

## RESEARCH ARTICLE

# The Impact of Green Supply Chain Management Practices on Sustainable Development Goals: A Case of PT PJP in the Energy Sector

Ni Putu Widya Nirmala Dewi<sup>1</sup>, Ratih Hendayani<sup>1\*</sup>, Muhammad Shabir Shaharudin<sup>2</sup>

<sup>1</sup> School of Economics and Business, Telkom University, Bandung Regency, West Java 40257, Indonesia

<sup>2</sup> University of Science Malaysia, University Road, 1170 Gelugor, Penang, Malaysia

**ABSTRACT** - The swift advancement of technology and urban growth has led to a substantial increase in the global demand for electricity, including in Indonesia, thereby exacerbating environmental concerns due to emissions from power plants. The current research thoroughly investigates the impact of Green Supply Chain Management (GSCM) strategies on achieving Sustainable Development Goals (SDGs) at PT PJP, a subsidiary of Freeport-McMoRan in Papua, Indonesia. Quantitative approaches and SEM-PLS analysis were conducted on a dataset comprising 125 employees of PT PJP. The results show that all GSCM practices, except for green purchasing and customer cooperation, have a positive and significant effect on environmental practices. Additionally, every GSCM strategy, aside from internal environmental initiatives, positively impacts community practices. Findings from the IPMA underscore eco-design as areas of high performance, highlighting the necessity for PT PJP to prioritize customer cooperation, green purchasing, and investment recovery to ensure sustainable operations. This research offers valuable insights to enhance both academic and managerial strategies concerning GSCM and SDGs.

## ARTICLE HISTORY

Received : 20-04-2024

Revised : 29-07-2024

Accepted : 31-12-2024

Published : 30-09-2025

## KEYWORDS

*Green Supply Chain Management  
Sustainable Development Goals  
Energy Sector*

## 1. INTRODUCTION

The rapid pace of technological development and the expansion of urban areas have triggered a surge in electricity demand. Projections from the Energy Information Administration (EIA) show that global energy demand will continue to rise, potentially by 50% by 2050. Indonesia, the fourth most populous country in the world, is facing a growing escalation in annual electricity demand (ESDM, 2023). According to the Environmental Protection Agency (2024), power plants operating on gas, coal, and oil release hazardous substances that jeopardize atmospheric conditions. In addition, conventional energy conversion methods exacerbate concerns regarding global warming and climate change. These methodologies cause irreversible, severe environmental and ecosystem damage by releasing greenhouse gases, carbon dioxide, and harmful industrial pollutants (Ali et al., 2019; Trinh, 2023). Environmental degradation is a global problem affecting various regions of the world, such as Indonesia, resulting in the disruption of ecosystems, climate change, and depletion of the ozone layer (Manurung et al., 2020). This impacts the Sustainable Development Goals (SDGs) set by the United Nations (UN) member states.

SDGs are segmented into 17 goals and 169 targets for global development, which are intended to be accomplished by the year 2030. Indonesia is currently positioned 75th among a total of 166 UN member states, attaining a score of 70.16 out of 100. This clearly indicates that Indonesia is within a significant position in its efforts toward sustainable development (Nations, n.d.). It is imperative for developing nations to attain the diverse SDGs as they bear the brunt of climate change occurrences (Debnath, 2023). Following its inception in 2015, there have been deliberations focusing on methods to incorporate SDGs into assessments of sustainability (Eberling & Langkau, 2024; Alejandrino et al., 2021). To achieve this sustainability, companies in different parts of the world have adopted Green Supply Chain Management (GSCM) activities over the last ten years to gain a competitive edge in the global market.

GSCM is a concept that aims to inherently decrease the likelihood of negative impacts, such as pollution, waste, and various other environmental risks (Hendayani et al. 2022). Some entities incorporate environmental practices into their supply chains to reduce these impacts. These practices are known as green supply chain management (Moreira et al., 2022). Integrating GSCM requires the adoption of five essential practices: internal environmental management (IEM), eco-design (ED), green purchasing (GP), customer cooperation with environmental concerns (CC), and investment recovery practices (IR) (Zhu & Sarkis, 2004; Sarkis & Dou, 2018). Integrating GSCM into the SDGs allows entrepreneurs to design more sophisticated supply chain management strategies, thus improving stability, efficiency, and ethics in the supply chain (Zimon, Tyan, & Sroufe, 2019).

