INDEPENDENT COMMISSIONERS MODERATING THE IMPACT OF GREEN INVESTMENT, CARBON PERFORMANCE, ON CARBON EMISSION DISCLOSURE

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Abstract

Global Climate Change emerged as a critical issue with extensive ramifications. Indonesia is one of the sixth countries in terms of carbon emissions in the world. Reducing carbon emissions is the top priority for the Indonesian government, which is why they've passed legislation. But carbon emission disclosure is still not widely used and is often unreliable. The research investigates the association between carbon disclosure, green investment and carbon performance, along with the moderating effect of independent commissioners. This research employs a quantitative methodology utilizing panel data regression on 55 energy sector firms listed on the Indonesia Stock Exchange from 2022 to 2024. The data was analyzed utilizing EViews 13. Green Investment does not significantly impact carbon emission disclosure, whereas carbon performance has significant positives, while independent commissioners do not strengthen the correlation between green investment and disclosure; rather, they enhance the association between carbon performance and carbon emissions disclosure. This discovery highlights the significance of carbon performance and green investment in fostering transparency and the necessity of independent oversight in enhancing disclosure quality.

Keywords: Green Investment, Carbon Performance, Carbon Emission Disclosure, Independent Commissioner

INTRODUCTION

Global climate change is no longer confined to certain geographical regions it has evolved into a pervasive phenomenon that impacts even the most susceptible ecosystems. Indonesia, as a tropical nation, is susceptible to the diverse effects of an intensifying climate crisis. The Intergovernmental Panel on Climate Change (2021) asserts that greenhouse gas and carbon emissions are the principal contributors of global warming. The rise in global temperatures resulting from unchecked emissions has precipitated global warming and climate change that require immediate attention.

Indonesia has the sixth position among countries with the largest carbon emissions globally (Zurhriyah, 2024). Data from the Badan Pusat Statistik (2025) indicates that carbon emissions from the national energy industry were approximately 700 million tons of CO_2 in 2021. Although this figure somewhat fell to 692 million tons of CO_2 in 2022, it remains elevated. In 2023, the government effectively reduced greenhouse gas emissions from the energy sector by 127.67 million tons of CO_2, indicating substantial progress towards a cleaner energy transition. These efforts are in line with the target set by the Kementrian Energi dan Sumber Daya Mineral (2023), which suggests that Indonesia aims to decrease carbon emissions by 358 million tons of CO_2 by 2030. This objective illustrates the government's commitment to addressing global climate change, especially in the energy sector, the principal source of national emissions.

In light of these circumstances, the Indonesian government has exhibited its dedication to emission reduction via a variety of strategic measures, including the involvement of the Otoritas Jasa Keuangan (OJK). The OJK has established the Phase II Sustainable Finance Roadmap (2021–2025) and issued OJK Regulation No. 51/POJK.03/2017, which requires public corporations and financial services institutions to create and disseminate sustainability reports, including Carbon Emission Disclosures. Nonetheless, in practice, Carbon Emission Disclosure by corporations in Indonesia remains inadequate. Numerous entities continue to report voluntarily, resulting in a lack of uniformity and consistency in the application of this regulation (Kurnia et al., 2021).

A contributing factor is anticipated to affect Carbon Emission Disclosure is Green Investment, which is essential in strengthening a company's environmental commitment. Zheng & Jin (2023) assert that Green Investment constitutes a capital allocation strategy employed by corporations that takes into account the environmental ramifications of each investment choice. Green Investment denotes the deployment of corporate capital to support environmentally-focused initiatives, including low-carbon technologies, renewable energy, energy efficiency, and waste management (Chen & Ma, 2021). However, in practice, there is still a perception that corporate spending on environmental causes is a burden that can reduce revenue and profits. In fact, based on legitimacy theory, public support for corporate activities that are in line with social values, norms, and constraints is very important to maintain the sustainability of corporate legitimacy in the public eye (Tanasya & Handayani, 2020).

