ICoBLAST
International Conference on Vocational Business, Logistics, Accounting, Supply Chain, and Tax

THE INDIRECT ROLE OF GREEN LEADERSHIP IN PROMOTING ECO-FRIENDLY OPERATIONS THROUGH GREEN INNOVATION AND SUPPLY CHAIN PRACTICES

Pratami Wulan Tresna

Business Administration, Universitas Padjadjaran, Indonesia
(pratami@unpad.ac.id)

Nurillah Jamil Achmawati Novel

Vocational School, Universitas Padjadjaran, Indonesia
(nurillah@unpad.ac.id)

R. Marsha Aulia Hakim

Business Administration, Universitas Padjadjaran, Indonesia
(marsha.aulia@unpad.ac.id)

Arbi Abdul Kahfi

Business Administration, Universitas Padjadjaran, Indonesia
(arbi@unpad.ac.id)

Hardian Eko Nurseto

Anthropology, Universitas Padjadjaran, Indonesia
(hardian.e.nurseto@unpad.ac.id)

Sharon Ong Yong Yee

Univerisiti Putra Malaysia, Malaysia
(sharon.ong@upm.edu/my)

ABSTRACT

Introduction/Main Objectives: The increasing urgency of sustainability has drawn attention to the implementation of eco-friendly operations (EFO) in business sectors worldwide. In Bandung Raya, Indonesia, the culinary industry faces growing pressure to adopt environmentally responsible practices due to consumer awareness, stricter environmental regulations, and competitive market dynamics. This study aims to examine how green leadership (GL) promotes EFO, particularly through the mediating roles of green innovation (GI) and green supply chain management (GSM).
Background Problems: Although leadership is acknowledged as a driver of sustainability, empirical evidence remains limited regarding how GL indirectly influences eco-friendly

operations through innovation and supply chain mechanisms. Therefore, this research addresses the question: Does green leadership influence eco-friendly operations directly, or is it mediated by green innovation and green supply chain management?
Novelty: This study contributes to sustainability and leadership literature by developing an integrated model that examines the indirect pathways linking GL, GI, GSM, and EFO, an area that remains underexplored, especially within the context of small and medium-sized enterprises in the Indonesian culinary sector.
Research Methods: A quantitative approach using Partial Least Squares Structural Equation Modeling (PLS-SEM) was applied to analyze data collected from structured questionnaires. Measurement validity and reliability were tested using outer loadings, composite reliability, and average variance extracted to ensure robust model evaluation.
Findings/Results: The results indicate that GL does not directly influence EFO ($\beta = 0.045$, $p = 0.701$) but significantly affects GI ($\beta = 0.821$, $p < 0.001$) and GSM ($\beta = 0.814$, $p < 0.001$), both of which positively impact EFO (GI → EFO: $\beta = 0.362$, $p = 0.005$; GSM → EFO: $\beta = 0.435$, $p = 0.001$). Mediation analysis confirms significant indirect effects of GL through GI ($\beta = 0.297$, $p = 0.010$) and GSM ($\beta = 0.354$, $p = 0.002$).
Conclusion: Green leadership alone is insufficient to directly enhance eco-friendly operations; however, when reinforced by innovation and sustainable supply chain practices, it becomes a powerful enabler of organizational sustainability.
Implementation Potential: The findings highlight the importance of integrating leadership development with innovation and supply chain strategies to achieve eco-friendly operations. These insights can guide industry practitioners and educators in designing leadership training, innovation initiatives, and logistics systems aligned with sustainability goals.

Keywords: *Green Leadership, Green Innovation, Green Supply Chain Management, Eco-Friendly Operations, Culinary Industry*

1. INTRODUCTION

The increasing urgency of sustainability has shifted global attention toward the integration of eco-friendly practices across business sectors, including the culinary industry. In Indonesia, the food and beverage sector contributes significantly to national waste production. According to the Ministry of Environment and Forestry (KLHK, 2023), approximately 18.9 million tons of food waste are generated annually, with a large proportion originating from the culinary sector. Reports from Sustainable Waste Indonesia (SWI, 2022) further reveal that over 60% of waste in landfills is organic waste, primarily from restaurants and catering businesses. These figures underline the pressing need for sustainable transformation in the culinary industry.

In West Java, Indonesia’s most dynamic culinary hub, businesses face growing demands from consumers, regulators, and markets to operate sustainably. However, the adoption of eco-friendly and zero-waste practices remains inconsistent, hindered by limited awareness, financial constraints, and lack of strategic leadership. In this context, green leadership (GL) and green innovation (GI) emerge as pivotal drivers of change. Green leaders inspire organizational commitment toward sustainability by promoting environmentally oriented strategies, resource efficiency, and process innovation (Chen et al., 2021; Tang et al., 2022).

In recent years, the urgency for sustainability has become a global priority, with particular attention to the environmental impact of the food and beverage sector. In the Bandung Raya area, which includes cities such as Bandung, Cimahi, and other surrounding areas, the culinary industry has become a significant contributor to waste generation. According to the Ministry of Environment and Forestry (KLHK, 2023), food waste in the region is substantial, with many local businesses, from small eateries to large restaurant chains, facing increasing pressure to adopt environmentally responsible practices.

