

# THE IMPACT OF GREEN SUPPLY CHAIN MANAGEMENT ON SUSTAINABLE PERFORMANCE: MEDIATED BY GREEN SUPPLIER INTEGRATION, GREEN CUSTOMER INTEGRATION, AND PROACTIVE ENVIRONMENTAL STRATEGY

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## Abstract:

**Background:** Indonesia is progressing toward sustainability by promoting green supply chain management (GSCM) practices among businesses. Despite their potential to improve environmental performance, farmers remain hesitant due to perceived complexity, high cost, and the need for operational adjustments.

**Purpose:** This research investigates how green supplier integration, customer integration, and proactive environmental strategies mediate the relationship between GSCM practices and sustainable performance. The goal is to identify ways to make GSCM more accessible and advantageous for farmers.

**Design/Methodology/approach:** The research employs a quantitative approach using Smart PLS-3, a structural equation modelling tool, to analyze the relationships between GSCM practices, integration strategies, and sustainable performance. Data were collected from farmers in Cuntel Village, Kopeng.

**Finding/result:** The study found that GSCM does not directly influence sustainable performance but works through mediating variables. Green supplier integration is the potent mediator, followed by green customer integration and proactive environmental strategy, which enhance GSCM's impact on sustainability.

**Conclusion:** Collaborative efforts between suppliers, customers, and farmers, combined with forward-looking environmental strategies, can make GSCM practices more practical and effective. These approaches address the skepticism of farmers by demonstrating tangible benefits and reducing implementation complexities.

**Originality/value (State of the art):** The research provides a unique perspective on mediating factors that bridge the gap between GSCM practices and sustainable performance. It offers actionable insights for policymakers, businesses, and farmers, aligning GSCM practices with Indonesia's sustainable development goals.

**Keywords:** green supply chain management, sustainable performance, green supplier integration, green customer integration, proactive environmental strategy

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## INTRODUCTION

Indonesia is currently entering an era of improving sustainable performance, evidenced by many business actors and buyers using green supply chain management to improve sustainable performance (Ye & Dela, 2023). Sustainable performance is a concept that combines economic, environmental, and social aspects within a company's operations to promote long-term viability. This approach seeks to balance these three key pillars: economic growth, environmental stewardship, and social responsibility (Afum et al. 2020; Hwang et al. 2021). It significantly impacts small to medium-sized business actors to improve economically, socially, and environmentally. Most have used the green supply chain management concept to reduce waste and emissions and increase a company's sustainability (Hejazi et al. 2023).

Green supply chain management in agriculture refers to the integration of the environment into the supply chain processes of agricultural products. According to Rehman et al. (2023), there are five indicators: green purchasing, green manufacturing, green packaging and distribution, internal environmental management, and green marketing. Green purchasing refers to procuring agricultural inputs, products, and services produced using environmentally friendly practices, such as organic farming methods, sustainable sourcing, and reduced chemical inputs (Thoo, Nurul Farah, & Zhang, 2020). Green manufacturing is adopting environmentally friendly practices and technologies in agricultural production to minimize waste generation, reduce energy and water consumption, and optimize resource use efficiency (Rajapakshe, 2023). Green packaging and distribution refer to using environmentally friendly packaging materials and logistics practices that minimize environmental impact during the transportation and distribution of agriculture (Khandelwal, Singhal, Gaurav, Dangayach, & Meena, 2021). Internal environmental management refers to implementing an environmental management system (EMS) within agricultural organizations to monitor, control, and improve environmental performance across all operations (Vapa et al. 2023). Green marketing refers to promoting and communicating agricultural products and practices that are environmentally friendly, highlighting their sustainable attributes to consumers and stakeholders (Muchenjeet al. 2023).

The implementation of green supply chain management (GSCM) in Indonesia not only applies to companies that already have large business scales, but the majority of people who work as farmers have also used green supply chain management as a method of increasing sustainable performance (Suryaningrat & Novita, 2022). In pursuing sustainable performance within the agricultural sector, key factors such as green purchasing, eco-friendly production, sustainable distribution, and environmentally conscious packaging are vital in enhancing overall sustainability (Yildiz et al. 2019). In its application, GSCM helps optimize resource use and reduce waste (Pulansari & Putri, 2020). One of them is the farmers in Cuntel village located in Kopeng, Semarang Regency, Central Java, who are business actors. Most work as farmers to supply and distribute harvests to business actors for resale. However, based on the research results, most farmers have implemented green supply chain management, but some still need to implement it. A study found that this implementation poses several challenges related to high costs, lack of expertise, and lack of support from the government (Noiki et al. 2023; Palazzo & Vollero, 2021). Apart from that, understanding green supply chain management in optimizing their experience to improve sustainable performance still needs to be improved (Trivellas et al. 2020; Yildiz et al. 2019).

