

The Effect of Carbon Emission Disclosure on Firm Values with Environmental Performance and Media Exposure as a Moderating Variable

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ABSTRACT

This study aims to examine the effect of carbon emission disclosure on firm value, and to determine whether environmental performance and media exposure moderates these relationships. Using a quantitative approach with secondary data from annual reports and sustainability reports, this research employs Moderated Regression Analysis test the hypotheses. The sample consist of 20 companies from carbon-intensive sectors (energy, industry and transportation). Firm value is measured using Tobin's Q, carbon emission disclosure by a dummy variable, environmental performance by ISO 14001 certification, and media exposure by dummy coding of media coverage. Result finding that carbon emission disclosure has a significant positive effect on firm value, but media exposure does not significantly moderate the relationship between carbon disclosure and firm value. This study supports signaling theory and legitimacy theory confirming carbon disclosure serves as a positive signal to investors and enhances corporate legitimacy. It also extends the understanding of stakeholder influences in emerging markets like Indonesia. Interestingly, while environmental performance strengthens this relationship, media exposure does not, suggesting in the Indonesian context, formal certification is more credible than media narratives.

Keywords: Carbon Emission Disclosure, Environmental Performance, Firm Value, ISO 14001, Media Exposure, Sustainability Reporting, Tobin's Q.



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Introduction

Since the 1990s, greenhouse gas emissions have increased significantly. This increase prompted the United Nations to establish the Intergovernmental Panel on Climate Change (IPCC) and publish the Kyoto Protocol at an international conference as an instrument to stabilize greenhouse gas (GHG) concentrations, which has been ratified by at least 55 member states. Indonesia is among the top ten countries contributing 0.61 GT of carbon emissions, equivalent to 2% of total global emissions (ucsusa.org). The Investment Coordinating Board (ICB), or Ministry of Investment, noted that Indonesia ranks 8th in the world for carbon emissions.

The Indonesian government responded to this fact and demonstrated its commitment to reducing carbon emissions by becoming part of the Climate Change Conference of the Parties

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(COP 26) held in Glasgow, which aims to achieve Net Zero Emissions by 2050. Indonesia, as one of the countries that signed the Kyoto Protocol, has ratified the Kyoto Protocol through Law No. 17 of 2004 in order to implement sustainable development and participate in efforts to reduce global GHG emissions (Apriliana, 2019)

In support of COP26, President Joko Widodo ratified Presidential Regulation No. 98 of 2021 concerning Carbon Pricing. This regulation aligns with the instruction of Indonesian Finance Minister Sri Mulyani, who requested the Indonesia Stock Exchange (IDX) to play an active role as a credible carbon trading platform. Publicly held companies must also play an active role in reducing their emissions. This disclosure will demonstrate that companies are taking serious action to reduce emissions and provide information to demonstrate transparency to stakeholders.

Companies known for causing environmental damage can reduce investor interest and even cause investors to cancel investments in the company. This will impact company performance and decline stock prices, which will ultimately reduce the company's value. Companies must continue to improve environmental management efforts as polluters are detrimental to the environment. In addition to disclosing carbon emissions containing carbon emission reduction efforts, environmental performance can also impact company value because environmentally friendly companies will minimize the risk of fines and penalties for investors (Li et al., 2020). Corporate value is investors' perception of a company's success in managing its operations, which is linked to its profitability. High corporate value can be derived from a high share price. Companies with high corporate value will influence market response because investors perceive a high corporate value as a guarantee of good prospects (Hardiyansah et al., 2021). Company value can also be defined as the price a potential buyer would be willing to pay if the company were sold. It assesses the company's current performance and its future prospects (Ng et al., 2022).

Environmental performance disclosure is considered as important as financial disclosure to maintain relationships between companies and investors and stakeholders. Carbon emissions disclosure is not yet fully integrated with financial reporting standards, which poses a risk that companies may hesitate to disclose any additional information about carbon emissions, unless required due to uncertain shareholder risk. Furthermore, this may compromise privacy security compared to their competitors (Liu et al., 2023) Furthermore, disclosure of emissions data may contain additional implied costs, so disclosure should also consider costs and benefits (Desai, 2022).