This study focuses on small and medium-sized enterprises (SMEs) within the Bandung Raya culinary industry, examining the role of green leadership (GL) in fostering eco-friendly operations (EFO). In the Bandung Raya context, where innovation and sustainability are increasingly becoming competitive differentiators, the local culinary businesses are under pressure from not only consumer awareness but also local regulations and market dynamics. This research investigates how green leadership influences eco-friendly operations, particularly through the mediating roles of green innovation (GI) and green supply chain management (GSM), with a focus on the specific characteristics and challenges faced by Bandung Raya's culinary SMEs.

Despite its importance, the mechanisms through which leadership fosters eco-friendly operations are still underexplored, particularly the indirect pathways mediated by green innovation and green supply chain management (GSM). This study investigates how GL indirectly promotes eco-friendly operations (EFO) through innovation and sustainable supply chain practices, focusing on small and medium-sized culinary enterprises in Bandung Raya, West Java.

2. LITERATURE REVIEW

a) Green Leadership (GL)

Green leadership refers to a leader's ability to integrate environmental values into business vision, strategy, and behavior. Rooted in transformational leadership theory (Bass, 1999), green leadership emphasizes idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration, each of which is aimed at fostering pro-environmental attitudes among employees. Chen et al. (2021) identified that green transformational leadership significantly enhances firms' green performance by embedding sustainability in corporate culture and employee behavior.

b) Green Innovation (GI)

Green innovation encompasses both **green product innovation** (designing environmentally friendly products) and **green process innovation** (reducing pollution and resource consumption in production). Prior studies have demonstrated that GI enhances competitive advantage and environmental performance simultaneously (Ghisellini et al., 2016). In the culinary context, GI can manifest through waste-to-resource transformation, biodegradable packaging, and renewable energy utilization.

c) Green Supply Chain Management (GSM)

GSM integrates sustainability principles throughout the supply chain, from sourcing to distribution. It emphasizes supplier collaboration, environmental compliance, green logistics, and waste reduction (Srivastava, 2007). Effective GSM reduces ecological footprints while improving operational efficiency and brand image. Studies such as Tang et al. (2022) have found that GSM mediates the relationship between leadership and operational sustainability by aligning strategic environmental goals across the value chain.

d) Eco-Friendly Operations (EFO)

EFO represents operational activities that minimize negative environmental impacts through efficient resource use, waste reduction, and eco-conscious decision-making (Unilever Foundation, 2022). For culinary businesses, this involves implementing composting systems, energy-efficient kitchen equipment, and eco-friendly packaging.

e) Hypotheses Development

Drawing from the above theoretical framework, this study proposes that:

H1: Green leadership directly influences eco-friendly operations.

H2: Green innovation positively affects eco-friendly operations.

H3: Green supply chain management positively affects eco-friendly operations.

H4: Green leadership positively influences green innovation and green supply chain management.

H5: Green innovation and green supply chain management mediate the relationship between green leadership and eco-friendly operations.

3. RESEARCH METHOD

This study adopts a **quantitative explanatory research design** supported by survey-based data collection. A **mixed-methods approach** was initially applied at the proposal stage, combining qualitative interviews and quantitative modeling; however, this paper focuses on the quantitative PLS-SEM analysis.

a. Data Collection

Primary data were collected from **owners and managers of culinary businesses in Bandung Raya, West Java**, through structured questionnaires distributed between April and June 2025. Sampling was conducted using a **purposive sampling technique**, targeting firms that had adopted or were transitioning toward eco-friendly practices.

b. Measurement

All constructs were measured reflectively:

1) **Green Leadership (GL)** – 17 items across four dimensions: Idealized Influence, Inspirational Motivation, Intellectual Stimulation, and Individualized Support.
2) **Green Innovation (GI)** – 16 indicators representing Green Product and Green Process Innovation.
3) **Green Supply Chain Management (GSM)** – 7 indicators across compliance, collaboration, distribution, and resource systems.
4) **Eco-Friendly Operations (EFO)** – 6 indicators assessing waste reduction, resource efficiency, and environmental compliance.

Each item was measured on a **five-point Likert scale** ranging from "strongly disagree" (1) to "strongly agree" (5).

c. Data Analysis

The **Partial Least Squares Structural Equation Modeling (PLS-SEM)** technique was employed using SmartPLS 4. Reliability and validity were assessed through **outer loadings, Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE)**. Discriminant validity was confirmed using the **Fornell–Larcker criterion**. The structural model was evaluated through **path coefficients, t-statistics, and p-values** obtained from bootstrapping with 5000 resamples.

4. RESULT AND DISCUSSION

Result

This section presents the empirical findings derived from the Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis, followed by an in-depth discussion of their theoretical and managerial implications. The results are structured to address the measurement validation process, the strength and direction of relationships among constructs, and the mediating roles hypothesized in the research model.

The analysis was conducted in two stages: evaluation of the measurement model (outer model) to ensure the reliability and validity of the constructs, and evaluation of the structural model (inner model) to examine causal relationships and test the research hypotheses. Statistical outputs, including loading factors, composite reliability, average variance extracted (AVE), R^2 values, and path coefficients, were used to interpret the strength and significance of each relationship.

The discussion integrates these quantitative results with relevant theories of green leadership, innovation, and supply chain management, providing a comprehensive interpretation of how leadership indirectly shapes eco-friendly operations within the culinary industry of West Java.

a) Outer Model Evaluation

Stage 1 (First-Order: Dimension-Level Measurement)

The first stage outer model evaluation examines the validity and reliability of indicators with respect to their associated first-order dimensions (constructs). This stage ensures that each indicator contributes meaningfully to its underlying dimension. In PLS-SEM, the key criteria considered are outer loadings, Composite Reliability (CR), and Average Variance Extracted (AVE).