The agricultural sector in Cuntel Village, Kopeng, is experiencing economic decline due to an inefficient supply chain, primarily caused by a lack of collaboration with suppliers and customers, which limits social welfare as the financial cycle remains stagnant. Environmentally, while some agricultural waste is recycled, a significant portion is still discarded despite its potential for reuse, and water waste from irrigation contains high levels of chemical fertilizers that threaten soil health. Additionally, weak knowledge transmission between farmers and suppliers hinders innovation and sustainable practices. A significant barrier to improvement is the limited understanding and adoption of Green Supply Chain Management (GSCM), as farmers exhibit low levels of implementation despite government efforts to promote sustainability (Hejazi et al. 2023). Many farmers remain skeptical about its benefits due to perceived complexity, high costs, and the operational changes required Zhaolei et al. (2023), while existing research by Maqsood et al. (2022) & Rehman et al. (2023) suggested that GSCM determinants do not always translate into acceptance by end-users. The financial burden of green technologies,

training, and infrastructure investments further discourages adoption, as stated by Sahoo & Vijayvargy (2020) & Trivellas et al. (2020), and significant changes in logistics and distribution, such as environmentally friendly packaging and emission reduction, add to the complexity. This study highlights a critical gap between GSCM strategies and their practical adoption by farmers in Cuntel Village, emphasizing that while GSCM holds potential for improving economic, social, and environmental sustainability, challenges such as limited collaboration, financial constraints, and lack of technique expertise must be addressed to bridge the gap between real-world implementation in the agricultural sector.

To address the research gap, this study uses green supplier integration, customer integration, and proactive environmental strategy to mediate the relationship between green supply chain management (GSCM) and sustainable performance. Building long-term supplier relationships committed to sustainable practices involves sharing knowledge, resources, and innovation to achieve common goals in an environmentally friendly supply chain (GSCM). The application of eco-friendly technology in production and distribution processes can reduce waste and utilize recycled raw materials (Han & Huo, 2020). Engaging customers through surveys, discussion forums, or beta product testing can garner feedback and involve them in the green development process. Educating customers about sustainability and the benefits of choosing eco-friendly products through green labels or transparent product information can enhance sustainable performance (Hoffmann, 2007). Farmers can adopt environmental monitoring systems to measure the impact of their operations on the environment, such as water use, pesticide use, or waste management (Rehman et al. 2023). This research aims to bridge the gap between GSCM and farmers' acceptance by examining the role of green supplier integration, green customer integration, and proactive environmental strategies. The novelty of this research lies in adapting these strategies as catalysts to encourage farmers to optimize GSCM attributes sustainably in their agricultural activities.

This research aims to examine the relationship between Green Supply Chain Management (GSCM) and Sustainable Performance in the agricultural sector, specifically among farmers in Cuntel Village, Kopeng, by identifying key mediating factors such as

green supplier integration, green customer integration, and proactive environmental strategy. The study seeks to investigate how these mediators enhance the effectiveness of GSCM in improving economic, social, and environmental sustainability. The benefit of this research is to identify factors that can facilitate aspects of GSCM attributes in encouraging sustainable performance among farmers in Cuntel Village, Kopeng. Practically, this research can provide possible solutions for farmers to optimize green supply chain management attributes sustainably in agricultural activities, including minimizing waste, water usage, soil usage, pesticides, etc. Furthermore, this research will provide another idea that will boost the sustainable performance which adopting the green supplier integration, the green customer integration, and a proactively environmental strategy. Therefore, the farmers can increase the sustainable performance, including the economic performance, social performance, and environmental performance.

## METHODS

The research design is explanatory or causal research with a quantitative approach, as it investigates how green supplier integration, green customer integration, and proactive environmental strategy mediate the relationship between GSCM and sustainable performance. The data used includes primary sources. Primary data was collected using a survey method, where questionnaires were distributed to selected respondents. This survey was conducted directly and distributed to farmers in Cuntel village, Kopeng. For the study, the population was farmers engaged in the green supply chain management in the Cuntel Village, Kopeng, totaling 100 people; the population was taken based on data from the Central Bureau of Statistics for the City of Kopeng for 2023.

This research selected Cuntel Village, Kopeng, because it is a region where farmers actively engage in agricultural supply chain processes. Due to its agricultural economy, the village provides a relevant setting for studying green supply chain management (GSCM) practices. Additionally, challenges such as high costs, limited expertise, and lack of government support make it an ideal case study to examine the adoption and effectiveness of GSCM strategies.

An interview procedure was explicitly constructed, and the survey was proposed and performed to depict the farmers' insights into green supply chain management, green supplier integration, green customer integration, proactive environmental strategy, and sustainable performance of farmers in Cuntel Village, Kopeng. An interview procedure has been established to obtain the supply chain attributes of farmers across the mentioned questionnaire. This research designed a framework and implemented it for a sample of 80 farmers in Cuntel Village. The samples taken will be calculated using the Slovin formula.

The research hypotheses were tested using path analysis. This approach facilitated the identification of both direct and indirect effects, allowing for a comprehensive understanding of the relationships between variables. This method also served as an index to assess validity and reliability. The study data were analyzed using partial least squares-structural equation modelling (PLS-SEM) using SMART PLS Ver 3.0 software, allowing robust testing and interpretation of the results. The partial least squares structural equation modeling (PLS-SEM) technique is a robust statistical method commonly used to analyze complex relationships between latent variables. This approach is particularly valuable in exploratory studies that aim to predict and explain variance in key outcome constructs (Joseph et al. 2019). PLS-SEM is advantageous because it can handle small sample sizes, non-normal data distributions, and complex models with multiple constructs and indicators. This research uses the mediating variables green supply integration, green customer integration, and proactive environmental strategy, which aim to measure the influence of green supply chain management on sustainable performance.

