



The Impact of Corporate Governance on Carbon Emission Disclosure: A Study of Listed Companies on the Indonesia Stock Exchange

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ABSTRACT

This study aims to examine the influence of corporate governance mechanisms on carbon emission disclosure among companies listed on the Indonesia Stock Exchange (IDX) from 2020 to 2023. The independent variables include board independence, gender diversity, the presence of a CSR department, and managerial ownership, while the dependent variable is carbon emission disclosure. Using multiple linear regression and the Newey-West method to address autocorrelation issues, the findings indicate that board independence, the presence of a CSR department, firm size, ROA, and leverage have a positive and significant effect on carbon emission disclosure. However, managerial ownership does not show a significant effect. This research contributes to the literature on corporate governance and environmental disclosure and provides insights for companies and regulators to enhance the transparency of carbon-related information.

INTRODUCTION

Climate change has emerged as one of the most pressing global challenges, with companies worldwide facing increasing pressure to be transparent in reporting their carbon emissions. Carbon emission transparency is essential for stakeholders—such as investors, governments, and the general public—to understand the environmental risks companies face and the mitigation measures taken to reduce their carbon footprint (Kwabi, Fulgence, & Adamolekun, 2024; Mehedi, Akhtaruzzaman, & Zaman, 2024; Barroso et al., 2024). In this context, carbon emission information becomes critically important as it can influence a company's reputation, sustainability strategies, and competitive advantage in global markets (Rattan & Patel, 2023; Yustina et al., 2024).

However, there is criticism that the carbon emission information disclosed by companies is often inadequate or even misleading (Kolk et al., 2021; Rattan & Patel, 2023). Some companies may only provide limited disclosures to demonstrate regulatory compliance without offering a complete picture of their true environmental impact (Yustina et al., 2024). As such, robust corporate governance is expected to improve this situation by enhancing managerial accountability to stakeholders, thereby encouraging companies to be more transparent in disclosing carbon emission information (Luo et al., 2023; Mehedi et al., 2024).

Previous research has shown that corporate governance mechanisms such as board independence, gender diversity on the board, environmental committees, and managerial ownership can influence the disclosure of carbon emission information. For instance, Liao et al. (2023) found that companies with greater female representation on their boards tend to have higher levels of carbon emission disclosure. This is associated with the idea that gender diversity brings different perspectives into decision-making and promotes more comprehensive disclosure of corporate social responsibility (CSR) matters (Barroso et al., 2024). In contrast, Rupley et al. (2022) found no significant influence of CSR committees on environmental disclosure, indicating that the effects of governance mechanisms may vary depending on the company and industry context (Yustina et al., 2024).

In Indonesia, carbon emission disclosure by companies remains relatively low, particularly in comparison to developed countries like Australia and the United Kingdom, which have stricter carbon reporting regulations (Rattan & Patel, 2023). The Indonesian government, through the Financial Services Authority (OJK), has encouraged more comprehensive sustainability reporting in recent years. Still, further research is needed to understand how corporate governance mechanisms in Indonesia influence carbon emission disclosure—especially in high-emission sectors such as energy and mining (Yustina et al., 2024; Kwabi et al., 2024).

This study makes three main contributions. First, it provides empirical evidence in a developing market context with unique institutional characteristics (Mehedi et al., 2024; Rattan & Patel, 2023). Most prior studies have focused on developed countries, and this study offers new insights into

how corporate governance can influence carbon transparency in different institutional settings (Liao et al., 2023). Moreover, it highlights the importance of considering institutional factors in developing countries that may limit or modify the influence of corporate governance mechanisms on carbon emission disclosure (Barroso et al., 2024).

Second, the study contributes theoretically by extending the literature on Corporate Governance and Corporate Social Responsibility (CSR), particularly in the context of carbon disclosure. It examines how various elements of corporate governance—such as board independence, gender diversity, environmental committees, and managerial ownership—affect carbon emission disclosure (Kwabi et al., 2024). The results will provide empirical evidence that either strengthens or challenges previous findings, especially within the relatively understudied developing market context (Yustina et al., 2024; Mehedi et al., 2024).

