Strengthening Corporate Governance to Enhance Carbon Emission Disclosure: Evidence from Indonesian Listed Companies

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Submitted:
OCTOBER 2025

Accepted:
DECEMBER 2025

ABSTRACT

In recent years, increasing global attention to climate change and environmental accountability has driven companies, including those in Indonesia, to enhance transparency through carbon emission disclosure as part of their corporate governance practices. This study investigates the influence of corporate governance in enhancing carbon emission disclosure among Indonesian listed companies. Grounded in legitimacy and stakeholder theory, the study examines whether shareholder pressure moderates the governance–disclosure relationship. Using panel data from 33 firms over the 2021–2023 period (99 firm-year observations), this research applies a Random Effect Model (REM) regression approach with company size and profitability as control variables. The results indicate that corporate governance has a positive and significant impact on carbon emission disclosure, suggesting that good governance promotes transparency and accountability in environmental performance. However, shareholder pressure weakens this relationship, implying that excessive financial performance pressure can reduce the effectiveness of governance systems in supporting sustainability transparency. These findings highlight the importance of aligning governance mechanisms with long-term sustainability goals and strengthening policy frameworks to promote carbon-related disclosure in Indonesia.

Keywords: *Carbon Emission Disclosure, Corporate Governance, Panel Data, Shareholder Pressure, Sustainability.*

ABSTRAK

Dalam beberapa tahun terakhir, meningkatnya perhatian global terhadap perubahan iklim dan akuntabilitas lingkungan telah mendorong perusahaan-perusahaan, termasuk di Indonesia, untuk meningkatkan transparansi melalui pengungkapan emisi karbon sebagai bagian dari praktik tata kelola perusahaan mereka. Studi ini menyelidiki peran tata kelola perusahaan dalam meningkatkan pengungkapan emisi karbon di antara perusahaan-perusahaan tercatat di Indonesia. Berdasarkan teori legitimasi dan pemangku kepentingan, studi ini mengkaji apakah tekanan pemegang saham memoderasi hubungan tata kelola-pengungkapan. Menggunakan data panel dari 33 perusahaan selama periode 2021–2023 (99 observasi perusahaan-tahun), penelitian ini menerapkan pendekatan regresi Random Effect Model (REM) dengan ukuran perusahaan dan profitabilitas sebagai variabel kontrol. Hasilnya menunjukkan bahwa tata kelola perusahaan memiliki dampak positif dan signifikan terhadap pengungkapan emisi karbon, yang menunjukkan bahwa tata kelola yang baik mendorong transparansi dan akuntabilitas dalam kinerja lingkungan.

JIAKES

Jurnal Ilmiah Akuntansi Kesatuan
Vol. 13 No. 6, 2025
pp. 1689-1700
IBI Kesatuan
ISSN 2337 – 7852
E-ISSN 2721 – 3048
DOI: 10.37641/jiakes.v13i6.4343

Namun, tekanan pemegang saham melemahkan hubungan ini, yang menyiratkan bahwa tekanan kinerja keuangan yang berlebihan dapat mengurangi efektivitas sistem tata kelola dalam mendukung transparansi keberlanjutan. Temuan ini menyoroti pentingnya menyelaraskan mekanisme tata kelola dengan tujuan keberlanjutan jangka panjang dan memperkuat kerangka kebijakan untuk mendorong pengungkapan terkait karbon di Indonesia.

