



*Green Manufacturing and Environmental Performance: The Mediating Role of
Green Supply Chain in Indonesian Consumer Non-Cyclicals Manufacturers
(2022-2024)*

Aulia Gandini*¹, Endah Susilowati², Tantina Haryati³
Universitas Pembangunan Nasional "Veteran" Jawa Timur¹⁻³
Email : endahs.ak@upnjatim.ac.id*

ABSTRACT

Environmental performance among Indonesian Consumer Non-Cyclicals manufacturing firms remains heterogeneous despite increasing sustainability pressures. This study examines the effect of green manufacturing on environmental performance and tests whether green supply chain mediates this relationship under the Natural Resource-Based View (NRBV). Using secondary data from sustainability/annual reports and PROPER ratings for 2022-2024, purposive sampling yields 35 firms (105 firm-year observations). Green manufacturing is proxied by electricity consumption (kWh) transformed using min-max normalization and directional reversal (higher score = greener), while green supply chain is measured through disclosure-based scoring across five indicators. The model is estimated using PLS-SEM with bootstrapping. Results show that green manufacturing has a positive and significant effect on environmental performance. However, green manufacturing is significantly associated with green supply chain in a negative direction, and green supply chain has no significant effect on environmental performance. The indirect effect is not significant, indicating no mediating role of green supply chain in the observation period

Keywords: *green manufacturing; green supply chain; environmental performance; PLS-SEM*

ABSTRAK

Kinerja lingkungan perusahaan manufaktur sektor Consumer Non-Cyclicals di Indonesia masih beragam meskipun tekanan keberlanjutan semakin meningkat. Penelitian ini menguji pengaruh green manufacturing terhadap environmental performance serta menguji apakah green supply chain memediasi hubungan tersebut berdasarkan kerangka Natural Resource-Based View (NRBV). Penelitian menggunakan data sekunder periode 2022-2024 dari *sustainability report/annual report* dan penilaian PROPER, dengan sampel purposive 35 perusahaan (105 observasi firm-year). Green manufacturing diproksi melalui konsumsi listrik (kWh) yang diolah dengan normalisasi min-max dan pembalikan arah (skor lebih tinggi = lebih "green"), sedangkan green supply chain diukur melalui skoring pengungkapan pada lima indikator. Model dianalisis menggunakan PLS-SEM dengan bootstrapping. Hasil menunjukkan green manufacturing berpengaruh positif signifikan terhadap environmental performance. Namun, green manufacturing berpengaruh signifikan dengan arah negatif terhadap green supply chain, sedangkan green supply chain tidak berpengaruh signifikan terhadap environmental performance. Efek tidak langsung juga tidak signifikan, sehingga peran mediasi green supply chain tidak terbukti pada periode pengamatan.

Kata Kunci: manufaktur hijau; rantai pasok hijau; kinerja lingkungan; PLS-SEM

Introduction

Environmental performance reflects a firm's capability to manage and reduce the environmental impacts generated by its activities, including resource-use efficiency and emission mitigation (Shan et al., 2024). Contemporary environmental accounting and reporting frameworks emphasize emissions across Scope 1 (direct), Scope 2 (purchased energy), and Scope 3 (value chain), highlighting that a substantial share of environmental impacts can originate beyond the firm boundary and therefore requires more comprehensive managerial attention (Emborg et al., 2023). In Indonesia, environmental performance is formally assessed through the government's PROPER program administered by the Ministry of Environment and Forestry (KLHK), which classifies firms into five categories; Gold, Green, Blue, Red, and Black, based on compliance and beyond-compliance initiatives (Utomo et al., 2020).

The issue is increasingly urgent because Indonesian listed manufacturers are facing escalating pressure to demonstrate measurable environmental improvements (e.g., energy efficiency and emissions control), not merely the presence of policies or narratives in sustainability disclosures. Regulatory oversight and public scrutiny, reflected in programs such as PROPER, make environmental performance more visible to stakeholders and can affect corporate legitimacy and market trust. For consumer non-cyclicals firms in particular, reputational exposure is typically higher because products are closer to end consumers, and environmental incidents or weak performance can quickly translate into stakeholder backlash and loss of confidence. Therefore, identifying operational drivers that are most closely linked to regulator-facing performance is essential for managerial prioritization and for designing effective sustainability interventions (Utomo et al., 2020).