The present study is concerned with PT PJP, a Freeport-McMoRan subsidiary situated in Papua, Indonesia. PT PJP manages the operations of three distinct power facilities, including a steam power plant, a diesel power plant, and a dual fuel power plant (DFPP). The latter is utilized to supply electricity to PT Freeport Indonesia. This research aims to address a gap in the current theoretical literature on environmental issues by examining the contribution of GSCM practices in

\*CORRESPONDING AUTHOR | R. Hendayani | ✉ [ratihhendayani@telkomuniversity.ac.id](mailto:ratihhendayani@telkomuniversity.ac.id)

this company to the achievement of SDGs. There has been a shortage of research focusing on the influence of green supply chain management on environmental practices and performance. Therefore, the objective of this study is to elucidate the impacts of GSCM practices, particularly those associated with environmental and community practices that align with SDGs.

Furthermore, in contrast to prior research conducted by Jum'a (2023), this study employs the "Importance-Performance Map Analysis" (IPMA) technique to facilitate the communication of findings and identify crucial areas necessitating significant enhancements (Nitzl & Chin, 2017).

## **2. LITERATURE REVIEW**

### **2.1 Key Practices of Green Supply Chain Management**

Green supply chain management (GSCM) is a key strategy for achieving sustainability and providing significant competitive advantages and substantial benefits to the company's bottom line (Achillas et al., 2019). Optimized decisions are taken quickly and in a decentralized manner, ensuring that all decisions are made in the best interest of the company. The increasing environmental deterioration, such as increased pollution and waste, and decreased raw material resources, are the main reasons why lean and green supply chains are becoming more important (Srivastava, 2007; Paksoy & Deveci, 2023). Most organizations have adopted GSCM to meet customers' demand for eco-friendly products and services while utilizing environmentally sustainable production processes (Yalviolita & Hendayani, 2022). Zhu and Sarkis (2004, as cited in Sarkis & Dou, 2018) identified five key practices for implementing GSCM: internal environmental management (IEM), green purchasing (GP), customer cooperation with environmental concerns (CC), eco-design (ED), and investment recovery practices (IR).

#### **2.1.1 Internal Environmental (IEM)**

GSCM implementation should begin with internal management to raise team awareness of environmental issues, strengthen organizational culture, encourage teams to become more sustainable, and prompt them to consider factors like pollution prevention and resource optimization (Jabbour & De Sousa Jabbour, 2016; Moreira et al., 2022). According to Qudrat-Ullah (2018), in the IEM approach, company leadership must demonstrate a strong commitment to the environment because starting and implementing environmental initiatives requires financial and organizational support. A mature IEM approach is the only way to guarantee success in adopting green practices and green innovations.

#### **2.1.2 Green Purchasing (GP)**

Green purchasing is the purchase of environmentally labeled, less hazardous, and recyclable or reusable materials (Sarkis & Dou, 2018). This practice not only aims to reduce the impact on the environment but also to promote sustainability in the entire supply chain. By prioritizing products with lesser environmental footprint, companies can significantly reduce waste, lower emissions, and conserve natural resources. Green purchasing not only helps streamline operations but also reduces the demand for physical storage and distribution of documents, resulting in cost savings and reduced environmental impact.

#### **2.1.3 Customer Cooperation (CC)**

Customer cooperation is defined as the collaboration of customers in the implementation of eco-design, cleaner manufacturing, and green packaging. This involves customers actively participating in and supporting sustainable practices that aim to reduce environmental impact. According to the Carbon Disclosure Project (CDP) 2013-2014 survey, 56% of the surveyed companies identified sustainable practices as the primary driver of customer cooperation (Sarkis & Dou, 2018:11). This highlights the significant role that customer engagement plays in promoting sustainability initiatives. By working together, companies and their customers can achieve greater environmental benefits, enhance the effectiveness of GSCM practices, and contribute to the overall sustainability goals.

#### **2.1.4 Eco-Design (ED)**

One of the most effective methods for reducing waste is through the implementation of eco-design principles within a company's product development process. According to Sarkis and Dou (2018), eco-design can be described as the environmental design of a process or product that focuses on reducing and preventing the environmental effects of a product before it is manufactured, distributed, and used. Eco-design entails the creation of products with the objective of minimizing material and the use of energy, developing designs that facilitate the reuse, recycling, and recovery of materials and components, reducing the utilization of hazardous materials, and/or enhancing manufacturing processes (Sarkis & Dou, 2018:10).