Third, from a practical perspective, the study's findings have direct implications for companies and regulators. For companies, the results may offer insights into how internal governance mechanisms can be employed to improve carbon emission transparency and, consequently, enhance their reputation and relationships with stakeholders (Kwabi et al., 2024; Barroso et al., 2024). For example, increasing board gender diversity or establishing a stronger environmental committee may effectively enhance carbon emission disclosure. For regulators such as OJK, these findings could inform policies that promote better transparency in Indonesia's capital market, particularly in high-emission sectors (Yustina et al., 2024). In the long term, greater carbon emission transparency may help Indonesia achieve its emission reduction targets as set forth in international agreements such as the Paris Agreement (Rattan & Patel, 2023).

Overall, this study not only advances theoretical understanding of carbon emission disclosure but also provides practical insights that can be implemented by companies and regulators in Indonesia to improve sustainability reporting transparency and accountability.

LITERATURE REVIEW

Board Independence

Board independence plays a crucial role in maintaining objective and accountable oversight of managerial decisions made by the board of directors. As an entity tasked with safeguarding stakeholder interests, an independent board of commissioners is expected to monitor management decisions objectively and without personal bias (Mori, Golesorkhi, Randøy, & Hermes, 2015). In this study, board independence is measured by the proportion of independent commissioners on the board.

From the perspective of legitimacy theory, companies have explicit or implicit social obligations to act in accordance with prevailing societal norms (Tang & Luo, 2016). Companies with strong governance and independent boards of commissioners are more likely to be socially and environmentally responsible. They tend to be more transparent in disclosing information about their operations' environmental impact, including carbon emissions.

Stakeholder theory suggests that managerial accountability extends beyond shareholders to various stakeholders, such as communities, governments, and employees. An independent board of commissioners has a broader responsibility to consider stakeholder interests, including the company's environmental impact (Tang & Luo, 2016). This is important for the company's long-term sustainability and environmental preservation.

Research indicates that boards with a higher proportion of independent commissioners are more effective in reducing conflicts of interest and ensuring greater corporate transparency, particularly regarding social and environmental information. For example, de Villiers et al. (2011) found that firms with more independent boards tend to be more forthcoming in disclosing carbon-related information. Jo and Harjoto (2011) also showed that CSR activities supervised by independent boards enhance the company's value in stakeholders' eyes.

Although some studies, such as Eng and Mak (2003), found a negative relationship between board independence and disclosure, most of the literature suggests a positive relationship. Lim et al. (2007) and Patelli and Prencipe (2007) noted that more independent boards contribute to increased environmental and social disclosure. Based on this literature, the first hypothesis is:

H1: Board independence is positively associated with carbon emission disclosure.

Gender Diversity on the Board of Commissioners

Gender diversity in corporate governance has gained prominence due to its impact on decision-making quality and disclosure practices. Diversity theory posits that boards with greater gender diversity are better equipped to incorporate a broad range of perspectives, ultimately improving decision-making quality and managerial accountability (Bear et al., 2010). Gender diversity on the board can enrich discussions at the decision-making level, particularly on social and environmental issues, including carbon emission disclosure.

Liao et al. (2015) found that firms with more women on their boards exhibit higher levels of carbon emission disclosure. This may be because female board members are often more sensitive to sustainability and social issues, supporting more transparent and accurate disclosures. Research by Post et al. (2011) also revealed that companies with higher gender diversity on their boards are more open in reporting social and environmental information.

However, Adams and Ferreira (2009) argued that while gender diversity improves the quality of oversight, its impact on disclosure can vary depending on industry context and organizational culture. Nevertheless, the general consensus is that gender diversity contributes positively to carbon emission disclosure, mainly due to the more holistic view brought by a diverse board. Thus, the second hypothesis is:

H2: Gender diversity on the board of commissioners is positively associated with carbon emission disclosure.

