

The Effects of Profitability, Environmental Performance, and Company Size on Carbon Emission Disclosure among Companies in Indonesia

Gebi Evelin Lumbantungkup*, Muhammad Dimar Alam

Universitas Brawijaya, Indonesia

Email: gebievelin@student.ub.ac.id*, dimar.alam@ub.ac.id

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Abstract

Carbon emission disclosure (CED) has become increasingly important as Indonesia commits to achieving Net Zero Emissions by 2060. The basic materials sector, as the largest contributor to national emissions (40%), faces increasing pressure to enhance environmental transparency. However, CED practices in Indonesia remain voluntary, resulting in significant variations in disclosure levels among companies. This study aims to examine the effects of profitability, environmental performance, and firm size on carbon emission disclosure among basic materials sector companies listed on the Indonesia Stock Exchange. This quantitative study employs a sample of 126 observations obtained through purposive sampling from companies in the basic materials sector during the 2022–2024 period. The data were analyzed using panel data regression with EViews software. The findings indicate that higher profitability and strong environmental performance have not yet become primary determinants of carbon emission disclosure, whereas larger firms tend to experience greater stakeholder pressure and legitimacy demands, encouraging them to disclose carbon emissions more extensively and comprehensively. This study contributes to enriching the understanding of legitimacy theory and stakeholder theory and provides a reference for regulators in strengthening carbon emission disclosure policies through more stringent and standardized reporting frameworks.

INTRODUCTION

Increased greenhouse gas (GHG) emissions resulting from industrial activities have attracted global attention toward climate change mitigation efforts. Indonesia, as one of the largest contributors to global GHG emissions, produced an average of 1,495 million tons of CO₂ equivalent annually during the 2018–2020 period (World Bank, 2023). In response, Indonesia has established a Net Zero Emissions (NZE) target by 2060, as outlined in the International Energy Agency report (2022). This commitment has been reinforced by Indonesia's participation in the Paris Agreement adopted in 2015 and its implementation through Presidential Regulation Number 98 of 2021, which requires countries to establish Nationally Determined Contributions (NDCs) and implement more systematic emissions transparency frameworks (Nastiti & Hardiningsih, 2022). To achieve this target, the government has developed a roadmap consisting of three main strategies: energy transition, energy efficiency improvement, and industrial sector decarbonization (Agency, 2022; Cresko et al., 2022; Sundaramoorthy et al., 2023).

The industrial sector, particularly the basic materials sector, is one of the largest contributors to emissions in Indonesia. According to the Climate Transparency Report (2022), this sector contributes nearly 40% of total national emissions, consisting of 22.9% from direct

emissions and 15.6% from indirect emissions associated with energy consumption. Energy-intensive production processes in industries such as cement, steel, chemicals, and pulp and paper have become major sources of emissions, which have continued to increase since 1990 and present significant technological challenges in mitigation efforts (Lamb et al., 2021). This condition is further intensified by the increasing impacts of climate change, including flash floods that occurred in late November 2025 in Aceh, North Sumatra, and West Sumatra, resulting in more than 1,200 fatalities due to rainfall exceeding 300 mm per day (BNPB, 2025). The substantial contribution of the basic materials sector to national emissions highlights the urgent need for stronger monitoring mechanisms and corporate accountability systems among companies operating within this sector (Sekarini & Setiadi, 2021; Wicaksono, 2024).

In this context, carbon emission disclosure (CED) serves as an important instrument for evaluating the extent to which companies contribute to climate mitigation efforts while functioning as a communication mechanism between companies and stakeholders (Lou et al., 2013; Hahn et al., 2015; Ratmono, 2021). The importance of such disclosure has increased as pressure from institutional investors, Environmental, Social, and Governance (ESG) rating agencies, and capital market regulators continues to grow, with climate transparency becoming an essential component of effective corporate governance (Transparency, 2022). However, carbon emission disclosure practices in Indonesia remain largely voluntary, resulting in considerable variations in disclosure quality among companies (Bae Choi et al., 2013; Kurnia et al., 2021; Luo et al., 2013). These variations are influenced by several internal factors, including profitability, environmental performance, and firm size. Companies with higher profitability generally possess greater financial capacity to address environmental concerns and fulfill stakeholder expectations (Choi et al., 2013). Environmental performance, measured through the Corporate Performance Rating Assessment Program (Program Penilaian Peringkat Kinerja Perusahaan dalam Pengelolaan Lingkungan Hidup/PROPER), has also been shown to have a positive association with carbon emission disclosure levels (Kurnia et al., 2021). Meanwhile, larger companies tend to provide more extensive environmental information due to greater public visibility and broader stakeholder pressures (Hahn et al., 2015).