Carbon Performance affects Carbon Emission Disclosure, as noted by Velte (2020) Carbon Performance pertains to a company's managerial initiatives concerning carbon emissions, specifically indicating the degree to which greenhouse gas (GHG) emissions, which may contribute to climate change, can be regulated, along with the strategic actions implemented by companies to diminish emission levels.

In line with this view, Jiang et al (2024) define Carbon Performance as a measure that shows the effectiveness of a company in managing and reducing carbon emissions arising from its operational activities. This performance reflects the effectiveness of companies in implementing emission reduction strategies, whether through energy efficiency, the use of clean technology, or other environmentally friendly initiatives (Benkraiem, 2022). Robust Carbon Performance is regarded as a concrete indication of a company's dedication to sustainability, a quality esteemed by the market (Darmawan & Firmansyah, 2025). Organizations exhibiting robust Carbon Performance typically garner stakeholder interest in their sustainability initiatives, leading to enhanced transparency regarding carbon emission matters (Mardini & Lahyani, 2023).

Despite substantial research on the relationship between Green Investment and Carbon Performance regarding Carbon Emission Disclosure, the conclusions remain inconsistent. Numerous research indicates that Green investment exerts a positive and considerable influence on Carbon Emission Disclosure (Ali & Widianingsih, 2025; Mulyati & Darmawati, 2023; Nurba Marsa Sativa & Sofie, 2024). In contrast Septa (2024), asserts that Green Investment does not facilitate Carbon Emission Disclosure Yesiani (2023) and Citra & Sastradipraja (2025) similarly demonstrated that Green Investment has no appreciable impact Carbon Emission Disclosure. In accordance with the study by Dani & Harto (2023), Green Investment, leverage, and firm size do not influence Carbon Emission Disclosure. Research indicates that Carbon Performance positively influences Carbon Emission Disclosure (Azzahra et al., 2025; Siddique et al., 2021) This aligns with Mardini & Lahyani (2023), whose research indicates that Carbon Performance affects Carbon Emission Disclosure, suggesting that companies with superior Carbon Performance are more adept at garnering stakeholder attention towards their sustainability initiatives, thus promoting an elevated level of disclosure regarding carbon emission matters. Conversely, some research has yielded contrasting findings, indicating that Carbon Performance does not influence Carbon Emission Disclosure (Priliana & Ermaya, 2023; Yuliana & Wedari, 2023). Considering the identified research gap concerning the implication of Green Investment and Carbon Performance on Carbon Emission Disclosure, alongside the inconsistent findings, it is crucial to acknowledge the potential moderating factors that may affect this relationship. Consequently, this research incorporates the variable of the Independent Board of Commissioners.

The existence of an Independent Board of Commissioners is a significant matter in the context of corporate governance that continues to be extensively discussed in the governance and sustainability literature. The Independent Board of Commissioners serves as one of the objective governance functions despite having a position unrelated to management. Nurhakiki (2024), asserts that the Independent Board of Commissioners is a governing body tasked with overseeing the performance of the board of directors, particularly in relation to the implementation of policies and activities within the company that are in line with the standards of sound corporate governance. It is thought that the board of commissioners' independence improves management performance and supervisory duties, which in turn aids in enhancing the standing of the business (I. Setiawan et al., 2022).

The Independent Commissioners must act objectively and have no personal interests in the company, enabling them to maintain accountability and fairness in decision-making (Manurung, 2022). However, inconsistency with stakeholder theory can also be demonstrated when Independent Commissioners are unable to encourage the company to

disclose all its activities to stakeholders (Maulidiavitasari & Yanthi, 2021). The effectiveness of Independent Commissioners is a key factor in ensuring that governance and sustainability principles are consistently implemented. Effective Independent Commissioners will make sure that management fulfills its responsibilities and keep an eye on whether the business has complied with all applicable laws, including those pertaining to carbon emissions (Saraswati et al., 2021). With independent oversight, company management will be encouraged to be more accountable in implementing real Green Investment, rather than merely symbolic or greenwashing.

