

Reporting on Environmental Innovation As a Means of Enhancing Firm Performance

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Abstrak

Dalam beberapa dekade terakhir, perhatian terhadap masalah lingkungan telah meningkat seiring dengan peningkatan kesadaran akan pentingnya keberlanjutan di seluruh dunia. Kinerja inovasi lingkungan adalah komponen penting dari strategi bisnis kontemporer. Dipercaya bahwa meningkatkan kinerja inovasi lingkungan dapat berdampak positif pada kinerja perusahaan. Profitabilitas, efisiensi operasional, dan reputasi di pasar adalah beberapa cara biasa untuk mengukur seberapa baik sebuah bisnis beroperasi. Tujuan dari penelitian ini adalah melihat pengaruh inovasi lingkungan terhadap kinerja perusahaan. Sampel penelitian ini diambil dari seluruh perusahaan yang terdaftar di Bursa Efek Indonesia (BEI) dengan memiliki laporan inovasi lingkungan. Metode yang dilakukan dengan metode *purposive sampling* untuk memilih sampel dan regresi linear untuk hasil dari penelitian ini. Hasil dari penelitian ini menunjukkan bahwa inovasi lingkungan memiliki pengaruh positif signifikan terhadap kinerja perusahaan. Kesimpulan dalam penelitian ini dapat memberikan wawasan kepada akademisi dan praktisi terkait isu inovasi dalam lingkungan dapat meningkatkan kinerja perusahaan, dapat memberikan wawasan bagi pemangku kepentingan dalam keputusan investasi hijau.

Kata Kunci: Inovasi Lingkungan, Investasi Hijau, Kinerja Perusahaan, Keberlanjutan

Abstract

In recent decades, there has been a notable increase in the attention paid to environmental issues, concurrent with a growing awareness of the importance of sustainability on a global scale. Environmental innovation performance constitutes an essential element of contemporary business strategy. It is hypothesized that enhancements to environmental innovation performance may yield favorable outcomes for corporate performance. A business's profitability, operational efficiency, and reputation typically indicate its overall performance. This study aims to examine the impact of environmental innovation on organizational performance. The sample for this study was drawn from all companies listed on the Indonesia Stock Exchange (IDX) that had submitted environmental innovation reports. The method employed was purposive sampling, which was used to select the sample, and linear regression was used to analyze the results of this study. The findings indicate that environmental innovation has a significant positive effect on firm performance. The conclusions of this study can provide insight to academics and practitioners on the issue of innovation in the environment, namely that it can improve firm performance, and can provide insight for stakeholders in green investment decisions.

Keywords: Environmental Innovation, Green Investment, Firm Performance, Sustainability

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INTRODUCTION

In recent decades, there has been a notable increase in the attention paid to environmental issues, accompanied by a corresponding rise in global awareness of the vital importance of sustainability. These changes impact government policies, public awareness, and companies' business strategies. One crucial aspect of modern business strategy is environmental innovation performance. Environmental innovation encompasses the development and implementation of new technologies and management practices to reduce the negative impact of business activities on the environment. This may include initiatives such as reducing greenhouse gas emissions, enhancing waste management efficiency, and promoting the sustainable utilization of natural resources.

It is posited that enhanced environmental innovation performance exerts a beneficial influence on corporate performance. The performance of a firm is frequently evaluated from a multitude of perspectives, including profitability, operational efficiency, and market reputation. A body of research indicates that firms that invest in environmental innovation tend to experience improved operational efficiency, which can in turn reduce production costs and increase profitability (Dangelico & Pujari, 2010; Porter & Van Der Linde, 1995). Furthermore, firms that are committed to sustainable environmental practices often gain a more favorable reputation among consumers and investors, which can increase the market value of the firm (Guinot et al., 2022).

In the context of Indonesia and other developing countries, corporate environmental performance is an important factor in attracting foreign investment. There is a growing tendency among global investors to consider environmental aspects in their investment decisions, and companies that demonstrate a commitment to environmental innovation are more likely to receive financial support from investors with a focus on sustainability (Guinot et al., 2022). Furthermore, the Indonesian government is also increasingly encouraging companies to adopt environmentally friendly business practices through the implementation of various incentives and regulations. Recent studies indicate a positive relationship between environmental innovation performance and overall company performance across multiple industries. Manufacturing firms adopting green innovations have achieved notable financial improvements, while energy sector companies investing in clean technologies have also experienced enhanced profitability and operational efficiency. These practices not only minimize environmental impacts but also boost economic performance (Chen & Golley, 2014; Chen et al., 2006). Thus, this study seeks to answer the following question: Does environmental innovation positively influence firm performance?