Although numerous studies have examined the determinants of carbon emission disclosure, several research gaps remain unresolved (Pratiwi et al., 2021). First, many previous studies relied on data collected before the full implementation of national sustainability strategies and post-pandemic economic recovery initiatives (World Bank, 2023). Consequently, empirical evidence reflecting disclosure practices during the period of strengthened commitment toward NZE 2060 remains limited. Second, previous studies have generally examined manufacturing companies as a whole and rarely focused specifically on the basic materials sector, despite its significant contribution to Indonesia's emissions (Pratiwi et al., 2021). Third, studies that simultaneously integrate profitability, PROPER-based environmental performance, and firm size as determinants of carbon emission disclosure within this sector remain limited, resulting in an incomplete understanding of the relationships among these factors (Putri et al., 2022). These research gaps demonstrate the need for more focused and contextual investigations to generate empirical evidence that can support effective environmental policy development.

The novelty of this study lies in its specific focus on Indonesia's basic materials sector, which represents one of the country's largest emission-contributing industries (approximately

40%) but remains relatively underexplored in previous carbon emission disclosure research. This study also employs the most recent observation period (2022–2024), capturing corporate disclosure practices during the early implementation phase of Indonesia’s NZE 2060 roadmap. Furthermore, this research integrates PROPER-based environmental performance, profitability, and firm size within a single analytical framework specifically designed for the basic materials sector, enabling the identification of the most influential determinants of carbon emission disclosure in one of Indonesia’s most emission-intensive industries.

This study aims to examine the effects of profitability, environmental performance, and firm size on carbon emission disclosure among basic materials sector companies listed on the Indonesia Stock Exchange (IDX) during the 2022–2024 period. This period was selected because it represents the initial stage of strengthening corporate commitments toward Indonesia’s Net Zero Emissions 2060 target, during which companies are expected to improve their environmental disclosure practices in a more consistent and measurable manner. Practically, this study provides regulators, including the Financial Services Authority (Otoritas Jasa Keuangan/OJK) and the Ministry of Environment, with empirical evidence to support the development of more targeted and standardized carbon disclosure policies. It also offers investors and ESG rating agencies valuable insights for evaluating corporate climate transparency. Theoretically, this study contributes to legitimacy theory and stakeholder theory by demonstrating that profitability and environmental performance do not necessarily lead to greater carbon emission disclosure in the Indonesian context, thereby challenging the universal applicability of these theories in emerging economies.

METHOD

This study employed a quantitative approach to examine the effects of profitability, environmental performance, and firm size on carbon emission disclosure among companies in the basic materials sector during the 2022–2024 period. Panel data regression analysis was conducted to test the relationships between the independent variables (profitability, environmental performance, and firm size) and the dependent variable (carbon emission disclosure). The population consisted of all basic materials sector companies listed on the Indonesia Stock Exchange (IDX) during the observation period.

The samples were selected using purposive sampling based on the following criteria: (1) companies that published annual reports and/or sustainability reports during the 2022–2024 period; and (2) companies that participated in the Corporate Performance Rating Assessment Program (Program Penilaian Peringkat Kinerja Perusahaan dalam Pengelolaan Lingkungan Hidup/PROPER) during the observation period. Based on these criteria, 126 firm-year observations were obtained as the research sample. Data analysis was performed using panel data regression with the EViews 12 software. The following section presents the research variables and regression model used in this study.