As a rule of thumb, indicators are considered convergently valid when their outer loadings are ≥ 0.70. However, indicators with loadings between 0.50 and 0.70 may be retained if the construct's CR and AVE remain within acceptable thresholds (Hair et al., 2017). This allows flexibility when measuring complex multidimensional constructs such as in this studywithout compromising the overall quality of the measurement model.

Figure 1. Research Model Path Diagram (First-Order and Second-Order Structure)

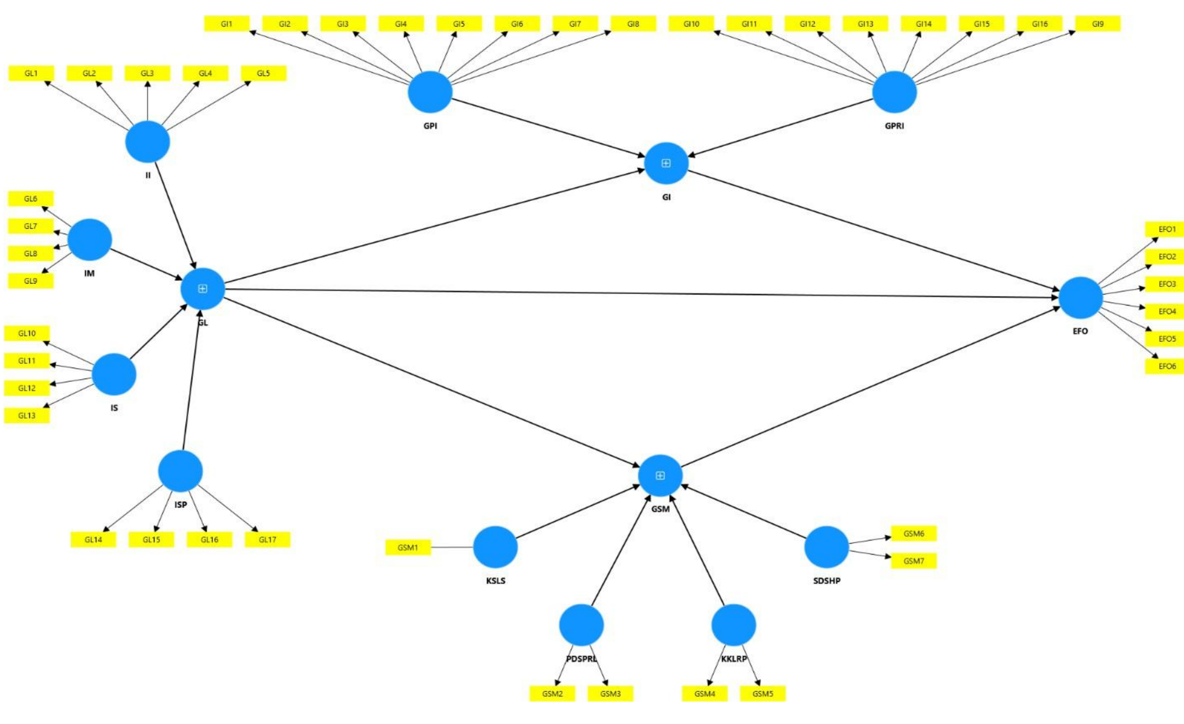

Figure 1 depicts the study's path model comprising four main constructs: Green Leadership (GL), Green Innovation (GI), Green Supply Chain Management (GSM), and Eco-Friendly Operations (EFO). Each main construct is modeled reflectively at two levels: second-order constructs formed by their first-order dimensions, with each dimension measured by multiple indicators.

Specifically, GL is formed by four dimensions: Idealized Influence (II), Inspirational Motivation (IM), Intellectual Stimulation (IS), and Individualized Support (ISP). GI comprises two dimensions: Green Product Innovation (GPI) and Green Process Innovation (GPRI). GSM consists of four dimensions: Environmental/Social Standards Compliance (KSLS), Green Distribution and Marketing Processes (PDSPRL), Supply Chain Collaboration and Environmental Awareness (KKLRP), and Resources, Systems, and Supplier Relations (SDSHP). EFO is modeled as an endogenous construct measured by six observed indicators. This path diagram provides the basis for structural evaluation and subsequent hypothesis testing.

Figure 2. First-Order Outer Loadings (Dimension-Level)

