The Impact of Carbon Emission Disclosure On Firm Value With Sustainability Performance As A Mediating Variable: Evidence From Palm Oil and Mining Companies In Indonesia

Muthia Harnida[1*], Sri Bulkia[2], Netty Nurhayati[3], Kemas Anshory[4], Pasha Aulia Tambang[5]

[1,2,3,4,5] Management Study Program, Faculty of Economics, Universitas Islam Kalimantan Muhammad Arsyad Al Banjari Banjarmasin, Jalan Trans Kalimantan Handil Bakti Barito Kuala Regency, South Kalimantan, Indonesia
*Corresponding Author:
Email: muthiaharnida@gmail.com

Abstract.
This study aims to analyze the impact of carbon emission disclosure on firm value, with sustainability performance as a mediating variable. This study focuses on palm oil and mining companies listed on the Indonesia Stock Exchange (IDX) with 105 data points for the period 2019–2023. Carbon emission disclosure is a form of corporate transparency in managing environmental impacts and is increasingly a major concern for stakeholders, particularly investors. However, the direct relationship between carbon emission disclosure and firm value remains a gap in various previous studies. This study used a panel data regression with a fixed effects model equipped with robust standard errors (clustered by company). Carbon emission disclosure is measured using the Global Reporting Initiative (GRI) 305: Emissions index, Sustainability performance with Environmental, Social, and Governance (ESG) score as the proxy for sustainability performance, and firm value by the Tobin's Q ratio. The results indicate that carbon emission disclosure has a direct effect on firm value. However, ESG in this study does not mediate the relationship between carbon emission disclosure and firm value. The implications of this research are expected to be a reference for companies in increasing sustainability transparency and for regulators in formulating policies for carbon emission disclosure and its incentive mechanism.

Keywords: *Carbon Emission Disclosure; sustainability performance; firm value; ESG and Indonesia Stock Exchange (IDX)***.**

I. INTRODUCTION

Climate change has become a major global concern in recent years. Companies face increasing pressure to reduce their carbon footprint and disclose information related to their carbon emissions. Carbon emission disclosure is an indicator of a company's transparency and environmental responsibility. Climate change has become a global issue that is gaining increasing attention from various parties, including governments, the public, and businesses. The company is forced to be more transparent in its carbon emission disclosure. The expansion of the palm oil plantation and mining sectors in Indonesia has put significant pressure on the ecosystems. Land clearing for palm oil plantations often leads to deforestation, and greenhouse gas (GHG) emissions will reduce the land's capacity to store carbon. Furthermore, mining activities in swamp areas can cause habitat destruction, water pollution, and soil degradation, negatively impacting the ecological function of swamps and the well-being of surrounding communities. The palm oil plantation and mining industries in Indonesia play a significant role in the national economy; however, they also have an environmental impact. Palm oil plantations are often associated with deforestation and land-use change, which contribute significantly to greenhouse gas emissions. Meanwhile, mining activities involve energy-intensive extraction and processing processes, which can generate significant carbon emissions.

Therefore, transparency in disclosing carbon emissions and sustainability performance is crucial for companies in this sector. Disclosure of carbon emissions is part of corporate social responsibility that can influence the perceptions of investors and other stakeholders [15]. Some studies have found that carbon emission disclosure impacts the firm value. [11], and [1] found that companies that transparently disclose their carbon emissions tend to have higher market value, because investors are more attracted to companies that are sustainability-oriented. This result is also aligned with the findings of [3]; [19], which state that carbon disclosure can increase investment attractiveness because it reflects better environmental risk management. Although many studies have shown a positive relationship between carbon emission disclosure and firm value, some studies have shown mixed results. [7] found that carbon emission disclosure does not always have a positive effect on firm value, depending on moderating factors such as environmental performance and corporate transparency.This suggests that the relationship between carbon emission

disclosure and firm value may be influenced by other variables, one of which is sustainability performance [4];[28]. Sustainability performance reflects the management of environmental, social, and governance (ESG) aspects.

Companies with good sustainability performance are often more attractive to investors, reduce operational risks, and increase long-term competitiveness [16]; [8] found that companies with higher sustainability performance tend to have more stable long-term financial performance. Sustainability performance can mediate the relationship between carbon emission disclosure and firm value, as higher carbon transparency can improve sustainability performance and contribute to increasing a firm's value. Disclosure of carbon emissions can encourage companies to be more proactive in improving their sustainability performance. According to Stakeholder theory [9], companies must consider the expectations of various stakeholders, including regulators, investors, and the public. With increased transparency in carbon disclosure, companies are encouraged to improve their ESG practices to maintain their reputation and avoid stakeholder pressure [16]. Based on Signaling Theory [21], carbon emission disclosure (CED) is a positive signal to investors that a company is committed to environmentally responsible business practices. This signal increases market confidence and has the potential to increase company value. Empirical research by [20] and [1] shows that carbon emission disclosure has a positive effect on company value. Therefore, the higher the level of carbon emission disclosure, the better investors perceive the company.

Hypothesis 1 (H1): Carbon emission disclosure has a positive effect on firm value.