CSR or Sustainability Departments

In Indonesia, responsibility for social and environmental issues within a company is typically held by the CSR or Sustainability Department. These departments manage sustainability policies and coordinate the company's social and environmental initiatives. Their existence reflects a company's commitment to sustainability and carbon emission disclosure (Peters & Romi, 2014).

The presence of a CSR or Sustainability Department demonstrates the company's effort to meet stakeholder expectations regarding social and environmental responsibility. This department also helps the company formulate policies to reduce environmental impacts, including carbon emission management (Luo & Tang, 2016). Haniffa and Cooke (2005) found that firms with sustainability departments tend to be more open in disclosing information related to environmental policies. Based on these findings, the third hypothesis is:

H3: The presence of a CSR or Sustainability Department is positively associated with carbon emission disclosure.

Managerial Ownership

Managerial ownership refers to the extent to which the company's managers hold shares in the firm they manage. Agency theory suggests that managerial share ownership can create conflicts of interest, where managers may prioritize decisions that personally benefit them rather than maximizing the firm's long-term value (Jensen & Meckling, 1976). In the context of carbon emission disclosure, managerial ownership is often associated with reduced disclosure of information deemed potentially damaging to the company's performance.

Eng and Mak (2003) found that firms with higher managerial ownership tend to have lower levels of information disclosure, particularly regarding data that could threaten the company's reputation or financial performance. Similarly, Lim et al. (2007) noted that managers who own shares often hesitate to disclose information that might reduce the firm's share value in the eyes of investors, including carbon-related information.

However, some studies yield opposite results. Haniffa and Cooke (2005) found that in certain cases, managers with ownership stakes may be more motivated to maintain the company's long-term reputation by enhancing transparency in environmental and social issues. Nevertheless, most literature suggests that managerial ownership generally correlates with lower levels of disclosure, particularly in carbon emission transparency. Therefore, the fourth hypothesis is:

H4: Managerial ownership is negatively associated with carbon emission disclosure.

METHODOLOGY

Research Design

This study employs a quantitative, explanatory research approach. The research tests the influence of corporate governance on carbon emission

disclosure among companies listed on the Indonesia Stock Exchange (IDX) that have consistently published Sustainability Reports over the 2020-2023 period. The study uses secondary data obtained from annual and sustainability reports published by the companies.

Population and Sample

The population includes all companies listed on the IDX. The sample selection uses purposive sampling based on the following criteria:

1. Companies listed on the IDX from 2020 to 2023.
2. Companies that consistently publish Sustainability Reports during that period.
3. Companies operating in high-carbon emission industries, such as energy, mining, and manufacturing.

Based on these criteria, 32 companies met the requirements and were included in the sample, as follows:

Table 1: List of Sample Companies

No	Code	Company Name
1	AALI	PT Astra Agro Lestari Tbk
2	ANJT	PT Austindo Nusantara Jaya Tbk
3	INDY	PT Indika Energy Tbk
4	BUMI	PT Bumi Resources Tbk
5	PTBA	PT Bukit Asam Tbk
6	PTRO	PT Petrosea Tbk
7	ELSA	PT Elnusa Tbk
8	MEDC	PT Medco Energi Internasional Tbk
9	ANTM	PT Aneka Tambang Tbk
10	INCO	PT Vale Indonesia Tbk
11	MDKA	PT Merdeka Copper Gold Tbk
12	TINS	PT Timah Tbk
13	INTP	PT Indocement Tunggal Prakarsa Tbk
14	WSBP	PT Waskita Beton Precast Tbk
15	TPIA	PT Chandra Asri Petrochemical Tbk
16	SMGR	PT Semen Indonesia Tbk
17	WTON	PT Wijaya Karya Beton Tbk
18	FPNI	PT Lotte Chemical Titan Tbk
19	CPIN	PT Charoen Pokphand Indonesia Tbk
20	SMCB	PT Semen Merah Putih Tbk
21	JPFA	PT Japfa Comfeed Indonesia Tbk
22	AUTO	PT Astra Otoparts Tbk
23	ASII	PT Astra International Tbk
24	UNVR	PT Unilever Indonesia Tbk
25	KLBF	PT Kalbe Farma Tbk