However, the adoption of environmental innovations faces significant challenges, particularly high initial costs and uncertainty regarding long-term benefits. To address these obstacles, companies must develop clear strategies and secure support from various stakeholders, including governments, businesses, and the public. This study aims to examine the impact of environmental innovation performance on improving firm performance in Indonesia. The findings are expected to offer valuable insights into how environmental innovation can be effectively integrated into business strategies to achieve enhanced and sustainable performance.

Resource-Based View (RBV) and Ecological Modernization Theory

The Resource-Based View (RBV) provides a framework for understanding how organizations achieve and sustain competitive advantage by leveraging unique and

imitable resources (Barney, 1986). According to RBV, resources that are difficult to transfer, replicate, or acquire—often requiring significant learning or cultural adaptation—are more likely to be exclusive to the firm, creating a foundation for sustained superior performance (Madhani, 2010). Environmental innovation fits this description, serving as a strategic resource that is challenging for competitors to imitate and offering long-term competitive advantages.

The theory of ecological modernization complements this perspective by emphasizing the interplay between technological advancement and environmental policies in achieving both economic and environmental improvements (Mol & Spaargaren, 2000). By embedding environmental considerations within economic systems, this theory underscores the potential for greater resource efficiency and minimized environmental impacts. Technological innovation is central to this process, enabling reduced waste, improved resource utilization, and lower greenhouse gas emissions. The integration of technological modernization with sustainable business practices provides dual benefits: enhanced economic performance and reduced environmental harm. These practices not only strengthen operational efficiency but also bolster a company's legitimacy and reputation among stakeholders. Furthermore, ecological modernization advocates for shared responsibility among governments, businesses, and society to meet sustainability goals (Huber, 2008; Mol & Spaargaren, 2000; Murphy, 2000; Spaargaren & Mol, 1992). Environmental innovation exemplifies these principles by driving resource efficiency and waste reduction, resulting in significant economic and environmental gains.

Environmental Innovation on Firm Performance

The concept of environmental innovation highlights its dual role in providing a competitive advantage to companies while promoting environmental sustainability. It involves the development and application of new technologies, products, processes, and management practices aimed at reducing negative environmental impacts. Green innovation, a subset of environmental innovation, focuses on creating products and processes that minimize resource use and emissions, improving energy and material efficiency while reducing waste and pollution (Rennings, 2000). Companies adopting such innovations can achieve competitive advantages through cost reductions, efficiency gains, and appeal to environmentally conscious consumers. Additionally, environmental innovation enhances corporate reputation and investor interest (Porter & Van Der Linde, 1995). Although initial costs may be high, studies show that reduced operational costs and increased efficiency often lead to significant financial returns over time (Hart & Ahuja, 1996).

Recent literature underscores the positive relationship between environmental innovation and firm performance. Implementing green technologies, energy-efficient systems, and waste management strategies can lower operational costs and improve production efficiency. Furthermore, companies prioritizing environmental sustainability often enjoy enhanced reputations and customer loyalty, which translate into higher revenues and market value. Yan et al. (2022) found that firms investing in green technologies not only mitigate environmental impacts but also achieve notable financial benefits by accessing cost savings and environmentally conscious markets. These findings affirm that environmental innovation is both a social responsibility and a profitable strategy.

H1: Environmental innovation has a significant positive effect on firm performance.

