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Green Logistics Role in Enhancing Green Supply Chain Performance Through Green Procurement and Eco-Friendly Transportation

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A B S T R A C T

This study aims to analyze the influence of green procurement and eco-friendly transportation on green supply chain performance in manufacturing companies in East Java with green logistics as a mediating variable. The approach used is a quantitative explanatory approach with a Likert scale questionnaire survey of 1–7 to 143 managers and supervisors involved in supply chain management and operations. Then the data were analyzed using Partial Least Squares-Structural Equation Modeling (PLS-SEM). The results show that green procurement and eco-friendly transportation have a positive and significant effect on green logistics, while green logistics and green procurement have a positive and significant effect on green supply chain performance. However, the direct effect of eco-friendly transportation on green supply chain performance was not proven to be significant. These findings also indicate that green logistics significantly mediates the effect of green procurement and eco-friendly transportation on green supply chain performance, thus confirming the role of green logistics as a key capability that translates green practices upstream into improved environmental and operational performance along the supply chain.

KATA KUNCI
Pengadaan Ramah Lingkungan, Transportasi Ramah Lingkungan, Logistik Ramah Lingkungan, Kinerja Rantai Pasokan Ramah Lingkungan, Tiga Pilar Keberlanjutan

A B S T R A K

Penelitian ini bertujuan untuk menganalisis pengaruh pengadaan hijau dan transportasi ramah lingkungan terhadap kinerja rantai pasokan hijau di perusahaan manufaktur di Jawa Timur dengan logistik hijau sebagai variabel mediasi. Pendekatan yang digunakan adalah pendekatan kuantitatif eksploratif dengan survei kuesioner skala Likert 1–7 kepada 143 manajer dan supervisor yang terlibat dalam manajemen dan operasi rantai pasokan. Kemudian data dianalisis menggunakan *Partial Least Squares-Structural Equation Modeling* (PLS-SEM). Hasil menunjukkan bahwa pengadaan hijau dan transportasi ramah lingkungan memiliki pengaruh positif dan signifikan terhadap logistik hijau, sedangkan logistik hijau dan pengadaan hijau memiliki pengaruh positif dan signifikan terhadap kinerja rantai pasokan hijau. Namun, pengaruh langsung transportasi ramah lingkungan terhadap kinerja rantai pasokan hijau tidak terbukti signifikan. Temuan ini juga menunjukkan bahwa logistik hijau secara signifikan memediasi pengaruh pengadaan hijau dan transportasi ramah lingkungan terhadap kinerja rantai pasokan hijau, sehingga menegaskan peran logistik hijau sebagai kemampuan kunci yang menerjemahkan praktik hijau di hulu menjadi peningkatan kinerja lingkungan dan operasional di sepanjang rantai pasokan.

1. Introduction

1.1. Research Background

Amidst the rapid pace of climate change and worsening global environmental issues, the application of sustainability principles has become an urgent matter that requires special attention [1]. Sustainability is no longer just a popular term but has evolved into a real necessity that must be implemented operationally and become the strategic foundation in facing today's global business dynamics [2]. The concept of sustainability has evolved significantly, from initially focusing on environmental preservation to a comprehensive approach that also encompasses economic and social aspects [3]. Sustainability in the global supply chain has become a priority in the business and academic worlds in recent years due to increasing environmental concerns, social awareness, and increasing demands for the implementation of an economic system that can maintain long-term environmental balance while promoting social justice [4].

Indonesia itself is classified as a country with a high level of vulnerability to the threats of climate change, particularly rising sea levels [5]. Climate change raises concerns about economic losses and environmental impacts, but these risks can be mitigated through the implementation of sustainable practices, which are

increasingly under public pressure [6], [7]. Furthermore, the Ministry of National Development Planning in 2022 stated that Indonesia is also among the countries with the highest concentration of air pollution in the world [8]. Globally, 2.2 years of life expectancy (AHH) are lost due to current high levels of air pollution.