Good sustainability performance indicates that a company can manage economic, social, and environmental aspects in a balanced manner [6]; [12]. This enhances reputation and investor confidence. The company is perceived as more stable and socially responsible. Studies by [5] and [10] show that high sustainability performance is correlated with increased firm value. Based on the integration of Signaling Theory and Stakeholder Theory, carbon emission disclosure does not directly increase company value, but rather through improved sustainability performance. Investors will positively evaluate this disclosure signal only if it is accompanied by concrete evidence of improved sustainability performance [13]; [14]. Thus, sustainability performance acts as a full mediator between carbon emission disclosure and company value. This is also in line with Legitimacy Theory [22], which states that companies strive to maintain their social legitimacy through environmentally responsible business practices [18]. Furthermore, a higher sustainability performance can increase company value through several mechanisms. Signaling Theory [21] explains that companies with good sustainability performance can send positive signals to investors regarding their long-term stability and responsibility. Investors who perceive a company as highly committed to sustainability tend to evaluate the company more positively, ultimately increasing company value [11]; [8]. Thus, sustainability performance can act as a mediator linking transparency in carbon disclosure with increased market trust.

Hypothesis 2 (H2): Sustainability performance mediates the relationship between carbon emissions disclosure and firm value.

This study aims to examine the role of sustainability performance as a mediator in the relationship between carbon emissions disclosure and firm value. Understanding this mechanism is expected to provide companies with insight into the importance of carbon emissions disclosure and improving sustainability performance to enhance firm value.

II. METHODS

This quantitative study used secondary panel data from the period of 2019–2023, covering palm oil and mining firms listed on the IDX. Samples were selected through purposive sampling—companies that consistently publish annual and sustainability reports.

Variable Measurement

- Dependent Variable: Firm Value, measured by Tobin's Q = (Market Value of Equity + Total Debt) / Total Assets.

- Independent Variable: Carbon Emission Disclosure (CED), calculated using an 18-item GRI 305 disclosure index (Choi et al., 2013).
  Mediating Variable**:** Sustainability Performance, by ESG scores from Refinitive data
- Control variables: Firm size = Ln (Total assets), and profitability= Return on Assets (ROA)

Analytical Technique

Panel data regression with a Fixed Effects Model (FEM) was employed, justified by the Chow and Hausman tests. Robust standard errors (clustered by firm) were applied to address heteroskedasticity and autocorrelation.

The models estimated include:

1. Direct Effect:
   $TQ=\beta0+\beta1CED+\beta2ROA+\beta3SIZE$
2. Mediation Test:
   $ESG= \alpha_0 + \alpha_1CED + \alpha_2ROA + \alpha_3SIZE + \varepsilon$
   $TQ=\gamma0+\gamma1CED+\gamma2ESG+\gamma3ROA+\gamma4SIZE+\varepsilon$

III. RESULT AND DISCUSSION

1. Statistic Descriptive

Table 1. Descriptive Statistic

Variabel	Mean	Std. Dev	Min	Max
Tobin's Q	1,116	0,470	0,610	3,570
CED	58,590	21,200	21,640	100,000
ESG	64,950	16,990	28,570	97,220
ROA	8,220	9,260	- 19,430	43,040
Size	24,770	9,260	9,430	56,320

N=105

2. Model Selection Test
   - Chow Test: F = 101.35, p < 0.001 → Fixed Effect preferred.
   - Hausman Test: χ^2 = 444.60, p < 0.001 → Fixed Effect confirmed.
3. Estimation Results of the Total Effect Model (Without ESG Mediator)

Table 2. Total effect model (Without ESG mediator)

Variabel	Coefficient	Std. error	t-value	p-value	Result
CED_X1	0.0031	0.0011	2.77	0.007	Significant
ROA_X2	0.0026	0.0018	1.43	0.156	Not significant
Size_X3	-1.02215	0.12424	-8.23	< 0.000	Significant

F-statistics = 177.15, p-value < 2.22e-16

R-squared = 0.8706

Adjusted R-squared = 0.8329

4. Estimation model with ESG mediator

Table 3. Estimation model with ESG mediator

Variable	Coefficient	Std. Error	t-value	p-value	Result
CED_X1	0.00231	0.00117	1.9696	0.05244	Not significant
ESG_M	0.00378	0.00217	1.7406	0.08570	Not significant
ROA_X2	0.00252	0.00147	1.7227	0.08890	Not significant
Size_X3	-1.05429	0.05145	-20.4905	< 2e-	Significant

Total Sum of Squares: 5.6362

Residual Sum of Squares: 0.70211

R-Squared: 0.87543

Adj. R-Squared: 0.8371

F-statistic: 137.035 on 4 and 78 DF, p-value: < 2.22e-16

5. Result of ESG mediation

Table 4. Result of ESG mediator

Step	Model	coefficient	p-value	Result
1.	CED → TQ	0,0031	0,0159	Significant → Condition 1 fulfilled
2.	CED → ESG	0,1990	0,0028	Significant→ Condition 2 fulfilled
3.	ESG → TQ	0,0038	0,2529	Significant → Condition 3 fulfilled
4.	CED → TQ (ESG mediator)	0,0023	0,124	The direct effect is not significant, and ESG fails as a mediator variable.

