Sustainability Disclosures, Environmental Investments, and Corporate Valuation: Examining the Interplay between Performance and Perception

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ABSTRACT

Firm value represents the market's assessment of a company's overall worth, often proxied through its share price and the volume of outstanding shares traded on the capital market. This study investigates the extent to which sustainability performance, environmental costs, and environmental performance influence firm value. The empirical analysis draws on a panel of 44 energy and mining firms listed on the Indonesia Stock Exchange over the 2019–2023 period, yielding a total of 178 firm-year observations. The findings reveal a significant negative association between sustainability performance and firm value, suggesting that market participants may interpret sustainability-related disclosures or initiatives as costly or misaligned with immediate financial performance. In contrast, environmental costs demonstrate a statistically significant positive relationship with firm value, implying that proactive environmental spending may signal responsible risk management or long-term strategic investment. However, environmental performance was not found to exert a statistically significant influence on firm value. These results underscore the nuanced manner in which capital markets interpret sustainability-related activities. For investors and other stakeholders, sustainability performance—despite its growing importance in corporate discourse—may warrant critical scrutiny in terms of its perceived value-adding potential.

Keywords: Sustainability Performance; Environmental Cost; Environmental Performance; Corporate Value

Pengaruh Kinerja Keberlanjutan, Environmental Cost, dan Environmental Performance Terhadap Nilai Perusahaan

ABSTRAK

Nilai perusahaan adalah nilai yang mencerminkan persepsi pasar terhadap suatu perusahaan, secara umum nilai perusahaan dapat dianalisis dari harga saham dan jumlah saham yang beredar di pasar modal. Penelitian ini bertujuan untuk mengeksplorasi pengaruh kinerja keberlanjutan, environmental cost dan environmental performance terhadap nilai perusahaan. Penelitian ini terdiri dari 44 sampel perusahaan energi dan pertambangan yang terdaftar di Bursa Efek Indonesia periode 2019-2023, dengan total 178 observasi. Hasil penelitian ini menunjukan bahwa kinerja keberlanjutan berpengaruh negatif terhadap nilai perusahaan. Environmental cost berpengaruh signifikan terhadap nilai perusahaan. Environmental performance tidak berpengaruh signifikan terhadap nilai perusahaan. Dari hasil penelitian ini para pemangku kepentingan dapat mempertimbangkan kinerja keberlanjutan suatu perusahaan sebelum membuat keputusan investasi

Keywords: *Kinerja Keberlanjutan; Biaya Lingkungan; Kinerja Lingkungan; Nilai Perusahaan*

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INTRODUCTION

Publicly listed companies often gain strategic advantages through increased access to diverse funding sources, particularly from institutional investors (Shalihin et al., 2020). These additional financial resources are vital to support expansion strategies and drive sustainable long-term growth. As investor confidence is closely tied to firm value, the stability of capital markets becomes a key determinant in shaping investor sentiment and decision-making.

This study focuses on the energy and mining sectors, which contribute substantially to Indonesia's Gross Domestic Product and thus attract considerable investor interest (Artha & Andhika Putra, 2020). However, these industries are also associated with significant environmental and social externalities. Industrial operations in energy and mining often result in ecological degradation, with negative consequences for communities situated near project sites(Lestari & Khomsiyah, 2023). For instance, data from Kompas.com (2022) indicate that approximately 58.2 percent of tropical forest loss in Indonesia is attributable to mining-related activities, primarily due to large-scale land clearing that severely disrupts local ecosystems (Albitar et al., 2020).

The environmental degradation caused by such activities can give rise to social unrest and erode stakeholder trust, ultimately affecting market perceptions of the firm. For example, in 2021, PT Aneka Tambang Tbk was implicated in an environmental pollution case in East Halmahera, North Maluku, which was followed by a decline in its stock price—from IDR 2,250 at the end of 2021 to IDR 1,985 in 2022. In contrast, despite environmental concerns related to PT Bukit Asam Tbk's waste disposal into the Kiahaan River, the company's share price rose from IDR 2,710 in 2021 to IDR 3,690 in 2022, suggesting that market responses to environmental incidents may vary depending on broader investor perceptions and firm-specific factors.

Drawing on legitimacy theory, companies that seek to retain public approval must disclose their environmental and social impacts transparently and demonstrate a commitment to sustainability performance (Kholmi & Nafiza, 2022). Stakeholder theory similarly posits that firms are accountable not only to shareholders but also to a broad range of stakeholders, including communities and environmental actors (Atikah et al., 2024). Within this context, environmental awareness emerges as a strategic imperative—not only to promote ecological and social welfare but also to enhance firm value.

