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Research Article

The Influence of Environmental Performance and Carbon Emission Disclosure on Firm Value with Profitability as a Mediating Variable

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Abstract: Stock price fluctuations, particularly in the energy sector, reflect market uncertainty regarding corporate performance and sustainability commitments. A high stock price indicates strong firm value. This study aims to provide empirical evidence on the influence of environmental performance and carbon emission disclosure on firm value, with profitability as a mediating variable. The study was conducted on energy sector companies listed on the Indonesia Stock Exchange during 2021–2023. The sample was selected using purposive sampling, resulting in 165 observations. Path analysis and Sobel test were employed. The results indicate that both financial and non-financial disclosures by companies can serve as either positive or negative signals influencing investor perceptions in decision-making. These supports signaling theory, which emphasizes the importance of information transparency to reduce information asymmetry and build market trust. Thus, companies, especially in the energy sector, must improve the quality and reliability of their disclosures by preparing transparent, accurate, and standard-compliant reports to strengthen their public image and increase firm value.

Keywords: Carbon Emission Disclosure, Environmental Performance, Firm Value, Profitability

1. Introduction

Every company aims to build its business and maximize profits. Firm value represents investors' perception of a company's success in managing its resources (Machmuddah et al., 2020). Achieving desired profitability requires enhancing firm value, which is often reflected in the company's stock price since investors evaluate company performance through stock price movements (Machmuddah et al., 2020).

Firm value is an important indicator for both companies and stakeholders, especially investors. For companies, increasing firm value is a long-term objective. For investors, it serves as a measure of overall performance and potential. High firm value guarantees shareholder prosperity and enhances investor confidence (Mardiana & Wuryani, 2019).

A high firm value can attract stakeholder investment and indicates the company is performing well. This value depends on management's ability to operate efficiently. Therefore, companies rely on financial managers to improve performance and create shareholder wealth. Good company performance is often mirrored in stock price (Anisyah & Purwohandoko, 2017).

In 2022, the Indonesian Composite Index (IHSG) demonstrated strong performance, peaking in April at 7,228.91. By year-end, it slightly declined to 6,850.62, marking a 4.09% increase from the previous year. These fluctuations were driven by external pressures such as monetary tightening by central banks in developed countries, affecting liquidity and investor sentiment in emerging markets like Indonesia. In 2023, IHSG showed more stability but remained volatile. A mid-year decline was triggered by global economic slowdown concerns,

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though it rebounded by year-end, reaching a yearly high of 7,272.80, reflecting optimism in Indonesia's domestic economy.

Overall, IHSG movement illustrates market responses to domestic and global economic dynamics. While some firms received positive investor responses, others did not. These fluctuations influence reinvestment decisions, making it crucial for firms to maintain and improve their value.

Companies typically prioritize maximizing profits, sometimes neglecting environmental concerns. Many firms prioritize profitability over environmental management programs (Lingga et al., 2017). However, sustainable firm value requires attention to economic, social, and environmental dimensions. Sustainability refers to balancing economic interests, societal needs, and environmental preservation (Lingga et al., 2017).

On January 25, 2021, the Indonesia Stock Exchange launched eleven new sectoral indexes under the IDX Industrial Classification (IDX-IC). The energy sector includes firms engaged in extracting non-renewable energy sources and those offering alternative energy solutions (IDX, 2021).

Despite relatively high prices, IDXENERGY showed volatility and slowed growth in 2023. It peaked in September at Rp2,131.67 before slightly declining. According to CNBC Indonesia, in June 2023, IHSG fell 0.54% to 6,682.70, with 287 stocks weakening; the energy sector experienced the largest drop at 1.65%. PT Bayan Resources Tbk. significantly impacted this decline due to its substantial IHSG weighting (Azwar, 2023). This decline was influenced by global factors such as coal price fluctuations and energy transition policies reducing fossil fuel dependence.

Stock price movements align with signaling theory, which explains how companies disclose financial and non-financial information to influence stock prices (Rahman et al., 2023). This disclosure reduces information asymmetry between management and external stakeholders (Rosiana et al., 2013), as supported by various studies (Kurnia et al., 2020; Hardiyansah et al., 2021; Murnita & Putra, 2018; Khanifah et al., 2020).

