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PROFITABILITY AND COMPANY SIZE EFFECTS ON CARBON EMISSIONS DISCLOSURE: EXAMINING THE MODERATING ROLE OF ENVIRONMENTAL PERFORMANCE IN INDONESIA'S MINING SECTOR 2021-2025

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ABSTRACT

Introduction*: This research examines the influence of profitability and company size on carbon emission disclosure, as well as analyze the role of environmental performance as a moderation variable in Mining Companies Listed on the IDX 2021-2025.*

Methods: *This study is a quantitative study that uses secondary data from annual reports, sustainability reports, and decree of the Minister of Environment/Head of the Environmental Control Agency. The sample for this study was selected using purposive sampling, resulting in 29 firms being retained for analysis with 145 observations. The data were analyzed using panel data regression.*

Results: *The results showed that profitability had no effect on carbon emission disclosure, while company size had a positive effect on carbon emission disclosure. Environmental performance was not able to moderate the relationship between profitability or company size on carbon emission disclosure.*

Conclusion and suggestion: *Carbon emission disclosure in the mining sector tends to be determined by company scale rather than financial capabilities, while environmental performance is proven to be not optimal in strengthening disclosure decisions.*

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INTRODUCTION

The increase in greenhouse gas concentrations in the atmosphere due to emissions from various human activities has triggered the phenomenon of global warming, which has become an environmental challenge facing the world (‘Aisy & Nahar, 2025; Almuaromah & Wahyono, 2022). According to the IPCC Special Report, this rise in greenhouse gas emissions has rised global temperatures by about 1°C compared to pre-industrial levels and is projected to rise by up to 1.5°C during 2030–2052.

Companies can improve transparency on environmental issues by disclosing information, that reflects their responsibility for the impacts of their operations. Carbon emissions reporting requires companies to disclose information about their greenhouse gas emissions, including emission sources and the measures they have implemented to manage them. This information gives stakeholders insight into the environmental impact of the company’s operations (Choi et al., 2013).The increasingly serious issue of global climate change requires companies to disclose the emissions they generate from their operational activities, especially since this practice has been shown to improve a company’s financial performance (Afrizal et al., 2023) and serves as a form of communication with investors and other external stakeholders (Dharma et al., 2024).

Profitability is a benchmark for company performance where each company has different targets to make a profit (Handayani et al., 2024). Profitability can influence a company’s decisions regarding carbon emissions disclosure by affecting the availability of financial resources for sustainability reporting. This is supported by the fact that voluntary disclosure generally entails significant costs, so companies with high profitability tend to be better able to do so thanks to adequate resources and encouragement from investors and stakeholders (Saraswati et al., 2021), as companies with high profitability demonstrate their ability to fulfill their social and environmental responsibilities (Wahyuningrum et al., 2024).

Company size is also a factor influencing corporate decisions regarding carbon emissions disclosure, where one indicator of a company’s quality can be seen in its willingness to voluntarily report carbon emissions(Rosita et al., 2024). The size of the company can influence management's considerations in making financial decisions to optimize the company's value (Alim et al., 2025). Large companies will disclose the emissions they generate to increase their transparency and maintain their legitimacy (Akhter el al., 2023; Choi et al., 2013; Satria, 2026). Consequently, large companies generally disclose information in greater detail than small companies.

Environmental performance, which is generally reflected in green accounting practices, is considered a crucial factor influencing the disclosure of carbon emissions, while also illustrating a company’s responsibility to preserve the environment around its operational areas (Dewi Fortuna Nur Rohmah & Nazmel Nazir, 2022; Maushufi & Widoretno, 2025). Mining activities have the potential to cause various environmental problems, ranging from changes in land cover, ecosystem damage, to environmental pollution. Based on the results of the Audit Board (BPK) audit of the Ministry of Environment and Forestry (KLHK), there are indications of environmental damage in former mining areas that have not been restored, so the government risks bearing the cost of land restoration covering an area of 432,697.66 hectares. The achievement of a company's environmental performance is determined by the organization's internal commitment to actively implementing environmental management practices, as well as encouragement from outside the company, such as government policies and media reports that encourage environmental awareness (Kusumaningtias & Putri, 2026). Good environmental performance can make companies more confident and motivated to disclose carbon emissions openly, as such disclosure can serve as a means of reinforcing the positive image they have already established.

