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Financial Performance Determinants: Sustainability Reporting, CSR, Environmental Performance, and Green Innovation in Indonesian Manufacturing Firms

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ABSTRACT

Manufacturing firms in emerging economies face growing pressure to balance profitability and sustainability, yet their financial outcomes remain inconclusive. This study aims to examine the effects of sustainability reporting (SR), corporate social responsibility (CSR), and environmental performance (EP) on the financial performance (FP) of Indonesian manufacturing firms during 2020–2024, while investigating the moderating role of green innovation (GI). Using a quantitative panel-data design with purposive sampling, data from 42 manufacturing firms (210 firm-year observations) were analyzed using multiple linear regression in STATA 17. The Common Effect Model ($R^2 = 0.2707$) indicates that SR (b = 1.162, p = 0.024), CSR (b = 3.363, p = 0.047), and GI (b = 6.090, p = 0.039) have significant positive effects on FP, whereas EP has a positive but insignificant effect (p = 0.583). Furthermore, GI negatively moderates the relationships between SR and FP (b = −30.809, p = 0.006) and between EP and FP (b = −6.206, p = 0.015), while its moderating effect on the CSR–FP relationship is insignificant (p = 0.619). These findings suggest that firms should strategically balance green-technology investment and sustainability initiatives to manage potential short-term resource trade-offs while pursuing long-term financial performance.

Keywords: Corporate Social Responsibility; Environmental Performance; Financial Performance; Green Innovation; Sustainability Reporting

JEL Classification: G30; M14; O31; Q56

INTRODUCTION

Financial performance (FP) is a fundamental indicator used by investors, managers, creditors, and other stakeholders to evaluate a company's ability to generate value and utilize its resources efficiently (Kayani et al., 2024). However, the criteria for assessing corporate success have evolved substantially as firms are increasingly expected to achieve not only economic growth but also environmental and social sustainability. In Indonesia, this expectation has become particularly important for manufacturing firms, which are among the country's largest contributors to economic development while simultaneously generating significant environmental impacts. During the 2020–2024 period, manufacturing companies faced a dual challenge of recovering from the economic disruption caused by the COVID-19 pandemic while adapting to increasingly stringent environmental regulations, particularly through the Corporate Performance Rating Assessment Program (PROPER) implemented by the Indonesian government (Muqorobin & Simamora, 2025). Consequently, companies are required to integrate sustainability practices into their business strategies to balance economic objectives with environmental and social responsibilities, rather than pursuing profitability alone (Odeyemi et al., 2024; Sarfraz et al., 2023).

Despite the growing adoption of sustainability practices, previous studies have not reached a consensus regarding their influence on FP, giving rise to what is often referred to as the sustainability–performance paradox. From the perspective of the resource-based view (RBV), sustainability reporting (SR) and corporate social responsibility (CSR) represent valuable intangible resources that can strengthen corporate reputation, improve stakeholder trust, create competitive advantages, and ultimately enhance FP (Sukirman & Dianawati, 2023; Maulana & Prasetio, 2025). Conversely, other studies argue that environmental initiatives frequently require substantial financial commitments, increase compliance costs, and reduce short-term profitability, particularly in emerging economies where institutional support and capital availability remain relatively limited (Bonsu et al., 2024; Casciello et al., 2024). These contrasting findings suggest that sustainability initiatives do not automatically translate into superior FP and indicate that the relationship between sustainability practices and FP may depend on additional organizational mechanisms that have not yet been adequately explored.

A critical limitation of previous studies is that they predominantly examine the direct effects of SR, CSR, or environmental performance (EP) on FP, while providing limited attention to the organizational capabilities that determine whether sustainability initiatives create tangible economic value. As a result, companies may successfully fulfill regulatory requirements and improve corporate legitimacy without necessarily improving operational efficiency or financial returns. This issue is particularly relevant in manufacturing firms, where sustainability initiatives often require substantial investments in cleaner production technologies, process redesign, and resource efficiency. In this context, green innovation (GI) may serve as an important internal mechanism that transforms sustainability commitments into operational improvements and long-term competitive advantages. Without adequate GI, SR and CSR initiatives risk remaining symbolic compliance activities or administrative disclosures that generate limited economic benefits (Sukirman & Dianawati, 2023). Accordingly, the inconsistent findings reported in previous studies indicate that the moderating role of GI deserves further empirical investigation.

Based on these considerations, this study aims to examine the effects of SR, CSR, and EP on FP among Indonesian manufacturing firms during the 2020–2024 period while investigating the moderating role of GI. Unlike previous studies that primarily focused on

the direct relationships between sustainability practices and FP, this study proposes that GI functions as an organizational capability that explains why sustainability initiatives generate different financial outcomes across firms. Accordingly, this study contributes theoretically by extending the application of the RBV, stakeholder theory, and legitimacy theory in explaining how sustainability practices create economic value through organizational innovation. From a practical perspective, the findings are expected to assist corporate managers in designing sustainability strategies that effectively integrate environmental initiatives with green technological innovation to improve FP. Furthermore, this study provides policy implications by offering empirical evidence that may support regulators in developing sustainability policies capable of balancing environmental objectives with corporate competitiveness in Indonesia's manufacturing sector.

LITERATURE REVIEW

Theoretical Review

Signaling Theory

Signaling theory originates from Spence (1973), who demonstrated that better-informed parties use observable, costly-to-imitate signals to credibly convey unobservable quality to less-informed parties. Alsulami (2024) extends this logic to corporate disclosure: managers hold private information about a firm's risk profile and prospects and reduce information asymmetry by issuing credible signals. In this study, SR and CSR disclosure function as such signals, communicating long-term environmental and social commitments to investors, lenders, and regulators, and thereby lowering perceived risk and the cost of capital. Crucially, signals are value-relevant only when perceived as substantive rather than symbolic; disclosures unsupported by real operational change risk being discounted as greenwashing. This conditional credibility is central to the present model, because it predicts that the financial payoff of SR and CSR depends on whether they are reinforced by tangible actions such as GI.

