesian economy, contributing 61% of national GDP and employing more than 117 million workers (Febrianda et al., 2025; Wardaya et al., 2019). Within this landscape, the food and beverage (F&B) sector represents the

largest segment, with more than 4.85 million business units concentrated mainly in urban areas such as Jabodetabek (Lussak et al., 2020). Despite their economic significance, F&B SMEs face structural vulnerabilities. A limited proportion possess formal business licenses or Halal and SNI certification (Ministry of Cooperatives and SMEs, 2023), and a substantial share discontinue operations within the first five years. These conditions highlight the urgency of strengthening strategic capabilities that support resilience and sustained performance under resource constraints.

F&B SMEs operate in highly competitive and uncertain environments. They experience thin profit margins, intense rivalry, and pressure from digital food delivery platforms, which force entrepreneurs to prioritize cost efficiency and daily operational control (Dhewanto et al., 2021; Upe & Aswan, 2022). Rapid environmental change requires continuous adjustment of strategies and resource allocation (Chen et al., 2021). However, many SMEs remain focused on short-term survival, emphasizing cash flow stability and customer retention rather than long-term strategic development (De Leede et al., 2020). In this context, operational performance becomes critical. Firms must improve efficiency, optimize resource use, reduce lead times, and maintain product quality to remain competitive (Kumar et al., 2025).

At the same time, F&B SMEs encounter increasing institutional and societal pressure to adopt sustainable practices (Wang et al., 2023). Sustainability initiatives often demand financial and organizational commitment, which many SMEs perceive as costly (Lamoureux et al., 2019; Wang et al., 2023). This dual pressure intensifies uncertainty because firms must pursue efficiency while responding to environmental and social expectations. Strategic Flexibility (SF) becomes essential in enabling firms to reconfigure resources and adjust operations in turbulent conditions (Shimizu & Hitt, 2004). Sustainability Orientation (SO) provides direction by integrating economic, social, and environmental considerations into strategy (Al-Shuridah & Ndubisi, 2023; Tardin et al., 2024). Yet, efficiency strategies and sustainability commitments alone may not generate measurable performance improvements (Utami et al., 2024).

Frugal Innovation (FI) emerges as a relevant approach that emphasizes cost reduction, functional simplicity, and stakeholder collaboration (Rossetto et al., 2023). Evidence shows that FI enhances firm performance (Singh et al., 2025), but limited research explains how strategic flexibility and sustainability orientation stimulate its development in resource-constrained contexts. The influence of SO on FI remains ambiguous, especially when sustainability investments appear to conflict with cost minimization. Likewise, the direct contribution of SF to FI and operational performance requires further empirical clarification. Therefore, this study examines how Strategic Flexibility and Sustainability Orientation influence Operational Performance through the mediating role of Frugal Innovation among F&B SMEs in Jabodetabek.

Conceptual Framework

From the perspective of Resource-Based View (RBV), firms achieve superior performance when they possess valuable, rare, inimitable, and non-substitutable (VRIN) resources (Bhandari et al., 2020; D'Oria et al., 2021). In this study, Frugal Innovation is conceptualized as a strategic capability that embodies these VRIN attributes. FI enables SMEs to generate efficiency, cost reduction, and customer value simultaneously (Qin, 2024). However, RBV alone does not sufficiently explain how such capabilities emerge under turbulent and resource-scarce conditions (Kosiol et al., 2023).

Therefore, Dynamic Capabilities Theory (DCT) provides the process-oriented explanation (Rohani et al., 2021). Strategic Flexibility (SF) represents a dynamic capability that allows firms to sense environmental changes, seize opportunities, and reconfigure resources efficiently. In volatile F&B markets characterized by digital platform competition and shifting consumer demand, SF becomes the mechanism through which firms develop frugal solutions (Watson et al., 2021). DCT thus explains how strategic agility enables the formation of FI as an operational capability.