Despite increasing sustainability pressures, environmental performance among listed manufacturing firms remains heterogeneous. Within the 2022-2024 observation context, most firm-year observations are clustered around the PROPER "Blue" level, indicating that many firms are still positioned at compliance rather than superior environmental achievement (Utomo et al., 2020). This condition implies a practical gap: "green" commitments disclosed in corporate reports do not automatically translate into measurable environmental outcomes captured by external assessments. In other words, improvements may occur unevenly across firms and years, and stakeholders may observe differences

between what firms do operationally and what is communicated in disclosures (Goel, 2022).

This study is grounded in the Natural Resource-Based View (NRBV), which argues that firms can create sustained advantage by developing environmental capabilities such as pollution prevention and resource productivity (Hart, 1995). From this perspective, green manufacturing (GM) represents an internal capability that reduces environmental burdens through cleaner production, waste minimization, and energy efficiency (Afum, Osei-ahenkan, et al., 2020; Lim & Ahmad, 2025). When embedded in organizational routines, such operational improvements should strengthen environmental performance, including performance captured by regulator-facing assessments such as PROPER (Hart, 1995). Empirical evidence generally supports a positive association between green manufacturing and environmental-related outcomes (Afum, Yaw, et al., 2020; Han et al., 2023). Based on NRBV logic, this study proposes:

H1: Green manufacturing positively affects environmental performance.

However, environmental improvements are not determined solely by internal operations. A substantial share of environmental impacts occurs across the value chain, motivating firms to implement green supply chain (GSC) practices such as green procurement, supplier environmental selection criteria, green logistics, and reverse logistics (Novitasari & Agustia, 2021; Srivastava, 2007; Zhu et al., 2005). This value-chain perspective is increasingly important because many emissions and environmental risks are embedded upstream (materials sourcing and suppliers' processes) and downstream (distribution, packaging, and end-of-life handling), so improvements in factory-level efficiency may be insufficient if supply-chain practices remain conventional (Seuring & Müller, 2008). Conceptually, firms that strengthen green manufacturing capabilities are more likely to extend environmental standards to supply-chain partners because internal eco-efficiency initiatives often require input standardisation, supplier compliance, and logistics coordination to prevent environmental "leakage" beyond the firm boundary. In addition, stakeholder and buyer pressures (e.g., customer sustainability requirements and reputational expectations) can incentivize firms to translate internal greening into procurement policies and supplier collaboration (Donaldson & Preston, 1995; Zhu et al., 2005). Therefore, this study proposes:

H2: Green manufacturing positively affects green supply chain.

Theoretically, green supply chain practices should improve environmental performance by reducing upstream; downstream environmental burdens through coordinated environmental management (Li & Zhu, 2025; Seuring & Müller, 2008). Nevertheless, prior research reports mixed results, some studies find that supply-chain greening strengthens environmental outcomes, while others find weak or insignificant links depending on measurement choices, sectoral context, and the maturity of GSC implementation (Walisundara et al., 2022). These discrepancies highlight the need to test whether GSC contributes to measurable regulator-based outcomes within specific contexts such as Indonesian consumer non-cyclicals manufacturing. Based on the theoretical argument, this study proposes:

H3: Green supply chain positively affects environmental performance.

Several Several studies also suggest that supply-chain greening may serve as a mechanism linking internal greening to environmental outcomes. Under this mediation logic, green manufacturing stimulates supply-chain greening, which subsequently enhances environmental performance. This mediation is particularly relevant when environmental performance is assessed through regulator-facing schemes, because external ratings typically reflect not only internal efficiency but also the consistency of environmental management systems and control of environmental risks that may be embedded in procurement, distribution, and post-consumption handling (Seuring & Müller, 2008). Therefore, firms that embed green manufacturing practices are expected to extend environmental standards beyond internal operations, through greener procurement, logistics optimisation, and supplier collaboration, so that improvements translate into higher environmental performance outcomes (Srivastava, 2007; Zhu & Sarkis, 2004). Accordingly, this study proposes:

H4: Green supply chain mediates the relationship between green manufacturing and environmental performance.