No	Code	Company Name
26	MLBI	PT Multi Bintang Indonesia Tbk
27	BSDE	PT Bumi Serpong Damai Tbk
28	GMTD	PT Gowa Makassar Tourism Development Tbk
29	PPRO	PT PP Properti Tbk
30	PWON	PT Pakuwon Jati Tbk
31	WSKT	PT Waskita Karya Tbk
32	WIKA	PT Wijaya Karya Tbk

Source: Indonesia Stock Exchange, 2024

Research Variables and Measurement

This study uses four independent variables, one dependent variable, and several control variables:

1. Board Independence (Independent Variable) measured by the percentage of independent commissioners on the board. A higher percentage indicates greater board independence.
2. Gender Diversity on the Board of Commissioners (Independent Variable) measured by the presence of women on the board. Assigned a value of 1 if there is at least one woman on the board, and 0 otherwise.
3. CSR or Sustainability Department (Independent Variable), a dummy variable indicating whether the company has a CSR or Sustainability Department. A value of 1 is assigned if present, and 0 otherwise.
4. Managerial Ownership (Independent Variable) measured by the percentage of shares owned by the company's management.
5. Carbon Emission Disclosure (Dependent Variable) measured by counting the number of items related to carbon emission information disclosed in the company's sustainability report. These disclosures include carbon emissions data, carbon mitigation strategies, and sustainability initiatives undertaken by the company.

Control Variables:

Control variables help neutralize other factors that may influence carbon emission disclosure but are not the main focus of the study.

- a. Firm Size measured by the natural logarithm of total assets.
- b. Profitability measured by the Return on Assets (ROA) ratio.
- c. Leverage measured by the Debt-to-Equity Ratio (DER).

Data Analysis Methods

Multiple linear regression is used to test the relationships between the independent and dependent variables. Before conducting the regression, several assumption tests are performed to ensure the model's validity:

1. Normality Test

A normality test checks whether the residuals are normally distributed using residual plots, Normal Probability Plots (P.P. plots), and histograms. Additionally, skewness and kurtosis tests are conducted. Data that is

approximately normally distributed will have skewness and kurtosis values close to zero. Ensuring normality is crucial for unbiased regression estimates.

2. Homoscedasticity Test

The homoscedasticity assumption requires that the variance of the residuals remains constant across the range of independent variables. This is tested through residual plots. If a discernible pattern emerges, the assumption may be violated.

3. Autocorrelation Test

The Durbin-Watson test is used to detect autocorrelation. Its values range from 0 to 4, with values near 2 indicating no significant autocorrelation. In this study, the Durbin-Watson value is 1.63, suggesting no significant autocorrelation (Field, 2009).

4. Multicollinearity Test

Multicollinearity is examined using the Variance Inflation Factor (VIF). VIF values less than 10 indicate that multicollinearity is not a significant issue (Gujarati, 2003). In this study, the highest VIF value is 2.32, which is below the threshold, indicating that multicollinearity is not problematic.