Meanwhile, Triple Bottom Line (TBL) introduces the normative and strategic dimension of sustainability. Sustainability Orientation (SO) reflects the integration of economic, social, and environmental considerations into business strategy. However, in survival-driven SMEs, the translation of sustainability commitments into tangible innovation outcomes is not automatic. The TBL framework suggests that long-term value creation requires balancing profitability with

environmental and social responsibility, yet this balance may be constrained by limited financial capacity

This research advances theory by clarifying the mechanisms through which sustainability orientation and strategic adaptability shape frugal innovation and ultimately enhance operational performance in emerging economy SMEs. By focusing on F&B SMEs in Jabodetabek a highly dynamic, digitally integrated, yet under-resourced context this research offers timely empirical evidence on the boundary conditions of sustainability-led innovation in emerging economies.

Hypothesis Development

Effect of Sustainability Orientation (SO) on Frugal Innovation (FI)

Sustainability Orientation (SO) plays a central role in encouraging firms to design products, services, and processes that prioritize resource efficiency, environmental stewardship, and affordability three pillars that strongly characterize Frugal Innovation (FI). Prior studies (Albert, 2019) highlight that FI is intrinsically aligned with sustainability principles, including waste minimization, functional efficiency, and reduced environmental impact. Empirical evidence further demonstrates that organizations with a strong sustainability orientation tend to exhibit higher levels of innovation performance because they pursue long-term efficiency, risk mitigation, and corporate social responsibility (Behnam et al., 2018; Jin et al., 2019).

Moreover, a direct influence on FI but also fosters an organizational culture that embraces constraint-based innovation and sustainability-driven creativity. Complementing these findings, Iqbal et al. (2025) show that sustainability-oriented leadership strengthens diversified knowledge-sharing mechanisms across internal and external networks, thereby stimulating FI. Collectively, these studies indicate that SO shapes both the technological and cultural foundations required to build a cost-efficient, inclusive, and sustainability-oriented innovation ecosystem particularly relevant within resource-constrained SMEs. Thus, the following hypothesis is proposed:

H1: Sustainability Orientation positively influences Frugal Innovation.

Effect of Strategic Flexibility (SF) on Frugal Innovation (FI)

Strategic Flexibility (SF) represents an organization's ability to rapidly adapt, reconfigure, and redeploy resources to respond to market turbulence, technological shifts, and regulatory uncertainty. Foundational studies (Zhou & Wu, 2010) and more recent evidence Awais et al., (2023) consistently demonstrate that strategic flexibility enhances a firm's responsiveness, enabling the development of innovative solutions under resource constraints an essential characteristic of FI.

Organizations with higher levels of SF are better equipped to iteratively adjust product features and operational processes, which is fundamental for frugal product development. Further, the pivotal role of SF in enabling FI, particularly among SMEs that must navigate competitive pressures while operating with limited financial and technological assets. Similarly, Awais et al. (2023), through a PLS-SEM approach in project-based organizations, demonstrate that SF enhances innovation outcomes and organizational performance by serving as a mechanism for efficient resource mobilization and adaptation. These findings collectively indicate that SF is not only a dynamic capability but also a strategic antecedent that facilitates affordable, simple, and sustainable innovation. Thus, the following hypothesis is proposed:

H2: Strategic Flexibility positively influences Frugal Innovation.

Effect of Frugal Innovation (FI) on Operational Performance (OP)

Frugal Innovation (FI) has been recognized as a key driver of operational excellence due to its focus on cost efficiency, functional simplicity, and resource optimization. Weyrauch & Herstatt (2017) and Zeschky et al. (2014) demonstrate that FI enables firms to reduce production costs, shorten development cycles, and improve customer satisfaction by prioritizing essential functionalities and avoiding unnecessary complexity.

Rossetto et al. (2023) provide empirical evidence that FI enhances various operational performance indicators including lead time, resource utilization, and output quality particularly in organizations facing budgetary constraints and efficiency pressures. Further strengthening this perspective, Berndt et al. (2023), using structural equation modeling on a sample of 154 Brazilian firms, confirm that FI exerts a significant and positive effect on operational performance. They argue that FI acts as a transformative mechanism linking organizational capabilities with superior

efficiency, quality, and competitiveness. These findings collectively establish FI not merely as a technical solution but as a strategic orientation vital for coping with crises, improving operational resilience, and delivering affordable value to the market. Thus, the following hypothesis is proposed:

H3: Frugal Innovation positively influences Operational Performance.