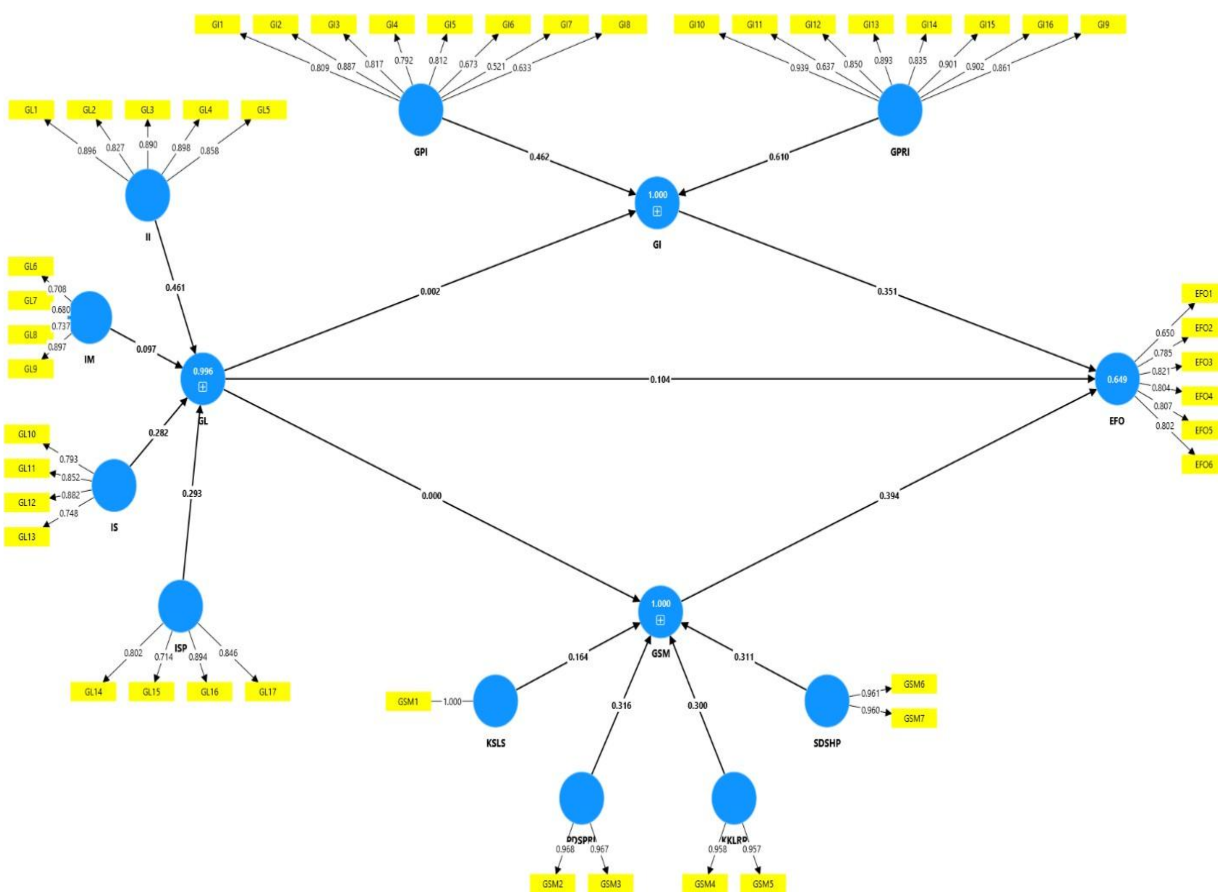

Table 1. Outer Loading Measurement Results on Dimensions

	GPI	GPRI	II	IM	IS	ISP	KSLS	PDSPRL	KKLRP	SDSHP
GI1	0,809									
GI2	0,887									
GI3	0,817									
GI4	0,792									
GI5	0,812									
GI6	0,673									
GI7	0,521									
GI8	0,633									
GI9		0,861								
GI10		0,939								
GI11		0,637								
GI12		0,850								
GI13		0,893								
GI14		0,835								
GI15		0,901								
GI16		0,902								
GL1			0,896							
GL2			0,827							
GL3			0,890							
GL4			0,898							
GL5			0,858							
GL6				0,708						
GL7				0,680						
GL8				0,737						
GL9				0,897						
GL10					0,793					
GL11					0,852					
GL12					0,882					
GL13					0,748					
GL14						0,802				
GL15						0,714				
GL16						0,894				
GL17						0,846				
GSM1							1,000			
GSM2								0,968		
GSM3								0,967		
GSM4									0,958	
GSM5									0,957	
GSM6										0,961
GSM7										0,960

Interpretation for Table 1: most indicators exceed the 0.70 threshold, indicating strong contributions to their respective dimensions (Hair et al., 2017). For instance, GI1–GI5 (GPI) range from 0.792 to 0.887, and GI9–GI16 (GPRI) are consistently high, with GI10 = 0.939. Some indicators show moderate loadings (0.50–0.70), such as GI6 = 0.673, GI7 = 0.521, GI8 = 0.633, and GI11 = 0.637. In exploratory settings, such indicators may be retained if CR and AVE remain acceptable (Chin, 1998; Hair et al., 2011).

GL dimensions (II, IM, IS, ISP) exhibit good consistency (many loadings > 0.70, several near 0.90, e.g., GL4 = 0.898**,** GL12 = 0.882**).** GSM dimensions are particularly strong **(**0.957-1.000**).** Although some dimensions have few indicators (even single-item), this can beacceptable in exploratory research with sound theoretical justification. Overall, the first-order results support proceeding to convergent validity, reliability, and discriminant validity assessments.

Table 2. Reliability and Convergent Validity (Dimension-Level)

Dimension	*Cronbach's alpha*	*Composite reliability (rho_a)*	*Composite reliability (rho_c)*	*Average variance extracted (AVE)*
GPI	0,886	0,903	0,910	**0,565**
GPRI	0,947	0,955	0,956	**0,734**
II	0,923	0,924	0,942	**0,764**
IM	0,754	0,790	0,844	**0,578**
IS	0,837	0,847	0,892	**0,673**
ISP	0,834	0,855	0,888	**0,667**
KKLRP	0,908	0,908	0,956	**0,916**
PDSPRL	0,932	0,933	0,967	**0,936**
SDSHP	**0,916**	**0,916**	**0,960**	**0,922**

All dimensions meet or exceed conventional thresholds: most α and CR values > 0.70 (many> 0.90), indicating strong internal consistency. All AVEs > 0.50, confirming convergent validity. Even where reliability is relatively lower (e.g., IM, AVE = 0.578), values remain acceptable. Very high AVEs (e.g., KKLRP, PDSPRL, SDSHP) indicate that most indicator variance is captured by their latent dimensions.