METHODOLOGY

The population for this study was drawn from all companies in Indonesia listed on the Indonesia Stock Exchange (IDX) between 2019 and 2023. Companies were selected using the purposive sampling method based on specific criteria. The inclusion criteria were as follows:

1. The company must have produced consecutive environmental innovation reports from 2019 to 2023 in Indonesia.

Table 1. Sample Selection

Description	Total
Companies in Indonesia listed on the Indonesia Stock Exchange (IDX) until 2023	833
Companies in Indonesia with incomplete environmental innovation performance reports from 2019 to 2023	(817)
Companies in Indonesia that report complete environmental innovation performance from 2019 to 2023	16
Number of observations from year 5	80

Source: Data processed, 2024

Dependent variable

The return on assets (ROA) is a metric used to assess the financial performance of a company. It is a ratio that indicates the extent to which a company manages its assets effectively to generate profits (Brigham & Ehrhardt, 2015). The ROA is calculated by comparing the company's net profit over a specified period with its total assets.

$$ROA = \frac{\text{Net income available to common stockholders}}{\text{Total assets}}$$

Independent variable

The term "environmental innovation" is derived from the Thomson Reuters' ASET 4 ESG database, which is now part of the Refinitiv database. This database assesses a company's capacity to diminish costs and environmental impacts for customers, thereby facilitating the creation of novel market opportunities for the company.

Control variable

Control variables play a crucial role in ensuring that the observed effects of independent variables are not confounded by other factors. Tobin's Q, a ratio comparing a company's market value to its asset value, is one such variable. A Tobin's Q greater than 1 indicates that the market values the company higher than its asset cost, reflecting investor confidence in the firm's future profitability (Lim & Mali, 2024). Including Tobin's Q in this study helps account for market valuation effects on firm performance, enhancing analytical accuracy. This is essential, as Tobin's Q can influence managerial and investor decisions regarding resource allocation and corporate strategy.

The Environmental, Social, and Governance (ESG) variable serves as another control, measuring a firm's adherence to sustainability principles. A company's commitment to ESG practices can significantly impact both environmental innovation and financial performance (Zaharia & Zaharia, 2021). ESG's three pillars provide detailed insights: the environmental pillar (E) focuses on resource management and environmental impact; the social pillar (S) addresses employee and community relationships; and the governance pillar (G) examines managerial structures and compliance. Controlling for these ensures that variations in firm performance attributed to environmental innovation are not confounded by broader sustainability practices (Ioannou & Serafeim, 2017). Gross Domestic Product (GDP), which measures the total value of goods and services produced

within a country, is also used as a control variable. GDP fluctuations can influence market demand, operating costs, and investment decisions, all of which may affect the link between environmental innovation and firm performance (Mankiw, 2021). Including GDP as a control accounts for macroeconomic effects, ensuring a clearer understanding of the specific relationship between environmental innovation and firm performance.

Table 2: Variable Definition

Variable type	Variable name	Variable symbol	Definition
Dependent	Firm Performance	ROA	Net income available to common stockholders divided by total assets
Independent	Environmental Innovation	EI	Thomson Reuters ASSET4 ESG base data
Control	Tobin's Q	QR	Total Market Value of Shares Outstanding plus Total Market Value of Liabilities) divided by the Replacement Value of Production Capacity
	ESG Score	ESG	ESG Score data from Refinitiv database
	Environmental Score	E	ESG Score data from Refinitiv database
	Social Score	S	ESG Score data from Refinitiv database
	Governance Score	G	ESG Score data from Refinitiv database
	GDP Growth	GDP	Country's GDP report

Source: Data processed, 2024

Model Contribution

The following model tests the hypothesis of the relationship between environmental innovation and firm performance. The higher the environmental innovation, the higher the company's performance:

$$ROA = \alpha_0 + \alpha_1 EI + \alpha_3 \text{Control Variable} + \epsilon.$$

Here, ROA is the Return on Asset that represents the company's performance, EI represents the company's environmental innovation performance, and the control variables represent the relevant control variables.

RESULTS

Table 3 provides descriptive statistics for the key variables in the study. The Return on Assets (ROA) variable shows an average of -0.076 with a standard deviation of 0.084, reflecting high variability and indicating that overall financial performance tends to be negative, ranging from a minimum of -0.361 to a maximum of 0.029. The Environmental Innovation (EI) variable has an average of 51.232 and a standard deviation of 23.672, highlighting significant disparities in environmental innovation among firms. Tobin's Q (QR), with an average of 1.292 and a standard deviation of 2.689, reveals substantial fluctuations in firm liquidity. The ESG score averages 60.174 with a standard deviation of 16.944, while the sub-pillars of ESG - Environmental (E), Social (S), and Governance (G) - show similar variability, averaging 53.642, 67.056, and 52.773, respectively. These variations suggest differences in sustainability performance across firms. The GDP variable averages 5.032 with a standard deviation of 0.097, indicating a relatively stable macroeconomic environment for the firms studied. As GDP can influence market demand, operating costs, and investment decisions, it is included as a control variable to

account for macroeconomic effects on the relationship between environmental innovation and firm performance (Mankiw, 2021). These findings underscore the importance of considering liquidity, sustainability performance, and macroeconomic conditions in analyzing financial performance and environmental innovation.