Mediating Role of Frugal Innovation (FI) between Sustainability Orientation (SO) and Operational Performance (OP)

Sustainability Orientation (SO) lays the conceptual and operational foundation for the adoption of frugal approaches that promote resource efficiency and operational sustainability. As Albert (2019) and Pansera (2018) emphasize, FI aligns seamlessly with sustainability pillars, particularly waste reduction and the optimization of material and energy use. Additionally, Iqbal et al. (2025) assert that sustainability-oriented leadership fosters a knowledge-rich environment that enhances productivity, operational efficiency, and innovative outcomes. Given that FI is an effective mechanism through which sustainability-driven strategies translate into operational improvements, its mediating role becomes crucial. Thus, the following hypothesis is proposed:

H4: Frugal Innovation mediates the positive relationship between Sustainability Orientation and Operational Performance.

Mediating Role of Frugal Innovation (FI) between Strategic Flexibility (SF) and Operational Performance (OP)

Strategic Flexibility (SF) enhances a firm's ability to experiment, adapt, and reallocate resources effectively, which in turn enables the development of frugal solutions that align with market needs under resource constraints. Awais et al. (2023) show that SF contributes positively to innovation capability and operational efficiency, particularly in dynamic business environments. Sacanamboy-Trujillo & Escandón-Barbosa (2025) reaffirm that SF serves as a fundamental capability for generating FI, which subsequently strengthens operational performance by enabling cost-efficient and functionally optimized outcomes. Thus, FI is positioned as a strategic mechanism through which SF can influence operational excellence. Thus, the following hypothesis is proposed:

H5: Frugal Innovation mediates the positive relationship between Strategic Flexibility and Operational Performance.

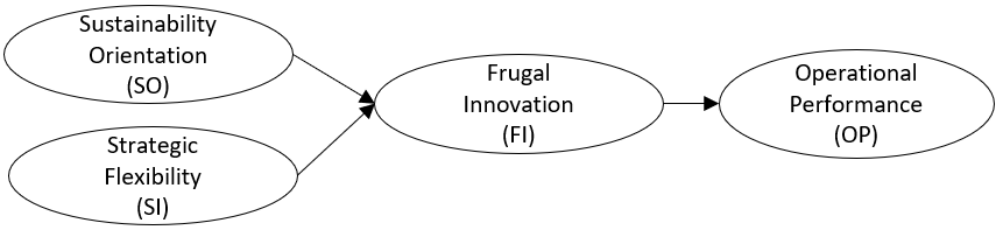

Figure 1. Research Framework

2. Methods

This study employs a quantitative approach using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test the proposed hypotheses. The research model includes four latent variables: Strategic Flexibility (SF) and Sustainability Orientation (SO) as exogenous constructs; Frugal Innovation (FI) as a mediating variable; and Operational Performance (OP) as the endogenous construct. All constructs are reflective and measured using established Likert-type scales adapted from prior literature.

The population consists of F&B SMEs in the Jabodetabek region (Jakarta, Bogor, Depok, Tangerang, Bekasi). Respondents were owners or operational managers of businesses with at least five employees and a minimum operational period of one year. This criterion ensures organizational stability and meaningful engagement with strategic capabilities. Data were collected through online and offline surveys using Google Forms, WhatsApp, social media and on-site visits. A total of 103

valid responses were obtained after pre-testing and refinement, exceeding the recommended 10:1 ratio for PLS-SEM.

The measurement scales for all constructs were adapted from established instruments in the literature. Frugal Innovation (FI) was operationalized as a multidimensional construct comprising three dimensions: substantial cost reduction, focus on core functionality, and sustainable shared engagement, following the conceptualization by Rossetto et al. (2023). Operational Performance (OP) was measured using six indicators adapted from Calantone, Cavusgil, & Zhao (2002), covering delivery time, speed of new product introduction, specification compliance, product mix flexibility, unit cost efficiency, and volume flexibility. Strategic Flexibility (SF) was assessed using the scale developed by Zhou and Wu (2010), which captures a firm's ability to reallocate resources and adjust strategies in response to environmental shifts, as contextualized in Sacanamboy-Trujillo (2025). Sustainability Orientation (SO) was measured using items from Santos et al. (2022) and Eide et al. (2020), reflecting the integration of economic, social, and environmental values into core business strategy, consistent with the Triple Bottom Line framework applied in Sacanamboy-Trujillo (2025). All items were measured on a 7-point Likert scale (1 = totally disagree to 7 = totally agree).