Previous research has yielded inconsistent findings. In a research examined by (Dharma et al., 2024) it was found that profitability had no effect on carbon emissions disclosure, but environmental performance was found to moderate the relationship between profitability and carbon emissions disclosure contrary to the research examined at (Meiryani et al., 2023), which found that profitability has a positive effect on carbon emissions disclosure. Research

conducted by (Rahmawati et al., 2024) found that environmental performance does not moderate the relationship between profitability and carbon emissions disclosure, a finding that contradicts the research (Dharma et al., 2024). Research conducted by (Abdullah et al., 2020; Afrizal et al., 2023) found that company size has a positive effect on carbon emissions disclosure. This research contradicts research conducted by (Riantono & Sunarto, 2022), which showed that company size was found not to have a positive effect on carbon emissions disclosure.

LITERATURE REVIEW

Legitimacy Theory

Legitimacy theory explains that organizations or companies strive to achieve alignment between the values they uphold and the prevailing social norms and expectations in the community where the organization operates (Dowling & Pfeffer, 1975). From the perspective of legitimacy theory, it is explained that a company's disclosures represent its response to environmental pressures to legitimize the company's existence and behavior (Choi et al., 2013).

Large companies face high demands for legitimacy due to their broader environmental footprint and visibility, which drives them to increase transparency in order to maintain public support (Akhter et al., 2023; Choi et al., 2013; Satria, 2026). Legitimacy theory suggests that companies disclose environmental information to maintain their social legitimacy as a direct response to public demands, including through the disclosure of carbon emissions generated by their operational activities (Xu & Narita, 2025).

Stakeholder Theory

Stakeholder theory asserts that any group or individual capable of influencing or being influenced by the achievement of an organization's objectives is a stakeholder (Freeman, 1984). This theory emphasizes that companies will face demands and pressure from stakeholders to help safeguard and fulfill the rights and interests of all relevant parties(Abdullah et al., 2020).

Companies use sustainability reports, particularly the section on carbon emissions disclosure to communicate the non-financial impacts of their activities and how they manage those impacts, which helps strengthen relationships with investors and other stakeholders (Afrizal et al., 2023; Buallay, 2019; Dharma et al., 2024).

This theory is highly relevant to this research because companies face the challenge of improving climate-related performance while achieving financial goals, consequently, highly profitable companies tend to face greater pressure from stakeholders to disclose comprehensive environmental information (Al-Mari & Mardini, 2024).

Previous Study and Hypothesis

Various previous studies, both those conducted in Indonesia and internationally, served as references for the author in conducting this research. The following are some findings from previous studies related to this research:

A study conducted by (Meiryani et al., 2023) found that profitability has a positive effect on carbon emissions disclosure, as measured by 18 disclosure items from the Carbon Disclosure Project (CDP). Similar results were also found in a study by (Abdullah et al., 2020), which found that profitability has a positive effect on carbon emissions disclosure. Thus, we can formulate the hypothesis that profitability has a positive effect on carbon emissions disclosure in this research. **H1 = Profitability Has a Positive Effect on Carbon Emissions Disclosure**

In studies conducted by (Afrizal et al., 2023; Saraswati et al., 2021), it was noted that company size has a positive impact on carbon emissions disclosure, indicating that the larger a firm is, the more it can influence the carbon emissions disclosure it provides. Thus, preliminary hypothesis in this research is that company size has a positive effect on the level of carbon emissions disclosure. **H2 = Company Size Has a Positive Effect on Carbon Emissions Disclosure**

Research conducted by (Dharma et al., 2024) noted that environmental performance strengthens the relationship between profitability and carbon emissions disclosure, and research by (Efendy et al., 2023) found that

environmental performance is assessed to strengthen the relationship between profitability and carbon emissions disclosure. Therefore, the preliminary hypothesis in this research is that environmental performance reinforces the relationship between profitability and carbon emissions disclosure. **H3 = Environmental Performance Strengthens the Relationship Between Profitability and Carbon Emissions Disclosure**

A research by (Efendy et al., 2023) found that environmental performance strengthens the relationship between company size and carbon emissions disclosure. Similar findings were reported in (Sinaga, 2026), which found that environmental performance moderates the relationship between company size and carbon emissions disclosure. Therefore, the preliminary hypothesis in this research is that environmental performance strengthens the relationship between company size and carbon emissions disclosure. **H4 = Environmental Performance Strengthens the Relationship Between Company Size and Carbon Emissions Disclosure**

RESEARCH METHODS

This research employs a quantitative research approach. Quantitative research methods are used to examine and investigate a research sample using research instruments designed to test established research hypotheses (Sugiyono, 2019). This study utilizes secondary data that obtained from the financial statements, sustainability reports of mining firms listed on the Indonesia Stock Exchange (IDX), and decrees issued by the Minister of Environment and Forestry and the Head of the Environmental Management Agency.