The SDGs will not be achieved without sustainability as a key goal, as they lack sustainable management of CO_2 emissions, pollution, climate change, ecosystem degradation, and food, water, and natural resource crises, particularly in developing countries [9]. Seeing the urgency of implementing sustainability principles, companies are no longer sufficient to just pursue profits (single bottom line), but are required to implement a triple bottom line, namely a business strategy that simultaneously benefits the company, people and the environment [10]. This theory changes the company's focus by increasing concern by providing benefits to the community and its surroundings, there are 3Ps as the main aspects of this concept, namely people, planet, and profit [11], [12].

In an operational context, the implementation of the triple bottom line principle requires companies not only to manage financial performance and environmental compliance internally but also to extend their responsibilities throughout the supply chain, ensuring comprehensive integration of sustainability efforts. Within the supply chain itself, all parties—from suppliers, manufacturers, distributors, and retailers to consumers—are involved in producing economical, high-quality, and fast-moving products, which has led to the development of the Green Supply Chain Management (GSCM) concept [13]. The integration of environmental aspects into supply chain activities within the GSCM concept makes it a sustainable development strategy in a competitive market, as every stage, from raw material procurement to the final product, is designed to achieve financial returns, reduce environmental risks, and strengthen the company's image [14]. Logistics activities are a crucial driver of global economic growth, but conventional logistics operations often create serious environmental pressures, particularly in the form of increased greenhouse gas emissions, air pollution, and highly intensive energy use [15]. However, research results show that technological factors, organizational climate, competition, regulations, as well as lack of knowledge, limited resources are still obstacles in the implementation of green logistics in Indonesia [16], [17].

Transportation plays a key role in the logistics system because its performance and management significantly determine the overall efficiency of goods flow in the supply chain [18]. However, air pollution has become a serious global problem primarily triggered by human activities, with the transportation sector being a major contributor [19]. Data from 2021 shows that the global transportation sector has the largest dependence on fossil fuels from the end-use sector, which contributes 37% of total carbon dioxide (CO2) [20]. Therefore, a change in development direction is needed through the implementation of eco-friendly transportation, which essentially focuses on developing an environmentally friendly transportation system by minimizing impacts, especially gas emissions [21]. Eco-friendly transportation prioritizes environmental sustainability and energy efficiency, aiming to reduce greenhouse gas emissions and dependence on fossil fuels [22]. Previous research has shown that eco-friendly transportation has proven effective in reducing vehicle emissions and improving air quality in urban areas [19].

The implementation of eco-friendly transportation also needs to be supported by green procurement, which serves as a starting point to optimally reduce emissions and improve sustainability in the supply chain. The increasing global environmental concerns are driving companies to implement green procurement, selecting environmentally friendly materials and suppliers, and establishing sustainable partnerships [23]. Green procurement is a sustainable procurement strategy that involves reducing, reusing, and recycling materials to obtain products and services that are environmentally friendly, energy-efficient, and easily recyclable, utilizing raw materials, processes, and uses to minimize environmental impact [24]. Examples of green procurement implementation include the minimal use of paper, stationery, and carbon emissions to provide environmentally friendly services [25]. Collectively, the implementation of several aspects of green procurement not only enables companies to comply with environmental regulations but also improves their competitive advantage and economic performance [26]. Despite this, the implementation of green procurement in Indonesia still faces obstacles, primarily due to human resources and regulatory, policy, guideline, and standard factors [27], [28].

The implications of suboptimal implementation of green procurement and eco-friendly transportation will become a more serious issue in regions with high concentrations of economic activity and transportation. The center of economic activity with the most advanced level of development in Indonesia is on the island of Java, with East Java being one of the largest industrial areas and one of the most densely populated provinces in [29]. East Java itself is the province with the highest number of medium- and large-scale manufacturing companies actively producing in Indonesia, with 6,151 businesses or companies [30]. Global climate change and surging greenhouse gas emissions demand sustainable solutions, particularly in the transportation sector, a major contributor to carbon pollution, which in Surabaya alone accounts for approximately 52% of total GHG emissions [31].

These findings strengthen the relevance of East Java as a research location to examine how the implementation of green procurement and eco-friendly transportation integrated with green logistics can help reduce emissions and improve green supply chain performance.