After fulfilling these assumptions, multiple linear regression is conducted to test the research hypotheses. The regression results indicate whether there are significant relationships between the corporate governance variables and carbon emission disclosure, as well as the strength of these relationships. The regression model is as follows:

$$C_DIS = \beta_0 + \beta_1 IND_DEKOM + \beta_2 GENDER_DEKOM + \beta_3 CSR_DEP + \beta_4 MANG_OWN + \beta_5 SIZE + \beta_6 ROA + \beta_7 DER + \epsilon$$

Where:

C_DIS	= Carbon emission disclosure
IND_DEKOM	= Board independence
GENDER_DEKOM	= Board gender diversity
CSR_DEP	= Presence of CSR/Sustainability Department
MANG_OWN	= Managerial ownership
SIZE	= Firm size (natural log of total assets)
ROA	= Return on Assets (profitability)
DER	= Debt to Equity Ratio (leverage)
ϵ	= Error term

RESEARCH RESULTS

Normality Test

A normality test was conducted using a Normal Probability Plot (QQ-Plot). The QQ plot results show that most points lie close to the diagonal line, indicating that the residuals are normally distributed. This suggests that the normality assumption is met. A visualization of the normality test is presented in the following figure:

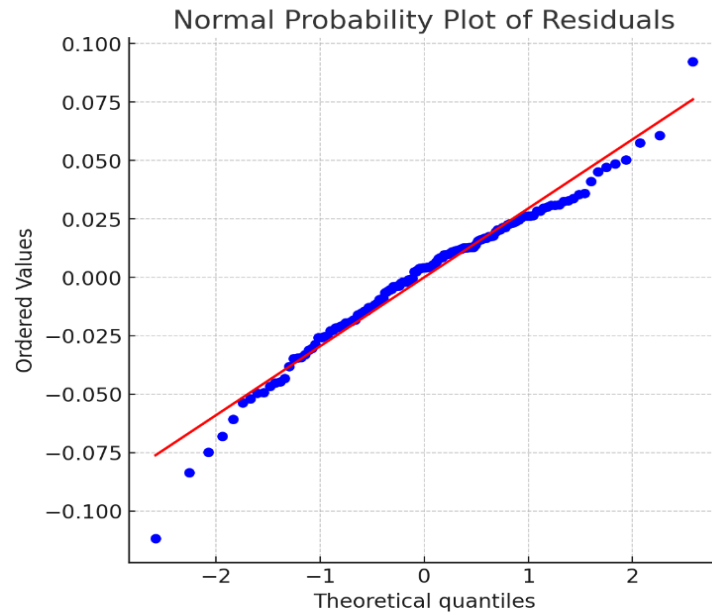


Figure 1. Normality Test

Homoscedasticity Test

Homoscedasticity was tested by plotting residuals against the fitted values. The plot of residuals versus fitted values does not exhibit a discernible pattern, indicating that the residual variance is constant across the range of predicted values. This means the homoscedasticity assumption is met, as shown in the figure below:

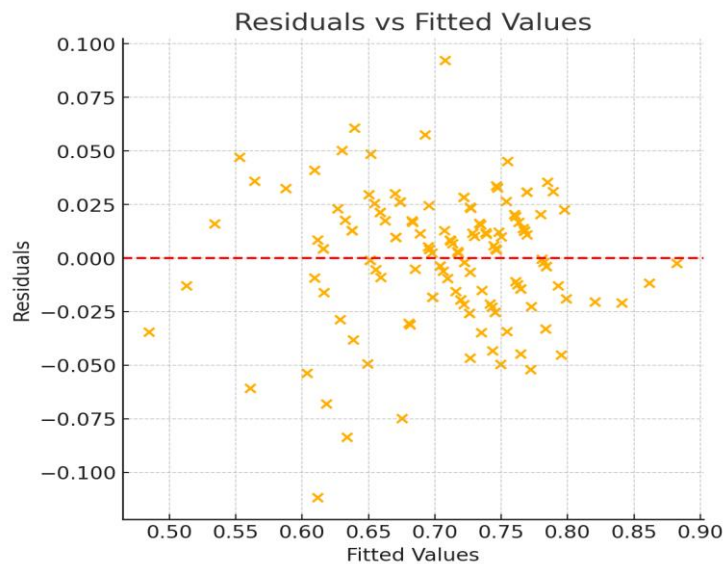


Figure 2. Normality Test

Autocorrelation Test

Autocorrelation was assessed using the Durbin-Watson test. The obtained Durbin-Watson value is 0.784, indicating the presence of positive autocorrelation in the residuals. This autocorrelation can bias the standard error estimates. To address this issue, Newey-West Standard Errors were applied, making the model more robust to both autocorrelation and heteroskedasticity.