***Kata kunci**: Pengungkapan Emisi Karbon, Tata Kelola Perusahaan, Panel Data, Tekanan Pemegang Saham, Keberlanjutan.*

INTRODUCTION

Due to global warming, climate change has become an urgent issue requiring attention from various sectors. Corporate operations cause global warming and require commitment and responsibility from industry players (IPCC, 2023). Acknowledging the complexity of climate change challenges, Indonesia has pledged to reach Net Zero Emissions (NZE) by 2060. This commitment is outlined in the 2025-2045 RPJPN as the fifth target for achieving the 2045 Golden Indonesia Vision (Utomo et al., 2020). Indonesia's approach to controlling climate change is to implement the Carbon Economic Value policy in 2023. Carbon Emission Disclosure (CED) is an important source of information in the carbon trading mechanism known as the "cap and trade" strategy, and supports this policy. However, in Indonesia, carbon emission disclosure is still voluntary. Companies are motivated to disclose information primarily to comply with regulations. Consequently, the level and quality of carbon emission disclosure by Indonesian companies is relatively low globally (Aguilera et al., 2018; Sandy & Ardiana, 2023; Oktaviani & Al Ghozi, 2025).

In 2013, only one of the four Indonesian companies included in the list of 500 emissions and response statuses was willing to disclose information, and none had disclosure performance scores. By 2022, however, more than 100 Indonesian companies had disclosed information to the CDP. While this data proves that the level of globally recognized disclosure continues to increase year after year, it also shows that the level of disclosure in Indonesia is still relatively low (Nasih et al., 2019). The quality of information disclosed regarding carbon emissions greatly influences investor perceptions and company value. According to CDP data, companies that receive an A rating outperform the market average by 6%. This demonstrates that the market values transparency and ambition to reduce environmental impact.

Despite growing regulatory awareness, the practice of carbon emission disclosure in Indonesia remains largely voluntary and inconsistent (Luo et al., 2012; Yustina et.al, 2024). Many companies disclose environmental information only to meet minimal compliance requirements rather than as part of a strategic governance initiative. This condition underscores the urgent need to position corporate governance as a core mechanism for driving transparency and sustainability performance. Good governance is expected to integrate environmental considerations into decision-making processes through accountability, oversight, and risk management systems. Board independence, audit committees, and disclosure policies are fundamental governance components that can enhance environmental transparency and legitimacy (Almagtome et al., 2020; Blesia et al., 2023).

Corporate governance, therefore, acts not only as a compliance tool but also as a strategic mechanism that aligns corporate objectives with societal expectations (Manurung et al., 2022; Hidayat et al., 2022). According to legitimacy theory, Suchman (1995), firms voluntarily disclose environmental information to maintain social acceptance and legitimacy. Likewise, stakeholder theory suggests that effective governance ensures responsiveness to stakeholder demands, including those of investors, regulators, and the community, by promoting reliable sustainability reporting. When shareholders demand constructive pressure toward long-term sustainability, such pressure can strengthen the monitoring and supervisory roles of governance bodies (Tila et al.,

2019; Doni et al., 2022; Murwaningsari & Riyanti, 2023). Shareholders who value environmental responsibility tend to demand transparent reporting, encourage the formation of sustainability committees, and advocate for integrated reporting frameworks. This form of pressure reinforces governance accountability and accelerates environmental disclosure, as observed by (Liao et al., 2015; Gerged et al., 2024).

By focusing on data from 33 firms over the 2021–2023 period, this research provides recent evidence on the governance–disclosure nexus within Indonesia's sustainability transition, contributing both theoretically and practically to the development of sustainable corporate governance frameworks in emerging economies. Many previous studies have identified corporate governance as a factor that influences the level of environmental information disclosure, especially emissions. However, the results have been inconsistent when applied to the Indonesian capital market context, which is characterized by centralized ownership and a relatively low level of institutional investor pressure. In addition, there is still limited research that considers shareholder pressure as a moderating variable that can strengthen or weaken the relationship between governance and carbon emissions disclosure. Therefore, this research aims to determine the model with Moderated Regression Analysis.

LITERATURE REVIEW & HYPOTHESIS DEVELOPMENT

Corporate Governance and Carbon Emission Disclosure

Legitimacy theory posits that companies operate under a social contract with society and must maintain legitimacy by aligning their activities with prevailing social values and norms (Suchman, 1995). Complementarily, stakeholder theory emphasizes corporate accountability not only to shareholders but also to broader stakeholders, including employees, consumers, governments, communities, and the environment (Freeman & McVea, 2005). Corporate governance mechanisms such as boards of directors, independent audit committees, and transparency support sustainability by promoting accountability, disclosure, and compliance with environmental and social standards, thereby strengthening legitimacy (Martínez-Ferrero & García-Sánchez, 2017; Ibrahim et al., 2025).