While various studies have shown that Green Supply Chain Management (GSCM) is positively correlated with emission reductions and improved company operational performance [32], [33], empirical evidence integrating it into a single model framework with green logistics, green procurement, and eco-friendly transportation remains limited, particularly in the context of developing countries like Indonesia. Previous studies in Indonesia have generally focused on only one dimension—for example, assessing the impact of transportation emissions [34] or examining the barriers to implementing green logistics and green procurement separately [16], [27], [28]—thus failing to provide a comprehensive picture of how the combination of green procurement and eco-friendly transportation managed through green logistics practices can impact green supply chain performance.

To address the existing gap, this study proposes a research model that examines the influence of green procurement and eco-friendly transportation on green supply chain performance with green logistics as a mediating variable, in manufacturing companies in East Java Province, Indonesia. This approach allows researchers not only to observe the direct influence of green procurement and eco-friendly transportation on GSCM performance, but also to assess the extent to which green logistics acts as a key capability that translates these green practices into improved environmental and operational performance.

Based on the aforementioned descriptions, this study aims to analyze the influence of green procurement and eco-friendly transportation on green supply chain performance, with green logistics as a mediator, in manufacturing companies in East Java. This research is expected to not only increase understanding of how green logistics bridges the influence of green procurement and eco-friendly transportation on green supply chain performance in the context of developing countries, but also provide a practical foundation for manufacturing management in East Java to more focused on integrate green procurement and eco-friendly transportation policies into logistics systems to reduce emissions and improve operational efficiency sustainably.

1.2. Literature Review

1.2.1. Triple Bottom Line (TBL)

The Triple Bottom Line (TBL) theory was proposed by Elkington in 1994 as a comprehensive approach involving various stakeholders and coordinating across many areas of government policy [35]. There are 3Ps as the main aspects in the TBL theory that are integrated in the evaluation of business performance, namely people, planet, and profit, where profit in this concept is defined as the benefits in the economic aspects obtained, while people are the company's responsibility towards social aspects, and planet is the company's responsibility towards environmental conditions [11], [12], [36]. Several dimensions in the TBL theory overlap in realizing sustainable performance, thus implying that sustainability only occurs when all dimensions are combined and considered simultaneously within the framework [36]. This framework is relevant to cover research because TBL is widely used as a conceptual foundation in sustainability studies that are assessed from the simultaneous achievement of economic, environmental, and social goals. Thus, the relationship between green procurement, eco-friendly transportation, green logistics, and green supply chain performance in this study can be understood as the company's efforts to optimize the three TBL dimensions simultaneously so that the research results can explain the company's sustainability performance holistically.

1.2.2. Green Procurement

Green procurement is a sustainable procurement strategy that involves reducing, reusing, and recycling materials to obtain products and services that are environmentally friendly, energy-efficient, and easily recyclable using raw materials, processes, and uses to minimize environmental impact [24]. Many companies have incorporated environmental standards into their purchasing processes and begun implementing green procurement strategies, but the majority still lack a systematic approach to achieving green procurement performance targets or fully integrating them into their organizational strategy [37]. However, the implementation of green procurement in Indonesia still faces obstacles, primarily due to human resources and regulatory, policy, guideline, and standard factors [27], [28].

The implementation of green procurement has been shown to have a strong relationship with a company's ability to retain customers [38]. Previous research found that green procurement partially contributes to green logistics, which also determines the achievement of the SDGs [39]. Other research also indicates that green procurement aligned with green logistics principles can improve operational efficiency while significantly reducing environmental impact. The synergy between these two practices is enhanced through the adoption of digital technology, which enables real-time monitoring and improved decision-making [26].

H1: Green procurement (GP) impacts green logistics (GL).

1.2.3. Eco-friendly Transportation

In the context of air pollutant emissions, the transportation sector is one of the largest contributors, so a sustainable transportation paradigm known as eco-friendly transportation is needed to anticipate and reduce its negative impacts [40]. The implementation of eco-friendly transportation is the development of a transportation system that encourages the use of environmentally friendly technology in an effort to meet the transportation needs of the community while minimizing impacts, especially gas emissions [21]. Certain study proposed key principles in eco-friendly transportation, namely energy efficiency, the use of clean energy, minimizing emissions, reducing congestion, and accessibility and affordability for all levels of society [41]. Research before emphasized the importance of increasing investment in green transportation infrastructure because it can effectively reduce air pollution, improve air quality and public health, while simultaneously encourage sustainable urban mobility and supporting environmental sustainability [19]. The implementation of eco-friendly transportation practices is classified as a core component of green logistics to reduce emissions and increase efficiency [42].