In accordance with Undang-Undang No 40 Tahun 2007 regulating Limited Liability Companies, the board of directors possesses complete authority to manage the firm in order to protect its interests and ensure operational continuity (Wiguna et al., 2025). The Independent Commissioner's supervision is crucial for guaranteeing the consistent implementation of carbon emission reduction strategies and processes in accordance with the company's sustainability standards. The board of commissioners assures compliance with rules and enhances the quality of Carbon Emission Disclosures by effectively managing the company's Carbon Performance through the oversight of the accuracy and transparency of the emission reports (Puspita & Tanjaya, 2022). Mardini & Lahyani (2023), contend that board qualities, especially independence, affect carbon disclosure, with corporations that have more independent boards typically offering more extensive information about their carbon emissions. Siddique (2021), research demonstrates that the board's efficacy is crucial for enhancing openness regarding carbon emissions, especially with its independence and meeting frequency. The correlation between Carbon Performance, carbon emission transparency, and Green Investment can be improved by the presence of an independent commissioners.

This research seeks to investigate the relationship between Green Investment, Carbon Performance, and Carbon Emission Disclosure, while evaluating Independent Commissioners as a moderating variable that may enhance or diminish this relationship, in light of the significance of environmental transparency and the growing global focus on climate change issues. This research is vital due to the necessity of comprehending how corporate sustainability initiatives, including Green Investment allocation and enhanced Carbon Performance, can facilitate environmental information disclosure as a means of public accountability. The significance of this topic is escalating in accordance with the demands of investors and regulators for company practices focused on social responsibility and environmental sustainability.

Nonetheless, a research gap persists as the majority of prior studies have solely investigated the direct correlation among Green Investment, Carbon Performance, and Carbon Emission Disclosure, neglecting governance factors such as Independent Commissioners, who are pivotal in ensuring the transparency and accountability of corporate environmental policies. Moreover, prior research indicates mixed results about the implications of Green Investment and Carbon Performance on Carbon Emission Disclosure, and there remains a deficiency of empirical studies in the context of developing nations like Indonesia. This research aims to enhance the theoretical and practical understanding of sustainable investment, corporate governance, and environmental responsibility, while also providing a foundation for the development of corporate policies that align more effectively with the green development agenda.

REVIEW OF LITERATURE

Dowling and Pfeffer (1975) legitimacy theory examines how companies strive to align their operations with the prevailing societal values and norms of their operational environment. Failure to adhere to established norms and laws might substantially jeopardize the company's viability.When a company takes steps to strengthen its relationship with the community, for example by adopting widely accepted standards of behavior, then the company will gain social support that strengthens its legitimacy (Priliana & Ermaya, 2023). Companies utilize voluntary disclosure of environmental information as a method to acquire and sustain public legitimacy, exemplified by Carbon Emission Disclosure, which serves as evidence of their concern for the environmental implication of their operational activities (Desvita & Rahma, 2025).

Stakeholder theory posits that a company's longevity hinges on its capacity to fulfill the expectations of all entities invested in its operations. (Freeman, 1984). Companies cannot function autonomously without acknowledging the involvement of stakeholders, which include suppliers, investors, government entities, customers, employees, and others (Nurba Marsa Sativa & Sofie, 2024). Consequently, the relationship between the organization and its stakeholders must be sustained by initiatives that demonstrate accountability and openness. One initiative is the publication of a sustainability report that includes data on the company environmental, social, and economic performance (Darmawan & Firmansyah, 2025).This report conveys information regarding the environmental implication of the company's activities and demonstrates the company's commitment to accountability for its actions (Desvita & Rahma, 2025). By providing transparent and precise data on carbon emissions, corporations may enhance public trust and fortify relationships with stakeholders. Borghei (2021) study affirms that Carbon Emission Disclosure serves as a company reaction to stakeholder expectations for evaluating climate risks and assuring compliance with established climate policies.