Proper disclosure of financial and non-financial information acts as a signal to attract investors, aiding their decision-making (Friske et al., 2023). Bappenas (2022) reported that in 2022, the energy sector overtook forestry as the largest emitter of greenhouse gases in Indonesia, accounting for 50.6% of total emissions. Emissions are projected to increase, reaching 1.4 Gt CO2eq (59%) by 2030. Crippa et al. (2023) noted a 10% GHG increase in 2021-2022 and a 4% rise in 2023, largely from power generation, industrial processes, transportation, and agriculture.

The environmental crisis is partly due to conventional accounting practices focusing solely on financial transactions (Lestari et al., 2019). Social and environmental events, vital to business operations, are often overlooked. Environmental disclosures are essential to address climate change, driven by CO2 emissions from fossil fuel use and land conversion (Anggraeni, 2015). Businesses must report their role in global warming. Transparent environmental impact disclosures serve as key indicators of a company’s environmental responsibility.

Environmental performance refers to a company's actions in minimizing environmental damage from its operations (Rahmawati & Subardjo, 2017). This can be enhanced through effective environmental management. Indonesia's Ministry of Environment developed the PROPER program to rate companies' environmental performance using five color indicators (gold, green, blue, red, and black), reflecting varying levels of compliance and environmental responsibility.

Another cause of climate change is corporate carbon emissions. These emissions contribute to the greenhouse effect and global warming (Ongsakul & Sen, 2019). Sources include fossil fuel use, organic matter decomposition, industrial activities, and fertilizer use.

Carbon emissions disclosure, as recommended by the Global Reporting Initiative (GRI), can improve stakeholder trust and firm value (Kuswanto, 2019; Hardiyansah et al., 2021).

Previous studies on environmental performance and carbon emission disclosure yield mixed results. Some report a positive impact on firm value (Fauzi, 2022; Mardiana & Wuryani, 2019; Asyifa & Burhany, 2022), others report negative or no significant effect (Khanifah et al., 2020; Fitriana et al., 2024; Ramadhana & Januarti, 2019).

These inconsistencies suggest the need for a mediating variable to better explain the relationship. This study introduces profitability as a mediator, defined as a firm's ability to generate profit from business activities (Mardiana & Wuryani, 2019). Profitable firms tend to be more transparent in environmental disclosures, which can attract investors and enhance firm value (Florencia & Handoko, 2021). This aligns with signaling theory, where disclosed information affects firm value through market responses (Murnita & Putra, 2018).

Profitability is measured using Return on Investment (ROI), deemed suitable for energy firms with substantial capital investments. Higher profitability indicates effective resource management (Sanjana & Rizky, 2020). Prior studies show that profitability positively influences firm value (Diana, 2020; Kurniawati & Anggraini, 2023; Indy & Uzliawati, 2023; Fatima et al., 2023).

This study contributes to the literature in three ways: (1) focusing on energy sector firms listed on the IDX, as recommended by Florencia & Handoko (2021); (2) measuring carbon emission disclosure using GRI standards rather than Choi et al. (2013); and (3) including profitability as a mediating variable.

2. Literature Review

1. Firm Value

Definition: Firm value represents investors' perception of a company's success in managing resources, often proxied by stock price movements (Machmuddah et al., 2020). Importance for companies: a long-term objective ensuring sustainability and competitiveness. For investors: a measure of overall performance and potential returns (Mardiana & Wuryani, 2019). Signaling Theory Context: Stock price fluctuations act as signals of firm performance. Transparent disclosures reduce information asymmetry and strengthen investor trust (Rahman et al., 2023; Rosiana et al., 2013).

2. Environmental Performance

Concept: Refers to corporate actions aimed at minimizing environmental damage (Rahmawati & Subardjo, 2017). Measurement: In Indonesia, the PROPER program by the Ministry of Environment and Forestry evaluates companies using color ratings (black, red, blue, green, gold). Theoretical connecting to Good environmental performance signals compliance, sustainability orientation, and reduced legal/operational risks. Investors perceive strong environmental performance as a positive signal, enhancing firm value (Lingga et al., 2017).