Table 3. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	80	-.076	.084	-.361	.029
EI	80	51.232	23.672	3.232	94.231
QR	80	1.292	2.689	.04	15.519
ESG	80	60.174	16.944	25.722	87.454
E	80	53.642	17.033	21.136	89.167
S	80	67.056	21.577	12.974	95.885
G	80	52.773	23.003	5.026	90.233
GDP	80	5.032	.097	4.876	5.174

Source: Data processed by STATA 17, 2024

As evidenced by the results of the heteroscedasticity test presented in Table 4, the chi-square (χ^2) value is 46.49 with degrees of freedom (df) 35 and a p-value of 0.0928. A p-value greater than 0.05 indicates that there is insufficient evidence to reject the null hypothesis that there is no heteroscedasticity in the regression model. In other words, the regression model used does not experience heteroscedasticity problems, and thus the variance of the residuals is constant. This indicates that the regression parameter estimation is efficient and that the statistical inference generated from this model can be considered valid.

Table 4. Heteroscedasticity Test Results

Source	chi2	df	P-value
Heteroskedasticity	46.49	35	0.0928

Source: Data processed by STATA 17, 2024

As evidenced by the results of the multicollinearity test presented in Table 5, the majority of variables in this study exhibit variance inflation factor (VIF) values that fall below the commonly employed threshold of 10, which is typically utilized as an indicator of severe multicollinearity. Specifically, the VIF values for the Environmental Innovation (EI) variable of 2,079, Tobin's Q (QR) of 1,247, Environmental (E) of 3,185, Social (S) of 5,178, Governance (G) of 3,154, and Gross Domestic Product (GDP) of 1,099, indicate that these variables do not experience significant multicollinearity. Although the ESG variable has a VIF value of 9.819, which is close to the critical limit, the average VIF of 3.68 indicates that the data is free from multicollinearity problems that could affect the results of the regression analysis. Therefore, it can be concluded that multicollinearity is not a significant issue in the regression model used in this study, and the regression parameter estimates can be considered valid and reliable.

Table 5: Multicollinearity Test Results

	VIF	1/VIF
EI	2.079	.481
QR	1.247	.802
ESG	9.819	.102
E	3.185	.314
S	5.178	.193
G	3.154	.317
GDP	1.099	.91
Mean VIF	3.68	.

Source: Data processed by STATA 17, 2024

As illustrated in Table 6, the regression results demonstrate the impact of the Environmental Innovation (EI) variable on Return on Assets (ROA) when different control variables are incorporated into the model. In the initial model, the effect of environmental innovation on return on assets is found to be statistically significant and

negative. This may be attributed to the considerable initial expenditure associated with implementing environmental innovations that have not yielded a direct positive impact on the company's financial performance. The implementation of environmental innovations frequently necessitates substantial investments in new technologies, employee training, and operational alterations, which can temporarily diminish a firm's profitability (Albort-Morant et al., 2018; Cheng et al., 2014).

In the second model, the effect of environmental innovation on return on assets remains negative and significant when the control variable ESG is included. However, the ESG variable itself is not significant in this model. This could indicate that although firms adopt ESG practices, the direct impact on financial performance is yet to be seen or takes longer to be realized. Alternatively, it may indicate that ESG variables in isolation are not strong enough to offset the high cost of environmental innovation, so the negative effect of environmental innovation remains dominant.

In the third model, the results underwent a notable alteration, with environmental innovation (EI) exhibiting a substantial positive influence on return on assets (ROA). This occurs after the incorporation of additional control variables, including Tobin's Q (QR), Environmental (E), Social (S), Governance (G), and GDP, into the model. The negative effect of Tobin's Q indicates that companies with lower liquidity may be more susceptible to environmental innovation costs. Conversely, the positive influence of ESG and GDP suggests that sustainability performance and favorable macroeconomic conditions can transform the impact of environmental innovation into a beneficial one. By incorporating additional control variables, the model offers a more comprehensive representation and demonstrates that environmental innovation can confer substantial financial advantages when supported by optimal liquidity conditions and effective sustainability practices.