Firm value reflects the market's evaluation of a company's ability to generate future economic benefits, typically captured through share prices and influenced by perceptions of performance (Ningrum et al., 2024). Sustainability performance, in turn, embodies a firm's commitment to long-term value creation by integrating economic, social, and environmental objectives (Hassan, 2021). One tangible indicator of such commitment is the implementation of environmentally oriented accounting, through which firms allocate environmental costs to specific activities and disclose these in their financial reports. This transparency enables stakeholders to assess a firm's environmental responsibility and may influence their investment decisions(Swari & Ratna Sari, 2023). Complementing environmental cost disclosure, environmental performance captures the firm's

actual contributions to environmental protection and resource sustainability (Amalia et al., 2024).

This study incorporates control variables to isolate the effects of sustainability-related disclosures on firm value. Specifically, profitability is included due to its established role in enhancing firm value, while firm size is accounted for as a proxy for asset base and market capitalization (Fristianti & Komara, 2024).

Prior research on the determinants of firm value has yielded mixed findings. Studies by Astari & Sari (2023) and Shalihin et al. (2020)suggest a positive relationship between sustainability disclosure and firm value. In contrast, Fernando et al. (2024) report no significant effect of green accounting disclosure, measured using GRI standards, on firm value. Similarly, while Abdi et al. (2022) find a positive relationship between ESG disclosure and firm value, Kell & Henny (2023), along with Fristianti & Komara (2023), report null findings for green accounting, environmental costs, and environmental performance using Tobin's Q as a valuation proxy.

To build on this body of work, the present study examines the influence of sustainability performance, environmental costs, and environmental performance on firm value, focusing specifically on energy and mining firms listed on the Indonesia Stock Exchange from 2019 to 2023. These sectors are central to national economic output but also pose significant environmental risks. Unlike prior studies that predominantly rely on single GRI indicators (e.g., GRI 300), this study adopts a comprehensive approach, incorporating the GRI 200 (economic), 300 (environmental), and 400 (social) series to assess corporate sustainability performance in a more holistic manner.

Tjahjadi et al. (2021)define corporate sustainability performance as an integrated assessment of long-term economic, social, and environmental achievements. Legitimacy theory emphasizes the importance of sustainability governance in meeting corporate obligations to broader society. Several studies support the view that sustainability disclosures enhance firm value (Loh et al., 2017); (Ammer et al., 2020); (Helfaya et al., 2023). Similarly, Mendra et al. (2021) and Annisa et al. (2023.) provide evidence that GRI-compliant sustainability reporting positively influences firm valuation. Accordingly, the first hypothesis is proposed:

H_1: Sustainability performance has a positive effect on firm value.

Lindawati et al. (2022)argue that environmental cost management is a corporate obligation, requiring systematic allocation in financial reporting. In line with stakeholder theory, firms can use financial and sustainability information to manage stakeholder relationships and build legitimacy. Studies by (Wulaningrum et al., 2020) and (Renaldi & Idrianita Anis, 2023) indicate a positive effect of environmental cost disclosure on firm value. Thus, the second hypothesis is proposed:

H_2: Environmental costs have a positive effect on firm value.

Environmental performance, as defined byKotango et al. (2024), reflects a company's efforts to reduce negative environmental impacts through operational practices. Legitimacy theory suggests that such efforts enhance public perception and societal acceptance. Empirical studies by Yoon et al. (2018), Harahap et al.

(2023), Aini & Faisal (2021), and Gunawan & Berliyanda (2024)demonstrate a positive relationship between environmental performance and firm value, particularly when measured using instruments such as the PROPER rating. Consequently, the third hypothesis is advanced:
H_3: Environmental performance has a positive effect on firm value.

RESEARCH METHODS

This study adopts a quantitative research design, employing an associative causal approach to examine the influence of sustainability performance, environmental costs, and environmental performance on firm value. To enhance model robustness, two control variables—profitability and firm size—are included. The analysis is based on secondary data, drawn from the annual and sustainability reports of companies operating in the energy and mining sectors. These reports were obtained from the respective companies' official websites and the Indonesia Stock Exchange (IDX) for the period 2019 to 2023.