Empirical Findings: Prior studies show mixed results—some find positive effects (Fauzi, 2022; Mardiana & Wuryani, 2019), while others report insignificant impacts (Khanifah et al., 2020).

3. Carbon Emission Disclosure

Concept: Transparency in reporting greenhouse gas emissions, often guided by GRI 305 indicators. Rationale: Disclosure demonstrates accountability and sustainability commitment, potentially improving stakeholder trust (Kuswanto, 2019). Signaling Theory: Positive signal: transparency reduces asymmetry, builds credibility. Negative signal: extensive disclosure may

highlight high emissions, raising investor concerns. Empirical Findings: Positive impact: disclosure enhances firm value (Asyifa & Burhany, 2022). Negative/no impact: disclosure may reduce firm value if perceived as evidence of environmental risk (Fitriana et al., 2024; Ramadhana & Januarti, 2019).

4. Profitability as a Mediating Variable

Concept: Profitability reflects a firm's ability to generate earnings, commonly measured by Return on Investment (ROI). Role in Mediation: Profitable firms are more transparent in disclosures, which can attract investors (Florencia & Handoko, 2021). Profitability strengthens the link between sustainability practices and firm value by signaling financial health. Empirical Findings: Profitability consistently shows a positive effect on firm value (Diana, 2020; Kurniawati & Anggraini, 2023).

Conceptual Framework

Firm Value

Firm value reflects investors' perception of a company's ability to manage resources effectively and generate long-term prosperity. It is often proxied by stock price movements, which act as signals of performance and sustainability. According to signaling theory, transparent disclosures reduce information asymmetry and strengthen investor confidence. Thus, firm value becomes the ultimate indicator of how well companies balance profitability and sustainability. Hypothesis (H1): Environmental performance positively influences firm value. Hypothesis (H2): Carbon emission disclosure positively influences firm value. Hypothesis (H3): Profitability positively influences firm value.

Environmental Performance

Environmental performance represents a company's commitment to minimizing environmental damage through compliance and proactive management. In Indonesia, this is measured by the PROPER program, which rates companies from black (poor) to gold (excellent). A strong PROPER rating signals responsible governance and sustainability orientation, reducing risks and enhancing investor trust. Within signaling theory, such performance is interpreted as a positive signal that can elevate firm value. Hypothesis (H1): Environmental performance has a positive effect on firm value. Hypothesis (H4): Profitability mediates the effect of environmental performance on firm value.

Carbon Emission Disclosure

Carbon emission disclosure, guided by GRI 305 standards, reflects transparency in reporting greenhouse gas emissions. While disclosure is intended to build credibility, it can also be perceived negatively if it reveals high emission levels. In signaling theory, disclosure may act as either a positive signal of accountability or a negative signal of environmental risk. The impact on firm value therefore depends on how investors interpret the information. Hypothesis (H2): Carbon emission disclosure has a positive effect on firm value. Hypothesis (H5): Profitability mediates the effect of carbon emission disclosure on firm value.

Profitability

Profitability, measured by Return on Investment (ROI), captures a firm's ability to generate earnings from its operations. High profitability signals financial strength, enhances investor confidence, and increases firm value. Moreover, profitability can act as a mediator: firms with strong earnings are more likely to disclose environmental information transparently, which in turn influences investor perception. Within signaling theory, profitability strengthens the credibility of both environmental performance and disclosure, linking sustainability practices to firm value. Hypothesis (H3): Profitability positively

influences firm value. Hypothesis (H4): Profitability mediates the effect of environmental performance on firm value. Hypothesis (H5): Profitability mediates the effect of carbon emission disclosure on firm value.

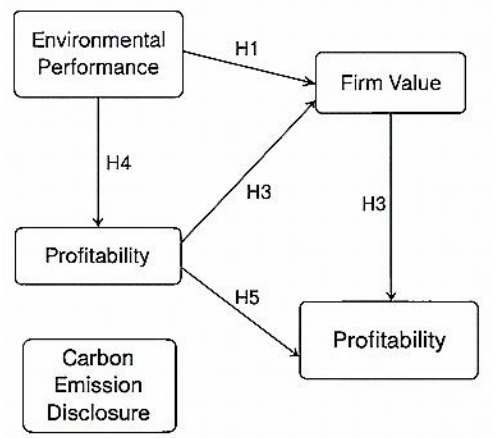

Figure 1. Conceptual Framework of the Influence of Environmental Performance and Carbon Emission Disclosure on Firm Value with Profitability as a Mediating Variable