The Impact of Carbon Emission Disclosure on Firm Value

The results of this study indicate that carbon emission disclosure (CED) has a significant positive effect on firm value (Tobin's Q) before ESG mediation variables are included in the model. These results align with Signaling Theory [22], which explains that environmental information disclosure is perceived as a positive signal for a company's long-term prospects. Companies that are more transparent in disclosing their carbon emissions are considered better able to manage environmental risks, thereby increasing market confidence.Research conducted by [11] found that carbon disclosure can strengthen a company's reputation and increase market value. Carbon emission disclosure can enhance the company's legitimacy and image in the eyes of the public and investors, which can encourage an increase in Tobin's Q. These findings also align with Legitimacy Theory [23], which states that companies disclose environmental disclosure to gain and maintain social legitimacy. Companies that actively disclose carbon emissions are perceived as more responsible for their environmental impacts, thus enhancing positive investor perceptions. Therefore, carbon emission disclosure serves not only as a form of social responsibility but also as an adaptive strategy to increasingly stringent environmental policies in Indonesia.

The Role of Sustainability Performance (ESG) as a Mediating Variable

These results differ from several previous studies that demonstrated the role of ESG as a mediating mechanism [18]; [8], and [19] emphasized that sustainability performance typically strengthens a company's social legitimacy, which in turn increases its market value. However, in the context of palm oil plantation and mining companies in Indonesia, these results indicate that the market responds more to direct disclosure of carbon information. At the same time, ESG scores have not yet been fully appreciated as a determinant of company value. The quality of ESG in Indonesia remains uneven; some sustainability reports are merely regulatory formalities (e.g., due to requirements under POJK 51/2017) and do not fully reflect actual sustainability practices [15]. Domestic investors focus more on fundamental information and direct disclosure of environmental risks than on ESG scores, which may be perceived as less transparent or credible [20]. The palm oil and mining sectors have a high stigma regarding environmental impact, making carbon emissions transparency a stronger indicator than aggregate sustainability scores. The results of this study indicate that sustainability performance (ESG) does not act as a significant mediator in the relationship between carbon emissions disclosure and firm value. The results of this study indicate that sustainability performance (ESG) does not act as a significant mediator in the relationship between carbon emissions disclosure and firm value. Although carbon emissions disclosure significantly influences ESG, ESG variables themselves do not considerably influence firm value. These results indicate that the role of ESG in Indonesia is still limited to administrative compliance with regulations, particularly POJK No. 51/POJK.03/2017, and does not fully reflect integrated sustainability practices in business strategy.

The Effect of Control Variables ROA and Size on Firm Value

The results of this study indicate that Return on Assets (ROA) does not significantly influence firm value, either in the total effect model or the mediation model. Theoretically, ROA reflects a company's ability to generate profits from its total assets. It should have a positive impact on investor perceptions and increase firm value. However, this study indicates that profitability is not yet a dominant factor in shaping firm value in the palm oil plantation and mining sectors. This finding aligns with research by [20], which found that profitability in the energy sector is not always significant to firm value due to the impact of global commodity price volatility. Investors pay more attention to non-financial factors. The control variable Size (firm size) shows a significant negative effect on Tobin's Q. This finding differs from the classical argument in financial theory, which states that large firm size reflects higher stability and competitiveness and should

therefore increase firm value. However, in the context of this study, the negative result actually indicates that large firms in the palm oil and mining sectors are more exposed to environmental risks, regulatory pressures, and high social demands. This is in line with the findings [16], which confirm that firms with large operational scales tend to face the "liability of size", increased public scrutiny, and legitimacy pressures due to their extensive environmental footprint. In other words, the greater the assets held by a firm in a high-risk environmental. Overall, the findings on these control variables reinforce the argument that traditional financial indicators (profitability and firm size) are not always the primary determinants of firm value in sectors with high environmental exposure. Instead, disclosure of carbon emissions and sustainability practices is considered more material by investors in assessing a company's long-term prospects [11]; [8]. These results emphasize the importance for large companies in the extractive sector to improve the quality of environmental and sustainability disclosures to maintain legitimacy and attract investor trust.

IV. CONCLUSION

This study found that carbon emissions disclosure transparency is a strategic instrument to enhance company value, as well as the need to improve the quality of sustainability reporting to ensure its relevance and market trust. This research provides theoretical contributions by supporting signaling theory and legitimacy theory in the context of emerging markets. However, it also reveals the limitations of applying stakeholder theory in the Indonesian context, as investors value concrete and direct information over aggregated ESG scores. Sustainability reports should be based on measurable data, verified by independent parties, and directly linked to business strategies and clear emission reduction targets.Future research is recommended to expand the sample size to other sectors, such as manufacturing, renewable energy, or banking, to obtain more comprehensive generalizability of the results. Further research can also include other variables such as institutional ownership, good corporate governance (GCG) quality, or regulatory pressure as additional moderating or mediating variables to uncover deeper relationship mechanisms.

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