Indonesian companies rarely disclose their environmental performance, particularly carbon emissions. Therefore, research on the role of corporations in carbon emissions disclosure in Indonesia is scarce. Furthermore, previous research has found inconsistencies in the findings on the relationship between corporate governance and carbon emissions disclosure. Therefore, in this study, carbon emissions disclosure is an interesting topic to study because corporate operations are inseparable from environmental issues, especially for companies with significant environmental impacts, such as the oil, gas, and coal industries. The role of the media is crucial with the rapid proliferation of communication tools and the internet. Media coverage can influence public attitudes toward a company, which in turn can influence stakeholders. The media plays a significant role in a company's public image, as it allows the

public to more easily see how the company is acting responsibly. Media exposure is a crucial tool for companies to attract investors to invest their capital (Probosari et al., 2019).

Research Gap and Contribution

Despite the growing body of literature on carbon emission disclosure in Indonesia, several critical gaps remain. First, a contextual gap exists as most research has been conducted in developed markets, with limited understanding of how institutional factors in emerging economies like Indonesia shape the disclosure-value relationship (Munir et al., 2025). Recent southeast Asian evidence reveals a disclosure value gap where environmental reporting remains heterogeneous and less valued by investors compared to developed markets. Second, a methodological gap persists as previous study often rely on simplistic dummy variable measurement for carbon disclosure, environmental performance and media exposure. Third, Inconsistent findings regarding media's role warrant further investigation while some studies suggest media exposure does not moderate the disclosure value relationship (Aruan et al., 2024; Bahriansyah et al., 2022), others indicate it may influence investor perceptions through different mechanism.

This study contributes to the literature in three ways. Empirically, it provides evidence from Indonesia's Carbon intensive sectors by testing a moderated model that distinguishes between an internal credibility signal (ISO 14001 certification as environmental performance proxy) and an external visibility signal (media exposure). Theoretically, by revealing that environmental performance significantly strengthens the disclosure value relationship while media exposure does not, the study refines signalling theory application in emerging markets suggesting that certain signals requiring substantial verification (ISO 14001) carry greater weight with Indonesian investors than signal from media exposure (Nasih et al., 2024). Methodologically, this research advocates moving beyond dummy variable measurement toward more nuanced approaches that capture disclosure quality and media exposure frequency, responding to calls for stronger ESG reporting frameworks in the region (Munir et al., 2025)

Theoretical Framework and Hypothesis

Carbon emissions affect company value

Investors are attracted to investing through environmental and social disclosures presented in annual reports. Investors will be better able to understand a company's obligations to environmental management and prevent future lawsuits related to environmental pollution if the company discloses its environmental information according to its annual report (Zuhrufiyah & Anggraeni, 2019). Based on signal theory, carbon emission disclosure is information that can be disclosed and can be good news for investors, namely that the investment risk in the company is low, so that it will result in a relatively low cost of company equity (Bahriansyah & Ginting, 2022). These results of this study are accordance with research (Tjahjadi & Permana, 2020) which shows that disclosure of greenhouse gas emissions has a positive and significant effect on company value. However, according to (Sari, 2022) carbon emission disclosure does not significantly impact company value. Various parties seeking

assurance regarding a company's social responsibility will increase trust in the company, thereby enhancing its value in the eyes of stakeholders.

Environmental performance moderates the influence of carbon emissions on firm value

Not only consumers, environmental performance is an environmental management practice that can help companies to obtain value from shareholders and reduce environmental impacts (Husnaini & Tjahjadi, 2021) stated that reducing carbon emissions and increasing environmental disclosure have a positive effect on a company's stock market price. Companies with superior environmental performance consistently make environmental disclosures. This contrasts with research conducted by (Tjahjadi & Permana, 2020) Investors prefer companies with greener production processes. However, overall environmental disclosures are not yet a reliable signal for companies due to low corporate awareness of environmental reporting.