From a theoretical perspective, stakeholder theory underscores firms' moral and strategic obligations to address stakeholder interests, including concerns over environmental sustainability and climate change (Cho & Patten, 2007). In this context, carbon emissions disclosure functions as a tool of communication and accountability, signaling firms' commitment to managing climate risks and enabling stakeholders to evaluate environmental performance (Elsayih et al., 2021; Asrorudin et al., 2024). Simultaneously, legitimacy theory explains such disclosure as a voluntary strategy to align corporate behavior with societal norms and regulatory expectations, thereby enhancing public

Corporate governance plays a critical role in shaping the extent and quality of disclosure. Governance mechanisms such as independent boards, audit committees, and environmental committees serve as internal controls that encourage transparency and sustainability-oriented accountability. Empirical studies by Choi et al. (2013) and Liao et al. (2015) found that strong governance structures, especially those emphasizing independence and environmental oversight, are positively associated with higher levels of carbon emissions disclosure. These findings indicate that disclosure practices are not merely administrative compliance but reflect strategic governance responses to sustainability challenges.

H1: Corporate governance has a significant effect on carbon emission disclosure.

Shareholder Pressure as a Moderating Variable

The concept of corporate governance has evolved toward sustainability, forming the basis of sustainable corporate governance that integrates Environmental, Social, and Governance (ESG) principles into strategic decision-making (Mrabure & Abhulimhen-

Iyoha, 2020). In Indonesia, good governance is guided by four pillars: ethics, transparency, accountability, and sustainability, as outlined in the 2021 General Guidelines for Good Governance (*Pedoman Umum Good Corporate Governance Indonesia*/PUGKI), with ethics as the foundation enabling accountability and sustainability (Mardiasmo & Pramono, 2023). Within this framework, carbon emission disclosure serves as an essential component of environmental reporting to demonstrate transparency, regulatory compliance, and responsiveness to stakeholder expectations, thereby maintaining corporate legitimacy (Freedman & Jaggi, 2005; Nurmala & Adiwibowo, 2023).

Stakeholder theory further emphasizes that companies are accountable not only to shareholders but also to a broad range of stakeholders, including regulators, customers, investors, and the community, whose interests can influence corporate behavior (Laia et al., 2024). Heightened stakeholder pressure encourages management to strengthen transparency and accountability through enhanced disclosure practices, while weak external pressure reduces incentives for comprehensive reporting (Tarigan et al., 2022). Accordingly, the interaction between stakeholder pressure and corporate governance reflects both legitimacy-seeking behavior and strategic responses to stakeholder demands (Rudyanto & Siregar, 2018; Kurnia et al., 2020).

Empirical evidence supports this theoretical reasoning. Wang et al. (2020) found that stakeholder pressure significantly and positively influences firms' environmental initiatives, encouraging proactive disclosure strategies. Their findings reveal that the extent of stakeholder influence varies depending on the stakeholder type, as well as the institutional, industrial, and national context. In emerging markets such as Indonesia, similar studies suggest that corporate environmental governance and disclosure are shaped by both internal governance quality and external stakeholder dynamics (Bedi & Singh, 2024). When stakeholders actively demand transparency, governance mechanisms like board oversight and sustainability committees become more effective in promoting credible environmental reporting. Therefore, stakeholder engagement serves as a reinforcing factor that enhances the role of governance in achieving sustainability-oriented transparency.

H2: Stakeholder pressure strengthens the impact of corporate governance on the disclosure of carbon emissions.