The conceptual framework of this study is grounded in signaling theory, which posits that companies communicate signals—both financial and non-financial—to reduce information asymmetry and influence investor behavior. In this context, environmental performance and carbon emission disclosure serve as strategic signals that may shape investor perceptions and ultimately affect firm value. Environmental performance, as measured by the PROPER rating, reflects a company's commitment to sustainability and regulatory compliance, while carbon emission disclosure, guided by GRI 305 standards, indicates transparency regarding environmental impact. Profitability, measured by Return on Investment (ROI), is introduced as a mediating variable that may strengthen or weaken the influence of these disclosures on firm value. The framework hypothesizes that environmental performance (H1) and carbon emission disclosure (H2) directly affect firm value, while profitability (H3) also contributes positively to firm value. Furthermore, profitability is expected to mediate the relationship between environmental performance and firm value (H4), and between carbon emission disclosure and firm value (H5), offering a more nuanced understanding of how sustainability practices translate into economic outcomes.

3. Research Methods

This study employs a quantitative approach with an associative design to analyze the influence of environmental performance and carbon emission disclosure on firm value, with profitability as a mediating variable. The object of the study is energy sector companies listed on the Indonesia Stock Exchange (IDX) during the period 2021–2023, chosen due to the significant stock price fluctuations experienced by this sector. The sample was selected using purposive sampling based on the availability of sustainability reports and completeness of the required data, resulting in 165 observations as the research dataset (Sugiyono, 2019).

The variables in this study include firm value (measured by Tobin's Q) as the dependent variable; environmental performance (measured by PROPER) and carbon emission disclosure (based on GRI 305 indicators) as the independent variables; and profitability (measured by ROI) as the mediating variable. Data were collected using a non-participant observation method by accessing financial and sustainability reports of each company, which are statistically processed using SPSS software and interpreted to examine causal relationships among the variables formulated within a path analysis model (Ghozali, 2018; Kurnia et al., 2021; Wahyuningrum et al., 2022).

The data analysis procedure consists of several stages, including descriptive statistics, classical assumption tests (normality, multicollinearity, autocorrelation, and heteroscedasticity), hypothesis testing (t-test and F-test), as well as path analysis and the Sobel test to assess both direct and indirect effects. The Sobel test is employed to determine whether profitability acts as a mediating variable in the relationship between environmental performance and carbon emission disclosure on firm value. Through this approach, the study aims to provide a comprehensive understanding of the strategic role of environmental sustainability in creating long-term economic value for firms (Utama, 2016; Fauzi, 2022; Sihabudin et al., 2021).

4. Results and Discussion

Results

Classical Assumption Test Results

1) Normality Test

Table 1. Normality Test Results

		Unstandardized Residual
N		106
Normal Parameters	Mean	0.00
	Std. Deviation	0.53
Most Extreme Differences	Absolute	0.08
	Positive	0.08
	Negative	-0.04
Test Statistics		0.08
Asymp. Sig. (2-tailed)		0.08

Source: processed data 2025

Based on the results of the Kolmogorov-Smirnov Test in Table 1, it shows the Asymp. Sig. (2-tailed) value of 0.08. The resulting value is greater than the significance level of 0.05 so it can be concluded that the data used in this study are normally distributed.

2) Multicollinearity Test

Table 2. Multicollinearity Test Results

Variables	Collinearity Statistics	
	Tolerance	VIF
Environmental Performance	0.62	1.60
Carbon Emissions Disclosure	0.52	1.91
Profitability	0.62	1.60

Source: processed data 2025

Based on Table 2, it shows that all independent variables used have a tolerance value of more than 0.01 where environmental performance is 0.53, carbon emission disclosure is 0.62 and profitability is 0.76. The VIF value also shows that all independent variables have a value smaller than 10, where environmental performance is 1.87, carbon emission disclosure is 1.59 and profitability is 1.30. These results indicate that all independent variables in this study are free from multicollinearity or correlation between independent variables.