The initial population comprised 45 mining firms listed on the Indonesia Stock Exchange (IDX) during 2021–2025. The sample selection in this study will use a purposive sampling technique based on the following criteria:

1. Consistent Mining Companies Listed on the Indonesia Stock Exchange for the period 2021-2025.
2. Mining Companies that consistently upload annual financial reports for 2021-2025 period.
3. Mining Companies that consistently upload sustainability reports for 2021-2025 period

Following the application of purposive sampling criteria, 29 firms were retained for analysis, yielding 145 firm-year observations. This research employed data analysis methods including descriptive statistics, classical assumption tests, panel data regression analysis, hypothesis testing, and Moderated Regression Analysis (MRA).

Table 1
Research Variables and Operational Definitions

Variable	Measurement	Scale
Carbon Emissions Disclosure	Measurement instrument proposed by Bae et al. (2013) = Total Disclosed Indicators / 18 Specified Indicators	Ratio
Profitability	Return on Assets = Net Income / Total Assets	Ratio
Company Size	Natural logarithm of total assets	Ratio
Environmental Performance	PROPER Rating	Ratio

RESULT AND ANALYSIS

Descriptive statistical analysis (table 2) is necessary to obtain a general overview of the data through the mean, maximum, minimum, and standard deviation values for each variable in this study, namely profitability, company size, carbon emissions disclosure, and environmental performance.

Table 2
Results of the Descriptive Statistical Analysis

	CED	ROA	SIZE	PROPER
Mean	0.649766	0.092441	30.51789	2.496552
Median	0.667000	0.058000	30.78100	3.000000
Maximum	1.000000	0.616000	36.70000	5.000000

Minimum	0.111000	-0.246000	25.78100	0.000000
Std. Dev.	0.223991	0.135900	1.920188	1.795535
Observations	145	145	145	145

Source: Processed Data (2026)

The descriptive statistical results provide an overview of the distribution of the four variables examined in this study. The findings are presented as follows:

1. Carbon Emission Disclosure. The dependent variable recorded values between 0,111 and 1,000. Its average was 0,64977, with a standard deviation of 0,223991.
2. Profitability. The profitability measure varied from -0,246 to 0,616, producing a mean of 0,09244 and a standard deviation of 0,135900.
3. Company Size. The observed values for company size extended from 25,78 to 36,700. The mean was 30,51789, while the standard deviation reached 1,920188.
4. Environmental Performance. This variable had scores ranging from 0 to 5. The average score was 2,49655, with a standard deviation of 1,795535.

In panel data regression, there are three model approaches common effects, fixed effects, and random effects (Rahmad et al., 2021). To determine the most appropriate model approach, the Hausman test, Chow test, and Lagrange Multiplier test must be conducted.

Table 3
Results of the Model Selection Tests

Name of the test	Probability Result	Interpretation
Chow Test	Probability 0.0001	The fixed-effects model considered to be more consistent and efficient for use in this study.
Hausman Test	Probability 0.0016	The fixed-effects model considered to be more consistent and efficient for use in this study

Source: Processed Data (2026)

In this research, Lagrange Multiplier test was not conducted because Chow test and Hausman test indicated that the use of the Fixed-Effects Model is more suitable for this study. Therefore, Lagrange Multiplier test was not conducted. The model selection test revealed that the fixed effects model is more effective and suitable for this study. If fixed effects model was choosen, the classical assumption tests conducted were the normality test, the multicollinearity test, the heteroscedasticity test, and the autocorrelation test, which was then followed by simultaneous tests, determination coefficient tests and Moderated Regression Analysis as well as hypothesis tests

Table 4
Results of of Normality Test

Jarque-Bera	1.156410
Probability	0.560904

Source: Processed Data (2026)

The normality test in this study sample uses the Jarque-Bera test. The data is said to have a normal distribution if it produces a probability value (Sig) >0.05. Based on the results of the normality test in table 4, it shows a Jarque-Bera probability value of 0.560904 which is above the threshold of 0.05. This indicates that the data of the research sample is distributed normally.