Table 3. Discriminant Validity — Fornell–Larcker Criterion (Dimension-Level)

	GPI	GPRI	II	IM	IS	ISP	KKLRP	KSLS	PDSPRL	SDSHP
GPI	0,752									
GPRI	0,731	0,857								
II	0,681	0,720	0,874							
IM	0,623	0,600	0,799	0,760						
IS	0,639	0,626	0,692	0,627	0,821					
ISP	0,729	0,679	0,693	0,651	0,602	0,817				
KKLRP	0,682	0,714	0,627	0,517	0,616	0,694	0,957			
KSLS	0,742	0,763	0,702	0,585	0,682	0,743	0,755	1,000		
PDSPRL	0,729	0,734	0,686	0,578	0,642	0,724	0,790	0,839	0,968	
SDSHP	0,703	0,691	0,669	0,544	0,586	0,685	0,822	0,710	0,762	0,960

For each dimension, the square root of AVE (bold diagonal) exceeds its correlations with other dimensions, confirming discriminant validity. Although some inter-dimension correlations are relatively high (e.g., GPI–ISP; GPRI–KSLS), they remain below the respective AVE square roots, preserving construct distinctiveness.

Stage 2 (Second-Order: Construct-Level Measurement)

In the second stage, the outer model is evaluated at the construct (second-order) level. Dimensions validated at stage 1 are aggregated to form the higher-order constructs. Convergent and discriminant validity are re-examined at this level to ensure that each higher-order construct is reliable and valid overall. This stage also includes second-order outer loadings and composite reliability.

Figure 3. Research Model Path Diagram (Second-Order Constructs)

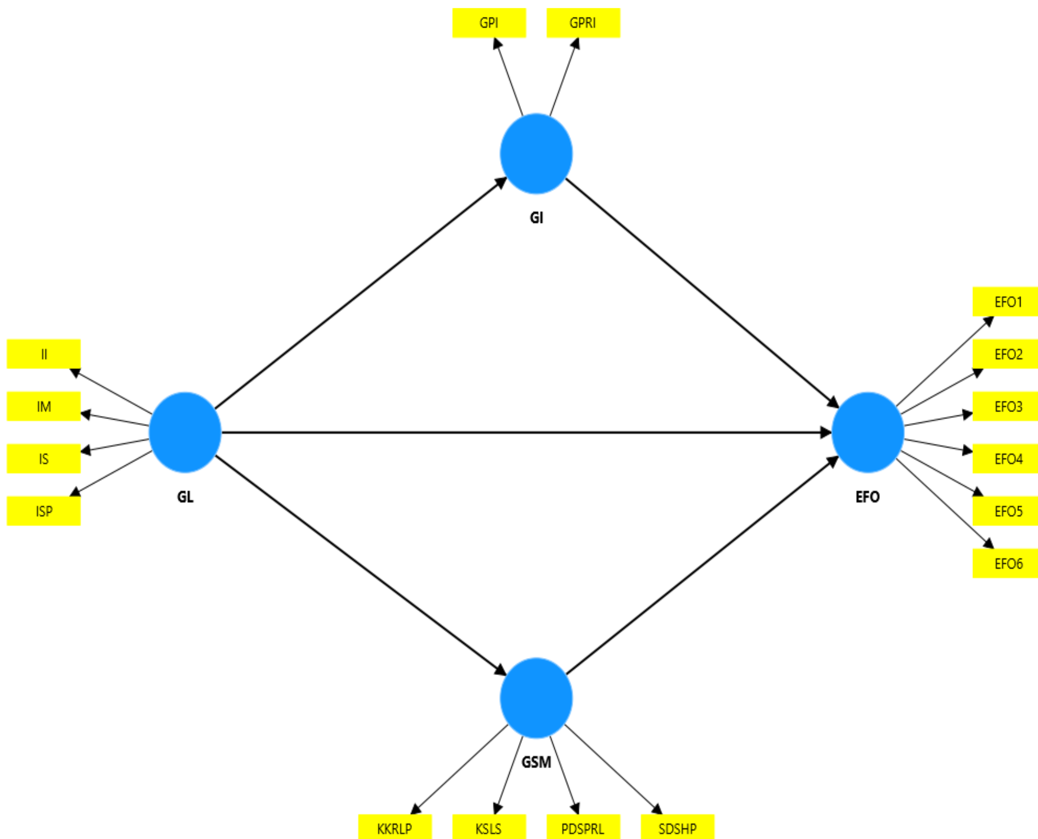

Figure 3 presents the second-order construct structure, focusing on relationships among the major variables. GL is formed by II, IM, IS, and ISP. GI is formed by GPI and GPRI. GSM is formed by KKLRP, KSLS, PDSPRL, and SDSHP. These three second-order exogenous constructs (GL, GI, GSM) are posited to influence the endogenous construct EFO, which is measured directly by its observed indicators. This simplified representation provides a clear basis for testing the hypothesized structural relationships.