Table 1. Variable Operational Definition

Variabel	Definition	Measurement
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Profitability (X1)	Profitability is the company's ability to generate profits from the company's operational activities.	$ROA = \frac{Laba\ Bersih}{Total\ Aset}$
Environmental Performance (X2)	Environmental performance is a company's performance that reflects the company's concern for the environmental impact caused by the company's operational activities.	<i>Peringkat PROPER</i>
Company Size (X3)	The size of the company is an overview of the operational scale and resource capacity of the company.	$SIZE = Ln(Total\ Aset)$
Carbon Emission Disclosure (Y)	<i>Carbon emission disclosure</i> is a form of disclosure of information in the form of a report by a company regarding greenhouse gas emissions generated from the company's operational activities and measured using <i>the Global Reporting Initiative (GRI) Standards</i> , especially GRI 305: <i>Emissions</i> (Lamb et al., 2021).	$CED = \frac{\sum di}{M}$

Source: Researcher-processed data (2026)

RESULTS AND DISCUSSION

Descriptive Statistical Test Results

Table 2. Descriptive Statistical Test

	Mean	Median	Maximum	Minimum	Std. Dev.
<i>Carbon Emission Disclosure</i>	0.58163	0.57143	1.00000	0.14286	0.28525
Profitability	0.05086	0.03736	1.03771	-0.27560	0.11881
Environmental Performance	2.87302	3.00000	5.00000	0.00000	1.23278
Company Size	29.00521	29.11985	32.87482	24.73734	1.86303

Source: Researcher-processed data (2026)

Based on the results of the descriptive statistical test shown in Table 2, the number of data samples (N) was recorded as many as 126 which were analyzed for each research variable. Profitability (X1) has an average value of 0.05086 with a maximum value of 1.03771 and a minimum value of -0.27560. The environmental performance (X2) has an average of 2.873016, with a minimum value of 0 and a maximum of 5. Company size (X3) has an average value of 29.00521, with a minimum value of 24.73734 and a maximum of 32.87482. Carbon Emission Disclosure (Y) has an average value of 0.581633, with a minimum value of 0.142857 and a maximum value of 1.0000.

Results of Selection of Panel Data Regression Model

1. Chow Test

Table 3. Chow Test

Rududant Fixed Effect Tests			
Equation: Untitled			
Test cross-section fixed effect			
Effect Test	Statistic	d. f.	Prob.
Cross-section F	6.656130	(41,81)	0.0000
Cross-section Chi-square	185.795689	41	0.0000

Source: Researcher-processed data (2026)

The Chow test is used to select the Common Effect Model (CEM) or Fixed Effect Model (FEM) research model. The results showed a Prob value of < 0.05, so the selected research model was the Fixed Effect Model (FEM).

2. Hausman Test

Table 4. Hausman Test

Redundant Fixed Effect Tests			
Equation: Untitled			
Test cross-section fixed effect			
Effect Test	Statistic	d. f.	Prob.
Cross-section F	6.656130	(41,81)	0.0000
Cross-section Chi-square	185.795689	41	0.0000

Source: Researcher-processed data (2026)

The Hausman test is used to select the Fixed Effect Model (FEM) or Random Effect Model (REM) research model. The results showed a Prob value of > 0.05 , so the selected research model was the Random Effect Model (REM).

3. Uji Lagrange Multiplier

Tabel 5. Uji Lagrange Multiplier

Lagrange Multiplier Tests for Random Effects			
Null hypotheses: No effects			
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives			
	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	49.96400 (0.0000)	6.379328 (0.0115)	56.34333 (0.0000)

Source: Researcher-processed data (2026)

The Lagrange Multiplier test is used to select the Random Effect Model (REM) or Common Effect Model (CEM) research model. The results showed that the Breusch-Pagan Cross-section Probability value was < 0.05 , so the selected research model was the Random Effect Model (REM).

Classical Assumption Test Results

1. Multicollinearity Test

Table 6. Multicollinearity Test

Variance Inflation Factors			
Date: 04/18/26			
Sample: 1 126			
Included observations: 126			
Variabel	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.134840	265.3441	ON
X1	0.036503	1.191625	1.005838
X2	0.000405	7.775385	1.200875
X3	0.000177	293.7297	1.197288

Source: Researcher-processed data (2026)

Based on the results of the multicollinearity test shown in Table 6, it was obtained that the Centered VIF value between variables was below 10. This shows that the data does not experience multicollinearity problems.

