

The Impact of Green Product Innovation on the Business Performance of Retail MSMEs in Samarinda: The Mediating Role of Green Supply Chain Management

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ABSTRACT

This study is motivated by the importance of improving the business performance of retail MSMEs in Samarinda through sustainability-oriented business strategies. Green Product Innovation (GPI) refers to MSMEs' efforts to develop more environmentally friendly products, while Green Supply Chain Management (GSCM) supports supply chain activities that consider environmental aspects. This study aims to analyze the effect of GPI on business performance, the effect of GPI on GSCM, the effect of GSCM on business performance, and the mediating role of GSCM in the relationship between GPI and business performance. This research employed a quantitative explanatory approach using a survey method by distributing questionnaires to 384 retail MSME actors in Samarinda, determined using the Krejcie and Morgan table. Data were analyzed using SPSS for descriptive statistics and SmartPLS with the SEM-PLS approach. The results show that GPI has a positive and significant effect on business performance (coefficient 0.235; $p=0.000$), GPI has a positive and significant effect on GSCM (coefficient 0.461; $p=0.000$), and GSCM has a positive and significant effect on business performance (coefficient 0.617; $p=0.000$). In addition, GSCM is proven to partially mediate the effect of GPI on business performance (indirect coefficient 0.285; $p=0.000$). These findings confirm that green product innovation can improve retail MSME business performance both directly and through strengthening green supply chain management.

INTRODUCTION

The micro, small, and medium enterprise (MSME) sector plays a central role in the national economic structure. The number of MSMEs in Indonesia increased from 64.2 million in 2018 to approximately 66 million in 2023, contributing more than 99% of the total national business actors, absorbing approximately 97% of the workforce, and contributing approximately 61% of the national Gross Domestic Product (GDP). In East Kalimantan, the

number of MSMEs also grew significantly, with a cumulative total growth of 33.56% during the 2021–2023 period (East Kalimantan Provincial Cooperatives and SMEs Office, 2023). This growth emphasizes the role of MSMEs as the backbone of the regional economy, but also requires MSMEs to adapt to the era of digitalization and sustainability through the implementation of green business principles and more environmentally friendly supply chain management.

The growth of MSMEs needs to be balanced with attention to environmental aspects, which are the focus of regional development policies. The East Kalimantan Provincial Government demonstrated its commitment to environmental management through Regional Regulation Number 1 of 2014 as a follow-up to Law Number 32 of 2009 concerning Environmental Protection and Management (Wicaksono et al., 2024). East Kalimantan's Environmental Quality Index declined from 78.81 in 2019 to 74.46 in 2022, before improving to 75.47 in 2023. Meanwhile, the reduction in greenhouse gas emissions in 2023 reached 49.46% from the business-as-usual baseline, exceeding the 29.33% target set in Regional Regulation Number 8 of 2021. This condition confirms that the transformation of MSMEs towards low-carbon business practices is an unavoidable necessity, including for retail MSMEs that interact directly with consumers and suppliers.

In an increasingly dynamic business environment, improving *business performance* has become a top priority for companies, including MSMEs, to survive and thrive (Porter & Kramer, 2011). Business performance is measured not only by financial indicators but also by non-financial aspects such as customer loyalty and adaptability to market changes. The performance of modern companies has been shown to be significantly influenced by sustainability orientation (Hermundsdottir & Aspelund, 2021), and companies that implement sustainable practices tend to demonstrate better financial and non-financial performance (Maziriri & Maramura, 2022).

Green Product Innovation (GPI) is one of the main strategies companies use to respond to consumer awareness of environmental issues, including the use of environmentally friendly materials, energy-efficient product design, low-emission production processes, and waste reduction (Ma et al., 2018). GPI has been shown to drive company performance through product differentiation and customer satisfaction (Ma et al., 2018), while significantly impacting profitability and competitive position (Yang, 2024; Novitasari & Agustia, 2022). *Green Supply Chain Management* (GSCM), on the other hand, plays a strategic role in integrating environmental aspects into the entire supply chain process, from raw material procurement to waste management (Liu & Yousaf, 2024). The implementation of GSCM has been shown to significantly improve company performance through operational benefits and environmental reputation (Fianko et al., 2025; Junejo et al., 2025), and is closely related to green innovation, including product and process innovation (Geng et al., 2017; Gelmez et al., 2024).