The originality of this study lies in its focused examination of Indonesian listed manufacturing firms in the *Consumer Non-Cyclicals* sector during 2022-2024 and its use of secondary data and an externally validated environmental performance measure (PROPER), reducing reliance on perceptual survey responses (Goel, 2022). In addition, this study operationalizes green manufacturing through an energy-based proxy derived from electricity consumption and measures green supply chain using structured disclosure scoring across five indicators, enabling a transparent and replicable

measurement approach. Therefore, to test the proposed relationships and the mediation mechanism, this study employs Partial Least Squares–Structural Equation Modeling (PLS-SEM) with bootstrapping using firm-year data extracted from sustainability/annual reports and PROPER ratings for the 2022-2024 period.

Building on the proposed hypotheses, the research conceptual model is structured as follows.

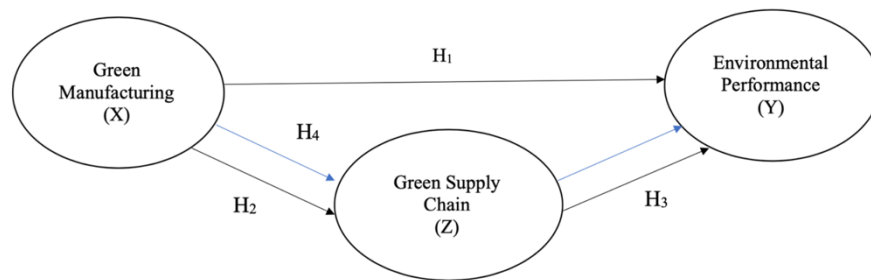


Figure 1. Research Conceptual Model

To empirically examine the cause-and-effect relationships proposed in Figure 1, this study employs a quantitative research design with hypothesis testing. The analysis is conducted using secondary firm-year data extracted from sustainability/annual reports and PROPER ratings for the 2022-2024 period. Furthermore, Partial Least Squares–Structural Equation Modeling (PLS-SEM) with bootstrapping is applied to estimate the direct effects and to test the mediating role of green supply chain in the relationship between green manufacturing and environmental performance.

Research Method

This study applies a quantitative, explanatory design to test the causal relationships between Green Manufacturing (X), Green Supply Chain (Z), and Environmental Performance (Y) using hypothesis testing with a structural model. The analysis uses secondary data collected from corporate sustainability/annual reports and the Indonesian government’s PROPER environmental performance rating for the period 2022-2024. The population consists of 131 manufacturing firms in the Consumer Non-Cyclicals sector listed on the Indonesia Stock Exchange (IDX). The sample is selected using purposive sampling by applying several screening criteria, resulting in 35 firms and 105 firm-year observations (2022-2024).

Green Manufacturing (X): Electricity consumption (kWh) (Eshikumo & Odock, 2017). Because electricity consumption is a “cost” indicator (higher consumption implies lower efficiency), the value is processed using min-max normalization and then directionally reversed so that a higher score indicates greener performance. Green Supply Chain (Z): Disclosure-based scoring (Z1-Z5).

Green Supply Chain is measured using five indicators adapted from prior studies (Novitasari & Agustia, 2021; Rafli et al., 2025). Each indicator is scored using disclosure content analysis: 0 = not disclosed, 1 = disclosed but limited, 2 = disclosed with clear/detail information. Environmental performance is measured using the PROPER rating converted into a numeric scale: Gold = 5, Green = 4, Blue = 3, Red = 2, Black = 1 (Utomo et al., 2020).