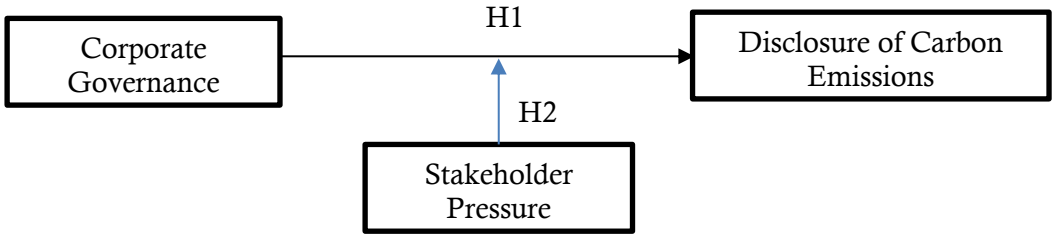

Figure 1. Conceptual Framework

Figure 1 illustrates a conceptual model showing the relationship between corporate governance, stakeholder pressure, and carbon emissions disclosure. In the model, corporate governance acts as an independent variable influencing the level of carbon emissions disclosure by a company. Meanwhile, stakeholder pressure serves as a moderating variable that can strengthen or enhance the relationship between corporate governance and carbon emissions disclosure. The arrow pointing from corporate governance to carbon emissions disclosure indicates that good governance is expected to increase environmental transparency, while the arrow pointing from stakeholder pressure to carbon emissions disclosure indicates that stakeholder pressure also influences the

extent to which companies are willing to disclose information related to their carbon emissions.

RESEARCH METHODS

This study employs a quantitative approach using archival data of Indonesian companies obtained from Thomson Reuters DataStream for the period 2021–2023. The focus on Indonesia is relevant given its evolving sustainability regulations and position as one of the world's largest carbon emitters in the energy and industrial sectors. The issuance of Regulation of the Minister of Environment and Forestry Number 21/2022 on greenhouse gas inventories and the Carbon Economic Value mechanism reflects the government's efforts to institutionalize emission management. However, according to the Financial Services Authority (*Otoritas Jasa Keuangan*/OJK), Sustainability Report Review, only a limited number of listed firms disclose comprehensive carbon data, indicating that while regulations exist, governance enforcement and corporate transparency practices remain underdeveloped.

The study employed a purposive sampling technique, selecting all Indonesian listed companies available in the Thomson Reuters Refinitiv database that disclosed governance and sustainability data consistently during 2021–2023. The dependent variable in this study is carbon emission disclosure, measured using an 18-item checklist and calculated as CED = (∑ Disclosed Items)/(∑ Total Items) (Choi et al., 2013). The independent variable is corporate governance, assessed through a Governance Pillar Score ranging from 0 to 100 (Ben-Amar & McIlkenny, 2015). Shareholder pressure serves as a moderating variable, measured by the ratio of parent company shares to total shares (Rudyanto & Siregar, 2018). Control variables include firm size, measured as the natural logarithm of total assets (Ln Total Assets) (Gerged et al., 2024). Profitability, measured by return on equity (ROE = Net Income/Total Equity).

Data analysis techniques using Moderated Regression Analysis. This research employs three regression models for panel data analysis: The Common Effect Model (CEM), the Fixed Effect Model (FEM), and the Random Effect Model (REM). The process of choosing the most suitable model is carried out by the Chow test (CEM versus FEM), the Hausman test (FEM against REM), and the Lagrange Multiplier (LM) test (CEM versus REM). After determining the appropriate model, classical assumption tests are conducted to ensure the validity of the estimation results. When either a common effect model or a fixed effect model is applied, verifying classical assumptions is necessary; however, if a random effect model is used, such tests are not required (Gujarati & Porter, 2009).

The hypothesis testing process includes evaluating the coefficient of determination (R^2), which indicates the proportion of variance in the dependent variable explained by the independent variables. Additionally, the F-test is employed to assess whether all independent variables collectively have a significant effect on the dependent variable. Meanwhile, partial testing (t-test) measures the individual influence of each independent variable on the dependent variable, determining its unique contribution to the model (Hadi & Pebruary, 2021).