## Hypothesis

### **Green Supply Chain Management and Sustainable Performance**

In determining the sustainable performance, including the economic performance, social performance, and environmental performance, green supply chain management plays an important role through several processes that focus on reducing environmental impacts, improving resource efficiency, and ensuring sustainability throughout the agricultural supply chain.

It is stated that green supply chain management has a significantly positive effect on sustainable performance (EP, EnP, and SP) with establish strong ties with eco-oriented supply chain partners by discussing the way of designing green products during the early stage of research and development. Onyango (2014) revealed a positive relationship between GSCM and economic performance. Furthermore, investing in green supply chain management can be optimized if firms collaborate with eco-oriented supply chain partners on a long-term perspective by assuring supply chain partners of mutual benefits built on trust, commitment, and credibility, which results in increased use of environmentally friendly raw materials and packaging (Afum et al. 2020). Thus, an indication that green supply chain management not only helps firms achieve direct economic gains but also helps in achieving environmental excellence and improves the quality of life of both organizational members and the community in which firms operate (Afum et al. 2020).

**H1: Green Supply Chain Management has a significant impact on Sustainable Performance**

### **Green Supply Chain Management and Green Supplier Integration**

To adopt environmentally friendly practices and technologies in agricultural production, it is essential to minimize waste generation, reduce energy and water consumption, and optimize resource use efficiency (Rajapakshe, 2023). This requires understanding the potential environmental impacts of operations and products and agreeing on shared responsibilities for mitigating these impacts (Ayarkwa et al. 2021). Achieving environmental goals together involves a collaborative effort between manufacturing companies and suppliers to set, pursue, and achieve shared environmental objectives, such as reducing pollutant emissions, improving resource efficiency, and promoting sustainable practices (Kim, Youn, & Roh, 2011). Additionally, internal environmental management refers to the implementation of an environmental management system (EMS) within agricultural organizations to monitor, control, and improve environmental performance across all operations (Vapa Tankosić et al. 2023).

**H2: Green Supply Chain Management has a significant impact on Green Supplier Integration**

## Green Supply Chain Management and Green Customer Integration

Green marketing involves promoting and communicating the environmentally friendly attributes of agricultural products and practices to consumers and stakeholders (Muchenje et al. 2023). This process highlights the sustainability of these products, emphasizing their eco-friendly characteristics. Effective green marketing requires collaboration, incorporating customer feedback, and involving participants in the development of environmentally friendly products and sustainability practices (Indrayanti et al. 2020). Furthermore, this leads to customer environmental awareness, where customers are informed about the environmental impact of agricultural products and practices, and their willingness to support sustainable products (Rossi et al. 2024).

H3: Green Supply Chain Management has a significant impact on Green Customer Integration

## Green Supply Chain Management and Proactive Environmental Strategy

Green manufacturing involves adopting environmental practices and technologies in agricultural production to minimize waste generation, reduce energy and water consumption, and optimize resource use efficiency (Rajapakshe, 2023). This approach aligns with the strategy of pollution prevention, which focuses on implementing measures and practices to minimize or eliminate pollutants generated by agricultural activities. (Wato, 2020). Additionally, the adoption and utilization of innovative technologies and practices, such as renewable energy, efficient irrigation systems, and precision farming techniques (Scharfy et al. 2017) will support green manufacturing goals by reducing environmental impact (Rajapakshe, 2023).

H4: Green Supply Chain Management has a significant impact on Proactive Environmental Strategy

## Green Supplier Integration and Sustainable Performance

In determining the sustainable performance, including the environmental performance, by collaborating with supply partners (Jum'a, 2022). Joint decision-making and problem-solving refer to the collaborative decision-making processes between manufacturing companies and suppliers regarding environmental issues, where

decisions are made jointly to address environmental challenges and solve problems effectively (Wang et al. 2023). Furthermore, sharing and accumulating environmental knowledge refers to the process by which manufacturing companies and suppliers exchange and gather environmental knowledge, including best practices, innovations, and lessons learned, to improve environmental performance collectively (Salim Ba Awain et al. 2023).

H5: Green Supplier Integration has a significant impact on Sustainable Performance

## Green Customer Integration and Sustainable Performance

Customers' awareness and preferences regarding the environmental impact of agricultural products and agricultural practices have a significant impact on sustainable performance, especially regarding environmental sustainability (M. Gong et al. 2019). When customers are informed about and prioritize the environmental impact of their purchases, they are more likely to support sustainable products (Yue et al. 2020). This consumer demand drives agricultural producers to practice sustainability and develop environmentally friendly products. As a result, increased consumer engagement in promoting sustainable choices drives a cycle of continuous improvement of environmental performance in the agricultural sector (Aibar-Guzmán et al. 2022).

H6: Green Customer Integration has a significant impact on Sustainable Performance

## Proactive Environmental Strategy and Sustainable Performance

Product stewardship takes responsibility for the entire life cycle of agricultural products, from production to disposal, and plays a key role in determining environmental performance. This approach ensures that environmental and social impacts during use are minimized. (Mbabazi et al. 2021). The introduction and use of innovative technologies and practices, such as renewable energy, efficient irrigation systems, and precision agriculture techniques, further reduce environmental impacts (Scharfy et al. 2017). These advances contribute to more sustainable agricultural practices and improved environmental performance.