However, research examining the role of GSCM as a mediating variable in the relationship between GPI and business performance, particularly in retail MSMEs in East Kalimantan, is still very limited. Wicaksono et al. (2024) also highlighted that studies on the impact of environmental regulations on the adaptability of MSMEs in East Kalimantan have not been widely conducted, even though low-carbon development policies require MSMEs to adjust their operational strategies and product innovation. Based on this gap, this study provides academic and practical contributions by examining how Green Product Innovation can improve Business Performance through the mediation of Green Supply Chain Management in retail MSMEs in Samarinda.

Various previous studies support the formulation of this research hypothesis. GPI has been shown to have a positive impact on business performance through the creation of environmentally friendly added value and increased market attractiveness (Ar, 2012; Wang & Ahmad, 2024). GSCM has also been shown to be closely related to GPI, where green supply chain practices encourage innovation in environmentally friendly products and processes (Geng et al., 2017; Wang & Liu, 2022; Gelmez et al., 2024). Furthermore, GSCM is known to influence business performance by increasing operational efficiency, competitive advantage, and company profitability (Jabbour et al., 2015; Holling & Backhaus, 2023; Alkandi et al., 2025). Furthermore, GPI is suspected to not only have a direct impact on business performance but also have an indirect effect through GSCM as a mediating variable, as GSCM encourages green innovation, which in turn improves company performance (Novitasari & Agustia, 2021; Xie et al., 2019). Based on the description, the research hypothesis is formulated as follows: H1: Green Product Innovation has a positive and significant effect on Business Performance; H2: Green Product Innovation has a positive and significant effect on Green Supply Chain Management; H3: Green Supply Chain Management has a positive and significant effect on Business Performance; H4: Green Product Innovation has a positive and significant effect on Business Performance through Green Supply Chain Management.

The research framework is designed to describe how Green Product Innovation (X) influences Business Performance (Y), both directly (H1) and indirectly through Green Supply Chain Management (M) as a mediating variable (H2 and H3), as presented in Figure 1.

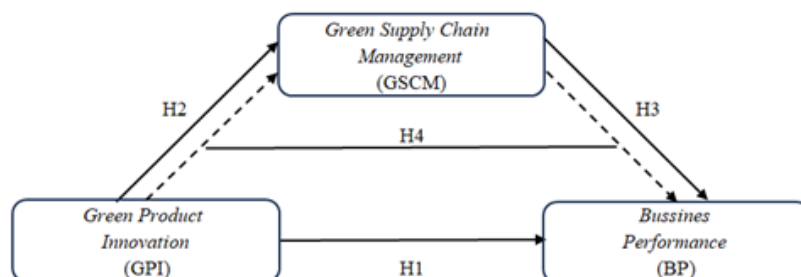


Figure 1. Conceptual framework of the research

RESEARCH METHODS

This research is a quantitative explanatory study that aims to examine the effect of Green Product Innovation on Business Performance with Green Supply Chain Management as a mediating variable in retail MSMEs in Samarinda. The approach used was a cross-sectional survey, and the analysis of relationships between latent variables was conducted using Structural Equation Modeling based on Partial Least Squares (SEM-PLS), which is recommended when the model is relatively complex, the sample size is small to medium, and the assumption of data distribution is not strictly normal (Hair et al., 2019).

The population of this study is all retail MSMEs in Samarinda that are still actively operating and engaged in sectors relevant to the implementation of GPI and GSCM. Based on East Kalimantan Provincial Regulation Number 11 of 2024, the number of MSMEs in East Kalimantan was recorded at 460,147 business units in 2023. The sample size was determined using the Krejcie and Morgan (1970) table, where a population of more than 100,000 requires a minimum sample of 384 respondents. Thus, this study determined 384 retail MSMEs in Samarinda as the sample, with each MSME represented by one respondent, namely the business owner or manager.

Primary data was obtained directly from MSME owners or managers through a structured questionnaire compiled based on research variable indicators adapted from Scopus-indexed international journals, while secondary data in the form of MSME profile documents and scientific journal articles were used as supporting data. The questionnaire was structured in the form of closed-ended statements measured using a four-point Likert scale (1 = Strongly Disagree to 4 = Strongly Agree), distributed both offline and online. Before being used in primary data collection, the questionnaire instrument was assessed through expert judgment and a pilot test to test the clarity of wording and consistency of answers (Hair et al., 2019).