Media exposure moderates the influence of carbon emissions on firm value

Media is a tool that plays an important role in a company, because it is a tool for companies to provide financial or non-financial information. (Sari, 2022) Based on According to signaling theory (Spence, 1973) media exposure is perceived by investors as a positive signal from the company. Furthermore, media exposure can increase public awareness of the company's brand. Thus, a company's communication through media can influence investor perceptions. According to Rosyid & Immawati (2022) revealed that media exposure has a positive effect on firm value. This is because media coverage containing positive news will influence firm value (Sari, 2022). However, this contradicts (Kurniansyah et al., 2021) media exposure and environmental disclosure do not serve as signals for investors to make investment decisions.

Research Methods

Samples and sampling techniques

This study employs a quantitative research design utilizing secondary data from annual and sustainability reports of carbon-intensive firms listed on the Indonesia Stock Exchange from 2017-2019, The sample was selected using purposive sampling, targeting firms in high-emission sectors such as energy, industry and transportation with final criteria requiring continuous listing, complete financial reporting at least one sustainability report yielding 20 companies (60 firm year observations). Firm value was measured by Tobin's Q, carbon disclosure and moderator variable environmental performance via ISO 14001 and media exposure were dummy coded and hypotheses were tested using Moderate Regression Analysis (MRA) alongside classical assumptions checks, ensuring methodological rigor while focusing on contextually relevant, data-available firms within Indonesia's emerging market settings.

Population and Sample

The population is the annual reports and sustainability reports of all companies listed on the capital market from 2017 to 2019. The sample in this study is companies whose business processes produce carbon emissions, namely companies in the agriculture, forestry, energy, and transportation sectors. After applying criteria, the final sample consisted of 20 companies,

observed over three years, resulting in 60 firm – year observations, thereby ensuring that the selected firms were not only relevant to the research objectives but also provided sufficient and consistent data for analysing the relationship between carbon disclosure and firm value within Indonesia’s emerging market context.

Measurement of Variables

Tobin’s Q is an indicator for measuring company performance, particularly company value, which shows a management pro forma in managing company assets. The Tobin’s Q value describes the condition of a company's investment (Leyva-de la Hiz et al., 2022) and better reflects the market’s judgment about a firm’s future, which is particularly important when dealing with firm value. Company value is measured by comparing a company's current market value with the amount required to replace all its assets (Bahriansyah et al., 2022).

$$Tobin's\ Q = \frac{MVE + PS + Debt}{Total\ Asset}$$

Where MVE is the market value equity can be estimated by using closing stock price multiplied by number of shares outstanding, PS is Preferred Stock are the liquidating value of the company’s preferred stock, if the company has no preferred stock, this component can be omitted. Debt is the value of the company’s debt and Total Asset are the book value of the company’s total assets. Disclosure of carbon emissions is measured using a dummy variable, namely by giving a value of 1 to companies that disclose information regarding carbon emissions and a value of 0 to companies that do not disclose information regarding carbon emissions in their reports (Angelina & Handoko, 2023). Environmental performance is measured based on ISO 14001 certification and assessed using a dummy variable. In this study, companies that obtain ISO 14001 certification are given a score of 1, and those that do not receive a score of 0. Media exposure is measured using a dummy variable, with a score of 1 for companies that disclose more information related to carbon emissions through their websites, and a score of 0 otherwise (Rosyd & Immawati, 2022).