In accordance with legitimacy theory, Green Investment is perceived as a corporate commitment to fulfilling societal expectations while ensuring environmental sustainability. Green Investment refers to the financial allocation required to mitigate climate change by decreasing emissions while maintaining production and consumption levels (Dani & Harto, 2023). Green Investment is operationally achieved by incorporating environmental protection goals into business decision-making processes (Guo et al., 2021; Y. Jiang et al., 2022).This implementation is reflected in various efforts, such as increasing energy efficiency, reducing pollutants, and reducing carbon emissions. This method enables corporations to attain public legitimacy while enhancing their reputation as environmentally responsible organizations (Ayu Wijayanti & Yoseph Agus Bagus Budi N., 2024). Moreover, Green Investment is crucial in mitigating environmental pollution by expanding energy conservation efficiency and reducing emissions, bolstering technical innovation capabilities, and refining the quality of industrial structures (Ren et al., 2022).

Research by Temesgen Hordofa (2023) corroborates that Green Investment significantly contributes to emission reduction, hence positively influencing environmental quality as evidenced by Carbon Emission Disclosures. Research by Mulyati & Darmawati (2023) and Kusumajaya & Budiasih (2024), indicates that Green Investment significantly impacts Carbon Emission Disclosure. A modest allocation of investment to environmentally friendly operations can impede the optimization of company strategy and innovation in the

development of green technology that enhance transparency in emissions disclosure (Septa et al., 2024). From this description, the hypothesis that can be proposed is:
H1: Green Investment has a positive effect on Carbon Emission Disclosure

In accordance with stakeholder theory, corporations with exemplary Carbon Performance are compelled to reveal more carbon-related information due to demand from diverse stakeholders, including as investors, regulators, and civil society (Mardini & Lahyani, 2023).In essence, Carbon Performance signifies the degree to which companies endeavor to diminish carbon emissions and actively engage in the decarbonization process to endorse the global sustainability agenda (Darmawan & Firmansyah, 2025). Nevertheless, within the context of developing countries, such as Indonesia, there exists a discrepancy among companies in terms of awareness and commitment regarding carbon reporting. Several organizations perceive Carbon Performance as a mandatory need; thus, they are reluctant to report or assess the carbon effect of their operational operations (Yuliana & Wedari, 2023).

This low level of awareness indicates that despite mounting pressure from stakeholders, the implementation of Carbon Emission Disclosure continues to encounter challenges, both in terms of regulatory frameworks and internal company readiness. For companies demonstrating commendable Carbon Performance, the process of carbon emissions reporting can evolve into a strategic instrument that fortifies their image and engenders public trust. Furthermore, clear and accurate Carbon Emission Disclosure can alleviate investor apprehension concerning the environmental hazards associated with the company's operating activities (Darmawan & Firmansyah, 2025). This requirement aims to reassure stakeholders of the company's dedication to environmental responsibility and promote internal accountability by clear Carbon Emission Disclosure (Imansari et al., 2024). In accordance with the conclusions of Siddique et al (2021) Carbon Performance positively influences Carbon Emission Disclosure. An enhancement in a company's Carbon Performance correlates with an increase in carbon disclosure. In light of this description, the subsequent hypothesis is put forth:
H2: Carbon Performance has a positive effect on Carbon Emission Disclosure

The Independent Board of Commissioners is crucial for sustaining the equilibrium of corporate governance. They serve as mediators in disputes between directors, monitor the implementation of governance principles, and provide strategic advice to management (A. Setiawan & Kusuma, 2023). Competent Independent Commissioners will facilitate management in executing their responsibilities efficiently and ensure the company complies with relevant rules, especially those pertaining to carbon emissions (Saraswati et al., 2021). The efficacy of the Independent Board of Commissioners' performance directly influences the extent of corporate Carbon Emission Disclosure (Abbas et al., 2021). Heightened stakeholder pressure on environmental concerns has prompted companies to exhibit accountability through transparent information disclosure. A manifestation of this obligation can be achieved through Green Investment, which focuses on environmental sustainability with the primary aim of reconciling economic profitability with social responsibility (Voicu, 2023). Nonetheless, in fact, Green Investment does not invariably ensure an enhancement in Carbon Emission Disclosure. Many companies still make Green Investments only to comply with external pressures from the government, investors, and the public, without a strong internal commitment to environmental transparency (Ramadhani & Astuti, 2023).This is due

to the low allocation of company funds for environmental management activities, which shows that this aspect is not yet a top priority in business strategies (Dani & Harto, 2023).