3) Autocorrelation Test

Table 3. Autocorrelation Test Results

	Unstandardized Residual
Test Value	0.01
Cases < Test Value	53
Cases >= Test Value	53
Total Cases	106
Number of Runs	48
Z	-1.17
Asymp. Sig. (2-tailed)	0.24

Source: processed data 2025

Based on the Runs Test in Table 3, it shows that Asymp. Sig. (2-tailed) is 0.24 which is greater than 0.05, so it can be concluded that this study does not show any symptoms of autocorrelation.

4) Heteroscedasticity Test

Table 4. Results of Heteroscedasticity Test

		Unstandardized Residual
Environmental Performance	Correlation Coefficient	0.03
	Sig. (2-tailed)	0.72
	N	106
Carbon Emissions Disclosure	Correlation Coefficient	0.01
	Sig. (2-tailed)	0.90
	N	106
Profitability	Correlation Coefficient	0.08
	Sig. (2-tailed)	0.39
	N	106

Source: processed data 2025

Based on Table 4. shows the level of significance (2-tailed) of environmental performance variables of 0.70, carbon emission disclosure of 0.89 and profitability of 0.38. The Sig. value (2-tailed) of the three variables is greater than 0.05 so it can be concluded that the research model is free from heteroscedasticity symptoms.

Path Analysis Results

Path analysis is an extension of multiple linear regression analysis or the use of regression analysis to estimate causal relationships between previously established variables based on theory.(Main, 2016:159). The steps to conduct a hypothesis test using path analysis are:

1) Designing a model

In designing the model, the research hypothesis that has been formulated is arranged in a regression substructure. Next, the substructural equation will be arranged as follows:

In this study, the influence of environmental performance and carbon emission disclosure on profitability was calculated using the SPSS 27 program. The results of the structural equation regression analysis I can be seen in Table 5 below.

Table 5. Results of Structural Equation Regression Analysis I

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.020	0.039		0.528	0.599
Environmental Performance (X1)	0.054	0.028	0.190	1,966	0.052
Carbon Emissions Disclosure (X2)	0.407	0.082	0.480	4,963	0,000
a. Dependent Variable: Profitability (X3)					
R2 = 0.376					
Sig. F = 0.000					

Source: processed data 2025

Based on the results of the linear regression analysis in Table 5, the following structural model I was obtained:

X3 = 0.054X1 + 0.407X2

The influence of environmental performance, carbon emission disclosure and profitability on firm value is calculated using the SPSS 27 program. The following are the results of the structural equation regression analysis II in Table 6.

Table 6. Results of Structural Equation Regression Analysis II

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1,109	0.023		47,516	0,000
Environmental Performance (X1)	0.065	0.017	0.315	3,843	0,000
Carbon Emissions Disclosure (X2)	-0.605	0.055	-0.985	-11,004	0,000
Profitability (X3)	0.133	0.059	0.183	2,243	0.027
a. Dependent Variable: Firm value (Y)					
R2 = 0.574					
Sig. F = 0.000					

Source: processed data 2025

Based on the results of the linear regression analysis in Table 6, the following structural model II was obtained:

Y = 0.065X1 – 0.605X2 + 0.133X3

2) Calculating the standard error value (e) and coefficient of determination (R^{2s})

The validity of the model in this study uses the total determination coefficient. The determination coefficient for structural equations I and II and the value of each error variable in each structure with the aim of compiling the final path diagram model. The calculation of the total determination coefficient to check the validity of the research model uses the R2 value data shown in Table 5 and Table 6. The results of the standard error calculation in structural equation I are 0.789 and the results of the standard error calculation in structural equation II are 0.652.

Next, the total determination coefficient is calculated to determine how much the exogenous variables can explain the endogenous variables in this study. The calculation of the total determination coefficient value in Appendix 13 is obtained at 0.735, which means that 73.5 percent of the firm value variables in the energy sector listed on the Indonesia Stock Exchange for the 2021-2023 period are influenced by environmental performance, carbon emission disclosure and profitability, while the remaining 26.5 percent is influenced by other factors not included in the research model.