Data Analysis Techniques

The analysis will follow the Moderated Regression Analysis (MRA) procedure. Moderated analysis is used to estimate the value of variable Y based on the value of variable X multiplied by variable Z, as well as the estimated change in variable Y for each unit change in variable X multiplied by variable Z. Moderated regression analysis is expressed in the form of multiple regression with a regression-like equation that describes the non-linear influence expressed in the form of the following equation:

$$Y = \alpha + \beta CED + \beta EP + \beta ME + \beta CED * EP + \beta CED * ME + \varepsilon$$

<i>Y</i>	= Company (Firm) Value
α	= Constant
β	= Coefficient of variable
<i>CED</i>	= Carbon Emission Disclosure (X1)
<i>EP</i>	= Environmental Performance (Z1)
<i>ME</i>	= Media Exposure (Z2)
<i>CED*EP</i>	= Interaction between Carbon Disclosure and Environmental Performance

$CED * ME$ = Interaction between Carbon Emission Disclosure and Media Exposure
 ε = Error

Results and Discussion

Result

The initial sample was obtained from a total of 192 companies from all sectors that cause carbon emissions (Table 1), but after selection based on the established criteria, the final sample was 20 companies.

Table 1.
Establish Sample Criteria

Criteria	Amount
Companies in the agriculture, forestry, energy, industry and transportation sectors listed on the IDX 2017-2019	192
Companies that do not have complete financial data consecutively for the period 2017-2019	75
Companies that do not report sustainability reports for at least 1 year in the 2017-2019 period	97
Number of samples	20
Number of x sample years	20 x 3
Total sample	60

Descriptive statistical analysis was conducted to gain a general overview of the research data in the form of mean values, standard deviations, as well as minimum and maximum values. Below are the results of the descriptive statistical tests (Table 2).

Table 2.
Results of Descriptive Analysis

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Firm Value (Y)	60	0.1742	2.2019	1.0192	0.3989
Carbon Emission Disclosure (X1)	60	0.0000	1.0000	0.8500	0.3601
Environmental Performance (Z1)	60	0.0000	1.0000	0.8500	0.3601
Media Exposure (Z2)	60	0.0000	1.0000	0.4167	0.4971

Descriptive statistics in this study were employed to summarize and describe the main features of the collected data for the variables of interest. For instance, firm value had a mean of 1.0192, ranging from 0.1742 to 2.2019 with a standard deviation of 0.39889, while carbon disclosure and environmental performance both showed a mean of 0.85 with no variability in their dummy-coded values for the sample and media exposure averaged 0.4167 with higher dispersion (standard deviation of 0.4971). This quantitative snapshot not only confirmed that the data were reasonably distributed without extreme outliers but also established a foundational overview that supported subsequent regression analyses and hypothesis testing by clarifying the sample's characteristics and variability.

Based on the simple linear regression results, the model has a positive constant value of 0.706. Then the carbon emission disclosure variable has a coefficient of $\beta_1 = 0.364$ indicates that if there is an increase in the carbon emission disclosure variable, it will increase the value

of the Company value variable by 0.364 (Table 3). This supports the hypothesis that companies disclosing carbon emissions have higher firm values compared to non-disclosing companies. This finding accordance with both national and international evidence that disclosure is a credible signal. Concluding that sustainability communication strategies receive positive responses from the market (Liu, et.al, 2025).

Table 3.
Analysis Test Result

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.706	0.080		8.848	.000
	Carbon Emission Disclosure	0.364	0.092	0.460	3.948	.000

a. Dependent Variable: Company Value

As derived from the moderated regression model, with a positive constant value of 0.478, the results indicate that carbon emission has a significant positive effect on firm value, with a coefficient of 0.276 and a significance level of 0.026 ($p < 0.05$), in Table 4. In contrast, media exposure does not significantly affect firm value, with a coefficient of 0.105 and a significance level of 0.450 ($p > 0.05$). Furthermore, the interaction term between carbon disclosure and environmental performance shows a significant moderating effect, with a coefficient of 0.236 ($p = 0.012$), suggesting that environmental performance strengthens the positive relationship between carbon disclosure and firm value. Conversely, the interaction between carbon disclosure and media exposure is not significant, with a coefficient of -0.271 and significance level of 0.100 ($p > 0.05$), indicating that media exposure does not moderate this relationship. Thus, while environmental performance enhances the impact of carbon disclosure on firm value, media exposure does not play a significant moderating role in the context of this study.