#### **2.1.5 Investment Recovery (IR)**

Investment recovery is the recovery of investment obtained from the sale of excess inventory/materials from the company, the sale of used goods and materials that have been used, or the sale of excess asset equipment (Sarkis & Dou, 2018: 11). As posited by Sabri (2019), the process of investment recovery within a company can be classified into three

main categories: the sale of surplus materials, the sale of waste materials and second-hand items, and the sale of redundant capital equipment.

**2.2 Key Practices of Sustainable Development Goals**

In 2015, the entire membership of the United Nations demonstrated its support for the 2030 Agenda for Sustainable Development, which comprises 17 goals and 169 targets. The agenda’s overarching objective is to ensure lasting sustainability, providing a collective framework for a more peaceful and flourishing future for humanity and the planet (Nations, n.d.). Nations of the world can collectively address the interconnected challenges of severe poverty, financial crisis, social exclusion, and environmental destruction through international collaboration (Jeremić & Sachs, 2014). These goals and targets, as described by Stafford-Smith et al. (2017), provide a sustainable development paradigm that is universally applicable, with a focus on environmental preservation, social inclusion, and economic growth. The Sustainable Development Goals discussed in this research are based on practices observed in communities and the environment.

**2.2.1 Environmental Practices**

As defined by Tavanti (2023), environmental practices refer to a company's efforts to safeguard natural resources and ecosystems for future generations. These practices encompass a range of activities aimed at minimizing environmental impact, such as reducing waste, conserving energy, and implementing sustainable sourcing and production methods. By adhering to stringent environmental regulations, these companies can broaden their international market activities, enabling them to operate in diverse regulatory environments (Bueno-García et al., 2022; Gonçalves et al., 2024). This compliance not only enhances their reputation as environmentally responsible entities but also opens new opportunities for business growth and partnerships in regions where sustainability is highly valued.

**2.2.2 Community Practices**

Community practices, in the terms of SDGs, refer to the actions and initiatives taken by communities to create social, economic, and environmental sustainability. These practices, which reflect the social aspects of sustainability, can be referred to as sustainable communities. Sustainable communities are areas where individuals desire to reside and work, both now and in the future (Dempsey et al., 2011; Jum'a, 2023).

The following hypotheses are formulated based on the previous discussion.

- H1. Internal environmental management has a positive effect on environmental practices.
- H2. Green purchasing has a positive effect on environmental practices.
- H3. Cooperation with customers has a positive effect on environmental practices.
- H4. Eco-design has a positive effect on environmental practices.
- H5. Investment recovery has a positive effect on environmental practices
- H6. Internal environmental management has a positive effect on community practices.
- H7. Green purchasing has a positive effect on community practices.
- H8. Cooperation with customers has a positive effect on community practices.
- H9. Eco-design has a positive effect on community practices.
- H10. Investment recovery has a positive effect on community practices.

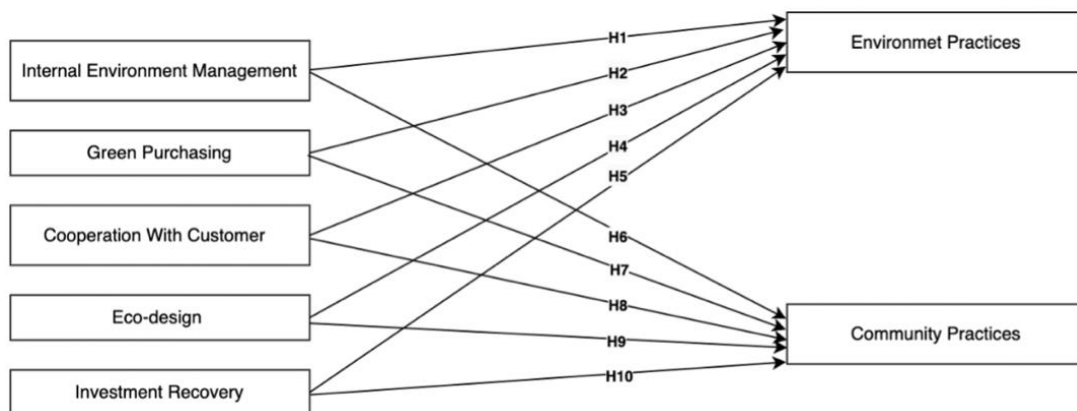


Figure 1. Conceptual Framework adapted from Jum'a (2023)

Zhu and Sarkis (2004, as cited in Sarkis & Dou, 2018) proposed that the integration of GSCM consists of various key practices that result in a positive effect on environmental sustainability. However, this study conducted at PT PJP highlights that not all GSCM practices, such as cooperation with customers and investment recovery, have significant effects on environmental practices, but internal environmental practices have significant effects on community practices.