H2: Eco-friendly transportation (ET) influences green logistics (GL)

1.2.4. Green Logistics

Green logistics is an innovation in the logistics sector that presents a renewable concept to minimize environmental impact and foster public awareness of the natural environment [43]. Green logistics encompasses the implementation of various environmentally friendly measures along the logistics chain aimed at reducing carbon emissions, increasing energy efficiency, and minimizing waste generation [44]. Research shows that technological factors, organizational climate, competition, regulations, lack of knowledge, and limited resources remain barriers to the implementation of green logistics in Indonesia [16], [17]. However, green logistics practices not only reduce environmental damage but also increase overall supply chain effectiveness by saving costs and improving operational performance [45]. Green logistics directly contributes to green supply chain performance by increasing operational efficiency and reducing environmental impact [46].

H3: Green logistics (GL) influences green supply chain performance (GSP).

1.2.5. Green Supply Chain Performance

Green Supply Chain Performance (GSCP) is an approach born out of environmental sustainability concerns, integrated through environmentally friendly practices throughout the supply chain to reduce ecological impacts while increasing operational efficiency, for example through waste management, energy savings, and the use of sustainable raw materials [47], [48]. The GSCP concept is a sustainable development strategy in a competitive market, as every stage, from raw material procurement to the final product, is designed to achieve financial returns, reduce environmental risks, and strengthen the company's image [14]. GSCP can only be realized if every stage of the supply chain implements environmentally friendly practices, and the more widespread their implementation, the greater their contribution to environmental protection [49]. A study conducted in Kenya showed that green procurement significantly increased the effectiveness of GSCP, because by prioritizing environmentally friendly products and services, the county was able to reduce waste while increasing the efficiency of resource use [50]. In implementing GSCP, companies also need to integrate internally and externally to more effectively encourage collaboration with suppliers at the Green Procurement (GP) stage and with customers, thereby expanding market share and strengthening competitive advantage, particularly in modern retail [51].

The implementation of eco-friendly transportation practices, from optimizing distribution routes to utilizing low-emission vehicles, can also significantly increase energy efficiency and reduce greenhouse gas emissions throughout the supply chain, thus having a strong and positive impact on GSCP [52]. Other research also shows a correlation between eco-friendly transportation and GSCP, both directly and indirectly through increasing supply chain capabilities to be more agile and responsive [53]. Green logistics is seen as a key mechanism that translates eco-friendly transportation efforts into measurable improvements in GSCP [54]. Eco-friendly transportation is also said to directly impact GSCP by reducing carbon emissions and operational costs, but its full benefits often depend on how well it is embedded within a larger green logistics framework.

H4: Green procurement (GP) influences green supply chain performance (GSCP).

H5: Eco-friendly transportation (ET) influences green supply chain performance (GSCP).

H6a: Green logistics (GL) mediates the effect of green procurement (GP) on green supply chain performance (GSCP).

H6b: Green logistics (GL) mediates the effect of eco-friendly transportation (ET) on green supply chain performance (GSCP).

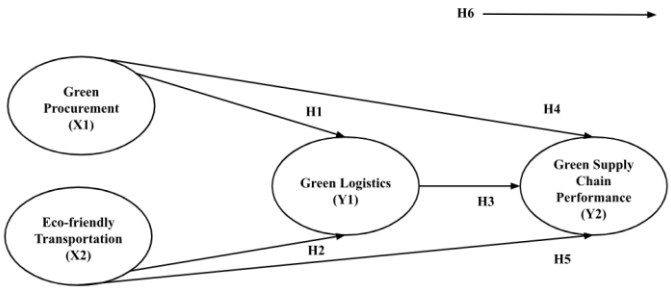

Figure 1. Research Framework

2. Research Method

This study was designed to examine the influence of green procurement (GP) and eco-friendly transportation (ET) on green supply chain performance (GSP) with green logistics (GL) as a mediating variable in manufacturing companies in East Java Province. The approach used was a quantitative explanatory approach with a Likert-scale questionnaire survey method from 1 to 7 developed from GP, ET, GL, and GSP indicators in accordance with the findings and recommendations of previous studies. The assessment scale consisted of (1) strongly disagree, (2) disagree, (3) somewhat disagree, (4) neutral, (5) somewhat agree, (6) agree, and (7) strongly agree.