H7: Proactive Environmental Strategy has a significant impact on Sustainable Performance

## **Green Supply Chain Management, Green Supplier Integration, and Sustainable Performance**

Implementing green supply chain management enhances the understanding of the potential environmental impacts of operations and products, fostering a commitment to shared responsibilities for mitigating these impacts (Ayarkwa et al. 2021). By adopting environmentally friendly practices and technologies in agricultural production, such as minimizing waste generation, reducing energy and water consumption, and optimizing resource use efficiency (Rajapakshe, 2023), organizations can further comprehend their environmental impacts and agree on collaborative mitigation strategies (Ayarkwa et al. 2021). Furthermore, green purchasing such as organic farming methods, sustainable sourcing, and reduced chemical inputs (Thoo et al. 2020) lead to achieving environmental goals together, supporting collaborative efforts between manufacturing companies and suppliers to set, pursue, and achieve shared environmental goals, such as reducing pollutant emissions, improving resource efficiency, and promoting sustainable practices (Maaz & Hashmi, 2023).

This approach to improving environmental performance in agriculture focuses on maintaining soil fertility, structure, and health through effective management practices like soil conservation and nutrient management strategies (Amalero et al. 2003). By carefully regulating pesticide use, including types and quantities applied, agricultural practices can effectively manage pests, insects, and diseases while minimizing environmental impacts (Tudi et al. 2021). Waste minimization strategies play a crucial role by reducing, reusing, and recycling agricultural waste such as crop residues and packaging materials, thereby reducing the overall environmental footprint (Borthakur et al. 2024). Additionally, optimizing water consumption for agricultural purposes, including irrigation, livestock watering, and processing needs, contributes significantly to sustainable water management (Ma et al. 2024). These integrated practices not only enhance environmental stewardship but also support long-term agricultural sustainability and resilience.

H8: Green Supplier Integration mediates the relationship between Green Supply Chain Management and Sustainable Performance

## **Green Supply Chain Management, Green Customer Integration, and Sustainable Performance**

Green customer integration plays a pivotal role in linking green supply chain management (GSCM) practices with sustainable performance in agriculture. It involves actively engaging customers in sustainability initiatives to align supply chain strategies with environmental goals and consumer preferences. This integration includes educating customers about sustainable agricultural practices, promoting green product offerings, and collaborating with them to achieve environmental objectives. By incorporating customer feedback into GSCM strategies, agricultural businesses can enhance their environmental performance and meet market demands for eco-friendly products (Aibar-Guzmán et al. 2022; Zhang et al. 2022).

Furthermore, green customer integration fosters a cycle of continuous improvement by encouraging dialogue and joint decision-making between businesses and customers on sustainability issues. This approach not only enhances environmental stewardship across the supply chain but also supports economic viability and social responsibility. By integrating green customer perspectives into their operations, agricultural companies can gain competitive advantages in terms of sustainability leadership and resilience, contributing to long-term profitability and societal well-being (Indrayanti et al. 2020; Rossi et al. 2024).

H9: Green Customer Integration mediates the relationship between Green Supply Chain Management and Sustainable Performance

## **Green Supply Chain Management, Proactive Environmental Strategy, and Sustainable Performance**

Proactive environmental strategy plays a crucial mediating role between green supply chain management (GSCM) and sustainable performance in agriculture. It involves integrating environmental protection initiatives into organizational planning and operational practices to mitigate the adverse impacts of agricultural activities on the environment. By adopting measures such as pollution prevention, which focuses on minimizing or eliminating pollutants generated from agricultural operations (Wato, 2020), agricultural firms can enhance their environmental stewardship. This proactive approach also encompasses product stewardship, where companies take responsibility

for managing the lifecycle impacts of agricultural products, ensuring they are handled and disposed of in an environmentally responsible manner (Mbabazi et al. 2021).

Moreover, clean technology adoption is another critical component of a proactive environmental strategy in agriculture. This involves implementing innovative technologies and practices, such as renewable energy systems, efficient irrigation methods, and precision farming techniques, to reduce environmental footprints and enhance resource efficiency (Scharfy et al. 2017). By integrating these proactive environmental measures with GSCM practices like green purchasing, manufacturing, packaging, and marketing (Rehman et al. 2023), agricultural businesses can achieve sustainable performance outcomes. These synergistic efforts not only improve environmental sustainability but also contribute to economic efficiency and social responsibility within the agricultural sector. Ultimately, a proactive environmental strategy acts as a catalyst, bridging the gap between GSCM initiatives and sustainable performance, thereby fostering resilience and competitiveness in agricultural operations.

H10: Proactive Environmental Strategy mediates the relationship between Green Supply Chain Management and Sustainable Performance

The conceptual framework illustrates the relationships between GSCM, its mediators, and sustainable performance. Green supplier integration, green customer integration, and proactive environmental

strategy as key mediators that enhance the effectiveness of GSCM in achieving sustainability. This model is visually represented in Figure 1.

## RESULTS

Table 1 presents demographic data of 80 farmers in Cuntel Village, highlighting gender distribution, age, and work experience. This demographic profile provides context for understanding the characteristics of respondents and their potential influence on the GSCM option.