These findings provide new insights into the effectiveness of certain GSCM variables in the context of energy companies in Indonesia. This study identifies a gap in previous literature regarding the impact of GSCM on environmental and community practices. Although numerous research efforts have explored the overall advantages of GSCM, a gap exists in the comprehensive examination of the precise influence of individual GSCM practices on the Sustainable Development Goals (SDGs). This research shows that practices, such as eco-design, have the highest performance scores for both environmental and community practices. It indicates areas that require further focus to improve sustainability and environmental performance in energy companies.

### 3. RESEARCH DESIGN

The quantitative methodological approach was employed in this research study through a cross-sectional time horizon, which defines the temporal scope of the investigation. Cross-sectional research involves gathering data within a single data collection period, spanning from several days to weeks or months, to fulfill the research objectives (Sekaran & Bougie, 2016). The primary data was collected by distributing an online questionnaire to 125 respondents, who were employees of PT PJP. Purposive sampling was employed to select the sample by focusing on specific criteria relevant to the research goals. In this study, the participants were chosen based on their tenure of over three years at PT PJP, particularly from the Highland Operation, Support Services, Technical Services, and Lowland Operation departments. SEM-PLS was utilized to conduct validity and reliability tests, while data analysis was performed using the SmartPLS 4 software. This research also utilized the "Importance-Performance Map Analysis" (IPMA) method, which reveals the connection between a variable's effects and values with other variables, aiding in a thorough analysis and practical understanding of research results (Ringle & Sarstedt, 2016).

In the initial stage, a measurement model test was conducted to describe the relationship between latent constructs and their indicators. Outer models were evaluated through Outer Loadings, Composite Reliability, Cronbach's Alpha, Average Variance Extracted (AVE), and Discriminant Validity (Hair et al., 2016). Consequently, a structural model assessment was conducted to evaluate the connections between the constructs of the model and to confirm the research hypothesis (Hair et al., 2019). The significance of the research findings was supported by the path coefficient value, t-statistic > 1.96, and p-value < 0.05 derived from the bootstrapping technique in PLS.

## 4. RESULTS AND DISCUSSION

### 4.1 Measurement Model

To ensure the reliability and validity of the constructs used in this research, several measurements were implemented to warrant the robustness of the data. These constructs include Internal Environmental Management (IEM), Green Purchasing (GP), Customer Cooperation (CC), Eco-Design (ED), Investment Recovery (IR), Environmental Practices (EP), and Community Practices (CP). The evaluation of each construct was based on their individual items. The findings are displayed in Table 1.

Table 1. Measurement model results

Constructs	Items	Factor loadings	Cronbach's Alpha	Composite Reliability	AVE
IEM	IEM 1	0.822	0.93	0.943	0.673
	IEM 2	0.825			
	IEM 3	0.827			
	IEM 4	0.757			
	IEM 5	0.846			
	IEM 6	0.825			
	IEM 7	0.791			
	IEM 8	0.867			
GP	GP 1	0.888	0.844	0.906	0.762
	GP 2	0.886			
	GP 3	0.844			
CC	CC1	0.829	0.845	0.907	0.764
	CC2	0.918			
	CC3	0.874			
ED	ED 1	0.876	0.845	0.896	0.685
	ED 2	0.881			
	ED 3	0.798			
	ED 4	0.747			

Table 1. (cont.)

Constructs	Items	Factor loadings	Cronbach's Alpha	Composite Reliability	AVE
IR	IR 1	0.886	0.885	0.92	0.743
	IR 2	0.89			
	IR 3	0.844			
	IR 4	0.827			
EP	EP 1	0.798	0.928	0.944	0.738
	EP 2	0.871			
	EP 3	0.93			
	EP 4	0.822			
	EP 5	0.82			
	EP 6	0.905			
CP	CP 1	0.816	0.878	0.911	0.673
	CP 2	0.842			
	CP 3	0.741			
	CP 4	0.864			
	CP 5	0.835			

**Note:** IEM = Internal Environment Management; GP = Green Purchasing; CC = Cooperation with Customer; ED = Eco-design; IR = Investment recovery; EP = Environmental practices; CP = Community practices.