The collected data were processed using SPSS for descriptive analysis and SmartPLS for structural model analysis with SEM-PLS approach, through four stages: (1) descriptive analysis of respondent characteristics and research variables; (2) testing the measurement model (outer model) through indicator reliability (outer loading ≥ 0.70), construct reliability (Cronbach's Alpha and Composite Reliability ≥ 0.70), convergent validity (AVE ≥ 0.50), and discriminant validity through Fornell-Larcker criteria and Heterotrait-Monotrait ratio (HTMT < 0.90) (Henseler et al., 2015; Hair et al., 2019); (3) testing the structural model (inner model) through examining multicollinearity (VIF < 5), coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), model fit (SRMR and NFI), and the significance of the path coefficient through bootstrapping 5,000 subsamples at a significance level of 5% (t-statistic ≥ 1.96 and p-value < 0.05); and (4) direct and indirect hypothesis testing to see the mediating role of GSCM between GPI and business performance, with VAF 20–80% interpreted as partial mediation and VAF $> 80\%$ as full mediation (Hair et al., 2019).

RESULTS AND DISCUSSION

Respondent Characteristics

Questionnaires were distributed to 414 potential respondents; after data screening for completeness and consistency of answers, 30 questionnaires (7.25%) were declared unsuitable, resulting in 384 data items (92.75%) suitable for analysis. The characteristics of the study respondents are presented in Table 1.

Table 1. Characteristics of research respondents (n = 384)

Characteristics	Category	Amount	Percentage (%)
Age	20–25 / 25–30 / >30 Years	130 / 165 / 89	33.9 / 43.0 / 23.2
Gender	Male Female	177 / 207	46.1 / 53.9
Last education	Elementary School / Middle School / High School / Bachelor's / Master's	15 / 15 / 159 / 165 / 30	3.9 / 3.9 / 41.4 / 43.0 / 7.8
Position	Store Manager / Owner	146 / 238	38.0 / 62.0
MSME Income (Rp/month)	3–5 million / 6–10 million / 11–15 million / 16–20 million / >20 million	86/135/84/48/31	22.4/35.2/21.9/12.5/8.1
MSME Experience	0–1 / 1–5 / >5 Years	70 / 186 / 128	18.2 / 48.4 / 33.3
Length of Time the MSME Has Been Established	0–1 / 1–5 / >5 Years	72 / 204 / 108	18.8 / 53.1 / 28.1

Source: Primary data processing results, SPSS and SmartPLS, 2026.

Based on Table 1, the majority of respondents were aged 25–30 years (43.0%), female (53.9%), and had a bachelor's degree (43.0%). Most respondents were shop owners (62.0%), indicating that the research data was largely obtained from parties with direct authority in business decision-making. The majority of MSMEs had monthly revenues in the range of IDR 6–10 million (35.2%), with the majority of business experience and length of operation being between 1–5 years.

Description of Variables and Evaluation of Measurement Model

Descriptive analysis using a Likert scale of 1–4 with categories: 1.00–1.75 very low, 1.76–2.50 low, 2.51–3.25 high, and 3.26–4.00 very high. The three research variables are in the high category with adjacent cumulative averages, namely GPI of 2.53, GSCM of 2.53, and business performance of 2.54, indicating that green product innovation, green supply chain practices, and business performance of retail MSMEs in Samarinda have been implemented and perceived quite well by respondents.

An outer model evaluation was conducted to assess the construct's reliability and validity. All indicators in the three constructs had outer loading values above 0.70 on their original constructs and higher than those on the other constructs, thus meeting convergent validity based on cross-loading. The results of the reliability and Average Variance Extracted (AVE) tests are presented in Table 2.

Table 2. Results of reliability and convergent validity tests

Construct	Cronbach's Alpha	Composite Reliability	AVE	Information
Business Performance (BP)	0.965	0.971	0.826	Fulfil
Green Product Innovation (GPI)	0.950	0.961	0.833	Fulfil
Green Supply Chain Management (GSCM)	0.962	0.968	0.814	Fulfil

Source: Primary data processing results, SPSS and SmartPLS, 2026.

All constructs had Cronbach's Alpha and Composite Reliability values above 0.70 and AVE above 0.50, thus declared reliable and convergently valid. Discriminant validity was tested using the Fornell-Larcker criterion (Table 3), where the square root of the AVE of each construct (diagonal value) was greater than its correlation with other constructs.