The study population comprises all energy and mining companies listed on the IDX during the 2019–2023 period, totaling 108 firms. A purposive sampling method was applied to select the final sample, resulting in 44 companies that met the following criteria: (i) continuous listing on the IDX throughout the study period; (ii) publication of both sustainability and annual reports from 2019 to 2023; and (iii) disclosure of sustainability information in accordance with the 2016 Global Reporting Initiative (GRI) guidelines.

Firm value, a critical measure of market perception, is closely tied to stock price. As share prices rise, investor interest and shareholder wealth increase, leading to higher overall firm valuation (Irnawati, 2021). In line with (Hardiningsih et al., 2020), this study employs Tobin's Q as the proxy for firm value. Originally introduced by Tobin (1969), Tobin's Q is calculated using the following formula:

$$Q = \frac{MVE + D}{TA} \quad \text{.....(1)}$$

Where:
Q = Tobin's Q
MVE = Market Value Equity
D = Total debt
TA = Total assets

Corporate Sustainability Performance is a company's performance that is expected to continue in the long term, covering three dimensions: economic, social, and environmental (Tjahjadi et al., 2021). Lindawati et al. (2022)The measurement indicator used is the Sustainability Report Disclosure Index (SRDI) based on the 2016 GRI standard. Based on research Kurniawan et al. (2018), Oktapriana et al. (2022) the formula that can be used is as follows.

$$SRDI = \frac{\sum Xij}{Nj} \quad \text{.....(2)}$$

Where:
SRDIj = Sustainability Report Disclosure Index
X_{ij} = Number of items disclosed by the company
N_j = Total items based on GRI Standard 2016 (77 items)

Disclosure of environmental costs demonstrates a company's awareness of the importance of the social environment, in addition to achieving profits. Higher environmental costs indicate a company's increased concern for the environment and the impacts of its operational activities (Arimbi & Mayangsari, 2022).The following formula can be used to measure environmental costs, according to Lindawati et al . (2022) and Arimbi & Mayangsari (2022*).*

$$\text{Environmental Costs} = \frac{\text{Cost of CSR}}{\text{Profit}} \quad (3)$$

Environmental performance serves as an indicator of how a company interacts with the surrounding environmental ecosystem and the impacts resulting from these interactions. The measurement indicator used is the rating obtained by the company in the company performance evaluation program in managing the environment (PROPER), which consists of a gold rating: 5, green: 4, blue: 3, red: 2, and black: 1. Based on research by Sheryn & Hendrawati (2020) the PROPER rating is very relevant for measuring a company's environmental performance, because of its compliance with ISO 14001. In this study, if a company does not participate in the PROPER program, its environmental performance variable will be given a value of 0 (Mutmainnah, 2024).

Profitability is a description of a company's financial condition over a specific period, analyzed using financial analysis tools. The measurement indicator used is the Return on Equity ratio , according to research. Ambari, et al. (2020) the Return on Equity ratio formula is as follows.

$$\text{ROE} = \frac{\text{Earning after Tax}}{\text{Shareholder Equity}} X\, 100\% \quad (4)$$

Firm size reflects the extent of a company's operations and ownership. Higher total revenue, assets, and capital reflect a company's greater capability in a particular area (Brammer & Pavelin, 2004). The measurement indicator used is the company's total assets. Research Astari & Sari (2023)indicates that company size can be seen from the total assets owned by the company at the end of the year.

This study employed a non-participant observation method. Data collection was conducted by downloading annual reports, sustainability reports, and financial reports from the official website of the Indonesia Stock Exchange *(www.idx.co.id)* and the official websites of each company. The data analysis technique used was panel data regression analysis with the assistance of STATA version 17 software. The panel data regression model equation in this study is as follows.

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 \quad (5)$$

Where:

Y	= Firm Value	X_3	= Environmental Performance
α	= Constant	Z_1	= Profitability
β	= Coefficient X	Z_2	= Firm Size
X_1	= Sustainability Performance		
X_2	= Environmental Cost		

RESULTS AND DISCUSSION

According to (Ghozali, 2024) data that do not meet the assumption of normality may be subjected to transformation procedures to approximate a normal distribution. Transformation involves rescaling data to reduce skewness and

kurtosis, thereby producing a distribution that is more symmetrical and suitable for parametric analysis. In this study, a square root transformation was applied to variables exhibiting non-normality. The results of the normality test, assessed using skewness and kurtosis statistics, are presented below, comparing values before and after the transformation.