Factor loadings for all items were satisfactory, indicating that the items serve as reliable indicators for their corresponding constructs. All factor loadings exceeded the commonly accepted threshold of 0.7, demonstrating that each item has a high degree of correlation with its underlying construct. Furthermore, the study evaluated the Cronbach's Alpha values for each construct to assess internal consistency reliability. All values exceeded the accepted threshold of 0.7, indicating strong internal consistency within each construct.

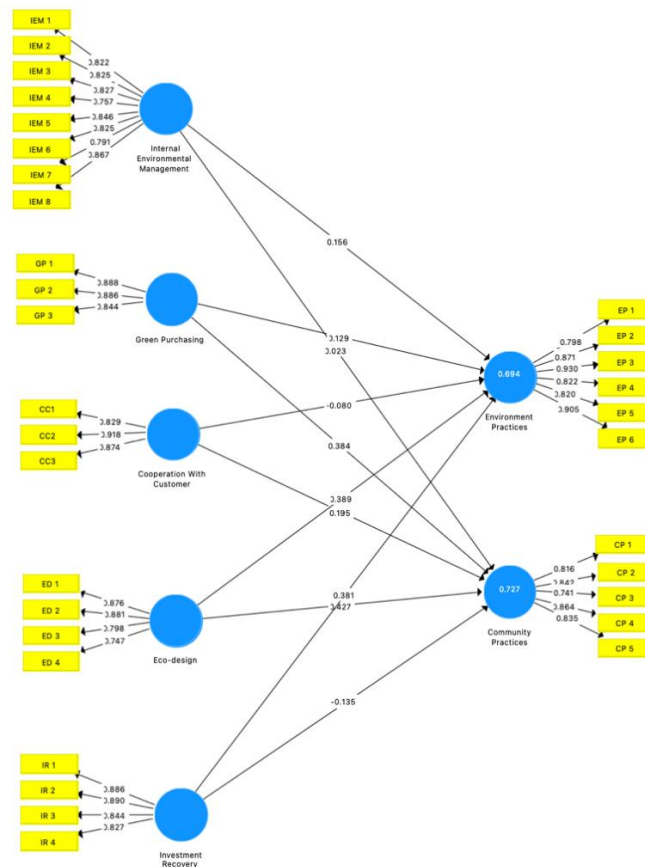


Figure 2. Structural Equation Modelling results

Additionally, composite reliability values were computed to gauge the overall reliability of each construct, further confirming their reliability by surpassing the 0.7 threshold. The calculation of average variance extracted (AVE) values

was also conducted to assess the convergent validity of the constructs. It was shown that all the values were above the recommended threshold (0.5). It indicates that more than half of the variance in the indicators is explained by the constructs, thereby confirming the validity of the construct.

**4.2 Hypothesis Testing**

Once the reliability and validity of the constructs have been confirmed, the study proceeded to test the hypotheses regarding the connections between Green Supply Chain Management (GSCM) practices and Environmental Practices (EP) and Community Practices (CP) in the scope of Sustainable Development Goals (SDGs). This was done using Structural Equation Modeling (SEM) via the SmartPLS 4 software, which provides clear insight into how these GSCM practices impact environmental and community practices at PT PJP.

Table 2. Summary of hypothesis testing

Hypotheses	Path	Path Coefficient (β)	Sample Mean	Standard Deviation (STDEV)	T Statistics ( O/STDEV )	P Values	Results
H1	IEM → EP	0.156	0.158	0.051	3.048	0.001	Supported
H2	GP → EP	0.129	0.125	0.098	1.32	0.093	Not Supported
H3	CC → EP	-0.08	-0.071	0.085	0.947	0.172	Not Supported
H4	ED → EP	0.389	0.384	0.108	3.606	0	Supported
H5	IR → EP	0.381	0.377	0.077	4.935	0	Supported
H6	IEM → CP	0.023	0.023	0.058	0.4	0.344	Not Supported
H7	GP → CP	0.384	0.38	0.074	5.207	0	Supported
H8	CC → CP	0.195	0.196	0.098	1.979	0.024	Supported
H9	ED → CP	0.427	0.425	0.097	4.394	0	Supported
H10	IR → CP	-0.135	-0.13	0.08	1.69	0.046	Not Supported