Table 3. Results of the discriminant validity test (Fornell-Larcker criterion)

Construct	BP	GPI	GSCM
Business Performance (BP)	0.909		
Green Product Innovation (GPI)	0.519	0.913	
Green Supply Chain Management (GSCM)	0.724	0.461	0.902

Source: Primary data processing results, SPSS and SmartPLS, 2026.

These results are supported by the Heterotrait-Monotrait Ratio (HTMT) values which are all below 0.90 (0.541 between GPI and BP; 0.751 between GSCM and BP; 0.482 between GSCM and GPI), so that all constructs have sufficient empirical differences to continue testing the structural model.

Structural Model Evaluation and Hypothesis Testing

The inner model evaluation includes multicollinearity test (VIF), coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and model fit, as summarized in Table 4.

Table 4. Results of the structural model evaluation (inner model)

Criteria	Mark	Information
VIF: GPI-BP / GPI-GSCM / GSCM-BP	1,271 / 1,000 / 1,276	There is no multicollinearity
R^2 Business Performance	0.567	Moderate
R^2 Green Supply Chain Management	0.213	Weak
f^2 GPI-BP / GPI-GSCM / GSCM-BP	0.100 / 0.271 / 0.689	Small / Medium / Large
Q^2 Model	0.660	Good predictive relevance
SRMR / NFI	0.024 / 0.972	Model fit / Good

Source: Primary data processing results, SPSS and SmartPLS, 2026.

All VIF values are below 5, so the model does not experience multicollinearity problems. The R^2 value for business performance of 0.567 (moderate) indicates that GPI and GSCM together explain 56.7% of the variation in business performance, while the R^2 for GSCM of 0.213 (weak) indicates that GPI explains 21.3% of the variation in GSCM. GSCM makes a significant contribution to business performance ($f^2 = 0.689$), exceeding the direct contribution of GPI ($f^2 = 0.100$). The Q^2 value of 0.660 indicates good predictive relevance, while the SRMR of 0.024 and NFI of 0.972 indicate good model fit. The results of the path significance test through bootstrapping are presented in Figure 2.

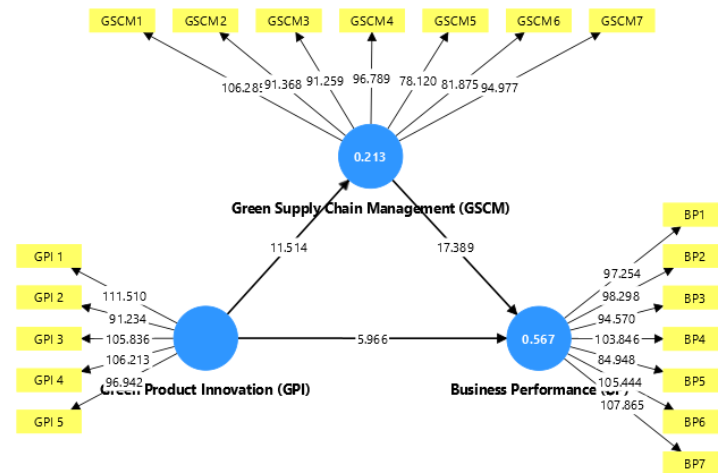


Figure 2. SEM-PLS bootstrapping structural model

Figure 2 shows that all structural paths have t-statistic values above 1.96, so all direct paths are declared significant. Hypothesis testing based on bootstrapping results with the criteria of t-statistic > 1.96 and p-value < 0.05 is presented in Table 5.

Table 5. Results of hypothesis testing (direct and indirect effects)

Hypotheses	Connection	Coefficient	T-Statistic	P-Value	Information
H1	GPI $\rightarrow$ BP	0.235	5,967	0,000	Accepted
H2	GPI $\rightarrow$ GSCM	0.461	11,514	0,000	Accepted
H3	GSCM $\rightarrow$ BP	0.617	17,359	0,000	Accepted
H4	GPI $\rightarrow$ GSCM $\rightarrow$ BP (indirect)	0.285	9,779	0,000	Accepted (partial mediation)

Source: Primary data processing results, SPSS and SmartPLS, 2026.