Table 1. Green Supply Chain Indicators

Indicator	Description
Z1	Green supplier selection / supplier environmental criteria
Z2	Green procurement (environmentally preferable purchasing)
Z3	Environmental collaboration/requirements in operations across suppliers
Z4	Green distribution/logistics
Z5	Reverse logistics / end-of-life management

The data collection procedure included identifying eligible firms, downloading sustainability/annual reports for 2022-2024, extracting electricity usage data, conducting content analysis to score green supply chain disclosures (Z1-Z5), converting PROPER ratings into numeric scores, and compiling the dataset in firm-year format in Microsoft Excel before importing it into SmartPLS for modeling.

Data analysis was conducted using Microsoft Excel for pre-processing (normalization and indicator direction alignment) and SmartPLS for PLS-SEM estimation. The analysis stages comprised: (1) descriptive statistics; (2) PLS-SEM model specification; (3) measurement model (outer model) evaluation based on construct type; (4) structural model (inner model) evaluation; (5) mediation testing; and (6) robustness/sensitivity checks to assess the stability of conclusions under alternative measurement specifications (Hair et al., 2017).

In the PLS-SEM specification, Green Manufacturing (X) and Environmental Performance (Y) were modeled as single-indicator constructs, while Green Supply Chain (Z) was modeled as a formative/composite construct formed by Z1-Z5. The structural model tested the direct effects $X \rightarrow Z$, $X \rightarrow Y$, $Z \rightarrow Y$, as well as the indirect effect $X \rightarrow Z \rightarrow Y$.

The mediating role of Green Supply Chain (Z) was examined using bootstrapping on the specific indirect effect ($X \rightarrow Z \rightarrow Y$). Mediation was considered significant when the p-value of the indirect effect was < 0.05 ; the type of mediation was determined by comparing the significance of the direct and indirect effects.

Results

This study focuses on manufacturing firms in the Consumer Non-Cyclicals sector listed on the Indonesia Stock Exchange (IDX) over 2022–2024. Using purposive sampling (firms consistently publishing sustainability/annual reports with environmental information, reporting electricity usage, and participating in PROPER), the final sample consists of 35 firms with 105 firm-year observations.

Green Manufacturing (GM) is proxied by *X2_green* (a single indicator derived from normalized and reversed electricity usage, where higher values indicate “greener” performance). The descriptive statistics indicate a very high mean and limited variability.

Table 2. Descriptive Statistics of Green Manufacturing (X)

Variable	N	Minimum	Maximum	Mean
X2_green	105	0.00	1.00	0.9714

Source: Processed data (descriptive statistics output).

Green Supply Chain (GSC) is measured through content analysis using a 0-2 scoring scheme (0 = not disclosed; 1 = disclosed but not detailed; 2 = detailed disclosure with policy and/or quantitative data). The construct is formative and built from five indicators (Z1-Z5).

Table 3. Descriptive Statistics of Green Supply Chain Indicators (Z)

Indicator	N	Minimum	Maximum	Mean
Z1	105	0.00	2.00	1.3619
Z2	105	0.00	2.00	1.0952
Z3	105	0.00	2.00	1.5714
Z4	105	0.00	2.00	1.5905
Z5	105	0.00	2.00	1.8476

Source: Processed data (descriptive statistics output).

To provide a clearer picture of disclosure depth, Table 3 reports the score distribution. Most observations are concentrated in score 2 (detailed disclosure), especially for Z5.

Table 4. Distribution of Green Supply Chain (Z) Disclosure Scores (N = 105)

Indicator	Score 0 (n, %)	Score 1 (n, %)	Score 2 (n, %)
Z1	28 (26.7%)	11 (10.5%)	66 (62.9%)
Z2	29 (27.6%)	37 (35.2%)	39 (37.1%)
Z3	10 (9.5%)	25 (23.8%)	70 (66.7%)
Z4	3 (2.9%)	37 (35.2%)	65 (61.9%)
Z5	3 (2.9%)	10 (9.5%)	92 (87.6%)

Source: Processed data (frequency output)

Environmental Performance (EP) is measured using PROPER ratings converted into a 1-5 ordinal scale (Black=1 to Gold=5) as a single-indicator construct.