2. Heteroscedasticity Test

Table 7. Heteroscedasticity Test

Heteroskedasticity Test: White			
Null hypothesis: Homokedasticity			
F-statistic	2.089283	Prob. F (9,77)	0.0359
Obs*R-squared	17.57556	Prob. Chi-Square (9)	0.0404
Scaled explained SS	11.63811	Prob. Chi-Square (9)	0.2345

Source: Researcher-processed data (2026)

Based on the results of the heteroscedasticity test shown in table 7, it was obtained that the Probability value of Chi-Square explained SS was 0.2345, which is greater than 0.05. This shows that the data is free from heteroscedasticity problems.

Multiple Linear Regression Analysis Results

Table 8. Multiple Linear Regression Analysis

Variabel	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.077826	0.540676	-1.993478	0.0484
X1	-0.213825	0.146858	-1.455998	0.1480
X2	0.020824	0.017962	1.159341	0.2486
X3	0.055525	0.018923	2.934178	0.0040
Weighted Statistics				
R-squared	0.104904	Mean dependent war	0.219921	
Adjusted R-squared	0.082894	S.D. dependent war	0.156840	
S.E. of regression	0.150199	Sum squared resid	2.752271	
F-statistic	4.766098	Durbin-Watson stat	1.304840	
Prob (F-statistic)	0.003544			

Source: Researcher-processed data (2026)

Based on the regression results that have been obtained, the form of regression equations can be formulated as follows:

$$CED = -1.078 - 0.214PROFit + 0.021PROPERit + 0.056SIZEit + \varepsilon$$

The interpretation of the multiple linear equation is that the value of the Y constant is obtained at -1.0778 which can be interpreted that without all independent variables (profitability, environmental performance, and company size), the carbon emission disclosure level will be -1.0778. This means that under the condition that all independent variables are zero, the disclosure rate of a company's carbon emissions tends to be low, which indicates the lack of information related to carbon emissions disclosed by the company. The value of the regression coefficient of the X1 variable is negative of -0.2138, if the value of the other variable is constant and the X1 variable increases by 1%, then the Y variable will decrease by 0.2138. The value of the regression coefficient of variable X2 has a positive value of 0.0208, if the value of other variables is constant and variable X2 increases by 1%, then variable Y will increase by 0.0208. The value of the regression coefficient of the X3 variable has a positive value of 0.0555, if the value of the other variable is constant and the X3 variable increases by 1%, then the Y variable will increase by 0.0555.

Hypothesis Test (t-Test)

Based on the results shown in Table 8, the following results were obtained:

1. The profitability variable has a probability value of 0.1480 which is greater than 0.05, meaning that profitability has no effect on carbon emission disclosure.
2. The environmental performance variable has a probability value of 0.2486 which is greater than 0.05, meaning that environmental performance has no effect on carbon emission disclosure.
3. The company size variable has a probability value of 0.0040 which is smaller than 0.05, meaning that the size of the company has no effect on carbon emission disclosure.

Model Test (F Test)

The F test (model test) is carried out to assess the extent to which the independent variables together have feasibility in influencing the dependent variables. If the significance value is less than 0.05, then the independent variable is considered feasible to influence the dependent variable. Conversely, if the significance value is more than 0.05, then the independent variable is considered unfeasible. Based on Table 8, the results show an F-Statistic value of 4.766098 with a Prob(F-statistic) value of 0.003544 which is less than 0.05. Therefore, it can be concluded that independent variables have a significant effect simultaneously (simultaneously) on dependent variables.

Coefficient of Determination Test (R²)

The coefficient of determination (R²) is used as a measure to determine the extent to which independent variables are able to explain variations in dependent variables in a single model. The R² value is in the range of 0 to 1 ($0 < R^2 < 1$), where the closer to 1 the better the model is at explaining the relationships between variables. Based on the research shown in Table 8, the Adjusted R-squared value is 0.082894. This shows that profitability, environmental performance and company size are only able to explain 8.29% of the dependent variables of carbon emission disclosure, while the remaining 91.71% are influenced by other factors that are not included in this research model.

