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The Effect of Halal Supply Chain Management on the Sustainability Performance of Food SMEs in Padang City

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ABSTRACT

This study examines the impact of Halal Supply Chain Management (HSCM) on the sustainability performance of food SMEs in Padang City, evaluating consumer trust as a mediator and Lean Green Practices as a moderator. Driven by low halal certification rates despite rising consumer demand for halal and sustainable products, data were collected from food SME owners using a survey method and analyzed via PLS-SEM. The results reveal that HSCM does not directly affect sustainability performance. However, consumer trust fully mediates this relationship, demonstrating that HSCM drives sustainability performance by fostering consumer confidence in halal integrity and quality. Additionally, Lean Green Practices do not significantly moderate the relationship between HSCM and sustainability performance. Overall, the findings emphasize the necessity for SMEs to build consumer trust and adopt eco-efficient operational strategies to ensure long-term business sustainability.

Contribution to SDGs:

SDG 3: Good Health and Well-being

SDG 8: Decent Work and Economic Growth

SDG 9: Industry, Innovation and Infrastructure

SDG 12: Responsible Consumption and Production

SDG 16: Peace, Justice and Strong Institutions

1. INTRODUCTION

1.1. Research Background

Small and Medium Enterprises (SMEs) play a crucial role in supporting economic development in many developing countries, particularly by strengthening local economies and generating employment opportunities. In Indonesia, SMEs represent among these sectors, the food industry has emerged as one of the most dominant and strategic contributors. In 2024, the food industry accounted for approximately 39.91% of the non-oil and gas manufacturing Gross Domestic Product (GDP) and contributed around 6.47% to Indonesia's total national GDP. In addition, the

sector accounted for approximately 19.4% of the country's non-oil and gas export performance, underscoring its strategic role in supporting Indonesia's economic resilience and competitiveness. At the regional level, the food industry also dominates the industrial structure of Padang City, West Sumatera. According to data from the Department of Manpower and Industry of Padang City (2024), there are 10,463 industrial units operating in the city, of which 6,594 belong to the food industry, representing approximately 63.02% of all industrial businesses [1]. This finding indicates that food SMEs constitute a leading local commodity sector with significant potential to support regional economic development and sustainable industry growth.

However, despite the large number of food SMEs and their strategic contribution to the regional economy, several structural



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and operational challenges remain. One of the most critical issues is the ability of these businesses to ensure product quality, safety, and compliance with halal standards, especially amid increasing expectations from consumers and regulatory authorities. The growing awareness of halal assurance, food safety, and sustainable production practices has encouraged consumers to become more selective in choosing food products [2]. As a result, food businesses are increasingly required to guarantee transparency in their production processes and maintain the halal integrity of their products. Failure to meet these expectations may reduce consumer trust, limit market opportunities, and ultimately hinder the long-term sustainability of food SMEs [3].

In recent years, global food markets have experienced a significant shift in consumer behavior, with increasing attention given to food safety, ethical production, environmental sustainability, and halal assurance. Consumers are becoming increasingly aware of issues related to food safety, ethical production, sustainability, and halal assurance. This trend is particularly relevant in countries with large Muslim populations, such as Indonesia, where halal compliance is not only a religious obligation but also an important factor influencing consumer trust and purchasing decisions. As a result, food businesses are expected to ensure transparency in their production processes and maintain the integrity of halal products throughout the supply chain [4].

In response to these developments, the Indonesian government has strengthened regulatory frameworks related to halal assurance. The enactment of Law No. 33 of 2014 concerning Halal Product Assurance requires products circulating in Indonesia to obtain halal certification, a requirement further reinforced by Government Regulation No. 42 of 2024 on the implementation of the halal product assurance system. These regulations aim to improve halal compliance and strengthen the role of certification institutions in ensuring that products meet halal standards.

Despite these regulatory efforts, the level of halal certification among food SMEs in Padang City remains relatively low. According to data from Badan Penyelenggara Jaminan Produk Halal (BPJPH) in 2024, only 1,702 food SMEs in Padang have obtained halal certification out of a total of 6,954 registered units, representing approximately 24.47%. This relatively low percentage indicates that many food business owners have not yet fully complied with halal certification requirements or may face difficulties in implementing halal assurance practices within their production systems [4].