Many companies still believe that spending on environmental investments will reduce revenue and suppress profitability (Septa et al., 2024). Independent Commissioners are crucial in balancing the company's economic goals with its social and environmental obligations. With their independence, boards of commissioners are able to maintain objectivity in supervising management, so that the Green Investment undertaken by the company is not just a formality, but also makes a real contribution to sustainability (Muchlish & Abbas, 2024). The presence of an Independent Commissioners not only promotes the disclosure of environmental information but also serves as a moderating variable that enhances the link between Green Investment and Carbon Emission Disclosure. A higher share of the Independent Commissioners correlates with a more significant implication of Green Investment on company Carbon Emission Disclosure levels. The hypothesis stated is based on this description:

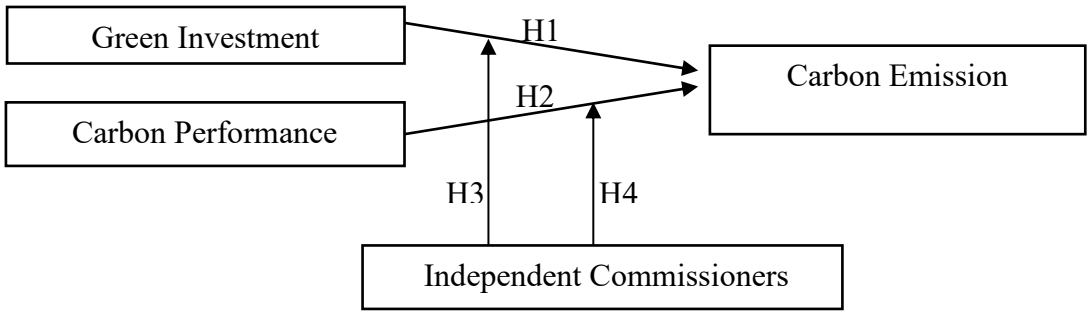
H3: Independent Commissioners strengthen the relationship between Green Investment and Carbon Emission Disclosure

A significant proportion of Independent Commissioners is thought to enhance supervision procedures and augment Carbon Emission Disclosure (Khan et al., 2022). The independent commissioners guarantee that the company's reports are transparent, truthful, and compliant with relevant rules. This will enhance the quality of Carbon Emission Disclosure by corporations (Puspita & Tanjaya, 2022). The Independent Commissioners performs frequent evaluations of environmental policy execution to guarantee that enterprises emphasize both internal performance and the transparent, precise, and accountable reporting of these outcomes to the public. Optimal Carbon Performance must correspond with enhanced Carbon Emission Disclosure, enabling the public to evaluate internal performance and acquire an accurate understanding through published reports (Mardini & Lahyani, 2023). Conversely, organizations with poor Carbon Performance often encounter a quandary regarding Carbon Emission Disclosure. Such disclosure can incur additional costs, especially if done voluntarily without regulatory obligations, as companies need to allocate resources for environmental audits, reporting, and operational adjustments (Priliana & Ermaya, 2023). Moreover, disclosures indicating inadequate Carbon Performance can adversely affect the company's reputation and image, fostering negative impressions among investors and the public, and diminishing stakeholder confidence in the company's sustainability pledges (Ratmono et al., 2021).