The discriminant validity test in Table 2 evaluates whether each construct is distinct from the others in the model. The Heterotrait-Monotrait Ratio of Correlations (HTMT) method is commonly used.  $HTMT < 0.90$  indicates acceptable discriminant validity (Henseler et al. 2015). Composite Reliability (CR)  $> 0.70$  confirms internal consistency (Hair et al. 2022). Average Variance Extracted (AVE)  $> 0.50$  ensures sufficient convergent validity (Fornell & Larcker; David, 1981). Factor analysis is conducted to assess the accuracy and reliability of the measurement model. The composite reliability for all variables is rated at 0.871 or higher, indicating that construct consistency has been achieved. Additionally, all variables' average variance extracted (AVE) exceeds 0.5 (Table 2), confirming convergent validity. Discriminant validity is established when the HTMT value is below 0.9, as shown in Table 3.

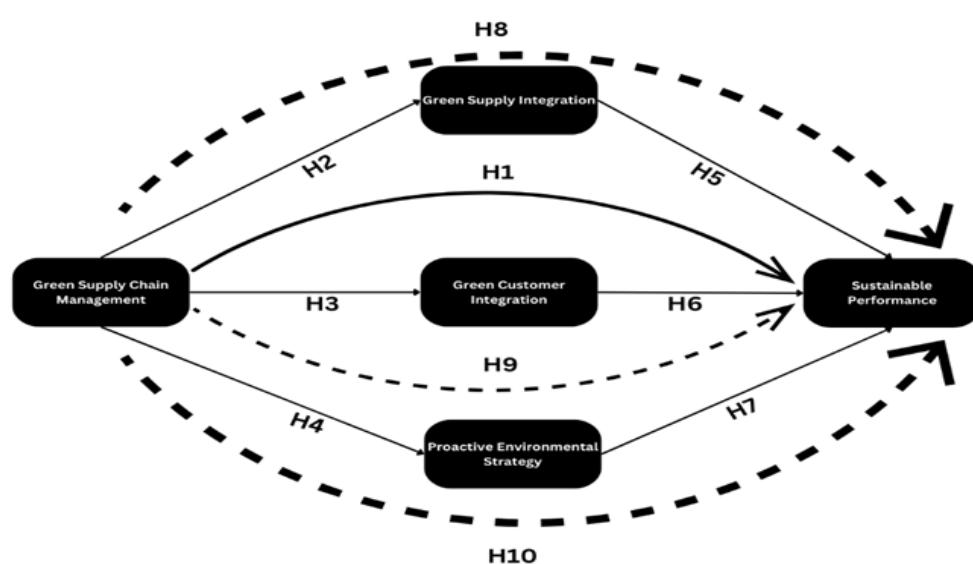


Figure 1. Research Model

Table 1. Demographics of 80 Farmers in Cuntel Village

Demographic Variable	Category	Sample size (n=80)	Frequency	Percentage
Gender	Male	43		53.75%
	Female		37	46.25%
Age (years)	18-30	58		72.5%
	> 30		12	15%
Work experience (years)	< 1	20		25%
	2-3		45	56.25%
	> 3		15	18.75%

Table 2. Validity and Reliability Test

Variable	Item Indicators	Loading Factors	Cronbach's Alpha	Rho_A	Composite Reliability	Average Variance Extracted
Green Supply Chain Management (GSCM)	GSCM1	0.934	0.946	0.946	0.959	0.823
	GSCM2	0.822				
	GSCM3	0.925				
	GSCM4	0.927				
	GSCM5	0.915				
Green Supplier Integration (GSI)	GSI1	0.935	0.944	0.947	0.958	0.820
	GSI2	0.928				
	GSI3	0.937				
	GSI4	0.939				
	GSI5	0.930				
	GSI6	0.939				
Green Customer Integration (GCI)	GCI1	0.891	0.971	0.971	0.976	0.874
	GCI2	0.918				
	GCI3	0.904				
	GCI4	0.912				
	GCI5	0.915				
Proactive Environmental Strategy (PES)	PES1	0.949	0.965	0.966	0.973	0.879
	PES2	0.915				
	PES3	0.934				
	PES4	0.955				
	PES5	0.941				
Sustainable Performance (SP)	SP1	0.944	0.972	0.972	0.978	0.898
	SP2	0.942				
	SP3	0.948				
	SP4	0.952				
	SP5	0.952				

Table 3. Discriminant Test

	GSCM	GSI	GCI	PES	SP
GSCM					
GSI	0.621				
GCI	0.745	0.765			
PES	0.532	0.625	0.525		
SP	0.712	0.684	0.629	0.664	

Noted: GSCM = Green Supply Chain Management; GSI = Green Supplier Integration; GCI = Green Customer Integration; PES = Proactive Environmental Strategy; SP = Sustainable Performance

The findings from the hypothesis tests presented in Table 4 can be summarized as follows: The variable “Green supply chain management” does not significantly influence sustainable performance, as evidenced by a t-statistic of 1.298, which is below the critical value of 1.96, and a p-value of 0.195, exceeding the significance level of 0.05. Conversely, the variables related to green supply integration show a significant positive effect on sustainable performance, with a t-statistic of 2.071 above the critical threshold of 1.96 and a p-value of 0.000, below the 0.05 significance level. Additionally, the “Green customer integration” variable positively impacts sustainable performance, indicated by a t-statistic of 2.847 and p-value of 0.000, exceeding the critical value of 1.96 and falling below the significance level of 0.05. Finally, the “Proactive environmental strategy” variable significantly affects sustainable performance, as shown by a t-statistic of 3.024 and a p-value of 0.003, above the critical value of 1.96 and below the 0.05 significance level.