The low level of halal certification is a serious concern, particularly amid rising consumer awareness and regulatory enforcement. Without clear halal assurance, businesses may face declining consumer trust, limited market access, and reduced competitiveness in both domestic and international markets.

To address these challenges, scholars and practitioners have increasingly emphasized the importance of Halal Supply Chain Management (HSCM). HSCM refers to the systematic management of supply chain activities to ensure the integrity of halal products is maintained at every stage of production and distribution, including raw material sourcing, manufacturing, storage, transportation, and final delivery to consumers [3].

Previous studies highlight that HSCM plays a critical role in ensuring product authenticity and maintaining consumer confidence in halal products. According to Khan, Haleem, and Khan (2018), the implementation of HSCM enables companies to

ensure that halal standards are maintained throughout the supply chain, preventing contamination by non-halal materials and improving product traceability. Furthermore, the adoption of HSCM practices is believed to positively contribute to businesses' sustainability performance by integrating economic, social, and environmental considerations [5].

From an economic perspective, implementing HSCM can enhance operational efficiency, strengthen business reputation, and expand market opportunities, particularly in the rapidly growing global halal market. From a social perspective, effective halal supply chain practices can enhance consumer trust and loyalty by providing transparency regarding product origins and production processes. Meanwhile, from an environmental perspective, integrated halal supply chain management can reduce production waste and encourage environmentally responsible practices by preventing contamination and improving resource efficiency [6].

This research is expected to provide several important contributions. From a theoretical perspective, the study contributes to the development of the halal supply chain management literature by integrating mediating and moderating mechanisms into the analysis of sustainability performance. This approach offers a deeper understanding of the complex relationships between halal practices, consumer perception, and operational efficiency.

From a practical perspective, the findings of this study may provide valuable insights for policymakers, halal certification institutions, and business practitioners in designing strategies to improve halal compliance and sustainability performance among food SMEs. By identifying the key factors that influence the effectiveness of HSCM implementation, this research can help businesses develop more effective strategies for improving operational performance, strengthening consumer trust, and expanding market opportunities [3].

1.2. Literature Review

In addition to HSCM, several scholars have also emphasized the importance of integrating operational efficiency and environmental responsibility through Lean Green Practices. Lean Green Practices focus on eliminating waste and improving process efficiency, while green practices emphasize environmental sustainability simultaneously.

Although previous studies have highlighted the potential benefits of HSCM implementation, empirical findings remain inconclusive regarding its direct impact on sustainability performance. Some studies suggest that the implementation of HSCM does not always directly translate into improved sustainability outcomes. Instead, the effectiveness of HSCM often depends on several supporting factors, including stakeholder perceptions, organizational capabilities, and operational practices [7].

In particular, consumer trust has been identified as a critical mediating factor that may influence the relationship between HSCM implementation and sustainability performance. Consumers' trust in halal integrity, production transparency, and product quality can significantly influence purchasing decisions and long-term brand loyalty. When consumers perceive halal assurance as credible and reliable, businesses are more likely to experience stable demand, improved reputation, and stronger sustainability performance.

Furthermore, operational factors within organizations may also influence the effectiveness of HSCM implementation. Lean Green Practices, which combine efficiency-oriented lean principles with environmentally responsible green practices, are expected to strengthen the relationship between HSCM and sustainability performance. These practices enable business to implement halal supply chain processes more efficiently while minimizing environmental impact [6].

Despite the growing body of research on halal supply chains, several important gaps remain. Previous studies have largely focused on examining the direct relationship between HSCM implementation and sustainability performance without thoroughly exploring the mechanisms or conditions that may influence this relationship. For example, Jannah and Wijayanti (2025) found that certain aspects of HSCM significantly affect organizational effectiveness and sustainability performance. However, their study did not specifically focus on food SMEs and did not investigate mediating or moderating variables that could explain how or under what conditions these relationships occur [5].