Figure 4. Second-Order Outer Loadings (Construct-Level)

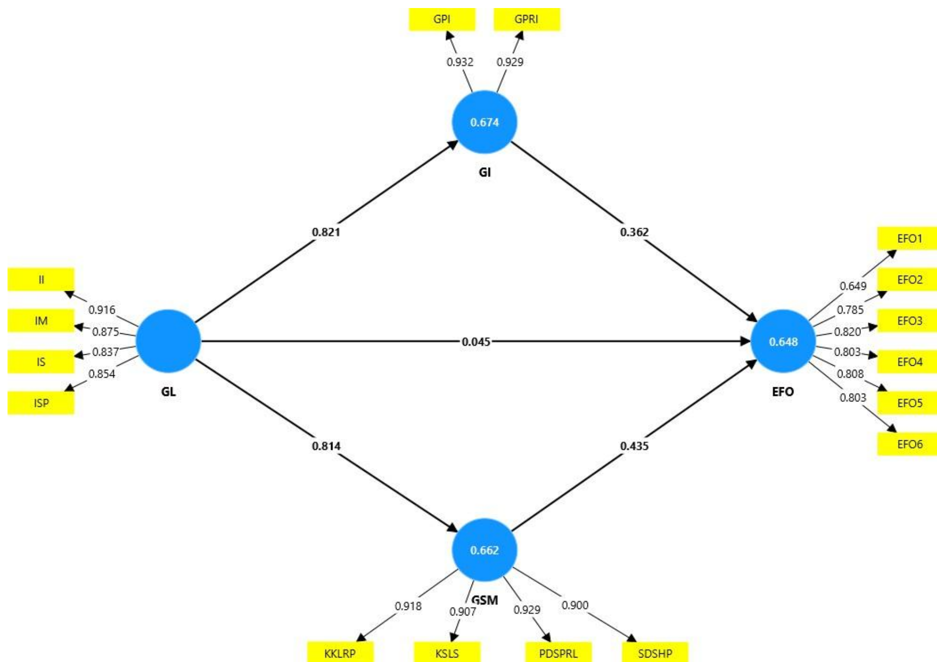

Table 4. Second-Order Outer Loadings

Dimension/ Indicator	EFO	GI	GL	GSM
EFO1	0,649			
EFO2	0,785			
EFO3	0,820			
EFO4	0,803			
EFO5	0,808			
EFO6	0,803			
GPI		0,932		
GPRI		0,929		
II			0,916	
IM			0,875	
IS			0,837	
ISP			0,854	
KKRLP				0,918
KSLS				0,907
PDSPRL				0,929
SDSHP				0,900

EFO is well measured by six indicators; five loadings are > 0.80, with one acceptable exploratory loading (EFO1 = 0.649). GI is strongly formed by GPI (0.932) and GPRI (0.929). GL shows high loadings for all four leadership facets (0.837–0.916).

GSM very strong loadings across all four dimensions (0.900–0.929). Overall, second-order constructs are valid and consistent, justifying further validity checks and structural testing.

Table 5. Reliability and Convergent Validity (Construct-Level)

Variable	*Cronbach's alpha*	*Composite reliability (rho_a)*	*Composite reliability (rho_c)*	*Average variance extracted (AVE)*
EFO	0,871	0,883	0,903	0,609
GI	0,845	0,845	0,928	0,865
GL	0,894	0,898	0,926	0,759
GSM	0,934	0,935	0,953	0,835

All higher-order constructs demonstrate excellent internal consistency (α and CR well above 0.70) and AVE > 0.50, confirming convergent validity. GI (AVE 0.865) and GSM (AVE 0.835) are especially strong; GL (AVE 0.759) is robust; EFO (AVE 0.609) is adequate.

Table 6. Discriminant Validity — Fornell–Larcker Criterion (Construct-Level)

	EFO	GI	GL	GSM
EFO	0,780			
GI	0,769	0,930		
GL	0,696	0,821	0,871	
GSM	0,779	0,851	0,814	0,914

The square roots of AVE (bold diagonal) exceed inter-construct correlations, confirming discriminant validity among the four second-order constructs. Despite some relatively high correlations (e.g., GI–GSM = 0.851), discriminant validity is preserved.

b) Inner Model Evaluation

After completing the two-stage measurement evaluation, R^2 and Adjusted R^2 are computed to determine the proportion of variance in endogenous constructs explained by their predictors. Next, t-statistics and p-values from bootstrapping are used to test the significance of structural paths, including direct and indirect (mediation) effects.

Table 7. Coefficient of Determination (R^2)

	R Square	Rsquare Adjusted
EFO	0,648	0,639
GI	0,674	0,671
GSM	0,662	0,659

Following Hair et al. (2017), $R^2 \approx 0.25$ (weak), 0.50 (moderate), 0.75 (substantial). Here, the model exhibits moderate to substantial explanatory power: GI (0.674), GSM (0.662), and EFO (0.648). Adjusted R^2 values are very close to R^2, indicating stable predictive performance and no apparent overfitting.

Table 8. Direct Effects (Bootstrapped Path Coefficients)

	Original sample (O)	**T statistics (|O/STDEV|)**	**P values**
GI -> EFO	0,362	2,780	0,005
GL -> EFO	0,045	0,384	0,701
GL -> GI	0,821	20,793	0,000
GL -> GSM	0,814	23,655	0,000
GSM -> EFO	0,435	3,279	0,001

Interpretation.

1) GI → EFO is positive and significant, indicating that green innovation improves eco-friendly operations.
2) GSM → EFO is positive and significant, underscoring the role of green supply chain practices in enhancing operational sustainability.
3) GL → GI and GL → GSM are both large and highly significant, evidencing leadership’s strong upstream effects on innovation and supply chain sustainability.
4) GL → EFO is not significant, implying that leadership does not directly enhance EFO; its influence is likely indirect via GI and GSM.