The Effect of Profitability on Carbon Emission Disclosure

The test results showed that profitability had no effect on carbon emission disclosure (CED), with a probability value of 0.1480 which was greater than 0.05, so the first hypothesis was rejected. These findings are not in line with the predictions of legitimacy theory or stakeholder theory that profitable companies have greater resource capacity to disclose and face stronger pressure from stakeholders to demonstrate environmental responsibility. The rejection of this hypothesis can be understood in the context that the disclosure of carbon emissions in Indonesia is still voluntary, so companies with high profitability tend to allocate resources for investments with a higher rate of return than environmental reporting purposes. These findings are in line with the research of Sekarini & Setiadi (2021) and Ratmono et al. (2020) which also found that profitability has no effect on CED, and confirms that a company's ability to generate profits does not necessarily drive decisions to disclose carbon emissions more broadly.

The Effect of Environmental Performance on Carbon Emission Disclosure

The test results showed that environmental performance had no effect on carbon emission disclosure (CED), with a probability value of 0.2486 greater than 0.05, so the second hypothesis was rejected. These findings contradict the prediction of legitimacy theory that companies with

better environmental performance will be motivated to make more comprehensive disclosures as a strategy to gain and maintain legitimacy in the eyes of the public. The rejection of this hypothesis can be explained by the tendency of companies in Indonesia that feel that they have adequately fulfilled their environmental responsibilities through operational compliance without feeling the need to document them in detail in their annual reports or sustainability reports. From the perspective of stakeholder theory, these results indicate that stakeholder pressure on carbon emission disclosure is uniform and indifferentiated based on each company's environmental performance rating, so good environmental performance is not necessarily an incentive for management to increase the transparency of carbon emission information. These findings are in line with research conducted by Pratiwi et al. (2021) and Sekarini & Setiadi (2021), which also found that environmental performance has no effect on CED, and indicates that in Indonesia's basic materials sector, efforts to improve environmental performance have not been fully integrated with companies' carbon emission reporting policies.

The Effect of Company Size on Carbon Emission Disclosure

The test results showed that the size of the company had a positive and significant effect on carbon emission disclosure (CED) with a coefficient value of 0.0040 and a significance level below 0.05, so the third hypothesis was accepted. These findings are in line with the legitimacy theory that large companies face a higher public spotlight and therefore have a greater need to maintain legitimacy through environmental transparency, where high media exposure and reputational risk make CED a crucial strategy in maintaining a positive image of the company. From the perspective of stakeholder theory, the larger the scale of the company, the more interested parties in its activities so that the demand for environmental information including carbon emissions is increasing. Structurally, large companies also have advantages in the form of human resources, reporting systems, and more established governance infrastructure to comprehensively prepare carbon emission disclosures, in contrast to small-scale companies that face such capacity limitations. The results of this study are consistent with the findings of Nastiti & Hardiningsih (2022) and Pratiwi et al. (2021) who also found a positive influence of company size on CED, and affirmed that the scale of a company's operations is the most reliable structural determinant in explaining the variation in carbon emission disclosure in companies in the basic materials sector in Indonesia.

CONCLUSION

Based on the results of the tests conducted, this study concluded that profitability and environmental performance did not have significant effects on carbon emission disclosure among basic materials sector companies in Indonesia. The findings indicate that a company's profitability level did not play a significant role in managerial decisions regarding the disclosure of carbon emission-related information to stakeholders. Furthermore, companies with strong environmental performance, as reflected by higher PROPER ratings, did not necessarily provide more comprehensive and transparent carbon emission disclosures. Conversely, firm size had a positive effect on carbon emission disclosure among basic materials sector companies in Indonesia, indicating that larger companies tended to disclose carbon-related information more extensively and in greater detail compared with smaller companies. Based on these findings, future researchers are encouraged to extend the observation period to obtain results

that better capture long-term trends in carbon emission disclosure practices, particularly in response to the continuous development of government regulations and environmental policies.

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