Similarly, Kurniati and Cakravastia (2023) identified significant challenges in integrating sustainability aspects within halal supply chains. Meanwhile, Khan et al. (2021) demonstrated that factors such as management commitment, government support, halal certification institutions, halal production systems, market demand, halal marketing, and competitive pressure positively influence sustainability performance [8].

This study seeks to address these research gaps by developing a more comprehensive analytical framework that integrates both mediating and moderating mechanisms within the relationship between HSCM implementation and sustainability performance. Specifically, this study introduces consumer trust as a mediating variable that explains how HSCM implementation influences sustainability performance. At the same time, Lean Green Practices are incorporated as a moderating variable that may strengthen or weaken this relationship, depending on the organisation's operational efficiency and environmental commitment.

By integrating these variables into a single conceptual model, this research provides a more holistic understanding of how halal supply chain practices influence sustainability outcomes within small and medium food enterprises [9].

1.3. Research Objective

Based on the issues described above, this study aims to analyze the role of consumer trust in mediating the relationship between Halal Supply Chain Management implementation and sustainability performance in food SMEs. In addition, the study aims to examine the moderating role of Lean Green Practices in strengthening the relationship between HSCM implementation and sustainability performance. The empirical context of this research focuses on food SMEs in Padang City, which represent a significant portion of the local industrial sector.

2. MATERIALS AND METHODS

This study adopts a quantitative research approach, using a survey-based method, to examine the relationships among Halal Supply Chain Management (HSCM), consumer trust, Lean Green Practices, and sustainability performance in food SMEs in Padang City, Indonesia. The research was designed as an explanatory

study to examine the causal relationships among the proposed construct [10].

Prior to the main survey, a preliminary study was conducted to obtain an in-depth understanding of the research context. This phase involved direct observations, semi-structured interviews with SME practitioners, and document analysis related to halal supply chain implementation. The findings from this stage were used to refine the measurement variables and ensure contextual relevance. A comprehensive literature review was subsequently undertaken to establish the theoretical foundation and identify research gaps. This process guided the development of the conceptual framework and hypotheses.

This study involves four main variables:

1. Independent variable: Halal Supply Chain Management (HSCM)
2. Dependent variable: Sustainability Performance
3. Mediating variable: Consumer Trust
4. Moderating variable: Lean Green Practices

HSCM is conceptualized as a supply chain management system that ensures halal integrity across sourcing, production, storage, and distribution processes. In the SME context, it is operationalized through three key stages: raw material procurement, production processes, and product distribution [3]. Consumer trust is positioned as a mediating variable, reflecting stakeholders' perception of halal assurance, product quality, and integrity. It is considered a fundamental mechanism linking HSCM implementation to sustainability outcomes [11]. Lean Green Practices are incorporated as a moderating variable, representing operational strategies that integrate efficiency (lean) and environmental responsibility (green). These practices are expected to strengthen or weaken HSCM's effect on sustainability performance [12]. Sustainability performance is measured using the triple bottom line approach (economic, social, and environmental performance) [2].

The target population consists of food SMEs in Padang City that have obtained official halal certification. This criterion ensures that respondents have relevant experience in implementing halal supply chain practices. A purposive sampling technique was employed to select respondents who are directly involved in business operations, such as owners, managers, or employees responsible for supply chain, production, or distribution activities.

The final sample consisted of 73 respondents, who completed the survey. Although relatively modest, this sample size is considered appropriate for Partial Least Squares Structural Equation Modeling (PLS-SEM), which is specifically designed for predictive models involving small to medium sample sizes and does not require multivariate normality. In addition to satisfying the widely accepted '10-times rule', the adequacy of the sample size is further supported by statistical power considerations. According to Hair et al. (2022), PLS-SEM can produce reliable parameter estimates when a minimum statistical power of 0.80 is achieved for detecting medium effect sizes. Furthermore, all respondents were purposively selected from halal-certified food SMEs that actively implement halal supply chain practices. This sampling approach ensured that, despite the relatively limited sample size, the collected data were information-rich and representative of the target population [13].