Sobel Test Results

Table 5 and Table 6 show the magnitude of the regression coefficient value and the calculation of the standard error which can then be used to determine the mediation effect using the Sobel test by entering it into the formula. The results of the Sobel test on the effect of environmental performance on firm value through profitability show a Zcount value of 0.07 which is smaller than the Ztable of 1.96 (0.07 <1.96), so this means that there is no mediation effect from the profitability variable. Thus, the fourth hypothesis (H4) of this study which states "profitability mediates the effect of environmental performance on firm value" is rejected.

The results of the Sobel test show that the Z-value of the effect of carbon emission disclosure on firm value through profitability is 0.07 which is smaller when compared to the Z-table of 1.96 (0.07 <1.96), so it can be concluded that there is no mediation effect from the

profitability variable. Thus, the fifth hypothesis (H5) of this study which states "profitability mediates the effect of carbon emission disclosure on firm value" is rejected.

Hypothesis Test Results

1) Results of the Determination Coefficient Test (R2)

The coefficient of determination (R2) value of structural equation I in Table 5 is 0.376, which means that 37.6 percent of the variation in the profitability variable is explained by the variation in the environmental performance variable and carbon emission disclosure, while the remaining 62.4 percent is explained by other variables outside the model. Then, the total coefficient of determination (R2) value of structural equation II in Table 4.9 is 0.574, which means that 57.4 percent of the variation in the firm value variable is explained by the variation in the environmental performance variable, carbon emission disclosure, and profitability, while the remaining 42.6 percent is explained by other variables outside the model.

2) Model Feasibility Test Results (F Test)

Table 5 shows the results of the F test with a significance level of F or p-value of 0.000 which is smaller when compared to $\alpha = 0.05$ which indicates that structural model I is feasible to use. The results of the F test are shown in Table 4.9 that the significance level of F or p-value of 0.000 which is smaller than $\alpha = 0.05$ which indicates that structural model II is feasible to use.

3) Hypothesis Test Results (t-Test)

Hypothesis test (t-test) is used to test the significance of each variable partially. Based on Table 6, the test results have the following meanings.

(1) Environmental performance has a positive effect on firm value

In Table 6, the unstandardized coefficient Beta value of the environmental performance variable on the firm value is 0.065, which indicates a positive direction and a significance value of t of 0.000 which is smaller when compared to the real level of $\alpha = 0.05$. The standardized coefficient Beta value is 0.315. Based on this, it is concluded that H1 is accepted so that it can be said that environmental performance has a positive effect on firm value.

(2) Disclosure of carbon emissions has a positive effect on firm value

Table 6 shows the unstandardized coefficient Beta value of the carbon emission disclosure variable on the company's value of -0.065 which indicates a negative direction and a significance value of t of 0.000, this value is smaller than the real level of $\alpha = 0.05$. The standardized coefficient Beta value is -0.985. Based on this, it can be concluded that H2 is rejected. It can be concluded that carbon emission disclosure has a negative effect on firm value.

(3) Profitability has a positive effect on firm value

In Table 6, the unstandardized coefficient Beta value of the profitability variable on the firm value is 0.133, which indicates a positive direction and a significance value of t of 0.027, this value is smaller when compared to the real level of $\alpha = 0.05$. The standardized coefficient Beta value is 0.183. Based on this, it can be concluded that H3 is accepted so that it can be said that profitability has a positive effect on profitability.

Discussion

The Influence of Environmental Performance on Firm Value

The first hypothesis states that environmental performance has a positive influence on firm value. Based on the results of the analysis, environmental performance indeed has a positive effect on firm value. This indicates that environmental performance, as proxied by PROPER, is perceived as a positive signal by investors, ultimately contributing to an increase in firm value. Thus, the first hypothesis in this study is accepted.