The PLS-SEM model is based on the Cuntel Village data from Figure 4. This shows the SEM results of Cuntel farmers. The results are evidence that green supply chain management does not significantly impact sustainable performance. Key factors of GSCM identified in the literature, Rehman et al. (2023), do not significantly influence end-user acceptance, particularly among farmers (Shahzad et al. 2022). Farmers often wonder if GSCM can improve their business performance due to the complexity of new technologies and operational changes that may not be feasible for all (Sahoo & Vijayvargy, 2020; Trivellas et al. 2020). The costs associated with green technologies, training, and infrastructure changes are high (Sahoo & Vijayvargy, 2020). Moreover, GSCM often requires significant changes in logistics and distribution, such as environmentally friendly packaging and reduced emissions during transportation. This complexity can lead farmers to believe that the benefits do not justify the effort required (Trivellas et al. 2020).

Table 4. Hypothesis testing

Hypothesis	Original Sample (O)	T-statistics ( O/STDEV )	p-value	S/NS
Green Supply Chain Management → Sustainable Performance	0.123	1.298	0.195	NS
Green Supply Chain Management → Green Supply Integration	0.942	56.079	0.000	S
Green Supply Chain Management → Green Customer Integration	0.954	102.004	0.000	S
Green Supply Chain Management → Proactive Environmental Strategy	0.935	56.226	0.000	S
Green Supply Integration → Sustainable Performance	0.397	3.872	0.000	S
Green Customer Integration → Sustainable Performance	0.252	2.847	0.005	S
Proactive Environmental Strategy → Sustainable Performance	0.215	3.024	0.003	S
Green Supply Chain Management → Green Supply Integration → Sustainable Performance	0.375	3.997	0.000	S
Green Supply Chain Management → Green Customer Integration → Sustainable Performance	0.241	2.834	0.005	S
Green Supply Chain Management → Proactive Environmental → Sustainable Performance	0.201	3.014	0.003	S

noted: significance (S); not significance (NS)