Although the sample size was small, purposive sampling was implemented to ensure the respondents had sufficient knowledge of and experience with halal supply chain

implementation. All respondents were from halal-certified food SMEs and were directly involved in operational decision-making. Consequently, the sample adequately reflects the characteristics of the target population. However, caution should be exercised when generalizing the findings beyond similar SME contexts. Therefore, future studies are encouraged to employ larger and more geographically diverse samples to enhance the generalizability of the findings [14].

Primary data were collected through a structured questionnaire survey distributed directly to selected SME practitioners. The questionnaire was designed based on validated constructs from previous studies and refined through expert judgment involving academics and practitioners in halal and sustainability fields.

Respondents were asked to evaluate statements using a five-point Likert scale (1 = strongly disagree to 5 strongly agree) [3]. The instrument captures perceptions related to:

- Halal supply chain practices
- Consumer trust
- Lean-green operational practices
- Sustainability performance (economic, social, environmental)

In this study, consumer trust is assessed indirectly through SME perceptions, as business actors are considered key informants who interact closely with consumers and understand their trust dynamics.

The measurement instrument was developed through a multi-stage process:

1. Item generation based on prior literature
2. Expert validation (content validity)
3. Instrument refinement

Content validity was assessed using expert judgment to evaluate item relevance, clarity, and representativeness. Quantitative measures were also applied, including:

1. Content Validity Index
2. Content Validity Ratio
3. Kappa coefficient

These metrics were used to ensure consistency and agreement among experts. Items were revised based on both quantitative scores and qualitative feedback.

Data analysis was conducted using SmartPLS 4.0 with Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. This method is particularly suitable for:

- Small sample size
- Complex models
- Non-normal data distributions

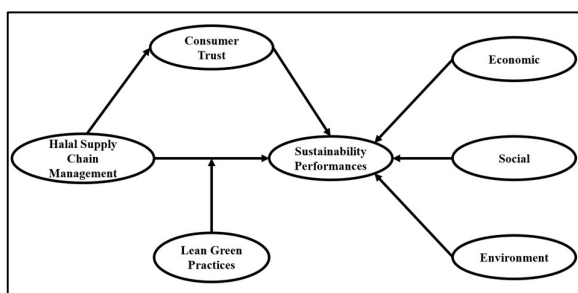


Fig. 1 Research Framework

The analysis consists of two main stages:

- 1) Measurement Model (Outer Model Evaluation)

This stage assesses the reliability and validity of the constructs:

- Indicator reliability: Outer loading ≥ 0.708
 - Internal consistency reliability: Composite Reliability (CR) > 0.708
 - Convergent validity: Average Variance Extracted (AVE) > 0.50
 - Discriminant validity: HTMT < 0.90
- 2) Structural Model (Inner Model Evaluation)
- This stage evaluates the relationships between constructs:
- Path coefficients significance: Bootstrapping
 - Coefficient of determination (R^2) (0.75 (strong), 0.50 (moderate), 0.25 (weak))
 - Mediation effect of consumer trust was tested through bootstrapping of indirect effect (HSCM $\rightarrow$ Consumer Trust $\rightarrow$ Sustainability Performance).
 - Moderation effect of Lean Green Practices using the two-stage approach in SmartPLS.
 - The significance of both effects was evaluated based on t-statistics, p-values, and confidence intervals [15].

All respondents participated voluntarily, and the data collected were treated confidentially. The study ensured that participants' identities and business information remained confidential [16].

3. RESULT AND DISCUSSION

3.1. Respondent profile and descriptive analysis

This study involved 73 food Small and Medium Enterprises (SMEs) in Padang City, Indonesia, that have implemented halal supply chain principles in their production processes. The respondents were business owners and managers who understood their operational activities and halal implementation practices. The sample met the minimum requirement for PLS-SEM analysis using the 10-times rule.