RESULTS

The descriptive statistics presented in Table 1 show that the corporate governance variable has a mean of 52.76 and a standard deviation of 22.82. This indicates that corporate governance practices in Indonesia are generally moderate, with a relatively wide range of data, indicating significant disparities between companies in implementing GCG principles. The Carbon Emission Disclosure (EMI) variable shows a mean of 68.86 and a standard deviation of 18.34, indicating that emissions disclosure is generally high; however, there are differences between companies, with some companies being quite proactive in reporting and others remaining more passive. The SIZE variable, quantified by the logarithm of total assets, has a mean of 22.05 and a standard deviation of 0.83, indicating that the study sample is quite homogeneous and consists mostly of large companies.

Table 1. Descriptive Statistics

Statistic	EMI	CG	SHARE	SIZE	ROE
Mean	68.86869	52.75758	0.590909	22.01010	0.191515
Median	72.00000	52.00000	0.600000	22.00000	0.140000
Maximum	94.00000	93.00000	0.900000	24.00000	1.420000
Minimum	11.00000	5.000000	0.300000	20.00000	0.010000
Std. Dev.	18.34736	22.81563	0.146448	0.931259	0.232315
Skewness	-1.440546	-0.143920	-0.018297	0.208573	3.996521
Kurtosis	5.169778	1.915187	2.300478	2.635388	20.35927
Jarque-Bera	53.66058	5.196141	2.024017	1.266178	1506.586
Probability	0.000000	0.074417	0.363488	0.530949	0.000000
Sum	6818.000	5223.000	58.50000	2179.000	18.96000
Sum Sq. Dev.	32989.29	51014.18	2.101818	84.98990	5.289073
Observations	99	99	99	99	99

Additionally, the Return on Equity (ROE) variable averages 0.19 with a standard deviation of 0.23, suggesting a relatively good profitability level despite considerable variation among companies, with some being very profitable while many others remain at a low level. The shareholder pressure (SHARE), has a mean of 0.59 and a standard deviation of 0.15. This indicates that share ownership is often focused among majority shareholders, yet with some variation that still showcases differences in ownership structure across companies.

Table 2 shows that the cross-section chi-square value is smaller than 0.05 (probability value 0.00 < 0.05), indicating that H_0 is rejected and suggesting that the fixed effect model is initially appropriate for this study. However, the Hausman test results show a Random Cross-Section probability of 0.5895, which is greater than 0.05. This means H_0 is accepted, implying that the random effect model is the most suitable regression model for this research, as it provides more efficient and unbiased estimations under these conditions.

Table 2. Chow Test and Hausman Test

Model Test	Probability	Conclusion	Description
Chow Test	0.0000	H1 Accepted	FEM
Hausman Test	0.5895	H0 Accepted	REM

The test result of the Lagrange Multiplier in Table 3 can be seen from the Prob value. The Breusch-Pagan (BP-value) obtained is 0.0000. This value is smaller than 0.05, so H0 is rejected, and the right regression model to be used is a Random Effect Model (REM).

Table 3. Lagrange Multiplier Test

Test	Cross-section	Time	Both
Breusch-Pagan	46.98399	0.090253	47.07425
	(0.0000)	(0.7639)	(0.0000)

The results of the Lagrange Multiplier (LM) test for random effects indicate that the Breusch-Pagan cross-section value is 46.98399 with a probability of 0.0000, which is smaller than 0.05. This finding leads to the rejection of the null hypothesis (no effects), suggesting that significant cross-sectional effects are present in the model. Meanwhile, the time effect shows a probability value of 0.7639, which is greater than 0.05, indicating that there are no significant time effects. The both-effects test yields a value of 47.07425 with a probability of 0.0000, confirming the presence of significant random effects across cross-sections. Therefore, based on the LM test results, the random effect model is considered the most appropriate for this study.

The result of the selection of the regression model shows that the random effect model is the most appropriate model used in this study. The result of panel data regression analysis with a random effect model can be seen in Table 4.