Table 5
Results of Multicollinearity Test

Variable	Centered VIF	Interpretation
ROA	2.773819	no signs of multicollinearity
SIZE	1.251912	no signs of multicollinearity
ROAxPROPER	2.365203	no signs of multicollinearity
SIZExPROPER	1.060551	no signs of multicollinearity

Source: Processed Data (2026)

The results of the multicollinearity test in Table 5, Variance Inflation Factor (VIF) values were found to be 2,773819 for profitability, 1,251912 for company size, the interaction variable between profitability and environmental performance was 2.365203, and the interaction variable between company size and environmental performance was 1.060551, indicating that the overall VIF is <10. Overall, the VIF values <10 from the multicollinearity test results indicate that no multicollinearity was found among the variables in this study (Ghozali, 2018).

Table 6
Results of Heteroscedasticity Test

Variable	Centered VIF	Interpretation
ROA	0.8605	no signs of heteroscedasticity
SIZE	0.2307	no signs of heteroscedasticity
ROAxPROPER	0.8578	no signs of heteroscedasticity
SIZExPROPER	0.2705	no signs of heteroscedasticity

Source: Processed Data (2026)

The results of the heteroscedasticity test above, the significance values were found to be 0.8605 for the Profitability variable, 0.2307 for the Company Size variable, 0.3157 for the Environmental Performance variable, the interaction between Profitability and Environmental Performance was 0.8578, and the interaction term linking Company Size and Environmental Performance was 0,2705. Overall, the probability values (sig.) in the heteroscedasticity test results were ≥ 0.05, therefore, it can be concluded that no evidence of heteroscedasticity was found in this study (Ghozali, 2018).

Table 7
Results of Autocorrelation Test

Durbin-Watson stat	1.804277

Source: Processed Data (2026)

According to the results of the autocorrelation test in table 7, the Durbin-Watson value was obtained as 1.804277, while the upper limit value (dU) based on the Durbin-Watson table was 1.771 with the result of the 4-dU calculation of 2.229. So that the Durbin-Watson value exceeded the upper limit (dU) but did not exceed the results of the 4-dU calculation. This shows that the Durbin-Watson test criteria have been met and no autocorrelation was found either positive or negative in this research model.

Table 8
Simultaneous Significant Test (F-Test)

F-statistic	19.23725
Prob(F-statistic)	0.000000

Source: Processed Data (2026)

Based on Table 8, it was found that the Simultaneous Significant Test probability value was 0.00 < 0.05 and the F calculated was 19.23725 > the F value of the table was 2.44. It can be stated that the independent variable and the moderation variable stimulantally affect the dependent variable.

Table 9
Results of Determination Coefficient Test

R-squared	0.851172
Adjusted R-squared	0.806926

Source: Processed Data (2026)

In table 9, it was found that the coefficient value of 0.807 showed that the independent variables in this study were able to explain most of the variation that occurred in the dependent variables with a percentage of 80.7%, while the remaining 19.3% were controlled by elements not covered in this study.

Table 10
Moderated Regression Analysis Test and Hypothesis Testing

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Interpretation
ROA	-0.574282	0.353863	-1.622894	0.1074	"H_1 Rejected"
SIZE	0.070146	0.030827	2.275496	0.0248	"H_2 Accepted"
ROAxPROPER	0.058878	0.097372	0.604672	0.5466	"H_3 Rejected"
SIZExPROPER	0.001314	0.008246	0.159317	0.8737	"H_4 Rejected"

Source: Processed Data (2026)

Profitability yielded t-statistic of -1.622894 with p-value of 0.1074 > 0.05. therefore, profitability does not influence the disclosure of carbon emissions. Disclosing carbon emissions requires additional costs, which may lead companies to prioritize achieving environmental performance over environmental information transparency. The findings of this study are inconsistent with stakeholder theory, which posits that companies must meet the information needs of their stakeholders as part of their responsibility for their business activities. This is reinforced by the fact that carbon emissions disclosure remains voluntary, which may result in companies with high profitability levels having no incentive to expand their disclosures (Efendy et al., 2023; Fransisca et al., 2024). Thus, H1 is rejected. The results of this study are consistent with the research (Dharma et al., 2024), which showed that profitability, as measured by ROA, does not affect carbon emissions disclosure.