The initial findings indicate that Eco-Design (ED) has the highest influence on Environmental Practices (EP) (β = 0.389, p < 0.001), while Internal Environment Management (IEM) has the least impact on Environmental Practices (EP) (β = 0.156, p = 0.001). However, Green Purchasing (GP) (β = 0.129, p = 0.093) and Customer Collaboration (CC) (β = -0.08, p = 0.172) do not demonstrate statistically significant effects on environmental practices. These results imply that while certain GSCM practices strongly impact environmental sustainability, others may necessitate further examination or enhancement in their implementation strategies. This advocates the relationship between GSCM practices and the community practices of the SDGs.

The hypothesis testing results in Table 2 show that Eco-Design (ED) (β = 0.427, p < 0.001) has the highest impact on Community Practices (CP). Conversely, Cooperation with Customer (CC) (β = 0.195, p = 0.024) shows the least impact on Community Practices (CP). On the other hand, Investment Recovery (IR) does not exhibit a significant influence on Community Practices (CP) (β = -0.135, p = 0.046). Despite IR having a negative correlation, the overall results emphasize the positive effects of these GSCM practices on community sustainability endeavors. These findings underscore the necessity of incorporating comprehensive GSCM strategies to promote environmental and community sustainability in alignment with the SDGs.

**4.3 Importance-Performance Map Analysis**

The empirical findings presented above are supported by the results obtained from applying the IPMA method. IPMA can be used to describe the relationship between the effects and values of a variable and other variables, which is helpful in more in-depth analysis and practical interpretation of research findings (Ringle & Sarstedt, 2016). Figure 3 shows the scatterplot results of IPMA based on indicators.

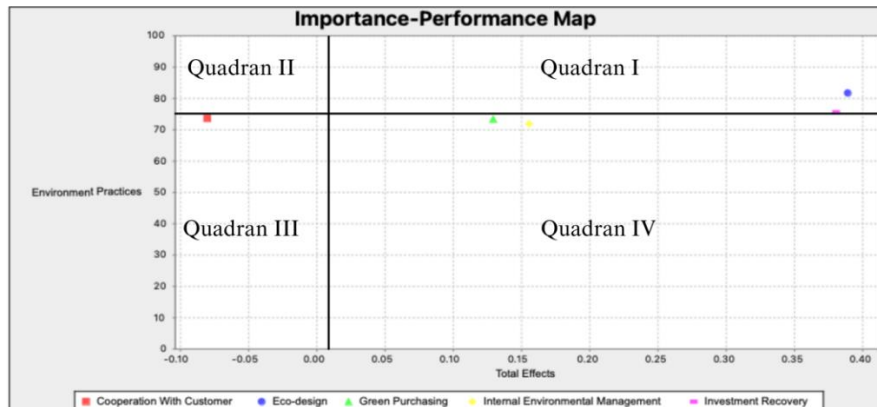


Figure 3. Importance-Performance Map of Environmental Practices based on construct

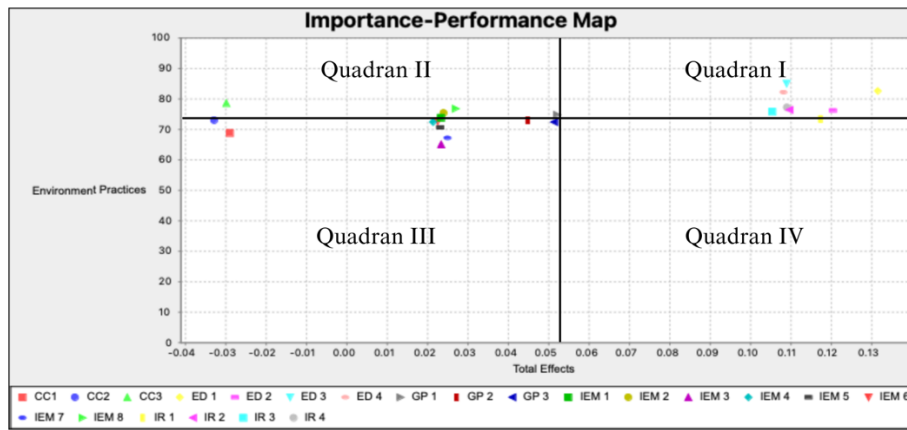


Figure 4. Importance-Performance Map of Environmental Practices based on indicators