Table 1. Normality Test Results

Obs	Pr(skewness)	Pr(kurtosis)	Prob>chi2	Information
178	0.001	0.080	0.003	Before the transformation
178	0.420	0.726	0.676	After the transformation

Source: Research Data, 2025

The normality of the residuals was initially tested using skewness and kurtosis statistics. Prior to transformation, the residuals yielded a probability value of 0.03, which falls below the 0.05 threshold, indicating a deviation from normality. Following the application of a square root transformation, the probability value increased to 0.676, exceeding the 0.05 benchmark and suggesting that the residuals conformed to the assumption of normal distribution.

Table 2. Descriptive Statistics Results

	N	Min.	*Max.*	*Mean*	*Std. Dev.*
Firm Values	178	0.267	1,340	0.763	0.198
Sustainability Performance	178	0.00	0.97	0.38	0.29
Environmental Cost	178	0.00	0.73	0.03	0.08
Environmental Performance	178	1.00	3.62	1.86	0.91
Profitability	178	0.12	84.48	17.72	17.46
Firm Size	178	22.73	32.76	29.47	2.06

Source: Research Data, 2025

As shown in Table 2, firm value (Y) is proxied by Tobin's Q ratio, calculated as the sum of the market value of equity and total debt divided by total assets. During the 2019–2023 observation period, Tobin's Q ranged from a minimum of 0.267 (SUNI, 2022) to a maximum of 1.340 (MBMM, 2020), with a mean value of 0.763. This average, which tends to approach the maximum value, suggests that, on average, firms in the energy and mining sectors were able to enhance their market valuation. The standard deviation of 0.198 indicates moderate dispersion around the mean.

The sustainability performance variable (X_1) is measured using the Sustainability Reporting Disclosure Index (SRDi), defined as the proportion of items disclosed by the company out of 77 GRI (Global Reporting Initiative) indicators. The SRDi values range from 0.00 to 0.97, with both the lowest and highest scores recorded by TINS in 2022. The average disclosure rate stands at 0.38, while the standard deviation is 0.29. The relatively low standard deviation compared to the mean suggests a moderate level of consistency in disclosure practices among firms.

Environmental cost (X_2) is measured as the ratio of corporate social responsibility (CSR) expenditures to net profit. The minimum observed value is 0.00 (PTRO, 2022), and the maximum is 0.73 (BUMI, 2019), with a mean of 0.03. The standard deviation of 0.08 exceeds the mean, indicating considerable variation in CSR spending across firms, likely reflecting differences in environmental strategy or profitability levels.

Environmental performance (X_3) is assessed using each firm's PROPER rating, an environmental compliance index issued by the Indonesian Ministry of Environment and Forestry. Scores range from a minimum of 1 to a maximum of 3.62. As this variable is coded as a categorical proxy (dummy), firm-year identifiers are not reported. The mean score of 1.86 and standard deviation of 0.91 suggest a relatively even distribution of environmental performance across the sample.

Profitability (Z_1), used as a control variable, is measured by the return on equity (ROE), calculated as net income divided by the market value of equity. The ROE ranges from 0.12 (WINS, 2021) to 84.48 (HILL, 2021), with an average of 17.72. The standard deviation of 17.46—close to the mean—suggests moderate variability in firm profitability across the sample period.

Firm size (Z_2), also a control variable, is measured using the natural logarithm of total assets. Values range from 22.73 (PTRO, 2020) to 32.76 (ADRO, 2022), with a mean of 29.47 and a standard deviation of 2.06. The relatively low standard deviation indicates a narrow distribution of firm size across the sample, reflecting comparable asset scales within the sector.

Table 3. Chow Test Results

NO	Testing	Provision	Results	Selected Model
1	Chow Test	CEM > 0.05 FEM < 0.05	0.001	FEM
2	Hausman test	REM > 0.05 FEM < 0.05	0.464	BRAKE
3	Lagrange Multiplier Test	CEM > 0.05 REM < 0.05	0,000	BRAKE

Source: Research Data, 2025

In this study, panel data regression analysis was preceded by a series of specification tests to determine the most appropriate estimation model. As shown in Table 3, the Chow test yielded a chi-square probability value below the 0.05 significance level, indicating that the fixed effects model provides a better fit than the pooled ordinary least squares (OLS) model. However, the subsequent Hausman test produced a chi-square probability value of 0.464, exceeding the 0.05 threshold, suggesting that the random effects model is preferred over the fixed effects alternative. Furthermore, the Lagrange Multiplier (LM) test returned a chi-square probability value of 0.00, which is below 0.05, confirming that the random effects model is superior to the pooled OLS model. Accordingly, the random effects model (REM) is adopted as the most appropriate specification for panel data estimation in this study.