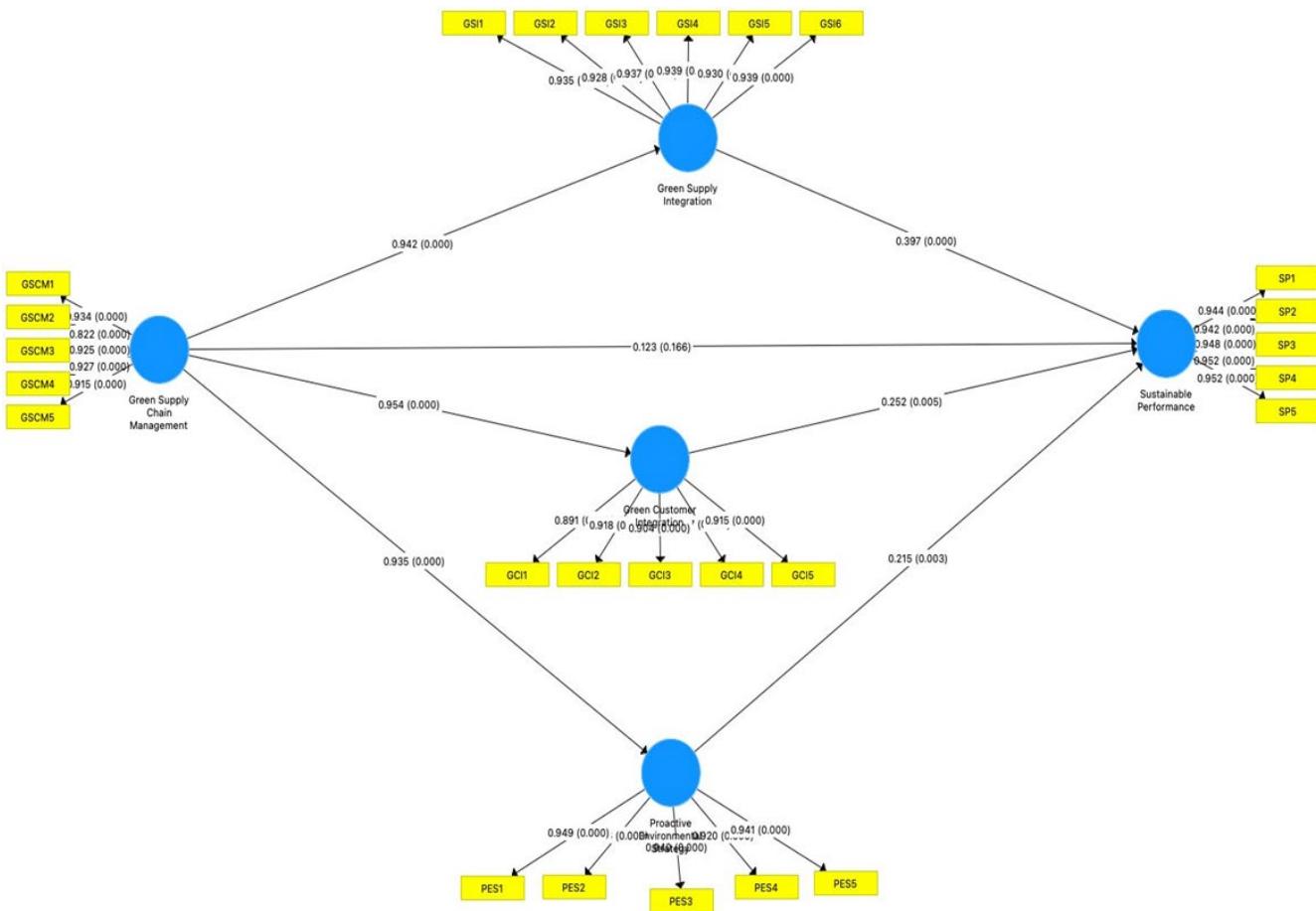


Figure 2. Results of the Research Model

The study found green supplier integration, customer integration, and proactive environmental strategies to be significant mediators between GSCM and sustainable performance. Each of these factors demonstrated strong positive relationships with sustainable performance. Green supply chain management positively impacts sustainable performance, with green supplier integration as a mediator. It indicates that effective collaboration with suppliers enhances resource utilization and aligns environmental goals, leading to better sustainable outcomes. Implementing green supply chain management helps organizations understand the environmental impacts of their operations, promoting shared responsibilities for mitigation (Ayarkwa et al. 2021). Farmers in Cunel Village benefit from integrating suppliers by accessing sustainable inputs, such as eco-friendly fertilizer and organic seeds, and adopting efficient resource management practices. Organizations can better assess their environmental footprints and develop collaborative strategies by adopting eco-friendly practices, such as minimizing waste and optimizing resource efficiency (Rajapakshe, 2023). Green purchasing initiatives, including organic farming and reduced chemical use, support

joint environmental goals among manufacturers and suppliers (Thoo et al. 2020). This approach enhances soil health through effective management practices, like soil conservation and nutrient management (Amalero et al. 2003). Careful regulation of pesticide use helps manage agricultural pests while minimizing environmental impacts (Tudi et al. 2021). Furthermore, waste minimization and optimized water consumption are crucial in reducing the overall environmental footprint and promoting sustainable agricultural practices (Borthakur et al. 2024).

Moreover, green customer integration could mediate the relationship between GSCM and sustainable performance. Engaging customers in sustainability efforts allows farmers to better align their production processes with market demands for eco-friendly products. This integration fosters a cycle of continuous improvement and responsiveness to customer needs. Green customer integration is vital for linking green supply chain management (GSCM) practices to sustainable performance in agriculture. It involves engaging customers in sustainability initiatives to align supply chain strategies with environmental goals and

consumer preferences. It includes educating customers about sustainable agricultural practices, promoting eco-friendly products, and collaborating to achieve shared environmental objectives (Aibar-Guzmán et al. 2022; Zhang et al. 2022). Farmers who actively interact with environmentally conscious customers, such as organic food buyers, wholesalers, and restaurants, experience higher demand for sustainable products, encouraging them to maintain eco-friendly farming practices. Furthermore, green customer integration fosters continuous improvement by encouraging open dialogue and joint decision-making on sustainability issues between businesses and customers. This approach enhances environmental stewardship while also supporting economic viability and social responsibility. By incorporating customer perspectives, agricultural companies can gain a competitive edge in sustainability, contributing to long-term profitability and societal well-being (Indrayanti et al. 2020; Rossi et al. 2024).

Additionally, the proactive environmental strategy could mediate the relationship between GSCM and sustainable performance. Adopting proactive measures to mitigate environmental impacts is crucial for enhancing sustainable performance. Farmers can significantly improve their practices when they take initiative beyond regulatory requirements. A proactive environmental strategy is a crucial mediator between green supply chain management (GSCM) and sustainable performance in agriculture. It involves integrating environmental protection initiatives into organizational planning and operations to mitigate the negative impacts of agricultural activities on the environment. By adopting measures like pollution prevention, agricultural firms can enhance their environmental stewardship by minimizing pollutants generated from their operations (Wato, 2020). This approach also includes product stewardship, where companies responsibly manage their products' lifecycle impacts (Mbabazi et al. 2021). Additionally, adopting clean technologies, such as renewable energy systems and precision farming techniques, further reduces environmental footprints and improves resource efficiency (Scharfy et al. 2017). By combining these proactive measures with GSCM practices, agricultural businesses can achieve sustainable performance, enhancing economic efficiency and social responsibility while fostering resilience and competitiveness in their operations (Rehman et al. 2023). Farmers who take the initiative beyond regulatory requirements, such as using

organic pesticides or reducing emissions, overcome operational barriers and improve environmental and economic performance.