Stakeholder Theory

Stakeholder theory, articulated by Freeman (1984), holds that a firm's long-run success depends on satisfying the legitimate claims of all parties affected by its operations: shareholders, employees, customers, communities, and regulators, rather than shareholders alone. Managing these relationships builds trust, secures access to critical resources, and reduces the likelihood of costly conflict. For Indonesian manufacturers, whose plants are embedded in local communities and subject to intense regulatory scrutiny, responsiveness to stakeholders is directly tied to operational continuity. The theory underpins the expected links from CSR and SR to FP: by addressing community, environmental, and employee expectations, firms strengthen reputation, customer loyalty, and their social licence to operate, which translate into more stable cash flows and easier access to capital. Stakeholder theory therefore frames sustainability practices as relationship investments with financial consequences rather than as discretionary philanthropy.

Legitimacy Theory

Legitimacy theory holds that organizations seek to ensure their activities are perceived as congruent with the norms and expectations of the society in which they operate (Suchman, 1995). Because legitimacy is conferred by external audiences, firms use disclosure and visible environmental action to demonstrate conformity with prevailing social and regulatory expectations and to maintain their implicit "social contract" (Dhanani & Kennedy, 2023). In the Indonesian manufacturing context, where the PROPER programme publicly rates environmental compliance, legitimacy pressures are

explicit and reputationally consequential. This perspective explains why CSR and EP are pursued even when their short-term financial return is uncertain: they protect the firm against sanctions, boycotts, and reputational loss. Legitimacy theory thus complements the signaling and stakeholder lenses by emphasizing that sustainability practices defend the firm's right to operate, a precondition for sustained financial performance.

RBV/Dynamic Capabilities Theory (DCT)

The RBV contends that sustained competitive advantage stems from resources that are valuable, rare, inimitable, and non-substitutable (Barney, 1991). Intangibles such as reputation, stakeholder trust, and—most relevant here—GI capability satisfy these criteria, enabling firms to differentiate their products and lower their cost structures in ways rivals cannot easily copy. Dynamic Capabilities Theory (DCT) extends the RBV by emphasizing the firm's ability to integrate, build, and reconfigure competences in response to changing environments (Teece et al., 1997). Green innovation embodies such a dynamic capability: it allows manufacturers to redesign processes, improve energy efficiency, and convert environmental compliance into strategic value (Sabihaini et al., 2026). Together, the RBV and DCT justify treating GI both as a direct driver of FP and as a moderator that conditions how effectively SR, CSR, and EP are translated into economic returns—while also implying that, when innovation is pursued under tight resources, its interaction with sustainability practices may impose short-term trade-offs.

Hypotheses Development

The Impact of SR on FP

According to signaling theory, SR serves as a strategic communication mechanism that companies use to convey credible information about their long-term sustainability commitments and the quality of their governance. By disclosing environmental, social, and economic performance, often based on standards such as the Global Reporting Initiative (GRI, 2021), companies reduce the information asymmetry between management and external stakeholders. This transparency sends positive signals to investors regarding lower risk, better management practices, and stronger long-term viability.

Furthermore, stakeholder theory posits that companies must consider the interests of various stakeholders to sustain their operations. Sustainability reports enhance accountability and strengthen stakeholder trust, which can lead to better access to capital, lower financing costs, and a stronger corporate reputation. Collectively, these factors contribute to improved FP.

Empirical evidence supports this theoretical argument. Putra and Subroto (2022) found that SR based on the GRI index positively influences return on assets (ROA) and Tobin's Q in Indonesian consumer goods companies. Similarly, Setyowati et al. (2024) demonstrated that SR significantly increases firm value in Indonesian state-owned enterprises. At the international level, Ismail and Azman (2024) demonstrated that sustainability practices positively influence long-term profitability in Islamic banking institutions.

H1: SR has a positive impact on the company's FP.

The Impact of CSR on FP

According to legitimacy theory, CSR serves as a strategic tool for companies to acquire and maintain social legitimacy. Through CSR initiatives, companies demonstrate their commitment to community well-being and environmental protection, thereby securing

social approval and operational sustainability (Teoh et al., 2025). Social legitimacy reduces the risk of public rejection, regulatory intervention, and reputational damage.

From the RBV perspective, CSR contributes to the development of intangible assets such as corporate reputation, stakeholder trust, and brand equity. These assets are valuable, rare, difficult to imitate, and irreplaceable, thereby forming a sustainable competitive advantage. A strong CSR reputation can enhance customer loyalty, boost employee morale, and strengthen investor confidence, ultimately leading to better FP.

Empirical findings generally support this positive relationship. Sarfraz et al. (2023) reported that CSR significantly and positively influences ROA, return on equity (ROE), and net profit margin (NPM) in Indonesian manufacturing companies. Setyowati et al. (2024) also found a positive impact of CSR on firm value. However, this relationship is not always consistent. Bonsu et al. (2024) identified a negative impact of CSR on NPM in mining companies, arguing that increased CSR expenditures can temporarily reduce profits. Similarly, Chouaibi et al. (2022) found no significant relationship between CSR and ROA in the banking sector. These mixed results suggest that the financial impact of CSR can vary across industries depending on cost structures and stakeholder pressures.

H2: CSR has a positive impact on the company's FP.

The Impact of EP on FP

According to Porter's Hypothesis, proposed by Porter and van der Linde (1995), strict environmental practices can drive innovation and efficiency, which ultimately enhance competitiveness and profitability. EP reflects a company's ability to effectively manage emissions, waste, and resource use. In the manufacturing industry, environmental efficiency is closely linked to reduced operational costs. Efficient energy use, waste reduction, and pollution control can significantly lower production costs while enhancing corporate reputation. Additionally, companies with strong EP are less exposed to regulatory fines and litigation risks.

Empirical evidence supports this argument. Muqorobin and Simamora (2025) found that environmental performance positively influences profitability and firm value in Indonesian manufacturing firms participating in the PROPER program. In Indonesia, Muqorobin and Simamora (2025) reported a significant positive impact of environmental disclosure on ROA and EPS in the chemical industry. However, Fitriasari (2023) observed that EP does not significantly affect ROE in Indonesian manufacturing firms. This inconsistency suggests that environmental initiatives may require complementary strategies, such as innovation, to generate measurable financial benefits.