Multicollinearity Test

Variance Inflation Factor (VIF) was used to check for multicollinearity. The results show that all variables have VIF values below 10, with the highest being 5.75 for ROA. This indicates that there is no significant multicollinearity problem in the model. The VIF for each variable is shown in the table below:

Table 2: Multicollinearity Test Results (VIF Values)

Variable	VIF
Constant (Carbon Emission Disclosure)	396.8253
Board Independence	3.321215
Board Gender Diversity	1.174617
CSR/Sustainability Department Presence	1.167678
Managerial Ownership	1.694756
Firm Size	2.288597
ROA	5.755575
DER	4.851038

Source: Processed from secondary data, 2024

Regression Analysis

After confirming that the regression assumptions were met, multiple linear regression analysis was performed to examine the influence of the independent variables on carbon emission disclosure. To address the autocorrelation issue, standard errors were adjusted using Newey-West Standard Errors.

The results of the multiple linear regression with Newey-West Standard Errors are presented in the following table:

Table 3: Regression Analysis Results (Newey-West Standard Errors)

Variable	Coefficient	Std. Error (NW)	t-value	p-value	Sig.
Constant (Carbon Emission Disclosure)	-0.4667	0.073	-6.408	0	***
Board Independence	0.4127	0.158	2.62	0.01	**
Board Gender Diversity	0.042	0.023	1.813	0.072	Marginal
CSR/Sustainability Department Presence	0.0994	0.024	4.144	0	***
Managerial Ownership	0.0568	0.27	0.211	0.834	Not signif.
Firm Size	0.052	0.007	7.453	0	***
ROA	5.5576	0.91	6.107	0	***
DER	0.1259	0.028	4.439	0	***

Note: *** significant at 1%, ** significant at 5%, * significant at 10%

Source: Processed from secondary data, 2024

Based on the multiple linear regression results, several key findings can be identified:

1. Board Independence shows a positive and significant effect on carbon emission disclosure (coefficient 0.4127, p-value 0.010). This suggests that greater board independence is associated with higher levels of carbon emission disclosure, consistent with corporate governance theories stating that more independent boards improve accountability and environmental transparency.
2. Board Gender Diversity shows a marginally significant result, with a coefficient of 0.0420 and a p-value of 0.072. This indicates that gender diversity on the board may have a positive influence on carbon emission disclosure, although it is not significant at the 5% level.
3. CSR/Sustainability Department Presence significantly affects carbon emission disclosure (coefficient 0.0994, p-value 0.000). Companies with a dedicated CSR or sustainability department are more likely to be transparent in disclosing their carbon emissions.
4. Managerial Ownership does not have a significant effect on carbon emission disclosure, with a p-value of 0.834. This indicates that managerial personal interests in the company do not significantly contribute to transparency in carbon emission disclosure.
5. Firm Size has a positive and significant influence on carbon emission disclosure (coefficient 0.0520, p-value 0.000). Larger firms tend to be more transparent in carbon-related information, possibly due to greater stakeholder pressure for transparency.
6. Profitability (ROA) shows a positive and significant effect, with a coefficient of 5.5576 and a p-value of 0.000. This indicates that more profitable companies are more transparent in disclosing their carbon emissions.
7. Leverage (DER) exhibits a positive and significant relationship with carbon emission disclosure (coefficient 0.1259, p-value 0.000). Companies with higher leverage tend to be more forthcoming with carbon emission information, possibly due to greater demands for transparency from creditors and investors in financial and sustainability reporting.