Table 9. Indirect Effects (Mediation)

	Original sample (O)	T statistics (|O/STDEV|)	P values
GL -> GI -> EFO	0,297	2,586	0,010
GL -> GSM -> EFO	0,354	3,098	0,002

Both mediation paths are significant. Notably, the GL → GSM → EFO pathway (β = 0.354) is stronger than GL → GI → EFO (β = 0.297), suggesting that green leadership most effectively translates into eco-friendly operations when embedded into supply chain processes and collaboration.

The strong GSM → EFO effect echoes findings that upstream sourcing, supplier collaboration, environmental compliance, and green distribution/logistics are decisive for environmental performance (Zhu & Sarkis, 2004; Rao & Holt, 2005; Seuring & Müller, 2008). For food service businesses in Bandung Raya, a large portion of environmental footprints is embedded in the supply chain (ingredients, packaging, transport). By focusing on aligning their operations with green supply chain practices, these local culinary businesses can achieve substantial improvements in their sustainability outcomes.

5. DISCUSSION

a) Why Green Leadership does not directly raise EFO, but works through systems

The non-significant direct path from green leadership (GL) to eco-friendly operations (EFO) indicates that leadership alone rarely translates into immediate operational outcomes. In line with transformational leadership logic (Bass, 1999), leaders primarily shape organizational conditions such as vision, norms, incentives, and learning, rather than day-to-day process parameters. Prior work shows that green transformational leadership improves environmental performance through organizational mechanisms such as green innovation and employee eco-behaviors, rather than by direct fiat (Chen et al., 2021; Tang et al., 2022). Our results reinforce this system-level pathway: GL acts as a catalyst that enables capabilities (innovation and green supply chain routines) which ultimately change operations.

b) Green innovation as a capability that converts intent into practice

The positive relationship between green innovation (GI) and eco-friendly operations (EFO) supports a large body of evidence that green product and process innovation reduce resource use, waste, and emissions while enhancing competitiveness (Dangelico & Pujari, 2010; Ghisellini et al., 2016). In culinary SMEs, GI typically involves recipe reformulation to minimize scraps, process redesign for water and energy efficiency, and material substitution (for example, biodegradable packaging). Such innovations alter the technical core of operations; therefore, it is unsurprising that they exhibit a direct, significant link to EFO. GI also functions as a learning mechanism through which firms experiment, codify, and scale effective practices, which is consistent with dynamic capability theory (Teece, 2007).

c) Why green supply chain practices matter, often even more than in-house initiatives

The strong effect of green supply management (GSM) on eco-friendly operations (EFO) echoes findings that upstream sourcing, supplier collaboration, environmental compliance, and green distribution/logistics are decisive for environmental performance (Zhu & Sarkis, 2004; Rao & Holt, 2005; Seuring & Müller, 2008). For food service businesses, a large portion of environmental footprints is embedded in the chain (ingredients, packaging, transport). GSM extends the firm's green routines beyond organizational boundaries by coordinating boundary-spanning actions such as supplier standards, reverse logistics, and joint waste valorization. This aligns with the natural-resource-based view (NRBV), which holds that firms create sustained environmental performance by developing hard-to-imitate bundles of green resources and inter-organizational routines (Hart, 1995; Hart & Dowell, 2011).

d) Why the mediation via GSM is stronger than via GI (in your model)

Leadership's effect is more pronounced through green supply management (GSM) than through green innovation (GI) because supply chains are coordination intensive: leaders allocate attention, set codes of conduct, align incentives, and broker collaboration across partners. That orchestration role resonates with dynamic capabilities, namely sensing, seizing, and reconfiguring, when applied to the chain (Teece, 2007). Moreover, institutional pressures such as customer expectations, local regulations, and ecolabel requirements often operate through supply-chain contracts and audits, which makes GSM a conduit for compliance and resilience (Zhu, Sarkis & Lai, 2013). In short, innovation refines the firm's internal "engine," while supply chains determine fuel quality and route efficiency and therefore have a larger impact on EFO.

e) Integrating theories: a leadership-enabled sustainability-capabilities view

Taken together, the results support an integrated view:

1. Transformational/Green Leadership supplies direction, meaning, and psychological safety for change (Bass, 1999; Chen et al., 2021).
2. NRBV explains why green capabilities (GI, GSM) are the actual carriers of performance (Hart, 1995; Hart & Dowell, 2011).
3. Dynamic capabilities explain how firms reconfigure processes and value chains to embed sustainability (Teece, 2007).

The contribution is a capability mediation model: GL → (builds) GI & GSM → (delivers) EFO. This clarifies contradictory findings in the literature about leadership's "direct effect" by showing that, in practice, the effect is primarily indirect through capability building (cf. Chen et al., 2021; Tang et al., 2022).

f) Managerial implications for culinary SMEs in Bandung Raya

1. Develop leaders who build systems, not slogans**.** Leadership programs should target innovation pipelines (idea scouting, pilot–scale–diffuse) and supply-chain orchestration (supplier onboarding, audits, shared KPIs).

2. Prioritize GSM quick wins. Codify supplier environmental criteria, introduce basic traceability, and coordinate return/reuse of packaging. Early GSM moves often yield larger operational gains than isolated in-house tweaks.

3. Institutionalize GI cycles. Run short PDCA cycles on waste-hotspots (plate waste, prep scraps, packaging). Tie chef/Kitchen KPIs to yield and water/energy intensity.