Based on Table 5, all hypotheses are accepted: GPI has a positive and significant effect on business performance ($\beta = 0.235$; $p = 0.000$) and on GSCM ($\beta = 0.461$; $p = 0.000$); GSCM has a positive and significant effect on business performance ($\beta = 0.617$; $p = 0.000$); and GSCM is proven to significantly mediate the effect of GPI on business performance ($\beta = 0.285$; $p = 0.000$). Since the direct effect of GPI on business performance remains significant after GSCM is included in the model, the type of mediation that occurs is partial mediation.

Discussion

The Influence of Green Product Innovation on Business Performance

The results of the study indicate that GPI has a positive and significant impact on business performance, meaning that the better the implementation of green product innovation, the better the business performance of retail MSMEs in Samarinda. This finding is supported by the characteristics of respondents, who were predominantly shop owners, thus having direct authority in determining product types, packaging, and sales strategies. These results align with Wang and Ahmad (2024) and Maziriri and Maramura (2022), who showed that green product innovation improves business performance through efficiency and competitive advantage. However, Ma et al. (2018) and Wang and Liu (2022) caution that the

benefits of GPI on company performance can be influenced by business model design and supply chain risks. Therefore, the successful implementation of GPI in retail MSMEs still requires support from appropriate business and supply chain management.

The Influence of Green Product Innovation on Green Supply Chain Management

GPI has also been shown to have a positive and significant effect on GSCM, meaning that retail MSMEs that are increasingly actively implementing green product innovations tend to be encouraged to manage their supply chains in a more environmentally friendly manner, for example through more selective supplier selection and the use of more environmentally safe packaging. This finding aligns with Geng et al. (2017) and Gelmez et al. (2024) who demonstrated a close relationship between green supply chain practices and green innovation. However, the direction of this relationship differs from Novitasari and Agustia (2021) who position GSCM as a driving factor for green innovation. Therefore, in the context of retail MSMEs in Samarinda, GPI is actually the initial trigger for the implementation of more environmentally friendly supply chain practices.

The Impact of Green Supply Chain Management on Business Performance

GSCM has been shown to have a positive and significant impact on business performance. The implementation of GSCM helps MSMEs choose suppliers who are more environmentally conscious, reduce waste, and improve operational efficiency, in line with Jabbour et al. (2015) and Alkandi et al. (2025) who proved that GSCM increases cost efficiency, competitive advantage, and profitability. The f^2 value of 0.689 confirms that GSCM is the predictor with the largest contribution in this research model, surpassing the direct contribution of GPI, relevant to the characteristics of respondents who have mostly been running their businesses for 1–5 years and therefore have sufficient understanding of the importance of supplier management and cost efficiency.

The Mediation Role of Green Supply Chain Management

The results of the mediation test indicate that GSCM partially mediates the effect of GPI on business performance, meaning that green product innovation not only directly improves business performance but also indirectly through strengthening green supply chain management. In the context of retail MSMEs, business actors developing environmentally friendly products require support from suppliers, materials, packaging, and distribution processes that align with sustainability principles so that the innovations they undertake truly impact business performance. This finding aligns with Novitasari and Agustia (2021) and Abu Seman et al. (2019) who demonstrated that GSCM and green innovation play a crucial role in improving company performance. Therefore, MSMEs need to view GPI and GSCM as two complementary strategies, not as stand-alone strategies.

CONCLUSION AND SUGGESTIONS

This study yields several conclusions. First, Green Product Innovation has a positive and significant impact on Business Performance in retail MSMEs in Samarinda. Second, Green Product Innovation has a positive and significant impact on Green Supply Chain Management. Third, Green Supply Chain Management has a positive and significant impact on Business Performance. Fourth, Green Supply Chain Management is able to partially mediate the effect of Green Product Innovation on Business Performance, meaning green product innovation contributes to business performance both directly and through strengthening green supply chain management.

This study has limitations, including the use of a questionnaire instrument that relies on respondents' subjective perceptions, a model scope that only involves three variables, a research object limited to retail MSMEs in Samarinda, and a cross-sectional approach that does not capture the dynamics of change longitudinally. Future research is recommended to integrate additional variables such as environmental regulations, digitalization, or government support, expand the research object to other sectors or regions, and use longitudinal or mixed methods approaches. Practically, retail MSMEs in Samarinda are advised to continue to improve the implementation of Green Product Innovation through environmentally friendly raw materials and packaging, strengthen Green Supply Chain Management by selecting suppliers who pay attention to environmental aspects, and make environmentally friendly practices part of the strategy to improve business performance sustainably.

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