Table 4.
Results of the Moderated Regression Analysis Test

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.478	.105		4.554	.000
	Carbon Emission Disclosure (X1)	.276	.121	.349	2.286	.026
	Environmental Performance (Z1)	.217	.095	.261	2.274	.027
	Media Exposure (Z2)	.105	.138	.152	0.762	.450
	Environmental Performance Moderation	.236	.091	.320	2.585	.012
	Moderation of Media Exposure	-.271	.162	-.362	-1.674	.100

a. Dependent Variable: Company Value

The value enhancing effect of carbon disclosure is conditional upon the presence of credible, verified environmental management systems, but is not significantly influenced by media exposure. This suggest that in Indonesia's carbon intensive sectors, substance through certification matters more than media exposure in shaping investor perception.

The coefficient of determination (R^2) measures the extent to which the model can explain variation in the dependent variable. Based on the analysis presented in Table 5, the adjusted R^2 is 0.40, indicating that 40% of the variance in firm value is explained by the independent variable carbon emission disclosure and the moderating variables environmental performance and media exposures. The remaining 60% of the variance is attributable to other factors not included in the model.

Table 5.
R Square Test Results

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.672 ^a	0.452	0.401	0.267

a. Predictors: (Constant), Media Exposure Moderation, Environmental Performance, Environmental Performance Moderation, Carbon Emission Disclosure, Media Exposure

The statistical results obtained a calculated F value of 8.910 with a significance of 0.000 (Table 6). This significance value is less than 0.050, so it can be concluded that all the independent variables in the model simultaneously have an influence on firm value. The variables in this study, have a statistically significant impact on company value. This means the model is valid and useful for understanding what drives firm value in these companies.

Table 6.
F Test Results

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.179	5	0.636	8.910	0.000 ^b
	Residual	3.853	54	0.071		
	Total	7.032	59			

a. Dependent Variable: Company Value

b. Predictors: (Constant), Moderation_Media Exposure, Environmental Performance, Moderation_Environmental Performance, Carbon Emission Disclosure, Media Exposure

Discussion

This study provides empirical evidence that carbon emission disclosure significantly enhances firm value among Indonesia carbon intensive companies. The regression results confirm a positive and significant relationship between disclosure and Tobin's Q, where $\beta = 0.276$; $p < 0.5$ (Table 4). This finding corroborates previous research by (Kurniansyah et al., 2021; Delizar & Lidiyawati, 2025; and Hardiyansah et al., 2021) who also found that carbon transparency in emerging markets acts as a strategic signal of corporate responsibility. However, while Hardiyansah et al. (2021) found a slightly stronger coefficient in a broader sample, the present study's results suggest that in the specific context of Indonesian energy and

transportation firms, the market premium for disclosure, while significant, may be more conservative. This reinforces the notion that carbon disclosure serves to reduce information asymmetry, enhance investor confidence, and clarify climate-related risks, thereby supporting long-term stakeholder trust and corporate legitimacy (Maharani, 2024).

Furthermore, the results demonstrate that the relationship between carbon disclosure and firm value is conditional upon the presence of credible environmental management systems. The interaction term between Carbon Emission Disclosure and Environmental Performance proxy by ISO 14001 was positive and significant $\beta = 0.236; p = 0.012$. This indicates that environmental performance acts as a strengthening moderator. The positive effect of disclosure on firm value is significantly amplified for companies that hold ISO 1400 certification. This finding aligns with (Hardiyansah et al., 2021), who argued that certification validates a firm's commitment to systematic management. It also extends the work of (Ouassou et al., 2024) by quantifying the moderating effect: certified firms gain an additional valuation premium beyond the base effect of disclosure alone, likely because certification reduces received environmental risk and enhances corporate credibility among investors who view third-party verification as more reliable than voluntary statements.