Table 4. Hypothesis Test

Variable	Model 1: (β)	Sig. (1)	Model 2: (β)	Sig. (2)	Model 3: (β)	Sig. (3)
Constant	-9.067 (-0.148)	0.8823	-37.870 (-0.617)	0.5388	-52.485 (-0.827)	0.4102
Corporate Governance	0.195 (0.100)	0.0546	0.2037 (0.099)	0.0422	0.5812 (1.5797)	0.1176
Shareholder Pressure			35.223 (15.326)	0.0238	60.7348 (2.1505)	0.0341
Corporate Governance x Shareholder Pressure					-0.6103 (-1.0725)	0.2863
ROE	-0.339 (-0.066)	0.9474	0.263 (5.049)	0.9585	-0.7043(-0.1377)	0.8908
SIZE	3.075 (2.727)	0.2622	3.413 (1.270)	0.2072	3.363 (1.237)	0.2191
R^2	0.046832		0.098716		0.108841	
Adjusted R^2			0.051884		0.010125	
F-statistic (Sig.)	1.555874 (0.205233)		2.573900 (0.042634)		2.271704 (0.053672)	
N	99		99		99	

The regression results presented in Table 4 show three models tested in this study. In Model 1, corporate governance has a positive but not statistically significant effect on carbon emission disclosure, with a coefficient of 0.195 and a significance value of 0.0546. The model's explanatory power (R^2) is 0.0468, and the F-statistic value of 1.556 ($p = 0.2052$) indicates that the model is not significant. In Model 2, when the shareholder pressure variable is added, its coefficient is 35.223 with a significance value of 0.0238, suggesting that shareholder pressure has a significant positive influence on disclosure. The R^2 increases to 0.0987, and the F-statistic becomes significant ($p = 0.0426$), showing improved model fit. In Model 3, the interaction term between corporate governance and shareholder pressure has a coefficient of -0.6103 with a significance value of 0.2863, indicating that shareholder pressure does not significantly moderate the effect of corporate governance on carbon emission disclosure. The R^2 slightly increases to 0.1088, and the F-statistic ($p = 0.0537$) suggests marginal significance. The results show that while shareholder pressure directly enhances disclosure, its moderating role on the relationship between corporate governance and carbon emission disclosure is not statistically significant.

DISCUSSION

The panel data regression findings in Model 1 reveal that corporate governance has a positive influence on carbon emission disclosure ($\beta = 0.195$; Sig. = 0.0546). This suggests that companies with stronger governance practices tend to be more transparent in reporting their carbon emissions. The result supports the premise of legitimacy theory, which explains that organizations aim to sustain social legitimacy by disclosing information that aligns with public expectations and regulatory standards (Suchman, 1995). In this context, carbon emission disclosure acts as a strategic communication tool through which firms demonstrate their commitment to environmental responsibility and adherence to prevailing social and environmental norms.

The regression outcomes across the three tested models reveal varying levels of influence among the variables. In Model 1, corporate governance demonstrates a positive but statistically insignificant relationship with carbon emission disclosure, showing a coefficient of 0.195 and a significance level of 0.0546. The model's explanatory capacity ($R^2 = 0.0468$) and the F-statistic value of 1.556 ($p = 0.2052$) indicate that the model as a whole is not significant. In Model 2, after incorporating shareholder pressure, the coefficient rises to 35.223 with a significance value of 0.0238, signifying a significant

positive effect on disclosure. The model fit improves, as reflected by a higher R^2 (0.0987) and a significant F-statistic ($p = 0.0426$). In Model 3, the interaction variable between corporate governance and shareholder pressure records a coefficient of -0.6103 with a significance value of 0.2863, suggesting that shareholder pressure does not significantly moderate the relationship between corporate governance and carbon emission disclosure. Although the R^2 slightly increases to 0.1088, the F-statistic ($p = 0.0537$) only approaches significance. These findings imply that while shareholder pressure independently enhances disclosure practices, its moderating effect on the link between corporate governance and carbon emission disclosure remains statistically insignificant (Anggita & Nugroho, 2022).