Theoretically, this study underscores the significant impact of green supply integration, green customer integration, and proactive environmental strategy on sustainable performance among farmers. Green supply chain management has played an increasingly important role in sustainability (Ye & Dela, 2023). However, in practice, green supply chain management is not enough to enhance the sustainable performance of farmers. The data reveals that green supply chain management mediated by green supply integration on sustainable performance has the optimal impact. This research addresses these issues and provides significant practical guidelines. First, the farmers should understand the meaning of sustainable performance in the education program. Farmers should develop collaborative training programs, farmers can educate their suppliers about sustainable practice, resource efficiency, and the benefits of using eco-friendly materials. Second, shared environmental goals with suppliers will encourage them to adopt practices that align with the farmers' sustainability objectives, fostering a sense of partnership in achieving mutual aims. Third, organizing local workshops and seminars can raise awareness about the benefits of green supply chain management and encourage community engagement in environmental stewardship. Fourth, a partnership with local NGOs can further promote sustainable practices and amplify these messages. Five, creating support networks can facilitate knowledge sharing and resource access. This will help the farmers to exchange experiences and best practices. Additionally, establishing mentorship programs where experienced farmers guide newcomers can help facilitate the transition to more sustainable methods.

### Managerial Implications

The supply chain management (SCM) process of farmers in Cuntel Village involves various suppliers, including seed vendors, fertilizer and pesticide suppliers, agricultural equipment providers, and financial institutions that support farming activities. Farmers cultivate crops using both conventional and sustainable methods, integrating eco-friendly practices such as organic farming and efficient irrigation. Once harvested, agricultural products such as vegetables (lettuce, cabbage, carrots, fruits (strawberries,

tomatoes, herbs and spices (shallot, garlic, chili), and staple crops (rice, maize) are distributed to different customers, including local markets, wholesalers, food processing companies, and HORECA business. Some farmers also sell directly to the consumer through farmers' markets. The distribution process involves transportation using local logistics providers, with an increasing focus on environmentally friendly packaging like biodegradable bags or reusable crates. Additionally, sustainable distribution methods, such as minimizing transportation distances and collaborating with local buyers, help reduce emissions and food spoilage, ensuring an efficient and environmentally responsible agricultural supply chain.

Farmers must develop critical thinking, problem-solving, and collaboration skills to address challenges within their organization effectively. Those who struggle with inefficiencies should be encouraged to participate actively in joint efforts, particularly in infrastructure development. One approach to achieving this is maximizing their contributions through a more focused and strategic effort to enhance sustainability. Additionally, resource sharing can be an intensive strategy to reduce costs while improving economic and environmental performance in Cuntel Village, Kopeng. Furthermore, collaborative initiatives can help overcome management system limitations, especially regarding farmer skill development, resource availability, and technology adoption in the agricultural sector. Farmers can jointly design and implement solutions to market challenges and environmental concerns by working closely with distributors. Strengthening supply chain collaboration will improve the quality of agricultural products while addressing key issues such as pesticide reduction, workforce development, and socio-economic growth, ultimately making the agricultural sector in Cuntel Village more resilient and competitive.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

The findings of this study align with existing literature on Green Supply Chain Management (GSCM) but also reveal some key differences. The study confirms previous research that green supplier integration, customer integration, and proactive environmental strategy significantly enhance sustainable performance. It aligns with studies emphasizing supplier

collaboration, customer awareness, and strategic environmental planning as crucial for sustainability improvements. However, the study disagrees with some past findings by showing that GSCM alone does not directly improve sustainable performance among farmers. Unlike prior research that found a substantial direct effect of GSCM on sustainability, this study suggests that GSCM requires mediating factors (such as supplier and customer integration) to have a meaningful impact. This contradiction highlights farmers' challenges in adopting GSCM, particularly the high costs, complexity, and lack of government support, which are often underestimated in previous studies.

Green supplier integration by effective collaboration with suppliers enhances resource utilization and aligns environmental goals, thereby improving sustainable performance. Green customer integration, which engages customers in sustainability efforts, allows farmers to meet market demands for eco-friendly products better, fostering continuous improvement and responsiveness. A proactive environmental strategy involves farmers who adopt proactive measures to mitigate environmental impacts and see significant improvements in sustainable practices and outcomes. The findings suggest that while GSCM may not lead to enhanced sustainable performance, its effectiveness can be significantly amplified through targeted integration with suppliers and customers and a proactive approach to environmental strategies.

### Recommendations

To support the findings of this study, stakeholders should invest in capacity-building initiatives aimed at training farmers in GSCM practices, particularly emphasizing green supplier and customer integration, as well as proactive environmental strategies. The government should also provide policy support through incentives for farmers who adopt green practices, including subsidies for environmentally friendly technologies and training programs. Furthermore, awareness campaigns are essential to educate farmers about the benefits of GSCM and sustainable practices while also targeting consumers to create demand for eco-friendly products. Establishing collaborative platforms can facilitate partnerships among farmers, suppliers, and customers, enabling knowledge sharing and resource pooling to enhance GSCM practices. Additionally, implementing monitoring and evaluation systems will allow for

regular assessment of the impact of GSCM initiatives on sustainable performance, enabling adjustments based on real-world outcomes. On the other hand, governments should provide incentives to farmers to gradually change their perception that GSCM strategies are superior to conventional practices. Lastly, further research into the specific barriers farmers face in adopting GSCM practices is encouraged, focusing on practical solutions tailored to the local context. By addressing these areas, the agricultural sector in Indonesia can better harness the potential of GSCM to achieve sustainable performance, ultimately benefiting farmers, the environment, and society as a whole.

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