Figures 3 and 4 are the Importance-Performance Maps used to evaluate different community practices based on their importance (Environmental Practices) and performance (Total Effects). The map divides the data into four quadrants, each representing a different strategic implication. Quadrant I show practices with high importance and performance that must be maintained, Eco-Design (ED1, ED2, ED3) and Investment Recovery (IR1, IR2, IR3). Strategically, the implication of this analysis is to maintain the quality of practices in Quadrant I since they are important and performing well. Quadrant II indicates practices that are important but low performing in the IPMA Environmental Practices. There are no constructs in Quadrant II that require attention and improvement. Quadrant III includes practices with low importance and performance, such as Cooperation with Customer (CC1, CC2), which can be prioritized lower or allocated minimal resources. Practices in Quadrant III may need to be prioritized lower because they are neither very important nor performing well. Quadrant IV includes practices with high performance but low importance, such as Green Purchasing and Internal Environmental Management. Resources from practices in Quadrant IV can be redirected to more critical areas identified in Quadrant II. The action plan includes further analysis of practices in Quadrant II to understand the reasons for their low performance, such as reviewing key performance indicators (KPIs) and conducting user satisfaction surveys.

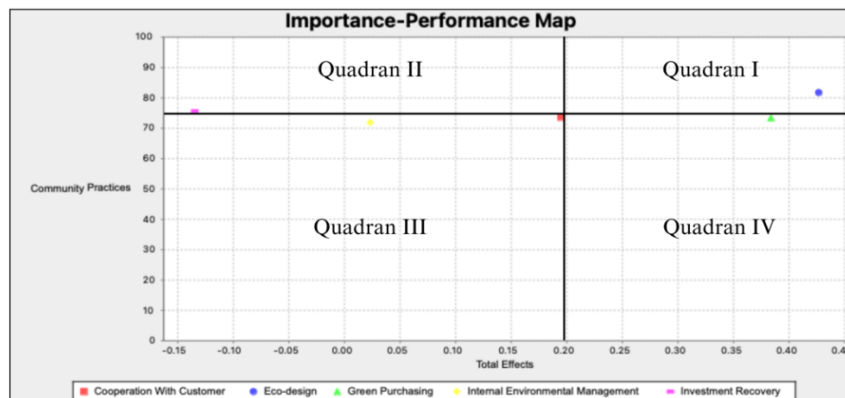


Figure 5. Importance-Performance Map of Community practice based on construct

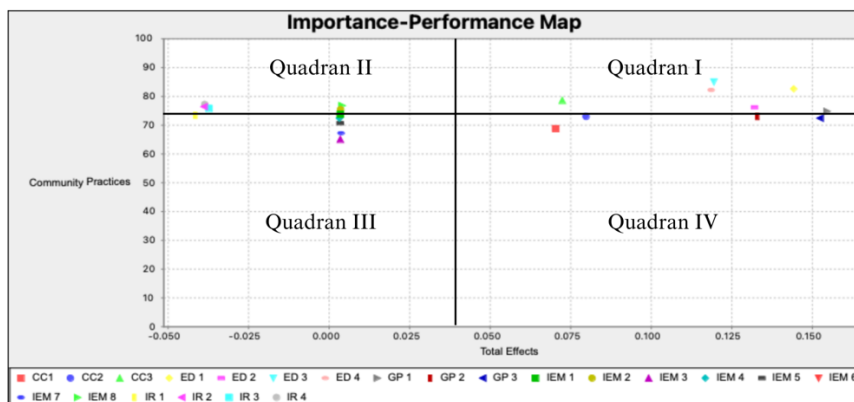


Figure 6. Importance-Performance Map of Community practice based on indicators

Figures 5 and 6 are the Importance-Performance Maps used to evaluate different community practices based on their importance (Community Practices) and performance (Total Effects). The map divides the data into four quadrants, each representing different strategic implications. Quadrant I shows practices with high importance and performance that must be maintained for quality, Eco-Design (ED1, ED2, ED3). Strategically, the implication of this analysis is to maintain the quality of practices in Quadrant I as they are important and performing well. Quadrant II shows practices that are important but low performing, such as some aspects of Investment Recovery (IR2, IR3) that require attention and improvement. Practices in Quadrant II need to be focused on improving as they are important but currently underperforming. Quadrant III includes practices with low importance and performance, such as Internal Environmental Management (IEM5, IEM7), which can be prioritized lower or allocated minimal resources. Practices in Quadrant III may need to be prioritized lower because they are neither very important nor performing well. Quadrant IV includes practices with high performance but low importance, such as some aspects of Green Purchasing (GP3) and Cooperation with Customer (CC1, CC2). Resources from practices in Quadrant IV can be redirected to more critical areas identified in Quadrant II.