H3: EP has a positive impact on the company's FP.

The Effect of GI on FP

GI reflects a company's ability to develop environmentally friendly products, processes, or technologies aimed at minimizing negative environmental impacts while improving operational efficiency and competitiveness. According to the RBV theory (Barney, 1991), GI can be considered a valuable, scarce, and inimitable strategic resource that provides companies with a sustainable competitive advantage. By adopting GI practices, companies can reduce energy consumption, minimize raw material waste, and lower compliance and reputational risks associated with environmental regulations. These improvements in efficiency and risk management ultimately contribute to increased profits and overall FP (Ha et al., 2024).

Furthermore, GI strengthens a company's reputation in the eyes of consumers, investors, and other stakeholders who increasingly prioritize sustainability. This aligns with legitimacy theory (Deegan, 2019), which states that companies seek societal approval by demonstrating environmentally responsible behavior. Companies that successfully market green products or adopt ecologically efficient production technologies can access new market segments and attract environmentally conscious consumers, thereby increasing sales, revenue, and profits (Kiyak & Grigoliene, 2023).

The empirical findings of this study, which indicate that GI has a positive and significant impact on FP ($p = 0.039 < 0.05$), reinforce previous research by Casciello et al. (2024), who found that companies actively engaged in environmental innovation tend to achieve higher profits and greater efficiency. Therefore, GI serves not only as an environmental management mechanism but also as a strategic business approach that enhances long-term economic value and sustainable financial growth.

H4: GI has a positive impact on the company's FP.

The Role of GI in Moderating the Relationship Between SR and FP

The moderating role of GI in the relationship between SR and FP can be theoretically grounded in signaling theory, the Substantive versus Symbolic Disclosure perspective, and the RBV. According to signaling theory, sustainability reports function as strategic signals conveying a company's long-term commitment to environmental and social responsibility. Through disclosure often guided by frameworks such as the GRI (2021), companies aim to reduce information asymmetry and enhance investor trust. However, the effectiveness of these signals depends heavily on their perceived credibility. When SR is not backed by concrete environmental initiatives or operational transformations, stakeholders may interpret it as symbolic disclosure or greenwashing. In such situations, the signaling effect weakens and may fail to translate into better financial outcomes.

GI enhances the credibility of SR by integrating sustainability commitments into a company's core operations. From an RBV perspective, GI represents a valuable, rare, and difficult-to-imitate strategic capability. Companies that develop environmentally friendly production processes, energy-efficient systems, and sustainable products demonstrate that sustainability is not merely rhetoric but is operationally integrated. Furthermore, GI enhances operational efficiency, reduces costs, and fosters market differentiation. When SR is bolstered by GI initiatives, stakeholders perceive such disclosures as substantive and performance-oriented. Consequently, investor confidence increases, risk perceptions decrease, and the positive impact of SR on FP becomes stronger.

Although Putra and Subroto (2022) confirmed the direct positive influence of sustainability reporting on FP, the presence of innovation capabilities provides a theoretical explanation for variations in the magnitude of this relationship across firms. Casciello et al. (2024) further demonstrate that environmental innovation significantly improves corporate financial outcomes, supporting the argument that innovation reinforces sustainability-driven value creation.

H5: GI moderates the relationship between SR and FP.

The Role of GI in Moderating the Relationship Between CSR Implementation and FP

The moderating role of GI in the relationship between CSR and FP can be explained through legitimation theory, stakeholder theory, and the RBV. CSR activities are

fundamentally designed to build legitimacy and strengthen relationships with stakeholders. Through social programs, environmental initiatives, and community engagement, companies seek to gain social approval and maintain long-term operational stability. However, the implementation of CSR often requires significant financial resources. In certain contexts, CSR expenditures can reduce short-term profits, as found by Bonsu et al. (2024), who demonstrated a negative relationship between CSR and NPM in mining companies. Similarly, Chouaibi et al. (2022) reported no significant relationship between CSR and ROA in the banking sector.

GI plays a critical role in transforming CSR from a cost-oriented obligation into a strategic investment that generates measurable economic returns. When CSR initiatives are integrated with advancements in green technology, such as ecologically efficient production systems or environmentally friendly product designs, companies not only enhance their external reputation but also improve their internal operational performance. From an RBV perspective, CSR contributes to reputational capital, while GI contributes to technological and organizational capabilities. The integration of these two resources creates synergistic value. CSR strengthens stakeholder trust and brand image, whereas GI boosts productivity, reduces environmental costs, and enhances competitiveness. Together, they create a reinforcing mechanism that improves FP more significantly than CSR alone. Empirical evidence from Bonsu et al. (2024) supports this moderating role, showing that GI strengthens the influence of CSR on FP in manufacturing firms, although the effect varies across industries. These findings suggest that the presence of innovation capabilities determines whether CSR activities yield significant financial returns.

H6: GI moderates the relationship between CSR implementation and FP.

GI in Moderating the Relationship Between EP and FP

The moderating effect of GI on the relationship between EP and FP can be theoretically explained using Porter's Hypothesis, the DCT, and the RBV. EP often reflects a company's ability to comply with environmental regulations and effectively manage environmental impacts. Compliance reduces the risk of fines, lawsuits, and reputational damage. However, compliance alone does not always yield superior financial returns. Environmental investments, such as pollution control systems or waste management facilities, can incur high costs without immediately increasing profits. According to Porter's Hypothesis, proposed by Porter and van der Linde (1995), environmental regulations can stimulate innovation that offsets compliance costs and enhances competitiveness. However, these benefits only materialize when companies develop the capacity to innovate. GI represents a mechanism through which EP evolves from compliance-driven behavior to strategic value creation. Companies with strong GI capabilities are better able to redesign production processes, improve energy efficiency, reduce material waste, and develop environmentally friendly products that appeal to consumers concerned about sustainability. Through innovation, environmental responsibility becomes a driver of competitive advantage rather than merely a regulatory obligation.