Table 4. Multicollinearity Test Results

Source: Research Data, 2025

	VIF	**1/VIF**
Environmental Performance	7.71	0.12
Firm Size	6.61	0.15
Sustainability Performance	3.57	0.27
Profitability	2.22	0.45
Environmental Cost	1.26	0.79
Mean VIF	4.27	

Source: Research Data, 2025

The multicollinearity test was conducted to assess whether a high correlation exists among the independent variables, which could distort regression estimates (Ghozali, 2021, p. 157). Multicollinearity is considered present when the tolerance value is below 0.1 and the variance inflation factor (VIF) exceeds 10. As shown in Table 4, all variables exhibit tolerance values above 0.1 and VIF values below 10. The average VIF is 4.27, indicating that the regression model is free from multicollinearity concerns and that the independent variables can be reliably interpreted within the model.

Table 5. Heteroscedasticity Test Results

H0: Constant variance	Mark
Chi ^{2}	1.78
Prob > Chi ^{2}	0.182

Source: Research Data, 2025

The heteroscedasticity test was employed to assess whether the regression model exhibits non-constant variance in the residuals across observations, which could bias standard error estimates and affect statistical inference (Ghozali, 2021, p. 179). Heteroscedasticity is indicated when the probability value of the regression for the independent variables is less than 0.05. As shown in Table 5, the test produced a probability value of 0.182, which exceeds the 0.05 threshold. This result indicates that the residuals are homoscedastic, and therefore, the regression model does not exhibit symptoms of heteroscedasticity.

Table 6. Panel Data Regression Test Results

Random-effect GLS regression Group variable: ID

R-squared:		Obs per group:	
Within	= 0.138	Min	=1
Between	= 0.007	Avg	= 4.1
Overall	= 0.013	Max	= 5
Corr.	= 0 (assumed)	Waldchi2	= 21.40
		Prob. > chi2	= 0.000

Hypothesis	Company Values	Coefficient	P>|z|	Hypothesis Results
H_1	Sustainability Performance	-0.067	0.006 *	Rejected
H_2	Environmental Cost	0.189	0.008 *	Accepted
H_3	Environmental Performance	-0.010	0.501	Rejected
	Profitability	0.001	0.015	
	Firm Size	0.005	0.660	
	Constanta	0.629	0.084	

Source: Research Data, 2025

As presented in Table 6, a panel data regression equation model can be created for this research.

$$Y=0.62 - 0.06X_1 + 0.18X_2 - 0.10X_3 + 0.00Z_1 + 0.00Z_2 \quad (6)$$

The regression output reveals a constant term of 0.62, suggesting that in the absence of sustainability performance (X_1), environmental cost (X_2), and environmental performance (X_3), firm value (Y) would increase by 0.62 units. The regression coefficient for sustainability performance (X_1) is −0.06, indicating that a one percent increase in sustainability performance is associated with a 0.06 percent

decrease in firm value, holding all other variables constant. The coefficient for environmental cost (X_2) is 0.18, implying a one percent increase in environmental cost corresponds with a 0.18 percent increase in firm value. The coefficient for environmental performance (X_3) is −0.10, suggesting a negative relationship whereby a one percent increase in environmental performance is associated with a 0.10 percent decrease in firm value. The coefficients for profitability (Z_1) and firm size (Z_2) are both 0.00, indicating no discernible effect on firm value when each increases by one percent, assuming other variables remain constant.

As reported in Table 6, the coefficient of determination (R^2) indicates that the explanatory variables—sustainability performance, environmental cost, environmental performance, profitability, and firm size—jointly explain 1.3 percent of the variation in firm value. Despite the relatively low explanatory power, the model's overall significance is supported by the Wald chi-square statistic of 21.40 with a p-value of 0.00, indicating that the independent variables exert a statistically significant joint influence on firm value.