Company size has a calculated t-value of 2.275496 > the table t-value of 1.97693, with a probability value of 0.0248 < 0.05 thus, company size has a positive effect on carbon emissions disclosure. The acceptance of H2 indicates that larger firms are better able to respond to environmental issues because they are supported by more adequate resources. These resources enable firms to respond optimally to the public's growing concern regarding environmental issues (Bowen, 2000). The findings of this study are consistent with legitimacy theory, which explains that companies strive to gain and maintain public acceptance through the disclosure of information regarding environmental responsibility (Abbas et al., 2023). Large companies tend to face greater pressure regarding environmental issues because their activities are more likely to attract public attention, which in turn encourages them to demonstrate concern and improve their response to environmental issues through management and broader information disclosure (Choi et al., 2013). The results of this study are consistent with the research by (Abdullah et al., 2020; Afrizal et al., 2023), which found that company size has a positive effect on carbon emissions disclosure. This means that the larger a firm is, the higher its level of carbon emissions disclosure.

The interaction term between environmental performance and profitability yielded a t-statistic of 0.604672 and a p-value of 0.5466 > 0.05; thus, no significant moderation by environmental performance was identified in the association between profitability and carbon emissions disclosure, so that H3 is rejected. This implies that a company's environmental performance does not influence its ability to generate profits in relation to the level of its carbon emissions disclosure. Good environmental performance does not necessarily lead to a company's transparency in disclosing information regarding its environmental policies and responsibilities (Dharma et al., 2024). The findings of this study are consistent with those of (Rahmawati et al., 2024; Wahyuningrum et al., 2024), which found that environmental performance does not moderate the relationship between profitability and carbon emissions disclosure.

The results of this study on environmental performance, indicate that good environmental performance is not always accompanied by increased carbon emissions disclosure.

The results indicate that environmental performance does not strengthen or weaken the relationship between company size and carbon emission disclosure. The moderation analysis provides insufficient evidence that environmental performance changes the effect of firm size on carbon emissions disclosure in the Indonesian mining sector during 2021–2025. Therefore, it can be concluded that H4 is rejected Environmental performance does not influence carbon emissions disclosure because achieving a high PROPER rating does not always encourage companies to disclose carbon emissions openly and specifically, as carbon emissions disclosure remains voluntary (Desai, 2022; Putri Halimah & Yanto, 2018).

CONCLUSION-Heading 1 (Times New Roman 10, Bold, Align Left, UPERCASE)

Based on the empirical findings obtained, this study draws conclusions regarding the influence of profitability and company size on carbon emissions disclosure, with environmental performance as a moderating variable, it is concluded that profitability has no effect on carbon emissions disclosure but positive effect on carbon emissions disclosure was found for company size. No moderating effect was found for environmental performance in the relationships of profitability and company size with carbon emissions disclosure.

This research aims to expand existing knowledge. To that end, the author offers several suggestions for future research and for stakeholders to consider. Future research is expected to broaden the scope of the study by taking various relevant aspects of the research subjects with a longer observation period. Future research could also employ alternative approaches, such as qualitative methods, to yield a broader understanding of how financial performance influences sustainability. Companies are encouraged to increase their attention to and awareness of sustainability issues, particularly regarding the disclosure of carbon emissions. The Ministry of Environment and Forestry of the Republic of Indonesia (KLHK) is expected to strengthen environmental performance evaluation policies and mechanisms so that assessments such as PROPER not only encourage company compliance with environmental regulations, but also encourage increased transparency in the disclosure of environmental information.

Author Contributions

Responsible for the research design, data collection, data processing, data analysis and drafting the manuscript under the supervision of the second author.

Declaration of the Use of Artificial Intelligence (AI)

During the drafting of the manuscript, the author used Artificial Intelligence to help improve grammar and sentence structure. The author has reviewed the entire contents of the manuscript and takes full responsibility for the accuracy and authenticity of its contents.

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Conflicts of Interest:

The author declares that there are no conflicts of interest in this research.

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