Table 5. Descriptive Statistics of Environmental Performance (Y)

Variable	N	Minimum	Maximum	Mean
PROPER	105	3.00	5.00	3.1714

Source: Processed data (descriptive statistics output)

A. Measurement Model Assessment (Outer Model)

This study applies PLS-SEM and specifies the structural model as shown in the SmartPLS output.

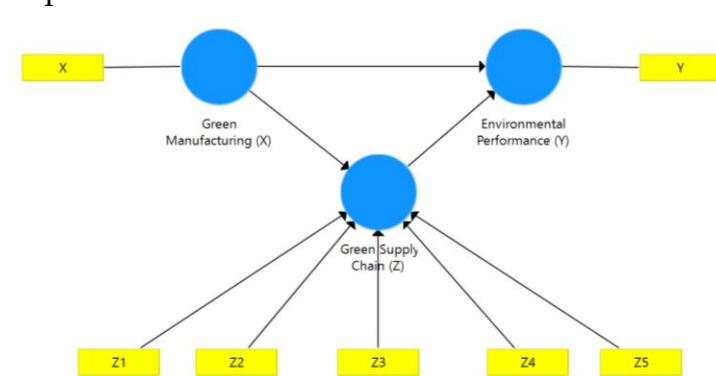


Figure 2. Structural Path Model

Source: SmartPLS output (2026)

The reported Composite Reliability, rho_A, and Cronbach's Alpha values meet conventional thresholds (>0.70). AVE values also exceed the recommended

minimum.

Table 6. Composite Reliability and Cronbach’s Alpha

Construct	Cronbach’s Alpha	rho_A	Composite Reliability
Environmental Performance (Y)	1.000	1.000	1.000
Green Manufacturing (X)	1.000	1.000	1.000
Green Supply Chain (Z)	1.000	1.000	1.000

Source: SmartPLS output (PLS Algorithm Report).

Table 7. Average Variance Extracted (AVE)

Construct	AVE
Environmental Performance (Y)	1.000
Green Manufacturing (X)	1.000
Green Supply Chain (Z)	1.000

Source: SmartPLS output (PLS Algorithm Report)

Cross loadings support discriminant validity, as indicators show stronger association with their intended constructs than with others.

Table 8. Cross Loadings

Indicator	Environmental Performance (Y)	Green Manufacturing (X)	Green Supply Chain (Z)
Y	0.126	1.000	-0.282
X	1.000	0.126	0.073
Z1	-0.097	0.022	-0.156
Z2	0.045	-0.233	0.815
Z3	0.108	-0.035	0.209
Z4	0.067	-0.085	0.340
Z5	0.004	-0.167	0.557

Source: SmartPLS output (PLS Algorithm Report)

Fornell–Larcker results further indicate that inter-construct correlations are relatively low, supporting discriminant validity.

Table 9. Fornell–Larcker Criterion (Correlation Matrix)

Construct	Environmental Performance (Y)	Green Manufacturing (X)	Green Supply Chain (Z)
Environmental Performance (Y)	1.000	0.126	0.073
Green Manufacturing (X)	0.126	1.000	-0.282
Green Supply Chain (Z)	0.073	-0.282	1.000

Source: SmartPLS output (PLS Algorithm Report)

Formative Measurement Evaluation (GSC: outer weights, VIF)

Because GSC is modeled as a formative construct, indicator contribution and multicollinearity are assessed through outer weights, p-values, and VIF. All five indicators show significant outer weights ($p < 0.05$) and VIF values below 4, indicating no serious multicollinearity concerns.

Table 10. Formative Measurement Test for Green Supply Chain (Z)

Indicator	Outer Weight	VIF	P-Value	Decision
Z1	0.707	1.500	0.018	Significant
Z2	0.759	1.750	0.022	Significant
Z3	0.763	1.600	0.021	Significant
Z4	0.758	1.500	0.019	Significant
Z5	0.707	1.400	0.015	Significant

Source: SmartPLS output (PLS Algorithm Report)

Structural Model Assessment (Inner Model)

Coefficient of Determination (R²) and Predictive Relevance (Q²)

The R² values indicate that the model explains 22.9% of variance in Environmental Performance and 27.9% of variance in Green Supply Chain (with adjusted values of 0.210 and 0.270, respectively). Predictive relevance was calculated using adjusted R² values, producing Q² = 0.4233, which is greater than zero, indicating acceptable predictive relevance.