Overall, these regression results, adjusted with Newey-West Standard Errors, suggest that corporate governance plays a significant role in promoting carbon emission disclosure. In particular, board independence, the presence of a CSR department, firm size, ROA, and leverage all have positive and significant effects on carbon emission disclosure. While gender diversity shows a marginal positive effect, managerial ownership does not significantly influence carbon emission disclosure.

With an Adjusted R-squared of 0.829, the model explains approximately 83% of the variation in carbon emission disclosure, indicating a strong predictive power.

DISCUSSION

This study highlights the importance of corporate governance mechanisms in influencing carbon emission disclosure, a topic widely examined in international contexts. The findings support previous research and offer new perspectives within the Indonesian corporate landscape.

Board Independence is found to have a positive and significant effect on carbon emission disclosure. This aligns with the work of de Villiers et al. (2011) and Jo & Harjoto (2011), which suggests that more independent boards tend to be transparent in disclosing environmental and social information. An independent board enhances managerial accountability, reduces conflicts of interest, and ensures more comprehensive sustainability disclosures.

Gender Diversity on the board shows marginal significance. This finding partially supports Liao et al. (2015), who found that gender diversity improves carbon emission disclosure, although its influence may not always be significant. Women on the board often bring greater sensitivity to social and environmental issues, though their impact may be more limited in Indonesia, where women's strategic decision-making roles remain relatively low.

The presence of a CSR/Sustainability Department has a highly significant impact on carbon emission disclosure. This finding corroborates Haniffa and Cooke (2005), showing that companies with dedicated CSR or sustainability departments are more transparent about environmental information. This reflects the company's commitment to social responsibility and accountability in sustainability reporting.

Managerial Ownership does not significantly affect carbon emission disclosure. This supports Eng and Mak (2003), suggesting that managers who hold shares may be reluctant to disclose information that could impact the company's short-term market performance. Managers may prioritize short-term share value over comprehensive environmental disclosures.

Control variables such as Firm Size, Profitability (ROA), and Leverage (DER) are also found to be significant. Larger firms show better information transparency, consistent with Peters & Romi (2014). ROA and DER contribute positively, reflecting investor and creditor pressure for robust environmental risk management, aligning with Rupley et al. (2012).

CONCLUSION AND RECOMMENDATION

This study finds that corporate governance mechanisms—such as board independence, gender diversity, CSR department presence, firm size, profitability, and leverage—significantly influence carbon emission disclosure among companies listed on the Indonesia Stock Exchange. Board independence, in particular, improves carbon emission transparency, supporting the theory that independent boards maintain stronger managerial accountability. Additionally, the presence of a dedicated CSR department underscores the critical role of sustainability management and reporting in enhancing corporate carbon transparency.

Gender diversity on the board shows marginal significance, indicating that while women in governance roles may encourage greater carbon emission disclosure, their influence may be constrained in Indonesia, where women's

roles in strategic decision-making are still limited. Meanwhile, control variables, such as firm size, profitability, and leverage, also significantly and positively affect carbon emission disclosure. Larger and more profitable companies tend to be more transparent, while higher leverage can lead to greater stakeholder scrutiny and thus more comprehensive carbon reporting.

However, managerial ownership does not have a significant impact on carbon emission disclosure, suggesting that managers who hold shares may focus on short-term gains rather than long-term environmental transparency. These findings contrast with some literature suggesting that managerial ownership could increase transparency, yet are consistent with studies indicating that managers may avoid disclosing information threatening short-term performance.

ADVANCED RESEARCH

This study's scope is limited to Indonesian companies. Future research should consider expanding the sample to other countries and incorporating additional variables, such as executive compensation structures or sustainability committees, to provide a more in-depth understanding of the factors influencing carbon emission disclosure. The findings are expected to provide insights for companies and regulators to enhance transparency in carbon reporting, thereby meeting stakeholder demands and contributing to long-term sustainability goals.

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