The research sample obtained was 143 manager or supervisor respondents involved in the management and operational processes of the supply chain in manufacturing companies in East Java that have been operating for at least one year to be able to describe the real conditions. Referring to power table, at an alpha significance level of 0.05 with a moderate effect size, the power value for a sample size of 100 is close to 1 (approximately 0.940), indicating a suitable probability for the statistical test to detect existing differences [55]. Therefore, the selection of 143 respondents in this study was deemed statistically adequate to identify the influence between variables in the proposed model, with the respondent profile can be seen on Table 1.

All collected data was processed and analyzed using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach with the aid of SmartPLS software. The testing steps in the PLS approach are divided into two main areas: evaluation of the outer model and the inner model. To test the measurement model (outer model), convergent validity testing is used, which ensures the consistency of the indicators with their latent constructs, and discriminant validity testing, which examines the extent to which the developed constructs are clearly distinct from one another. This approach not only tests the strength of the relationship between variables but also assesses the legitimacy of the indicator measurement and the clarity of construct separation within the proposed analysis model.

Table 1. Respondent Profile

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	97	67.8
	Female	46	32.2
Age	< 30 years	29	20.3
	30–39 years	61	42.7
	40–49 years	38	26.6
	≥ 50 years	15	10.4
Education Level	Diploma	21	14.7
	Bachelor's degree	88	61.5
	Master's degree or higher	34	23.8
Job Position	Supervisor	58	40.6
	Manager	69	48.3
	Senior Manager / Head of Department	16	11.1
Years of Working Experience	1–5 years	33	23.1
	6 - 10 years	57	39.9
	11 - 15 years	34	23.8
	>15 years	19	13.2
Company Size	Medium-sized enterprise	79	55.2
	Large enterprise	64	44.8
Industry Type	Food & Beverage	41	28.7
	Chemicals & Pharmaceuticals	27	18.9
	Textile & Garment	31	21.7
	Automotive & Machinery	23	16.1
	Others	21	14.6
Length of Company Operation	1–5 years	26	18.2
	6–10 years	47	32.9
	> 10 years	70	48.9

3. Results and Discussion

Respondents consisted of 143 managers and supervisors working in manufacturing companies located in East Java, Indonesia. The respondent profile on Table 1 indicates that the majority of participants were male (67.8%) and aged between 30 and 39 (42.7%), reflecting a mature managerial workforce actively involved in supply chain decision-making. Most respondents held at least a bachelor's degree (61.5%), with nearly a quarter holding postgraduate qualifications, indicating sufficient cognitive ability to assess green procurement, environmentally friendly transportation, and green logistics practices.

In terms of organizational role, 59.4% of respondents held managerial or senior managerial positions, while the remainder were supervisors directly involved in operational supply chain activities. This distribution supports the relevance and reliability of the responses for evaluating green supply chain performance.

Regarding company characteristics, 55.2% of respondents worked in medium-sized manufacturing companies, while 44.8% represented large companies. The sample encompassed a diverse range of manufacturing subsectors, with the food and beverage, textile, and chemical industries being the dominant industries. In addition, almost half of the companies have been operating for more than ten years, which indicates organizational stability and accumulated experience in implementing sustainability initiatives.

Table 2. Confirmatory Factor Analysis

Laten Constructs	Observed Variable	Factor Loading	Cronbach's Alpha	Composite Reliability	AVE
Green Procurement (X_1)	X1.1 Middle Management Support	0.816	0.793	0.617	0.865
	X1.2 Awareness	0.835			
	X1.3 Social Corporate Responsibility	0.750			
	X1.4 Approach to Green Supplier	0.736			
Eco-Friendly Transportation (X_2)	X2.1 Lower Fuel Costs	0.779	0.738	0.657	0.851
	X2.2 Lower Emissions	0.855			
	X2.3 Benefiting Local Communities	0.795			
Green Logistics (Y_1)	Y1.1 Financial Economics	0.740	0.725	0.661	0.907
	Y1.2 Environmental & Social Performance	0.746			
	Y1.3 Logistics Networking & Transport	0.743			
	Y1.4 Information Sharing	0.733			
Green Supply Chain Performance (Y_2)	Y2.1 Green Manufacturing	0.817	0.871	0.661	0.907
	Y2.2 Green Purchasing	0.842			
	Y2.3 Cooperation with Customer	0.851			
	Y2.4 Eco Design	0.733			
	Y2.5 Green Information System	0.817			