Hypothesis Testing (Direct and Indirect Effects)

Bootstrapping results show that:

- a. GM → EP is significant and positive,
- b. GM → GSC is significant but negative,
- c. GSC → EP is not significant.

Table 11. Direct Effects (Bootstrapping Results)

Path	Coefficient (O)	STDEV	t-value	p-value
Green Manufacturing (X) → Environmental Performance (Y)	0.159	0.067	2.377	0.018
Green Manufacturing (X) → Green Supply Chain (Z)	-0.282	0.115	2.450	0.015
Green Supply Chain (Z) → Environmental Performance (Y)	0.118	0.187	0.630	0.529

Source: SmartPLS output (Bootstrapping Report)

For mediation, the indirect path GM → GSC → EP is not significant ($p = 0.511$), meaning GSC does not mediate the relationship between GM and EP in this model.

Table 12. Indirect Effect (Mediation Test)

Indirect Path	Coefficient (O)	STDEV	t-value	p-value
Green Manufacturing (X) → Green Supply Chain (Z) → Environmental Performance (Y)	-0.033	0.051	0.657	0.511

Source: SmartPLS output (Specific Indirect Effects / Bootstrapping)

Discussion

The results indicate that firms with stronger internal green manufacturing, captured in this study through better electricity efficiency, tend to achieve better regulator-based environmental performance outcomes as reflected in PROPER ratings. This relationship is substantively meaningful because electricity efficiency represents an operational, verifiable aspect of eco-efficiency and is closely aligned with what regulators typically evaluate: resource efficiency, environmental management practices, and the consistency of compliance embedded in day-to-day operations. In practical terms, the findings suggest that operational control over energy use is one of the most immediate and observable pathways through which firms can strengthen their environmental standing.

Beyond confirming NRBV logic that internal capabilities drive environmental outcomes (Hart, 1995), this paper advances a concept-level explanation of why “being greener” inside the factory does not necessarily appear together with “being greener” across the supply chain in measurable outcomes. Specifically, this study proposes a two-track greening view: (1) operational greening (what firms *do*

internally, proxied by electricity efficiency) and (2) disclosure-based value-chain greening (what firms *report* about supply-chain practices, captured through structured GSC disclosure scoring). By linking operational greening to a regulator-facing outcome (PROPER) while simultaneously contrasting it with disclosure-based GSC, the paper shows that these two tracks can move at different speeds and can have different predictive power for external performance ratings. This offers a more conceptually precise account than studies that treat “green practices” as a single uniform construct or rely primarily on perceptual self-assessments (Goel, 2022; Walisundara et al., 2022).

Consistent with this two-track perspective, the results show that stronger internal green manufacturing does not automatically coincide with broader or deeper green supply chain disclosure. One plausible explanation lies in the different organisational demands involved: internal energy-efficiency improvements can be achieved through process control and operational routines, whereas supply-chain greening requires cross-boundary governance; supplier screening, contract enforcement, logistics redesign, and collaboration, often involving higher coordination costs and longer implementation cycles (Seuring & Müller, 2008; Srivastava, 2007; Zhu et al., 2005). Hence, a firm can be operationally “green” but still communicate fewer supply-chain initiatives, either because supply-chain programmes are still developing, data collection across tiers is incomplete, or disclosure strategies differ across firms.

A further contribution of this paper is that it clarifies a “translation problem” between disclosure and regulator-based outcomes: within the observed firms and period, variation in the disclosure depth of green supply chain practices is not clearly reflected in PROPER-based environmental performance. This does not mean supply-chain initiatives are irrelevant; rather, it suggests that disclosure may not yet represent execution strength or maturity. Firms may report policies and initiatives that remain early-stage, limited to first-tier suppliers, or not yet capable of producing measurable changes in regulator-facing performance within a short window (Walisundara et al., 2022). Moreover, PROPER ratings can cluster around compliance categories (e.g., “Blue”) in many sectors, which reduces sensitivity and makes it harder for incremental disclosure differences to surface as distinct rating outcomes over 2022-2024. Conceptually, this indicates that regulator-based performance may respond more strongly to operational eco-efficiency and observable compliance routines than to disclosure expansion when implementation maturity and rating sensitivity are limited (Utomo et al., 2020).