DCT further suggests that firms capable of integrating, restructuring, and adapting resources in response to environmental challenges are more likely to achieve superior performance. GI reflects these adaptive capabilities, enabling firms to transform environmental management efforts into long-term financial gains. Empirical findings support this argument. Sukirman and Dianawati (2023) demonstrate that GI strengthens the positive relationship between EP and profits in energy companies. Similarly, Muqorobin and Simamora (2025) show that environmental efficiency increases profits in

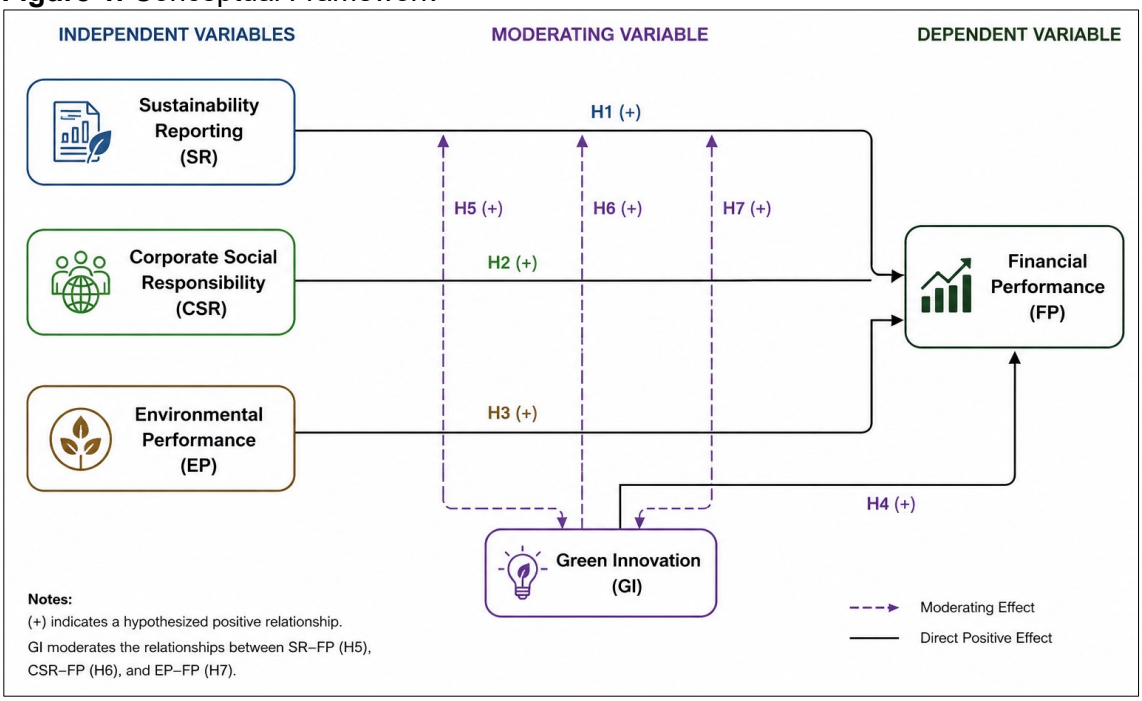
manufacturing firms, suggesting that innovation-oriented environmental management contributes to financial success.

H7: GI moderates the relationship between EP and FP.

Conceptual Framework

Figure 1 shows the conceptual framework of the study.

Figure 1. Conceptual Framework



RESEARCH METHOD

Research Design

This study employed a quantitative research design with an associative approach to examine the relationships among SR, CSR, EP, GI, and FP. A quantitative approach was considered appropriate because it enables objective measurement of relationships among variables using numerical data and statistical analysis (Sugiyono, 2021). The associative design was adopted to investigate both the direct effects of SR, CSR, and EP on FP and the moderating role of GI in these relationships. Panel data covering the 2020–2024 period were analyzed to capture variations across firms and over time, thereby providing more robust empirical evidence than a single-year cross-sectional analysis.

Population and Sampling

The population consisted of medium- and large-scale manufacturing companies operating in Indonesia during the 2020–2024 period, totaling 31,795 firms based on Statistics Indonesia (BPS) data. Because this study required publicly accessible financial and sustainability information, purposive sampling was employed to obtain firms that met the research requirements. The sample selection was based on the following criteria: (1) the company operated continuously throughout the 2020–2024 observation period; (2) the company consistently published audited annual reports and disclosed sustainability reporting or CSR activities during the study period; (3) the company participated in the PROPER environmental assessment program or had available environmental

performance data; and (4) the company provided complete financial and non-financial information required to measure all research variables. After applying the inclusion criteria, companies with incomplete audited financial statements, unavailable sustainability or CSR disclosures, missing PROPER ratings or environmental performance data, and incomplete information required to measure the research variables were excluded from the analysis. The remaining 42 manufacturing firms satisfied all sampling criteria and constituted the final research sample. Observing these firms over the five-year period (2020–2024) resulted in a balanced panel dataset comprising 210 firm-year observations.

Data Collection

This study relied exclusively on secondary data collected from publicly available sources. Financial information was obtained from audited annual reports, while sustainability disclosures were collected from companies' sustainability reports or integrated reports. Environmental performance data were obtained from the PROPER database published by the Ministry of Environment and Forestry of the Republic of Indonesia. The observation period covered five consecutive years, from 2020 to 2024, allowing the study to evaluate sustainability practices and their relationship with FP during the post-pandemic recovery period.

Variable Measurement and Operationalization

All variables were operationalized using secondary archival data collected from annual reports, sustainability reports, and the PROPER database.

Financial Performance (FP)

FP was measured using ROA, which was calculated as:

$$ROA = \frac{Net\ Income}{Total\ Assets}$$

Consistent with Kayani et al. (2024), ROA was selected because it reflects management's ability to generate profits from the firm's total assets and is less sensitive to differences in capital structure than alternative indicators such as ROE or NPM.