In this research model, convergent validity was tested against several indicators, namely green procurement (X1), eco-friendly transportation (X2), green logistics (Y1), and green supply chain performance (Y2). The multiple regression model has a general threshold value for outer loading of 0.70 [56]. The indicators in this study can be declared valid because they have a loading value ≥ 0.70, which can be seen on Table 2 and considered to adequately reflect the construct. All indicators in this study met this criterion, with outer loading values ranging from 0.733 to 0.855, thus each indicator was deemed capable of adequately explaining the latent variable.

Furthermore, reliability testing refers to the consistency of the results obtained from an instrument [57]. To test the construct reliability in this study, two measures were used: Cronbach's Alpha and Composite Reliability (CR), which require a minimum value of 0.70 for the construct to be declared reliable [56], [58]. Green procurement (X1) has a Cronbach's Alpha of 0.793 and a Composite Reliability of 0.865, while eco-friendly transportation (X2) has a Cronbach's Alpha of 0.738 and a Composite Reliability of 0.851; both constructs meet the threshold and demonstrate good internal consistency. Furthermore, green logistics (Y1) achieved a Cronbach's Alpha of 0.725 and a Composite Reliability of 0.829, while green supply chain performance (Y2) had a Cronbach's Alpha of 0.871 and a Composite Reliability of 0.907, indicating that all endogenous constructs in the model were also considered reliable.

Convergent validity was further evaluated using the Average Variance Extracted (AVE) value. The Average Variance Extracted (AVE) test measures the amount of indicator variance, and its value is considered good or valid if the AVE value for each variable is ≥ 0.50, indicating that 50% or more of the indicator's variance can be explained [59]. The calculation results show that the AVE for green procurement (X1) is 0.607, eco-friendly transportation (X2) is 0.657, green logistics (Y1) is 0.548, and green supply chain performance (Y2) is 0.661. All of them are above the minimum limit. Thus, all constructs in the model are declared convergently valid, and the instruments used are considered capable of adequately measuring the concepts of green procurement, eco-friendly transportation, green logistics, and green supply chain performance.

Hypothesis testing was conducted to assess the causal relationship between latent variables in the structural model, namely green procurement (X1), eco-friendly transportation (X2), green logistics (Y1), and green supply chain performance (Y2). Path coefficients, t-statistics, and p-values were obtained through a bootstrapping procedure, with significance criteria if the t-statistic is ≥ 1.96 or p-value < 0.05 [60].

The test results on Table 3 and Figure 2 showed that green procurement has a positive and significant effect on green logistics with a path coefficient of 0.400 and a t-statistic of 4.921 (p = 0.000), thus hypothesis H1 was accepted. Eco-friendly transportation was also proven to have a positive and significant effect on green logistics with a path coefficient of 0.303 and a t-statistic of 5.640 (p = 0.000), thus H2 was also accepted. Furthermore, green logistics has a positive and significant effect on green supply chain performance with a path coefficient of 0.474 and a t-statistic of 3.362 (p = 0.001), thus H3 is accepted. Green procurement has a positive and significant direct effect on green supply chain performance with a path coefficient of 0.139 and a t-statistic of 2.313 (p = 0.021), thus H4 is also accepted. In contrast, the direct effect of eco-friendly transportation on green supply chain performance is insignificant, with a path coefficient of 0.408 and a t-statistic of 1.337 (p = 0.181), thus H5 is rejected.