4. Measure what matters**.** Use a small scoreboard: (i) waste per cover, (ii) energy/water per cover, (iii) % compliant suppliers, (iv) % green menu items.

5. Leverage collective action. Join local networks (market associations, waste processors) to share costs of composting, anaerobic digestion, or reusable logistics.

g) Limitations and future research

The cross-sectional design limits causal inference and masks learning trajectories. Future work should adopt longitudinal or panel designs to observe how GL-enabled capabilities accumulate and diffuse. Multi-source or archival environmental data (e.g., energy/water bills, waste audits) would mitigate common-method bias. Finally, comparative studies across regions or subsectors (e.g., hotels vs. street food) could unpack contextual moderators such as regulation intensity, cold-chain needs, or digital readiness.

5. CONCLUSION

The findings substantiate the argument that green leadership operates indirectly by fostering organizational systems conducive to sustainability. This aligns with Chen et al. (2021) and Tang et al. (2022), who reported that leaders influence sustainability outcomes primarily through organizational mechanisms rather than direct operational intervention.

From a managerial perspective, the results emphasize that leadership training and culture-building initiatives must focus on innovation capabilities and supply chain alignment to achieve measurable eco-friendly outcomes. Culinary businesses should institutionalize environmental goals through innovation ecosystems, integrating suppliers, employees, and customers in circular practices such as waste valorization and green logistics. et al. (2022), who reported that leaders influence sustainability outcomes primarily through organizational mechanisms rather than direct operational intervention.

From a managerial perspective, the results emphasize that leadership training and culture-building initiatives must focus on innovation capabilities and supply chain alignment to achieve measurable eco-friendly outcomes. Culinary businesses should institutionalize environmental goals through innovation ecosystems, integrating suppliers, employees, and customers in circular practices such as waste valorization and green logistics.

REFERENCES

Bass, B. M. (1999). Two decades of research and development in transformational leadership. *European Journal of Work and Organizational Psychology, 8*(1), 9–32. https://doi.org/10.1080/135943299398410

Badan Pusat Statistik (BPS). (2023). *Statistik industri kuliner di Jawa Barat tahun 2023.* Jakarta: BPS.

Chen, Y., Tang, G., Jin, J., Li, J., & Paillé, P. (2021). Green transformational leadership and green performance: The mediating role of green innovation and the moderating role of green organizational identity. *Journal of Business Ethics, 170*(1), 219–238. https://doi.org/10.1007/s10551-019-04322-6

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. In G. A. Marcoulides (Ed.), *Modern Methods for Business Research* (pp. 295–336). Lawrence Erlbaum Associates.

Dangelico, R. M., & Pujari, D. (2010). Mainstreaming green product innovation: Why and how companies integrate environmental sustainability. *Journal of Product Innovation Management, 27*(5), 473–489. https://doi.org/10.1111/j.1540-5885.2010.00760.x

Ellen MacArthur Foundation. (2021). *The circular economy in food: Redefining growth for sustainable development.* https://ellenmacarthurfoundation.org/publications

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production, 114*, 11–32. https://doi.org/10.1016/j.jclepro.2015.09.007

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). Sage Publications.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of*

Marketing Theory and Practice, 19(2), 139–152. https://doi.org/10.2753/MTP1069-6679190202

Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review, 20*(4), 986–1014. https://doi.org/10.2307/258963

Hart, S. L., & Dowell, G. (2011). A natural-resource-based view of the firm: Fifteen years after. *Journal of Management, 37*(5), 1464–1479. https://doi.org/10.1177/0149206310390219

Kementerian Lingkungan Hidup dan Kehutanan (KLHK). (2023). *Laporan pengelolaan sampah nasional 2023.* Jakarta: KLHK.

Kementerian Pariwisata dan Ekonomi Kreatif. (2023). *Strategi keberlanjutan dalam sektor kuliner: Menuju Indonesia bebas sampah 2025.* Jakarta: Kemenparekraf.

NVivo. (2023). *NVivo user guide for qualitative research.* QSR International

Rao, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management, 25*(9), 898–916. https://doi.org/10.1108/01443570510613956

Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production, 16*(15), 1699–1710. https://doi.org/10.1016/j.jclepro.2008.04.020

SmartPLS. (2023). *Partial least squares structural equation modeling (PLS-SEM) user guide.* SmartPLS GmbH.

Sustainable Waste Indonesia (SWI). (2022). *Laporan nasional: Pengelolaan sampah organik di Indonesia.* SWI Publishing.

Tang, G., Chen, Y., Jiang, Y., Paillé, P., & Jia, J. (2022). Green transformational leadership and environmental performance: The role of pro-environmental behaviors and green innovation. *Business Strategy and the Environment, 31*(5), 2131–2145. https://doi.org/10.1002/bse.2968

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal, 28*(13), 1319–1350. https://doi.org/10.1002/smj.640

Unilever Indonesia Foundation. (2022). *Zero waste to landfill: Best practices for sustainable business.* Unilever Indonesia Press.

Wibowo, A., & Sutrisno, T. (2022). Implementasi inovasi hijau dalam industri kuliner Indonesia. *Jurnal Manajemen dan Inovasi, 19*(3), 45–60. https://doi.org/10.31219/osf.io/xyz123

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *International Journal of Operations & Production Management, 24*(7), 1212–1231. https://doi.org/10.1108/01443570410552142

Zhu, Q., Sarkis, J., & Lai, K. (2013). Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices. *Journal of Purchasing and Supply Management, 19*(2), 106–117. https://doi.org/10.1016/j.pursup.2012.12.001