Sustainability Reporting (SR)

SR was measured using a sustainability disclosure index developed through content analysis based on the GRI Standards 2021 (GRI, 2021). Each applicable disclosure item received a score of 1 if disclosed and 0 otherwise. The disclosure index was calculated as:

$$SR\ Index = \frac{Number\ of\ Disclosed\ GRI\ Items}{Total\ Applicable\ GRI\ Items}$$

To better capture disclosure quality, greater weight was assigned to quantitative disclosures than to narrative disclosures because quantitative information provides stronger evidence of firms' sustainability practices. Consequently, firms presenting more comprehensive quantitative disclosures could obtain index values exceeding 1.

Corporate Social Responsibility (CSR)

CSR was measured using a CSR disclosure index based on social and community-related disclosure items reported in annual or sustainability reports. Similar to the SR measurement, each applicable disclosure item received a score of 1 if disclosed and 0 otherwise. The CSR index was calculated as:

$$CSR\ Index = \frac{Number\ of\ Disclosed\ CSR\ Items}{Total\ Applicable\ CSR\ Items}$$

Environmental Performance (EP)
EP was measured using the PROPER rating issued annually by the Ministry of Environment and Forestry. The ratings were converted into an ordinal scale consisting of five categories: Black = 1, Red = 2, Blue = 3, Green = 4, and Gold = 5, where higher scores indicate better environmental management and regulatory compliance.

Green Innovation (GI)
GI was measured using the ratio of green technology-related research and development (R&D) expenditure to total operating revenue, reflecting the firm's investment intensity in environmentally oriented innovation. The ratio was calculated as:

$$GI = \frac{Green\ R\&D\ Expenditure}{Total\ Operating\ Revenue}$$

This proxy was selected because it reflects the intensity of firms' investment in environmentally oriented innovation relative to their operating scale. A higher GI ratio indicates a stronger organizational commitment to developing environmentally friendly products, production processes, and technologies that support long-term sustainability and competitiveness.

To examine the moderating role of GI, three interaction variables were constructed: SR × GI, CSR × GI, and EP × GI. Prior to constructing the interaction terms, all predictor variables and GI were mean-centered to minimize multicollinearity between the interaction terms and their constituent variables. Each interaction term was then calculated by multiplying the corresponding mean-centered independent variable by the mean-centered GI value, following the standard moderated multiple regression procedure.

Data Analysis Technique
The data were analyzed using STATA version 17. Panel data regression was employed because the dataset combined cross-sectional observations across firms with time-series observations over the five-year study period.

Model selection was conducted through a sequential three-stage procedure. First, the Chow test was performed to determine whether the Common Effect Model (CEM) or the Fixed Effect Model (FEM) was more appropriate. Second, if the FEM was preferred, the Hausman test was conducted to determine whether the FEM or the Random Effect Model (REM) provided the better specification. Third, the Lagrange Multiplier (LM) test was used to compare the CEM and REM when necessary. The final regression model was selected based on the outcomes of these specification tests.

Before hypothesis testing, classical assumption tests, including normality, multicollinearity using the Variance Inflation Factor (VIF), heteroscedasticity, and autocorrelation, were conducted to verify that the selected panel regression model satisfied the assumptions required for reliable parameter estimation. The regression coefficients were subsequently interpreted based on their direction, magnitude, and statistical significance at $\alpha = 0.05$ to evaluate both the direct and moderating effects proposed in the research hypotheses:

$$FP = \beta_0 + \beta_1 SR + \beta_2 CSR + \beta_3 EP + \beta_4 GI + \beta_5 (SR \times GI) + \beta_6 (CSR \times G + \beta_7 (EP \times GI) + \varepsilon$$

where β_0 denotes the constant, β_1–β_7 represent the estimated regression coefficients, and ε is the error term. The regression coefficients were interpreted based on their direction, magnitude, and statistical significance to evaluate both the direct and moderating effects proposed in the research hypotheses.

RESULTS

Descriptive Statistical Test Results

Descriptive statistical analysis provides an overview of the characteristics of the research data before hypothesis testing is conducted. The variables analyzed include SR, CSR, EP, GI, and FP, as presented in Table 1.

Table 1. Descriptive Statistics

Variable	Minimum	Maximum	Mean	Std. Deviation
SR	0.30769	1.56044	1.0197	0.1671
CSR	0.70238	1	0.9106	0.0639
EP	3	5	3.7810	0.7119
GI	0.1733	0.3333	0.2530	0.0485
FP	-1.2273	0.3777	0.0644	0.1308

Note: Sustainability Reporting (SR), Environmental Performance (EP), Green Innovation (GI)

Based on Table 1, the average SR of 1.0197 indicates a fairly good level of sustainability disclosure. CSR has a high average of 0.9106, indicating strong social responsibility implementation. EP, with an average of 3.781, shows that most companies have demonstrated good environmental compliance and practices. GI, with an average of 0.253, still shows a moderate level of GI that is not yet evenly distributed across the sample. Meanwhile, FP has a positive average of 0.0644, indicating stable FP but varying between companies. Overall, these results indicate considerable variation between companies in the application of sustainability practices and GI, which is an important basis for further hypothesis testing.

Normality Test

The normality test was conducted using the Shapiro–Wilk (SW) Test to ensure that the residual data were normally distributed. This test examined the null hypothesis that the residuals followed a normal distribution. The decision criteria are based on the p-value with a significance level of 0.05; if the p-value is ≥ 0.05, the data is considered to be normally distributed, whereas if the p-value is < 0.05, the data are not normally distributed.

Table 2. SW Normality Test Results

Variable	Obs	W	V	z	Prob > z
Regression residuals	210	0.99412	0.915	-0.205	0.58132

Note: The SW normality test indicates that the regression residuals are normally distributed because the p-value (Prob > z = 0.58132) is greater than 0.05.

Based on the test results in Table 2, a p-value of 0.58132 was obtained, which is greater than the significance level of 0.05. Thus, it can be concluded that the residual data is normally distributed, so the normality assumption is satisfied. This indicates the regression model satisfies one of the required classical assumptions, so the analysis results can be considered valid and can be used for further hypothesis testing.