Table 3. Hypothesis Testing

Research Hypothesis	Description	Path coefficient	T statistics	P Values	Information
RH1	Green Procurement (X_1) → Green Logistics (Y_1)	0.400	4.921	0.000	Supported
RH2	Eco-friendly Transportation (X_2) → Green Logistics (Y_1)	0.303	5.640	0.000	Supported
RH3	Green Logistics (Y_1) → GSCP (Y_2)	0.474	3.362	0.001	Supported
RH4	Green Procurement (X_1) → GSCP (Y_2)	0.139	2.313	0.021	Supported
RH5	Eco-friendly Transportation (X_2) → GSCP (Y_2)	0.408	1.337	0.181	Unsupported
RH6a	Green Procurement (X_1) → Green Logistics (Y_1) → GSCP (Y_2)	0.163	3.037	0.002	Supported
RH6b	Eco-friendly Transportation → Green Logistics (Y_1) → GSCP (Y_2)	0.193	2.665	0.008	Supported

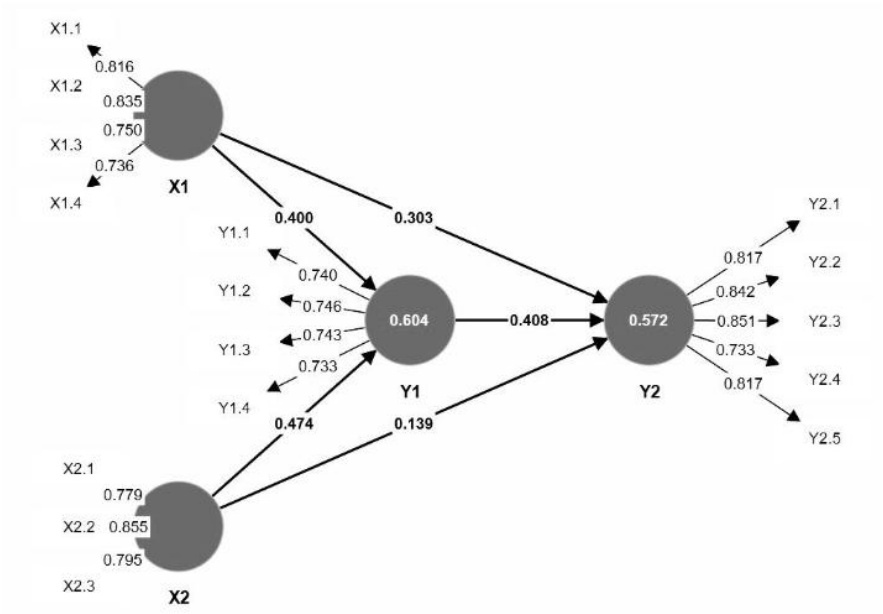

Figure 2. Partial Least Square Model

The indirect effect of green procurement on green supply chain performance through green logistics is also proven significant, with a mediation coefficient of 0.163 and a t-statistic of 3.037 (p = 0.002), indicating that green logistics acts as an effective mediator in the GP–GSCP relationship and supports hypothesis H6a. Similarly, eco-friendly transportation has a significant indirect effect on green supply chain performance through green logistics with a coefficient of 0.193 and a t-statistic of 2.665 (p = 0.008), thus the H6b hypothesis is accepted. Overall, these findings confirm that the main contribution of green procurement and eco-friendly transportation to green supply chain performance in this model is largely mediated by the improvement of green logistics practices, while eco-friendly transportation has not shown a strong direct effect without the existence of green logistics as a key capability in the green supply chain.

4. Conclusion

This study concludes that green procurement and eco-friendly transportation play a crucial role in strengthening green logistics practices at manufacturing companies in East Java. Both variables have been shown to have a positive and significant impact on green logistics, making green procurement policies and the implementation of environmentally friendly transportation systems the foundation for developing green logistics capabilities. Furthermore, green logistics and green procurement have a positive and significant impact on green supply chain performance, while the direct effect of eco-friendly transportation on green supply chain performance is insignificant. This indicates that green supply chain performance is largely determined by how companies manage their logistics and procurement processes in an integrated manner. Mediation analysis revealed that green logistics significantly mediates the effect of green procurement and eco-friendly transportation on green supply chain performance, thus confirming the role of green logistics as a key capability that translates upstream green initiatives into improved environmental and operational performance throughout the supply chain.

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