Data analysis was conducted using SmartPLS 3.2.9. The evaluation followed a two-stage approach: (1) assessment of the measurement model (outer model) for reliability (Cronbach's Alpha > 0.7, Composite Reliability > 0.7) and validity (outer loadings > 0.7, AVE > 0.5, discriminant validity via HTMT < 0.9); and (2) assessment of the structural model (inner model) through path coefficients, R^2, Q^2, f^2, and bootstrapping (5,000 subsamples) to test direct and indirect effects. The hypotheses are implicitly stated through the model's directional relationships.

3. Results

The measurement model demonstrates excellent reliability and validity. All outer loadings exceed 0.833, with the highest at 0.966 (SO1). Cronbach's Alpha and Composite Reliability are above 0.931, and AVE values range from 0.722 (FI) to 0.913 (SO), confirming strong convergent validity. Discriminant validity is established, as all HTMT values are below the conservative threshold of 0.96.

Table 1. Outer Loading (n = 103)

Variable	Dimension	Indicator	Outer Loading
Frugal Innovation	Cost Reduce	FI-B1	0.934
		FI-B2	0.905
		FI-B3	0.902
		FI-B4	0.833
	Core Functionality	FI-F1	0.850
		FI-F2	0.891
		FI-F3	0.876
	Sustainable engangement	FI-K1	0.924
		FI-K2	0.949
		FI-K3	0.843
Operational Performance		OP1	0.854
		OP2	0.865
		OP3	0.883
		OP4	0.850
		OP5	0.880
		OP6	0.845
Strategic Flexibility		SF1	0.905
		SF2	0.904
		SF3	0.863
		SF4	0.935
		SF5	0.882
		SF6	0.929
Sustainability Orientation		SO1	0.966
		SO2	0.941
		SO3	0.959

Cronbach's Alpha and Composite Reliability are above 0.700, and AVE values range from 0.722 (FI) to 0.913 (SO), confirming convergent validity.

Table 2. Construct Reliability and Convergent Validity (n = 103)

Variable	Dimension	CA	CR	AVE
Frugal Innovation	Cost Reduce	0.957	0.963	0.722
	Core Functionality	0.957	0.963	0.722
	Sustainable Engagement	0.957	0.963	0.722
Operational Performance		0.931	0.946	0.745
Strategic Flexibility		0.955	0.964	0.816
Sustainability Orientation		0.952	0.969	0.913

Discriminant validity is established as all HTMT (Heterotrait-Monotrait ratio) values are below the conservative threshold of 0.85. The highest HTMT value observed is 0.960 between Frugal Innovation (FI) and Operational Performance (OP), which, while slightly exceeding 0.85, remains below the more lenient criterion of 0.90 commonly accepted in PLS-SEM when constructs are theoretically and empirically closely related. Given that FI is posited as a direct antecedent of OP in the conceptual model, a high correlation is theoretically expected. Nevertheless, all other HTMT values such as 0.943 (FI–SF), 0.916 (OP–SF), 0.817 (FI–SO), and 0.821 (OP–SO) fall within acceptable ranges, confirming that each construct captures a distinct concept and demonstrating adequate discriminant validity for the measurement model.

Tabel 3. Discriminant Validity (HTMT, n = 103)

	FI	OP	SF	SO
Frugal Innovation				
Operational Performance	0.960			
Strategic Flexibility	0.943	0.916		
Sustainability Orientation	0.817	0.821	0.786	

Tabel 4. R-Square

	R Square	R Square Adjusted
FI	0.877	0.872
OP	0.823	0.821

The structural model exhibits strong explanatory power, with $R^2 = 0.877$ for Frugal Innovation and $R^2 = 0.823$ for Operational Performance, both indicating substantial predictive relevance. The key findings are summarized in Table 4. Model fit is adequate, with SRMR = 0.075 (< 0.08), which meets the recommended threshold for acceptable model fit in PLS-SEM.