Multicollinearity Test
The multicollinearity test was conducted using the VIF to assess the correlation between independent variables. A VIF value below 10 indicates no multicollinearity.

Table 3. Multicollinearity Test (VIF)

Variable	VIF	1/VIF
GI	3.72	0.268494
EP	3.64	0.275071
CSR	2.12	0.471778
GI x EP	1.43	0.700870
GI x CSR	1.38	0.725992
SR	1.35	0.741980
GI x SR	1.17	0.853615
Mean VIF	2.11	

Note: VIF = Variance Inflation Factor; SR = sustainability reporting; CSR = corporate social responsibility; EP = environmental performance; GI = green innovation; GI x SR, GI x CSR, GI x EP = interaction (moderation) terms. All VIF < 10, indicating no multicollinearity.

Based on the results in Table 3, all independent variables have VIF values below 10, so it can be concluded that there is no multicollinearity. The regression model is considered reliable because the independent variables do not strongly influence each other.

Autocorrelation Test
The Runs Test is used to assess whether the residuals are randomly distributed. If the p-value > 0.05, then there is no autocorrelation.

Table 4. Autocorrelation Test (Runs Test)

Statistic	Value
Number of observations	210
Number of runs	103
z	-0.42
Prob>|z|	0.68

Note: Runs test on regression residuals. Prob>|z| = 0.68 > 0.05, indicating no autocorrelation.

The results in Table 4 show a p-value of 0.68, which is greater than 0.05, indicating that there is no autocorrelation between residuals. The model meets the assumption of residual independence.

Heteroscedasticity Test
The Breusch–Pagan Test is conducted to detect differences in residual variance.

Table 5. Heteroscedasticity Test (Breusch–Pagan)

Statistic	Value
Null hypothesis (H0)	Constant variance (homoscedastic)
chi2(1)	2.37
Prob > chi2	0.1234

Note: Breusch-Pagan / Cook-Weisberg test. Prob > chi2 = 0.1234 > 0.05, so the homoscedasticity assumption is satisfied.

A p-value of 0.1234 > 0.05 in Table 5 indicates no heteroscedasticity. The model meets the assumption of homoscedasticity with constant residual variance.

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Determination of Estimation Models Between CEM and FEM Using the Chow Test
The Chow test was conducted to determine whether the CEM or the FEM was more appropriate to use. The results of data processing using STATA 17 are shown in Table 6.

Table 6. Chow Test Result

Statistic	Value
F(5, 197)	0.24
Prob > F	0.9431

Note: Chow test (CEM vs FEM). Prob > F = 0.9431 > 0.05; H0 cannot be rejected, so the CEM is preferred.

Based on Table 6, a probability value of 0.9431 (> 0.05) is obtained, so the null hypothesis (H_0) cannot be rejected. Thus, the CEM is the most appropriate model for this study. This result indicates that differences in characteristics between companies do not significantly affect the relationship between variables, so that all entities can be treated as homogeneous.

Determination of the Estimation Model Between the FEM and Random Effect Model (REM) with the Hausman Test
To determine the best model, the Hausman test was conducted to compare FEM and REM. The test results are presented in Table 7.

Table 7. Hausman Test Results

Statistic	Value
chi2(7)	12.81
Prob > chi2	0.0770

Note: Hausman test (FEM vs REM). Prob > chi2 = 0.0770 > 0.05; H0 cannot be rejected, so the Random Effect Model (REM) is preferred over FEM.

Based on Table 7, the probability value of 0.0770 (> 0.05) indicates that the null hypothesis cannot be rejected. Therefore, the REM is declared to be more appropriate. This indicates that individual effects are not significantly correlated with independent variables, making the REM model efficient and unbiased.

Determination of Estimation Models Between CEM and REM Using LM Test
To compare CEM and REM, the LM test was conducted. The test results are shown in Table 8.

Table 8. Lagrange-Multiplier (LM) Test Results

Statistic	Value
chibar2(01)	0.00
Prob > chibar2	1.0000

Note: Breusch-Pagan LM test (CEM vs REM). Prob > chibar2 = 1.0000 > 0.05; H0 cannot be rejected, so the CEM is confirmed as the most appropriate estimation model.

According to Table 8, the probability value obtained was 1.0000 (> 0.05), indicating that there was no significant difference between CEM and REM. Thus, the CEM was again declared as the most appropriate estimation model to use. These results confirm that the addition of random effects did not significantly improve the explanatory power of the model.

Hypothesis Testing

Table 9. Results of Coefficient of Determination (R^2), F-test, and t-test (CEM)

Variable	Coef.	Std. Err.	t	P>|t|	95% CI Lower	95% CI Upper
SR	1.162181	0.512576	2.27	0.024	0.151495	2.172867
CSR	3.363175	1.681276	2.00	0.047	0.048073	6.678278
EP	0.108721	0.197633	0.55	0.583	-0.280967	0.498410
GI	6.090148	2.934497	2.08	0.039	0.303974	11.876320
GI x SR	-30.809260	11.107980	-2.77	0.006	-52.711720	-8.906800
GI x CSR	14.050080	28.229360	0.50	0.619	-41.611920	69.712090
GI x EP	-6.206563	2.534420	-2.45	0.015	-11.203880	-1.209251
Constant	-6.420516	1.423152	-4.51	0.000	-9.226656	-3.614376

Note: Dependent variable = financial performance (FP, ln-transformed). Model fit: Obs = 210; F(7, 202) = 10.71; Prob > F = 0.0000; R-squared = 0.2707; Adj. R-squared = 0.2455; Root MSE = 1.0668. SR = sustainability reporting; CSR = corporate social responsibility; EP = environmental performance; GI = green innovation; GI x SR, GI x CSR, GI x EP = moderation (interaction) terms.