Environmental performance reflects a company’s commitment to sustainability by ensuring its operations consider environmental preservation. In this study, environmental

performance was measured using PROPER, a company performance rating program in environmental management organized by the Ministry of Environment and Forestry (KLHK). PROPER provides a company performance rating in environmental management with several categories, namely black, red, blue, green, and gold. The rating indicates the level of company compliance and initiative in fulfilling environmental regulations and making more efforts in environmental management. Companies that obtain a blue, green, or gold PROPER rating mean that they have been able to meet or even exceed the minimum standards set by the government in environmental management. This rating is an indicator for investors in assessing the company's commitment to the environment. Investors will see companies with good environmental performance as companies that comply with regulations and pay attention to business sustainability. Thus, good environmental performance can increase investor confidence and influence their investment decisions. Based on signal theory, companies will give signals to external parties, especially investors, to reduce information asymmetry between management and external stakeholders. Good environmental performance is a positive signal that shows that the company has responsible governance, is able to manage environmental risks, and has good sustainability prospects in the future. Investors who do not have direct access to the company's internal conditions will use this information as a basis for making investment decisions. This signal provides confidence that the company is not only focused on short-term profits, but also pays attention to the social and environmental impacts of its operational activities. A positive response from investors to this signal will encourage an increase in the company's stock price, which ultimately reflects an increase in the company's value. Furthermore, companies that show concern for the environment will also receive support from the government, society, and shareholders, so that they can run their business activities more smoothly.

The results of this study strengthen the relevance of signal theory in the context of environmental performance. Good environmental management not only shows the company's social responsibility, but also provides strategic benefits in the form of increased market confidence. Active participation in programs such as PROPER can be real evidence of the company's commitment to protecting the environment, as well as being an effective communication tool to investors regarding the company's sustainability position and orientation. Investors tend to respond positively to companies that have good environmental performance because they are seen as being able to reduce legal risks, recovery costs, and potential operational disruptions. With increasing investor interest, the company's stock price is also pushed up, which directly increases the company's value.

The Influence of Carbon Emission Disclosure on Firm Value

The second hypothesis posits that carbon emission disclosure positively influences firm value. However, the analysis reveals a negative relationship between carbon emission disclosure and firm value. This means that the more a company discloses its carbon emissions, the lower its firm value. Therefore, the second hypothesis is rejected.

Carbon emission disclosure represents a company’s transparency in reporting the amount of carbon emissions generated from its operations. In this study, disclosure is measured using the GRI Standard 305, which governs greenhouse gas emissions reporting. While such disclosure is intended to promote transparency, it may also trigger negative perceptions among external stakeholders, including investors. High disclosure levels may imply that a company produces substantial emissions, raising concerns about its environmental impact.

According to signaling theory, companies convey signals to external parties to reduce information asymmetry. These signals can be positive or negative. In this context, extensive carbon emission disclosure may be interpreted as a negative signal, indicating significant

environmental impact and raising doubts about the company's sustainability efforts. Consequently, such signals can diminish investor interest, reducing demand for the company's stock and lowering its price—a key indicator of firm value.

Moreover, a high level of disclosure may indicate that the company operates in a high-emission sector, prompting concerns about its commitment to environmental responsibility. Investors may perceive this negatively, reconsidering their investment decisions, and leading to a decline in firm value.

The Influence of Profitability on Firm Value

The third hypothesis states that profitability has a positive influence on firm value. The results support this hypothesis, indicating that increased profitability leads to higher firm value.

Profitability represents a company's ability to generate earnings, which significantly shapes investor perception (Kasmir, 2016). High profitability signals strong financial health, enhancing the company's reputation and appeal to investors. Greater profits also increase the potential for dividend distribution, making the firm more attractive in the capital market (Dewi & Wirajaya, 2013).

Profitability as a Mediator of the Relationship Between Environmental Performance and Firm Value

The fourth hypothesis suggests that profitability mediates the relationship between environmental performance and firm value. However, the analysis shows that profitability does not mediate this relationship. This indicates that good environmental performance does not directly translate into higher profits or increased firm value. Thus, the fourth hypothesis is rejected.

Although good environmental performance may act as a positive signal to investors, this study finds that the signal is not strong enough to influence investor confidence or profitability. This may be due to the relatively low level of environmental engagement among companies, meaning environmental efforts are not yet strategic priorities. Additionally, most companies in the sample do not generate sufficiently high profits to serve as a mediating factor, rendering the mediation effect of profitability insignificant.

This implies that environmental performance alone does not affect firm value through profitability. The market has yet to respond strongly to environmental signals, as they are not seen as sufficient to impact stock prices or firm value.

Profitability as a Mediator of the Relationship Between Carbon Emission Disclosure and Firm Value

The fifth hypothesis proposes that profitability mediates the relationship between carbon emission disclosure and firm value. However, the analysis shows that profitability does not mediate this relationship. Thus, the fifth hypothesis is rejected.