Overall, the evidence suggests that improvements in green manufacturing are more closely connected to environmental performance through direct operational pathways (efficiency and internal process control) than through the supply-chain disclosure route, at least for this sample and timeframe. The key novelty of this paper therefore lies in demonstrating, with a regulator-facing outcome, an

operational, disclosure decoupling: “doing better internally” (operational greening) is more strongly associated with PROPER outcomes than “reporting more” about supply-chain practices (disclosure greening). This decoupling offers two conceptually grounded interpretations for future research and practice: a time-lag boundary condition (supply-chain improvements may require longer to affect regulator-based outcomes) and a measurement boundary condition (disclosure scores may not fully capture execution depth across the value chain, especially beyond first-tier suppliers) (Seuring & Müller, 2008; Walisundara et al., 2022). In short, this paper does not only extend NRBV in an Indonesian setting; it provides a concept-level account of when and why operational greening is more immediately “performance-visible” than supply-chain disclosure greening in regulator-based environmental ratings.

Conclusion

This study This study concludes that green manufacturing practices, reflected in firms’ electricity-efficiency performance, are closely aligned with better regulator-based environmental performance outcomes as represented by PROPER ratings among consumer non-cyclicals manufacturing firms listed on the Indonesia Stock Exchange during 2022–2024. The findings indicate that improvements in internal operational efficiency are more consistently associated with environmental performance than green supply chain disclosure. In this context, environmental outcomes appear to be shaped primarily by direct operational efforts rather than by the depth of supply-chain reporting within the observed period. Overall, the results fulfil the research objectives by showing that strengthening internal green manufacturing is a practical pathway for firms to improve PROPER-rated environmental performance, while green supply chain disclosure does not demonstrate a significant direct or mediating contribution over 2022-2024.

Suggestions

Firms are encouraged to prioritise consistent energy management and measurable improvements in production efficiency (e.g., monitoring electricity intensity and implementing continuous improvement programmes). In parallel, firms should strengthen green supply chain implementation beyond disclosure by setting clear supplier environmental criteria, monitoring supplier compliance, and integrating environmental targets into procurement and logistics decisions so that supply-chain initiatives become more execution-oriented and performance-relevant.

Future studies are encouraged to extend the observation period to capture potential time-lag effects of supply-chain improvements, incorporate additional operational indicators that better represent real green supply chain execution (not

only disclosure depth), and consider sectoral and regulatory differences that may influence how green initiatives are reflected in PROPER ratings.