The majority of respondents were categorized as small enterprises (89.04%), with most businesses operating for 8–12 years (43.83%). Furthermore, halal certification was predominantly obtained in 2023 (53.42%), indicating increasing awareness among SMEs regarding halal compliance following the strengthening of halal product assurance regulations in Indonesia. The dominant business sectors were bakery and cake products (24.65%), followed by processed meat products (17.80%) and food service businesses (12.32%).

Table 1 presents the descriptive statistics of the research constructs. All variables obtained high mean values, indicating that respondents strongly agreed with the implementation of halal supply chain practices and sustainability-related activities.

Table 1. Descriptive Statistics of Research Constructs

Construct	Mean Value	Category
Halal Supply Chain Management (HSCM)	4.723	Very High
Consumer Trust (CT)	4.608	Very High
Lean Green Practices (LGP)	4.524	Very High
Economic Performance	4.195	High
Social Performance	4.575	Very High
Environmental Performance	4.548	Very High

The results indicate that halal practices have been widely adopted by food SMEs, particularly in ensuring the availability of halal raw materials, production cleanliness, packaging safety, and transparency in product information. However, the economic benefits of sustainability practices require longer implementation periods than social and environmental improvements [5].

3.2. Measurement model assessment

The measurement model was evaluated using Partial Least Squares Structural Equation Modelling (PLS-SEM) through SmartPLS version 4.0. The assessment included convergent validity, reliability, and discriminant validity. Indicators with insufficient loading values were removed to improve model quality. Table 2 summarizes results of the measurement model evaluation.

Table 2. Measurement Model Evaluation

Criterion	Result	Requirement	Conclusion
Outer Loading	>0.70	≥0.70	Valid
AVE	0.572–0.681	≥0.50	Valid
Composite Reliability	0.823–0.875	≥0.70	Reliable
Cronbach's Alpha	0.676–0.813	≥0.70*	Acceptable

*The LGP construct remained acceptable because AVE and Composite Reliability values met the recommended criteria.

The measurement model results confirm that all constructs demonstrated adequate validity and reliability. Therefore, the model was considered appropriate for subsequent evaluation of the structural model [17].

3.3. Structural model assessment

The structural model was evaluated using R^2 and Q^2 values to evaluate explanatory capability and predictive relevance.

Table 3. Structural Model Evaluation

Evaluation	Construct	Value	Interpretation
R^2	Consumer Trust	0.517	Moderate explanatory power
R^2	Sustainability Performance	0.987	Substantial explanatory power
Q^2	Consumer Trust	0.279	Predictive relevance
Q^2	Sustainability Performance	0.362	Strong predictive relevance

The results indicate that the proposed model has strong explanatory power for sustainability performance. Almost 98.7% of the variation in sustainability performance can be explained by the proposed variables, demonstrating that economic, social, environmental, and consumer trust play important roles in determining SME sustainability [18].

3.4. Hypothesis testing and discussion

Hypothesis testing was conducted using bootstrapping in SmartPLS 4.0. The significance criteria were determined based on T-statistics >1.96 and p-value <0.05.

Table 4 Hypothesis Testing Results

Relationship	β	T-statistic	p-value	Result
HSCM → Sustainability Performance	-0.000	0.027	0.979	Not Supported
HSCM → Consumer Trust	0.718	11.528	0.000	Supported
Consumer Trust → Sustainability Performance	0.322	15.715	0.000	Supported
Economic Performance → Sustainability Performance	0.263	13.725	0.000	Supported
Environmental Performance → Sustainability Performance	0.211	11.204	0.000	Supported
Lean Green Practices → Sustainability Performance	0.187	9.784	0.000	Supported
Social Performance → Sustainability Performance	0.251	12.651	0.000	Supported
LGP × HSCM → Sustainability Performance	-0.000	0.043	0.966	Not Supported

According to bootstrapping results (Table 2), HSCM did not significantly improve sustainability performance. This indicates that halal implementation among SMEs is primarily focused on compliance and certification rather than on integration into a comprehensive sustainability strategy. Compared with larger organisations with advanced management systems, SMEs often implement halal practices primarily to comply with regulatory requirements and consumer expectations.