In signaling theory, companies issue voluntary disclosures to reduce information asymmetry. Carbon emission disclosure, guided by GRI 305 standards, is intended as a positive signal of environmental accountability. However, the findings suggest that the market does not respond strongly to this signal, and profitability does not mediate its effect on firm value.

This indicates that investors still prioritize financial indicators over environmental disclosures when evaluating firms. The lack of response from profitability as a mediating variable shows that environmental disclosure has not yet become a decisive factor in investment decisions. Investors may still view environmental information as supplementary rather than essential.

Companies should enhance the strength and clarity of their signals to gain market attention. This can be done by improving the quality, consistency, and transparency of their disclosures and demonstrating a real commitment to sustainability. Without strong signals, environmental disclosure will struggle to positively influence firm value.

In conclusion, profitability does not mediate the relationship between carbon emission disclosure and firm value, consistent with the findings of Hariadi & Nurwanda (2024). Environmental signals, including carbon emission disclosures, have yet to become primary considerations for the market in determining firm value. Companies must improve their communication and commitment to environmental responsibility to ensure that such signals are recognized and valued by investors.

5. Conclusion

This study investigated the influence of environmental performance and carbon emission disclosure on firm value, with profitability as a mediating variable, using energy sector firms listed on the Indonesia Stock Exchange during 2021–2023. The findings demonstrate that environmental performance has a positive and significant effect on firm value, indicating that strong environmental ratings such as those measured by the PROPER program are perceived as favorable signals by investors. In contrast, carbon emission disclosure was found to have a negative effect on firm value, suggesting that extensive reporting may be interpreted as evidence of high emissions and environmental risk, thereby reducing investor confidence. Profitability, measured by ROI, was shown to positively influence firm value, reinforcing its role as a key determinant of market valuation. However, profitability did not mediate the relationship between environmental performance or carbon emission disclosure and firm value, implying that while profitability independently strengthens firm value, it does not alter the impact of sustainability-related disclosures. Overall, the results support signaling theory, where environmental performance acts as a positive signal and carbon emission disclosure may be perceived as a negative one, while profitability remains a strong independent driver of firm value.

Managerial Implications

The results of this study provide several important implications for managers in the energy sector. First, companies should strengthen their environmental performance programs by actively participating in initiatives such as PROPER and adopting best practices in environmental management, as higher ratings can enhance investor trust and firm value. Second, managers must carefully design carbon emission disclosures to emphasize mitigation strategies, reduction targets, and progress toward sustainability goals rather than presenting raw emission figures, thereby reframing disclosure as a sign of responsibility rather than risk. Third, profitability should be leveraged as a complementary signal in sustainability communication, demonstrating that environmental responsibility can coexist with strong financial performance. Fourth, firms should adopt a balanced signaling strategy that integrates both financial and non-financial disclosures to reduce information asymmetry and build long-term investor confidence. Finally, managers must anticipate regulatory changes related to carbon emissions and energy transition policies, aligning corporate strategies with government and international standard

Future Research Directions

Although this study provides valuable insights into the relationship between environmental performance, carbon emission disclosure, profitability, and firm value in the energy sector, several opportunities remain for future research. First, subsequent studies could expand the sample beyond energy firms to include other industries with varying levels of environmental impact, such as manufacturing, transportation, or finance, to test whether the findings are generalizable across sectors. Second, future research may incorporate

additional mediating or moderating variables—such as corporate governance, innovation capability, or stakeholder engagement—that could further explain the complex relationship between sustainability practices and firm value. Third, longitudinal studies covering longer time horizons would provide deeper understanding of how environmental performance and disclosure influence firm value over different economic cycles. Fourth, qualitative approaches, such as interviews with investors or managers, could complement quantitative findings by capturing perceptions and decision-making processes related to sustainability disclosures. Finally, comparative studies across countries or regions could highlight the role of institutional frameworks, regulatory environments, and cultural differences in shaping investor responses to environmental and carbon-related disclosures. By addressing these areas, future research can enrich the theoretical development of signaling theory in sustainability contexts and provide more comprehensive guidance for both academics and practitioners.

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