The results of the individual parameter significance tests (t-tests), estimated using Stata version 17, are also presented in Table 6. The sustainability performance variable (X_1) has a regression coefficient of −0.067 with a p-value of 0.006, which is below the 0.05 threshold. This suggests that sustainability performance has a statistically significant but negative effect on firm value. Hence, Hypothesis 1 (H_1) is rejected. These findings do not support the legitimacy theory, which posits that robust social and environmental disclosures should enhance compliance and firm legitimacy. One possible explanation for the observed negative association lies in the uncertainty surrounding the practical implementation of GRI standards. As noted by (Fatemi et al., 2018), firms may hesitate to fully adopt GRI reporting frameworks due to concerns over cost-effectiveness or perceived irrelevance to investor interests. Moreover, sustainability disclosures may be viewed by some firms as symbolic compliance rather than substantive efforts to improve performance (Nugrahani & Rohmah, 2023). In this context, disclosure practices may be perceived as regulatory obligations rather than strategic imperatives, potentially diminishing their value in the eyes of investors. These findings are consistent with those of Widjanarko & Oktorina (2024) and (Fernando et al., 2024), who also reported a negative association between GRI-based sustainability disclosure and firm value.

The environmental cost variable (X_2) yields a regression coefficient of 0.18 and a p-value of 0.008, indicating a positive and statistically significant relationship with firm value. Thus, Hypothesis 2 (H_2) is accepted. These findings align with both legitimacy theory and stakeholder theory, suggesting that firms that allocate resources to environmental protection and social responsibility are perceived more favorably by stakeholders. Incurring environmental costs signals commitment to regulatory compliance and risk mitigation, particularly in industries with high environmental exposure. Firms with strong environmental policies are seen as better equipped to manage long-term risks, including those related to evolving regulatory frameworks. These results are consistent with prior studies by Jo et al. (2016), (Arimbi & Mayangsari, 2022), and (Artha & Andhika Putra, 2020), who found that environmental expenditures positively influence firm

valuation by serving as credible indicators of social and environmental accountability.

In contrast, the environmental performance variable (X_3) yields a regression coefficient of −0.01 with a p-value of 0.501, indicating no statistically significant effect on firm value. Consequently, Hypothesis 3 (H_3) is rejected. This finding does not support legitimacy theory's proposition that superior environmental performance enhances firm reputation and stakeholder support. One plausible explanation is that many firms in the energy and mining sectors listed on the Indonesia Stock Exchange from 2019 to 2023 did not consistently participate in the Ministry of Environment and Forestry's PROPER program, which serves as the benchmark for environmental performance assessment in this study. The lack of participation may reflect limited engagement or perceived irrelevance of the PROPER program at the corporate level. As noted by Dellaconi et al. (2024), PROPER assessments tend to focus on operational units or subsidiaries, often overlooking corporate-level strategies, policies, and integrated environmental management systems. Consequently, PROPER ratings may not fully capture the comprehensive environmental performance of diversified firms or holding companies, thereby limiting their explanatory power in relation to firm value.

CONCLUSION

Based on the analysis and discussion, this study concludes that sustainability performance has a significant negative effect on the firm value of energy and mining companies listed on the Indonesia Stock Exchange (IDX) during the 2019–2023 period. In contrast, environmental costs exhibit a positive and significant influence on firm value, while environmental performance does not show a statistically significant effect. In light of these findings, companies in the energy and mining sectors are encouraged to enhance the transparency of their sustainability performance by aligning disclosed programs more closely with substantive sustainability initiatives. Firms should also improve their internal capacity to apply sustainability disclosure guidelines effectively, particularly those based on GRI standards. Increased participation in the PROPER program is likewise recommended, as this may contribute to strengthening the company's environmental reputation and, in turn, positively influence investor perceptions.

For investors, the findings suggest that environmental cost disclosures should be considered as an important signal when evaluating firm value. Greater attention to such sustainability-related indicators may support more informed investment decision-making in high-impact sectors such as energy and mining. This study acknowledges several limitations that may serve as a basis for future research. First, sustainability performance could be further assessed through the inclusion of official third-party certifications reflecting adherence to recognized sustainability standards. The extent and quality of such certifications, as disclosed in sustainability reports, may offer a more robust measure of a firm's long-term environmental and social commitments. Second, future studies could explore the role of eco-efficiency—defined as the firm's ability to manage resources efficiently and reduce environmental impact—as an additional explanatory factor for firm value. Finally, this research may be extended to other environmentally sensitive

sectors, such as textiles and chemicals, where the risks of pollution and regulatory scrutiny are comparably high. Such expansion would contribute to a broader understanding of how environmental and social responsibility influences firm valuation across industries.

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