Table 5. Path Coefficients and Mediation Effects (n = 103)

Hypothesized Path	β	95% Confidence Interval		t Value	p Values	Significance
		Lower	Upper			
FI -> OP	0.907	0.687	0.966	10.512	0.000	***
SF -> FI	0.469	0.290	0.661	4.861	0.000	***
SO -> FI	0.191	0.037	0.291	2.893	0.004	***
SF -> FI -> OP (indirect)	0.426	0.251	0.591	4.725	0.000	***
SO -> FI -> OP (indirect)	0.173	0.027	0.270	2.773	0.006	***

Notes: *** p < 0.01.

The results show that Strategic Flexibility significantly and positively influences Frugal Innovation ($\beta = 0.469$, $p < 0.001$), and Sustainability Orientation also has a significant positive effect ($\beta = 0.191$, $p = 0.004$). In turn, FI has a very strong positive effect on Operational Performance ($\beta = 0.907$, $p < 0.001$). Both indirect effects (SF → FI → OP and SO → FI → OP) are significant, confirming the full mediating role of FI.

4. Discussion

This study addresses the research gap regarding how sustainability orientation and strategic flexibility translate into measurable operational performance in SMEs. Prior research emphasizes Sustainability Orientation as a strategic commitment that shapes organizational practices (Al-Shuridah & Ndubisi, 2023; Tardin et al., 2024), yet it does not clearly explain how this orientation improves operational outcomes under resource constraints. The findings show that Sustainability Orientation significantly supports the development of Frugal Innovation, which aligns with evidence that sustainability-driven business pursue efficiency and responsible value creation (Wang et al., 2023).

Strategic Flexibility also demonstrates a strong positive effect on Frugal Innovation, which supports the argument that flexible resource reconfiguration enables adaptive strategic responses in turbulent environments (Shimizu & Hitt, 2004; Chen et al., 2021). These results confirm that adaptability and Sustainability Orientation alone do not directly enhance operational performance. Instead, firms must convert these orientations into practical innovation practices that simplify processes and optimize resource use. This mechanism clarifies the missing link in prior studies that often treat Strategic Orientation and performance as directly connected.

The results further reinforce the combined logic of the Resource-Based View and Dynamic Capabilities Theory. Frugal Innovation exerts a strong positive effect on operational performance, which indicates that it functions as a valuable and performance-enhancing capability (D'Oria et al., 2021; Kosiol et al., 2023). This finding supports the view that resources generate superior outcomes only when firms deploy them through effective actions (Bhandari et al., 2020). Strategic Flexibility enables firms to sense and respond to environmental shifts, which reflects the dynamic capability perspective (Rohani et al., 2021). The significant mediating effects confirm that Strategic Flexibility and Sustainability Orientation influence performance indirectly through innovation-based transformation. This pattern aligns with evidence that innovation and operational improvement determine SME survival and competitiveness (Lussak et al., 2020; Upe & Aswan, 2022). Therefore, this study advances theory by demonstrating that Frugal Innovation operationalizes strategic and sustainability orientations into concrete operational excellence within resource-constrained SMEs.

5. Conclusion

This study examines how F&B SMEs can improve operational performance while facing resource constraints, intense competition, and rising sustainability pressures. Although Strategic Flexibility and Sustainability Orientation are often recognized as important drivers of firm success, their direct contribution to operational outcomes remains unclear. This research demonstrates that Frugal Innovation serves as the critical mechanism that translates these strategic orientations into tangible performance improvements. The findings show that Strategic Flexibility enhances a firm's ability to adapt and reconfigure resources, while Sustainability Orientation provides direction toward responsible and efficient business practices. However, neither orientation alone is sufficient to generate superior performance. Operational improvement occurs when firms convert adaptability and sustainability commitment into simple, cost-efficient, and functionally focused innovation practices. Frugal Innovation enables SMEs to reduce waste, optimize processes, and deliver value without increasing operational complexity. Theoretically, this study strengthens the integration of Resource-Based View and Dynamic Capabilities Theory by showing that strategic resources create value only when enacted through appropriate innovation mechanisms. Practically, the results suggest that SME support policies should emphasize adaptive capability development and frugal innovation practices. By doing so, SMEs can achieve resilience, competitiveness, and sustainability simultaneously in demanding market environments.

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