Based on Table 9, the R^2 value of 0.2707 indicates that the independent variables, SR, CSR, EP, and GI explain approximately 27.07% of the variation in FP, while the remaining 72.93% is influenced by other factors outside the model. The Prob > F value of 0.0000 (< 0.05) indicates that all independent variables simultaneously have a significant effect on FP.

Partial Significance Test (t-test) and Regression Equation

The resulting regression equation is:

$$FP = -6.42 + 1.162SR + 3.363CSR + 0.1087EP + 6.09GI - 30.809(GI \times SR) + 14.05(GI \times CSR) - 6.206(GI \times EP) + e$$

Based on the t-test results presented in Table 9, several key findings emerge. SR is found to have a significant positive effect on FP (p = 0.024). Similarly, CSR also demonstrates a significant positive influence on FP (p = 0.047). In contrast, EP shows a positive but statistically insignificant effect on FP (p = 0.583), indicating that its contribution is not strong enough to be considered meaningful in this model.

The regression analysis reveals that GI significantly influences FP (p = 0.039). However, its role as a moderator shows a complex interaction. The interaction between GI and SR (GI \times SR) is significant (p = 0.006) but carries a negative coefficient (-30.809). This indicates that GI weakens (dampens) the positive relationship between SR and FP. Similarly, the interaction between GI and EP (GI \times EP) is significant (p = 0.015) with a negative coefficient (-6.206). This suggests a buffering effect, where the financial benefits derived from environmental compliance are diminished as firms face higher capital intensity for green technological transitions. Conversely, GI does not significantly moderate the relationship between CSR and FP (p = 0.619). These results highlight the conditional nature of sustainability benefits, which are subject to resource trade-offs between reporting compliance and innovation expenditures.

Table 10. Summary of Hypothesis Testing Results

Hypothesis		Coefficient (β)	P-Value	Result
H1	(SR) - FP	1.162	0.024	Supported
H2	CSR - FP	3.363	0.047	Supported
H3	EP - FP	0.1087	0.583	Not Supported
H4	GI - FP	6.090	0.039	Supported

H5	GI - FP SR × GI → FP	-30.809	0.006	Supported (Negative)
H6	GI - CSR - FP CSR × GI → FP	14.05	0.619	Not Supported
H7	GI - EP - FP EP × GI → FP	-6.206	0.015	Supported (Negative)

Table 10 presents the empirical results of the hypothesis testing. The findings indicate that H1, H2, and H4 are supported, as SR (beta = 1.162, p = 0.024), CSR (beta = 3.363, p = 0.047), and GI (beta = 6.090, p = 0.039) demonstrate significant positive impacts on FP. This suggests that transparent disclosure, social engagement, and eco-friendly technological advancement are direct drivers of corporate profitability. However, H3 is not supported, as EP (beta = 0.1087, p = 0.583) shows a positive but statistically insignificant direct influence.

Regarding the moderation analysis, the results provide a critical insight into the interaction effects. H5 is supported with a significant negative interaction coefficient (beta = -30.809, p = 0.006), indicating that GI weakens (dampens) the positive relationship between SR and FP. Similarly, H7 is supported with a negative coefficient (beta = -6.206, p = 0.015), suggesting that GI also acts as a buffering variable that diminishes the financial gains typically expected from high EP. Conversely, H6 is not supported, as the interaction between GI and CSR is not statistically significant.

The coefficient of determination (R^2) of 0.2707 indicates that the model explains 27.07% of the variance in FP among Indonesian manufacturing firms. While the overall model is significant (Prob > F = 0.0000), the negative moderation results highlight a strategic trade-off, where the high capital intensity of GI may temporarily offset the financial benefits of sustainability compliance in the emerging market context.

DISCUSSION

The Effect of SR on FP

The empirical results indicate that SR has a significant positive effect on FP (beta = 1.162, p = 0.024). This finding confirms that the transparent disclosure of Environmental, Social, and Governance (ESG) aspects is not merely an administrative burden but a strategic investment. According to signaling theory, sustainability reports serve as a credible signal to the capital market, reducing information asymmetry. Investors tend to assign higher valuations to transparent firms because they are perceived to have lower non-financial risks and more stable corporate governance (Ismail & Azman, 2024).

Furthermore, through the lens of legitimacy theory, SR helps Indonesian manufacturing firms secure their "social license to operate" from society and regulators. By aligning business activities with global sustainability norms, firms avoid legal sanctions and consumer boycotts, which directly maintains cash flow stability. Internally, the process of preparing an SR compels management to conduct efficiency audits on energy and material usage, ultimately reducing operational costs and improving NPM. This finding is consistent with Putra and Subroto (2022), who state that information transparency is a primary catalyst in enhancing social capital and corporate equity value.

The Effect of CSR on FP

This study finds that CSR has a significant positive influence on FP (beta = 3.363, p = 0.047). In line with stakeholder theory, firms that proactively meet the expectations of stakeholders, such as local communities and employees, build a solid reputation and high brand loyalty. In the manufacturing sector, harmonious relationships with the community surrounding factory locations are crucial to preventing social conflicts that could halt operations (Freeman, 1984).

Although CSR requires substantial budget allocation, this investment yields long-term returns through increased employee productivity and a positive public image. Firms perceived as socially responsible have stronger bargaining power in attracting top talent and easier access to "Green Financing." These results support the study by Dutt and Dwivedi (2023), which emphasizes that CSR integrated into the firm's core strategy provides a sustainable competitive advantage compared to firms that only engage in symbolic or purely philanthropic CSR.

The Effect of EP on FP

Unlike previous variables, EP was found to have a positive but non-significant effect (beta = 0.1087, p = 0.583). This indicates that environmental achievements, such as high PROPER ratings, have not been instantaneously converted into financial gain during the observation period. Theoretically, environmental investments are often capital-intensive with a long payback period (time-lag effect). The initial costs for advanced waste treatment systems or ISO environmental certifications may suppress profit margins in the short term before energy efficiencies are fully realized economically.