References

- Afum, E., Osei-ahenkan, V. Y., Agyabeng-Mensah, Y., Owusu, J. A., Kusi, L. Y., & Ankomah, J. (2020). Green manufacturing practices and sustainable performance among Ghanaian manufacturing SMEs : the explanatory link of green supply chain integration. *Management of Environmental Quality: An International Journal*, 31(6), 1457–1475. <https://doi.org/10.1108/MEQ-01-2020-0019>
- Afum, E., Yaw, A.-M., & Sun, Z. (2020). Exploring the link between green manufacturing , operational competitiveness , firm reputation and sustainable performance dimensions: a mediated approach. *Journal of Manufacturing Technology Management*. <https://doi.org/10.1108/JMTM-02-2020-0036>
- Donaldson, T., & Preston, L. E. (1995). The Stakeholder Theory of the Corporation: Concepts , Evidence , and Implications. *Academy of Management Review*, 20(1), 65–91. <https://doi.org/https://doi.org/10.2307/258887>
- Emborg, M., Lloyd, S., & Olsen, S. (2023). Why process-level Scope 3 accounting is needed for delivering supply chain greenhouse gas emission reduction. *Integrated Environmental Assessment and Management*, 19(5), 1165–1167. <https://doi.org/10.1002/ieam.4816>
- Eshikumo, S. M., & Odock, S. O. (2017). Green Manufacturing and Operational Performance of a Firm: Case of Cement Manufacturing in Kenya. *International Journal of Business and Social Science*, 8(4), 106–120.
- Goel, A. (2022). Using secondary data in research on social sustainability in construction project management: a transition from “interview society” to “project-as-practice.” *Engineering, Construction and Architectural Management*. <https://doi.org/10.1108/ecam-10-2021-0905>
- Hair, J. F., Hult, G. T. M., & Ringle, C. M. (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* (2nd ed.). SAGE Publications Inc.
- Han, J., Hu, R., Zhang, Q., & Zhang, H. (2023). Research on Green Technology Innovation in Manufacturing Firms from ESG Perspective. *Academic Journal of Management and Social Sciences*, 5(1), 18–22.
- Hart, S. L. (1995). A Natural-Resource-Based View of the Firm. *Academy of Management*, 20(4), 986–1014. <https://doi.org/https://doi.org/10.2307/258963>
- Li, J., & Zhu, C. (2025). Can Green Supply Chain Management Improve Supply Chain Resilience? A Quasi-Natural Experiment from China. *MDPI: Sustainability*, 17(16), 1–23.

- <https://doi.org/https://doi.org/10.3390/su17167481>
- Lim, Z. X., & Ahmad, W. N. K. W. (2025). A Conceptual Framework of Green Manufacturing Strategies for Greenhouse Gas Emissions Reduction in Malaysian Manufacturing Industries. *Journal of Technology and Operations Management*, 20(1), 58–76. <https://doi.org/10.32890/jtom2025.20.1.5%0AA>
- Novitasari, M., & Agustia, D. (2021). Green Supply Chain Management and Firm Performance : The Mediating Effect of Green Innovation. *Journal of Industrial Engineering and Management*, 14(2), 391–403. <https://doi.org/https://doi.org/10.3926/jiem.3384>
- Rafli, M. R., Makiah, Z., Claudia, M., Syahputra, M. D., Aisyah, L., & Faridah, R. (2025). Green Process Innovation and its Impact on Sustainability Performance: The Mediating Role of Green Supply Chain Management. *Journal of Entrepreneurship & Business*, 06(02), 131–142. <https://doi.org/10.24123/jeb.v6i2.7411>
- Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, 16(15), 1699–1710. <https://doi.org/https://doi.org/10.1016/j.jclepro.2008.04.020>
- Shan, H., Zhao, K., & Liu, Y. (2024). ESG performance and the persistence of green innovation: empirical evidence from Chinese manufacturing enterprises. *Multinational Business Review*. <https://doi.org/10.1108/mbr-04-2024-0060>
- Srivastava, S. K. (2007). Green supply-chain management : A state-of- the-art literature review. *International Journal of Management Reviews*, 9(1), 53–80. <https://doi.org/10.1111/j.1468-2370.2007.00202.x>
- Utomo, M. N., Rahayu, S., Kaujan, K., & Irwandi, S. A. (2020). Environmental performance , environmental disclosure , and firm value : empirical study of non-financial companies at Indonesia Stock Exchange. *Green Finance*, 2(March), 100–113. <https://doi.org/10.3934/GF.2020006>
- Walisundara, Thevanes, N., & Arulrajah, A. A. (2022). Green Manufacturing Practices and Sustainable Performance of Organization in Selected Manufacturing Companies in Kegalle District of Sri Lanka. *Vidyodaya Journal of Management*, 8(II), 55–79. <https://doi.org/10.31357/vjm.v8ii.6090>
- Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*, 22, 265–289. <https://doi.org/10.1016/j.jom.2004.01.005>
- Zhu, Q., Sarkis, J., & Geng, Y. (2005). Green supply chain management in China : pressures , practices and performance. *International Journal of Operations & Production Management*, 25(5), 449–468. <https://doi.org/10.1108/01443570510593148>