This study provides pivotal insights into the intricate relationships between Green Supply Chain Management (GSCM) practices and Sustainable Development Goals (SDGs), specifically Environmental Practices (EP) and Community Practices (CP). By employing robust statistical methodologies, including Structural Equation Modeling (SEM) and Importance-Performance Map Analysis (IPMA), the research underscores both the strengths and areas requiring improvement in current GSCM strategies within the energy sector. The significance of this study cannot be overstated, particularly within the energy sector, which plays a critical role in global sustainability efforts. As global energy demand is projected to rise significantly by 2050, understanding the impact of GSCM practices becomes increasingly vital. The findings offer actionable insights for energy companies striving to align their operations with the SDGs. For instance, the high impact of eco-design on both environmental and community practices suggests that integrating eco-design principles can be a cornerstone of effective sustainability strategies in the energy sector. The study opens avenues for further research to explore the underlying reasons behind the differential impacts of GSCM practices. Although this study focuses on five essential GSCM practices (IEM, ED, GP, CC, IR) within the context of PT PJP, other GSCM practices, such as supplier assessment and environmental education, may also influence sustainability outcomes. Future research could explore the impact of a broader range of GSCM practices, thus providing a more comprehensive understanding of how to enhance sustainability in the energy sector. By addressing these gaps, the study contributes significantly to the ongoing discourse on sustainable energy practices and offers practical pathways for achieving the SDGs.

## 5. CONCLUSION

The results of this study lead to the conclusion that GSCM practices, such as eco-design, green purchasing, and internal environmental management, significantly improve corporate performance in achieving environmental and societal goals in line with the SDGs in the energy sector. Investment recovery was identified as the variable with the highest impact on environmental practices. However, it still needs to be more optimal. Therefore, PT PJP can make improvements to achieve better results. For instance, they can sell excessive inventory by implementing a buyback program or collaborating with the same supplier by having the supplier repurchase unused assets at a specific price.

On the other hand, green purchasing was identified as the variable with the highest impact on community practices. However, applying green purchasing is still not optimal. Therefore, PT PJP can improve its green purchasing by labelling the company's products as those that use eco-friendly design (eco-design). One possible way is by educating the local community about the importance of energy efficiency. This can be done by providing online tools that allow consumers to calculate potential energy savings using eco-friendly products.

This research fills a gap in the literature by providing a deeper understanding of how GSCM can be effectively applied in the energy context to achieve SDGs. For PT PJP, this research can serve as a consideration to provide additional information related to GSCM practices within the company to achieve the SDGs. It can also help managers to better understand how far PT PJP's GSCM practices have advanced in enhancing the company's sustainable development goals. Although it offers several recommendations for policymakers and managers, this research has limitations. First, this research limits the use of SDG variables to only the dimensions of environmental practices and community practices. Future research is recommended to include other dimensions, such as economic practices. Additionally, future research of similar object and model may consider using a qualitative methodology to develop strategies and action plans for the company through in-depth interviews, observations, and content analysis.

## ACKNOWLEDGEMENTS

We would like to thank PT PJP for their assistance with data collection.

## FUNDING STATEMENT

This study was funded by Telkom University. The sponsor had no role in the study design; data collection, analysis, and interpretation; writing of the manuscript; or the decision to submit it for publication.

## AUTHORS' CONTRIBUTION

N. P. W. N. Dewi (Data curation; Methodology; Writing - original draft); R. Hendayani (Conceptualization; Writing - review & editing; Supervision; Project administration); S. Shaharudin (Formal analysis; Writing - review & editing)

## AVAILABILITY OF DATA AND MATERIALS

The data supporting this study's findings are available on request from the corresponding author.

## ETHICS STATEMENT

Not Applicable.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

## GENERATIVE ARTIFICIAL INTELLIGENCE DECLARATIONS

The author(s) declare that no generative AI or AI-assisted technologies were used in the writing of this manuscript. All content, including text, figures, and tables, was created by the author(s).

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