This insignificance also suggests that the manufacturing market in Indonesia may not yet provide a "price incentive" for firms with high ecological performance. Regulatory pressure may force compliance, but such compliance does not necessarily lead to a drastic increase in sales or a significant reduction in costs immediately. This finding aligns with Fitriasari (2023), who states that EP is often neutral toward short-term FP but remains crucial for long-term risk mitigation.

The Effect of GI on FP

GI is proven to have a significant positive effect on FP (beta = 6.09, p = 0.039). Referring to the RBV, GI is a strategic asset that meets the VRIN criteria (Valuable, Rare, Inimitable, and Non-substitutable). The ability of a firm to re-engineer production processes to be more energy-efficient and waste-minimal creates significant cost efficiencies (Barney, 1991).

GI also allows manufacturing firms to achieve "green differentiation" in the market, enabling them to set premium prices or reach new eco-conscious consumer segments. Beyond cost efficiency, GI helps firms mitigate the risk of future compliance costs as government emission standards tighten. This study reinforces the argument of Sabihaini et al. (2026) that firms investing in eco-friendly technology will possess a more competitive cost structure and stronger economic resilience in the green economy era.

GI as a Moderator of SR and FP

The moderation analysis shows that GI has a significant interaction effect (p = 0.006) but with a negative coefficient (-30.809). This means that GI weakens (dampens) the positive impact of SR on FP. This phenomenon indicates a "resource crunch" within Indonesian manufacturing firms. When a firm aggressively pursues capital-intensive green technology innovation while simultaneously maintaining intensive SR, the massive R&D investment burden can deplete corporate liquidity.

In this condition, the reputational benefits from sustainability reports become less effective in increasing profitability because they are offset by high depreciation costs of new machinery or green technology research expenses. Strategically, this result serves as a warning that the integration between "communication" (SR) and "action" (GI) must be managed gradually to avoid a double financial burden that reduces capital efficiency in the short term.

GI as a Moderator of CSR and FP

Statistical analysis shows that GI does not moderate the relationship between CSR and FP (p = 0.619). This implies that the effectiveness of CSR programs in generating financial profit does not depend on the firm's level of GI. In Indonesia, CSR initiatives often still focus on external community development and social activities that are decoupled from the firm's core production lines or technological innovations. Consequently, the synergy between green technology investment and social responsibility programs has not been optimally formed. The absence of this moderation effect suggests that manufacturing firms have not yet integrated CSR into their GI ecosystems to create additional financial value.

GI as a Moderator of EP and FP

GI is proven to moderate the relationship between EP and FP (p = 0.015) with a negative coefficient (-6.206). This finding indicates that GI acts as a buffering variable that weakens the financial sensitivity toward EP. Although EP and GI are individually positive, combining them creates "over-compliance costs."

Firms that have already achieved high environmental standards (good EP) but continue to force radical GI may experience a decline in financial efficiency because the additional costs of such innovation exceed the savings derived from standard environmental compliance. This result corrects general assumptions and emphasizes the importance of a strategic balance; GI must be implemented at an optimal point to support ecological performance without sacrificing the firm's profit margins (Sukirman & Dianawati, 2023).

CONCLUSION

This study examined the effects of SR, CSR, and EP on the FP of Indonesian manufacturing firms during the 2020–2024 period while investigating the moderating role of GI. Using panel data from 42 manufacturing firms (210 firm-year observations) analyzed with the CEM, the study provides empirical evidence regarding the financial implications of corporate sustainability practices within Indonesia’s manufacturing sector.

The findings indicate that SR, CSR, and GI have significant positive effects on FP, suggesting that transparent sustainability disclosure, responsible corporate practices, and investments in environmentally oriented innovation contribute positively to firms’ financial outcomes. In contrast, although EP exhibits a positive relationship with FP, its effect is not statistically significant, indicating that improvements in environmental performance alone may not immediately translate into superior financial performance. Furthermore, the moderating analysis reveals that GI negatively moderates the relationships between SR and FP as well as between EP and FP, indicating that higher levels of GI weaken the positive influence of these variables on FP. Meanwhile, GI does not significantly moderate the relationship between CSR and FP. These findings suggest that although GI independently enhances FP, the simultaneous implementation of intensive green innovation and sustainability initiatives may create short-term resource allocation pressures that reduce their immediate financial benefits.

The findings contribute to the literature by extending the application of the RBV, stakeholder theory, and legitimacy theory in explaining how organizational innovation influences the relationship between sustainability practices and financial performance. Rather than functioning solely as a complementary capability, GI may also introduce short-term resource trade-offs that alter the financial returns associated with sustainability reporting and environmental initiatives. This perspective provides a more

nuanced understanding of the sustainability–performance paradox, particularly within emerging economies.

From a managerial perspective, the results suggest that manufacturing firms should not only strengthen sustainability reporting, corporate social responsibility initiatives, and green innovation independently but also carefully coordinate the timing and allocation of resources devoted to these activities. Managers should consider phased implementation strategies that balance sustainability investments with firms' financial capacity to maximize long-term value creation while minimizing short-term financial pressures. For policymakers, the findings highlight the importance of developing regulatory incentives and support mechanisms that encourage firms to adopt green technologies without imposing excessive financial burdens during the transition toward more sustainable business practices.

LIMITATION

This study has several limitations. First, the analysis is limited to 42 manufacturing firms observed over the 2020–2024 period, which may restrict the generalizability of the findings to other industries or countries. Second, the explanatory power of the model (R^2 = 27.07%) indicates that a substantial proportion of the variation in FP is influenced by factors beyond those examined in this study. Finally, the study focuses on a limited set of sustainability-related variables and therefore may not fully capture the complexity of corporate sustainability strategies.

Future studies are encouraged to extend the observation period, include firms from additional industrial sectors or different countries, and incorporate other organizational, governance, financial, or market-related variables that may further explain variations in FP. Future research may also examine alternative measures of green innovation or explore additional mediating and moderating mechanisms to provide a more comprehensive understanding of how sustainability practices create long-term economic value.

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DECLARATION OF CONFLICT OF INTEREST

The authors declare that they have no potential conflicts of interest related to the research, authorship, and/or publication of this article.

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