Conversely, the results reveal that media exposure does not significantly moderate the disclosure value nexus. The interaction term for Media Exposure was not significant $\beta = -0.271; p = 0.100$ indicating the media coverage neither strengthens nor weakens the impact of carbon disclosure on firm value. This finding aligns with (Hidayat et al., 2025), suggesting that media coverage exerts limited influence on investor perceptions in Indonesia's market. Investor appear to prioritize formal reporting channels-such as annual and sustainability reports over media or web base disclosures when evaluating environmental accountability (Bryantseva & Dubanov, 2011) Thus, while carbon transparency and environmental certification drive firm value, media visibility does not function as a meaningful moderating variable in this context. This finding contradicts studies that suggest media acts as a simple positive signal (Sari, 2022) but aligns with Hidayat et al (2025), who found that media coverage exerts limited influence on investor perceptions in the Indonesian market. An explanation for this insignificant result lies in the nature of the signal itself. Unlike ISO 14001 certification, which requires regular audits and continuous compliance, media exposure in Indonesia may be perceived by investor as "noise" rather than substantive information. Investors in this context appear to prioritize formal, audited reporting channels such as annual and sustainability reports over unverified media or web-based disclosure when evaluating environmental accountability, Therefore, while carbon transparency and environmental certification drive firm value, media visibility does not function a meaningful moderating variable in this specific context.

Practical and Theoretical Implications

For companies, disclose carbon data clearly, obtaining ISO 14001 certification can strengthen a company's environmental credibility and enhance firm value. It signals a commitment to sustainable environmental management and attracts investors. For investors and financial analysts, investors in Indonesia may not be heavily influenced by media coverage

regarding carbon issues. Instead, they should scrutinize sustainability reports and annual disclosures for genuine environmental performance

The study provides empirical support for signalling theory, showing that carbon emission disclosure acts as a positive signal to investors, companies that disclose carbon emissions are perceived as more transparent and environmentally, which enhances their firm value (Tobin's Q) The reinforces the idea that voluntary environmental disclosures can reduce information asymmetry and influence investor perceptions. The findings support legitimacy theory, as companies engage in carbon disclosure to align with societal and regulatory impact expectations. This helps maintain their social license to operate and enhances corporate legitimacy. Environmental performance (ISO 14001 Certification) further strengthens legitimacy, showing that certified firms are viewed more favourably by stakeholders.

Limitations and Future Research

While the study provides valuable insights, several limitations warrant consideration:

- Expand sample and period, future studies include more companies and a longer time period to improve generalizability
- Use different metrics instead of dummy variables for carbon disclosure, future research could use Carbon Disclosure Project scored or GRI - based indices for more nuanced measurement
- Explore other moderators, variables such as corporate governance quality, industry type or geographic location could be tested as additional moderators

Conclusion, Implications, Suggestions, and Limitations

This study empirically demonstrates that carbon emission disclosure significantly increases the value of carbon intensive firms in Indonesia. The findings suggest that transparent environmental reporting functions as a credible positive signal for investors, thereby supporting the principles of signalling theory while simultaneously strengthening the company's corporate which aligns with signalling theory and reinforces corporate legitimacy. The study further reveals that environmental performance, measured by ISO 14001 certification, strengthens this positive relationship, demonstrating that certified companies are perceived as more committed to sustainability, thereby amplifying investor confidence and market valuation. Interestingly, media exposure does not moderate this relationship, suggesting that in Indonesia's market context, investors prioritize formal corporate disclosures over media narratives when assessing environmental responsibility. These findings carry important cross-sector implications for corporations, they underscore the strategic value of obtaining environmental certifications and improving disclosure quality. For researchers, they invite further exploration into how institutional, cultural and regulatory factors shape the disclosure-values nexus across different emerging economies. Ultimately, this research contributes to the broader discourse on sustainable finance by illustrating how voluntary environmental transparency can drive tangible market rewards while advocating for more integrated and regulated approaches to carbon accountability in rapidly industrializing regions.

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