Table 6. Regression Test Results

ROA	(1)	(2)	(3)
EI	-0.001** (-2.32)	-0.001** (-2.12)	0.001** (2.61)
QR			-0.025*** (-12.29)
ESG		0 (-0.45)	0.009*** (4.13)
E			-0.003*** (-5.25)
S			-0.004*** (-3.98)
G			-0.002** (-2.64)
GDP			0.128** (2.40)
Constant	-0.03 (-1.37)	-0.017 (-0.47)	-0.722** (-2.64)
R-squared	0.065	0.067	0.762
F-Test	5.398	2.771	32.908

Source: Data processed by STATA 17, 2024

Notes:

In parentheses is the "t" value

*** p<.01, ** p<.05, * p<.1

DISCUSSION

The regression results in Table 6 show that environmental innovation positively impacts firm performance, particularly in the third model, where the Environmental Innovation variable has a positive and statistically significant effect on Return on Assets.

This supports the hypothesis and can be explained through mechanisms linking environmental innovation to improved firm performance.

First, environmental innovation enhances operational efficiency. By adopting eco-friendly technologies and efficient production processes, firms can reduce long-term costs such as energy and raw materials. For instance, Cheng et al. (2014) found that firms implementing eco-innovation practices reduced energy costs and improved material efficiency, directly boosting profitability. Second, environmental innovation strengthens reputation and customer loyalty. In a market where consumers increasingly value sustainability, companies committed to environmental practices can differentiate themselves. Such companies often attract customers willing to pay a premium for sustainable products and investors prioritizing responsible business practices (Eccles et al., 2012). This leads to higher sales, improved access to capital, and increased market valuation. Third, environmental innovation provides a long-term competitive advantage. Firms that integrate ESG (Environmental, Social, and Governance) practices adapt better to regulatory demands and market shifts, ensuring compliance while benefiting from incentives like tax breaks. For example, proactive carbon reduction strategies may secure government subsidies, enhancing profit margins (Giese et al., 2019). Additionally, avoiding penalties for non-compliance protects financial performance.

Moreover, environmental innovation fosters stronger relationships with stakeholders and communities. Firms investing in sustainability often gain regulatory support, easing licensing and reducing bureaucratic hurdles. Positive stakeholder relationships bolster public trust and market position while neglecting environmental considerations can lead to community resistance and loss of operational licenses (Albort-Morant et al., 2018). The third model's results underscore that the positive effects of environmental innovation are more pronounced when factors like Tobin's Q, ESG, and GDP are controlled. Notably, ESG variables show a significant positive impact, suggesting that integrating environmental, social, and governance factors amplifies the benefits of environmental innovation. Meanwhile, the negative Tobin's Q coefficient indicates that liquidity constraints may hinder firms from financing environmental innovations, though firms with sufficient liquidity can overcome these challenges and benefit over time.

CONCLUSIONS

This study investigates the impact of environmental innovation on organizational performance using regression analysis. The results reveal a positive and statistically significant effect of environmental innovation on return on assets (ROA), indicating that investments in environmental innovation not only promote sustainability but also enhance financial performance. Control variables like Tobin's Q (QR) and environmental, social, and governance (ESG) factors further support the conclusion that responsible business practices yield substantial financial benefits. These findings affirm that environmental innovation can effectively improve firm performance.

Companies are encouraged to invest in green technologies to boost operational efficiency and reduce long-term costs, aligning environmental goals with profitability. Employee training on sustainable practices, including the adoption of advanced technologies and efficient production methods, is essential. Transparency in ESG reporting can enhance reputation and attract sustainability-focused investors. Additionally, fostering positive relationships with stakeholders, such as governments, communities, and customers, builds trust and strengthens business performance.

This study is limited to Indonesian companies, so the findings may not fully apply to other regions or industries. The data is also restricted to a specific period, and future changes in environmental policies or economic conditions could affect the results. While key control variables like QR, ESG, and GDP are included, other factors such as market conditions and alternative strategies may also influence the relationship between environmental innovation and firm performance. Lastly, the regression analysis used has limitations in capturing complex causal relationships. Future research could employ panel data analysis or qualitative methods for deeper insights.

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