The results of Model 3 indicate that the interaction variable between corporate governance and shareholder pressure has a negative coefficient and is statistically insignificant. This suggests that shareholder pressure does not enhance the relationship between governance and carbon emission disclosure; instead, it appears to weaken the effectiveness of governance mechanisms. Empirically, this finding implies that when shareholder pressure intensifies, such as through demands for short-term profits or emphasis on financial performance, the focus of corporate governance may shift away from sustainability objectives toward profit maximization (Hardiyansah et al., 2021).

This outcome aligns with both stakeholder theory and legitimacy theory, which posit that firms tend to prioritize the interests of dominant stakeholders who exert the greatest influence on corporate decisions. In this context, powerful shareholders often emphasize financial returns over environmental transparency, thereby diminishing the governance system's ability to function as an effective check-and-balance mechanism. Consequently, carbon emission disclosure becomes less consistent and less comprehensive. These results support the observations of Cho and Patten (2007) and Clarkson et al. (2008), who noted that shareholder pressure can create a legitimacy gap, a discrepancy between societal expectations and corporate actions, particularly when sustainability initiatives are perceived to conflict with short-term profitability goals.

In practice, excessive shareholder pressure can actually degrade the quality of corporate governance. Excessive scrutiny of financial results can hinder board independence and reduce the space for long-term strategic decision-making in the area of sustainability. This aligns with the contingency theory of governance, which emphasizes that governance effectiveness depends on the environmental context and external pressures (Tan et al., 2022; Alfi et al., 2025). Thus, these findings convey an important message: strengthening corporate governance must be accompanied by shareholder awareness and support for the sustainability agenda, not simply financial gain.

CONCLUSION

The findings of this research demonstrate that corporate governance positively affects carbon emission disclosure, underscoring the crucial role of oversight and transparency mechanisms in enhancing corporate environmental legitimacy. Nevertheless, shareholder pressure tends to weaken this relationship, indicating that a focus on short-term profits can undermine the effectiveness of governance frameworks in promoting sustainability disclosure. These results highlight that effective governance relies not only on formal institutional structures but also on the ethical commitment and strategic alignment of shareholders toward sustainability goals.

From a practical perspective, the results emphasize the importance of building synergy between sustainability-driven governance and shareholder ownership. Investors should evaluate corporate performance not solely on profitability but also on the fulfillment of environmental and social responsibilities. In addition, regulatory bodies and capital market authorities must strengthen sustainability reporting regulations that encourage companies to integrate environmental accountability within their governance systems.

Nonetheless, this research has several limitations. The study's sample size and scope are relatively narrow, as it only includes companies listed on the Indonesia Stock Exchange that published sustainability reports during the observation period. This

constraint may affect the generalizability of the results to other industries or non-public firms. In addition, the shareholder pressure variable, which is measured based solely on share ownership, may not capture the full complexity of shareholder influence on corporate environmental strategies. Hence, future studies are encouraged to broaden the sample across various sectors and incorporate additional qualitative dimensions such as institutional, stakeholder, or media pressures to develop a more holistic understanding of the relationship between governance practices and carbon emission disclosure.

Thus, this study confirms that strong governance without the support of a shareholder sustainability vision is insufficient to promote carbon transparency. Collaboration between management, the board, and investors is necessary to build adaptive, responsible governance that aligns with the direction of sustainable green development.

Acknowledgement

We would like to express our sincere gratitude to the Directorate of Research and Community Service, Directorate General of Research and Development, Ministry of Higher Education, Science, and Technology, for their support and funding of this research through Contract Number 155/SPK/LL1/AL.04.03/PL/2025. We also extend our appreciation to the Higher Education Service Institution (LLDikti) Region I and Politeknik Wilmar Bisnis Indonesia for their assistance and hospitality, which made this research possible.

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