However, HSCM significantly influences consumer trust, demonstrating that halal assurance serves as an important and credible signal for consumers. Transparent information regarding halal ingredients, production processes, and certification status increases consumer confidence. This finding is consistent with previous studies reporting that halal practices strengthen trust and purchasing intentions among Muslim consumers [9].

Furthermore, consumer trust significantly contributes to Sustainability Performance, indicating that it serves as an

important mechanism linking halal practices to business sustainability. The mediation analysis suggests that HSCM contributes to sustainability performance indirectly by increasing consumer confidence, strengthening customer relationships, and maintaining market stability.

The moderating effect of Lean Green Practices (LGP) on the relationship between Halal Supply Chain Management (HSCM) and sustainability performance was not statistically significant. This suggests that food SMEs have not yet implemented lean and green initiatives to a degree that would enhance the effectiveness of halal supply chain practices. According to the Resource-Based View (RBV), sustainable competitive advantage is achieved when organizations possess valuable, rare, inimitable, and well-organized resources. However, many SMEs continue to face constraints in financial resources, managerial expertise, technological capabilities, and human resources. These limitations hinder their ability to integrate halal practices with lean and environmentally sustainable operations. Consequently, LGP remains primarily focused on operational activities rather than on strategic organisational capabilities that can strengthen HSCM's impact on sustainability performance.

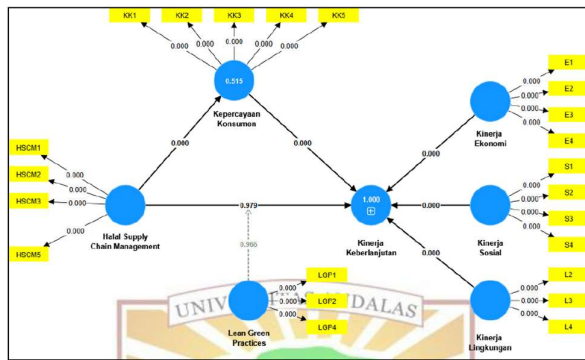


Fig. 2 Result of bootstrapping analysis in SmartPLS 4.0

Organizational readiness also provides a relevant explanation for this finding. Successful integration of halal, lean, and green practices requires sufficient organizational commitment, employee competencies, leadership support, and process maturity. While many SMEs have implemented halal certification to comply with government regulations, they are not ready to adopt continuous improvement initiatives and environmental management practices simultaneously. Therefore, Lean Green Practices have not yet functioned as an effective strategic moderator in enhancing sustainability performance. Finally, economic, social, and environmental dimensions significantly influence sustainability performance. Economic performance showed the strongest contribution, indicating that financial stability remains a fundamental factor for SME sustainability. Meanwhile, social and environmental performance demonstrate that stakeholder relationships and environmental responsibility are also essential components of sustainable halal business development [8].

These findings suggest that government agencies and halal certification institutions should supplement their certification programs with training in managerial capabilities, lean implementation, environmental management, and digital supply chains. Strengthening these organizational capabilities may allow SMEs to integrate halal assurance with operational excellence

and environmental sustainability, improving their long-term competitiveness.

4. CONCLUSION

This study concludes that Halal Supply Chain Management (HSCM) does not directly improve sustainability performance among food SMEs in Padang City; however, it significantly enhances consumer trust, which acts as an important mechanism for strengthening sustainability outcomes. The findings indicate that halal practices create greater value when they are recognized and trusted by consumers rather than implemented solely as regulatory compliance. Furthermore, Lean Green Practices do not significantly moderate the relationship between HSCM and sustainability performance, suggesting that lean and environmental initiatives among SMEs remain inadequately integrated with halal supply chain practices. The study also confirms that economic, social, and environmental dimensions significantly contribute to sustainability performance, highlighting the importance of a balanced triple-bottom-line approach. These findings emphasize that food SMEs should integrate halal assurance into broader consumer trust-building strategies and sustainability-oriented management practices to achieve long-term competitiveness. Future studies should expand the research context by involving different regions, industries, and additional variables related to digitalization, innovation, and organizational capability.

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