Consequently, certain companies opt to refrain from providing comprehensive reports on their carbon emissions or disclose only information that is advantageous to them. This condition indicates that the correlation between Carbon Performance and Carbon Emission Disclosure is not consistently linear. Companies exhibiting strong Carbon Performance are likely to demonstrate greater transparency, whereas those with inadequate performance tend to withhold unfavorable information. A governance framework is essential to guarantee the objectivity and transparency of information, especially during suboptimal firm performance. The presence of an Independent Board of Commissioners acts as a moderating element that enhances the correlation between Carbon Performance and Carbon Emission Disclosure. A higher share of Independent Board of Commissioners correlates with a more significant beneficial implication of the company's Carbon Performance on the extent of Carbon Emission Disclosure. This aligns with the conclusions of Siddique (2021), which

indicate that the efficacy of the board, particularly its independence, significantly impacts carbon disclosure. Firms with boards of commissioners exhibiting a high degree of independence typically disclose their Carbon Performance results with greater transparency, since such independence enables the board to remain objective and unencumbered by management pressure in revealing sensitive information. The hypothesis formulated from this description is:

H4: Independent Commissioners strengthen the relationship between Carbon Performance and Carbon Emission Disclosure



Source: Created by the author (2025)

RESEARCH METHOD

All energy-related firms listed on the IDX from 2022 to 2024 make up the research population. The researcher employed a method known as purposive sampling to select a sample. This approach involves selecting samples based on particular criteria that are relevant to the research goals. This research relies on secondary data collected from energy sector firms' financial reports, annual reports, and sustainability reports. These reports may be found on the official website of the IDX and other credible sources, such as the companies' own websites. We used EViews 13 to look at the collected data.

Table 1.
Research Sample

Criteria	Total
Energy corporations registered on the IDX	89
Energy businesses who failed to consistently release annual and sustainability reports from 2022-2024	(34)
Companies included in the sample	55
Observation Year (2022-2024)	3
Total Observation Data	165

Source: Created by the author (2025)

All variables in this research were adopted and validated from previous studies. The formulas used to measure each variable are presented in full in Table.

Table 2.
Operational Measurement of Variables

Variable	Formula	Scale
Carbon Emission Disclosure (Choi et al., 2013)	$CED = \frac{\Sigma\ item\ disclosed}{18} \times 100\%$	Ratio

Green Investment (Chen & Ma, 2021)	$GI = \frac{total\ environmental\ expenditure}{total\ assets}$	Ratio
Carbon Performance (Al-Fakir Al Rabab'a et al., 2024)	$CP = \frac{\Sigma carbon\ emissions}{\Sigma\ sales}$	Ratio
Independent Commissioner (Saraswati et al., 2021)	$IC = \frac{\Sigma\ independent\ \ commissioners}{\Sigma\ board\ of\ commissioners}$	Ratio

Source: Created by the author (2025)

RESULTS AND DISCUSSION

Utilizing the purposive sampling method, 55 energy companies were chosen as research samples with a 3 year observation period (2022-2024), resulting in 165 observation data. However, of the 165 data, some of them were not normally distributed, and it was necessary to reduce the data containing outliers (extreme data) so that the data met the assumption of normality. In this research, the author eliminated 9 outlier data, leaving only 138 observations that could be used for further analysis.

Descriptive statistics provide a succinct and instructive overview of the gathered data, encompassing measurements such as mean, median, variance, and standard deviation. These measures help in understanding and interpreting the data effectively (Gujarati & Porter, 2009). The findings of the descriptive statistical analysis are summarized as follows:

Table 3.
Descriptive Statistical Test Results

	CED	GI	CP	IC	IC_GI	IC_CP
Rata- rata	0.810	4888.674	9.819	0.428	0.001	4.401
Median	0.889	565.000	11.114	0.400	0.000	4.158
Maximum	1.000	162529.0	17.564	1.000	0.054	12.480
Minimum	0.056	0.000	0.000	0.000	0.000	0.000
Std. Dev	0.221	16107.98	4.675	0.136	0.005	2.736
Observation	138	138	138	138	138	138

Source: Created by the author (2025)

Table 3 presents the descriptive statistics derived from the analysis of 138 observations in this research. The Carbon Emission Disclosure (CED) variable has an average of 0.810, a Std. Dev of 0.221, a min. of 0.056, and a high of 1.000. The Green Investment (GI) variable had an average value of 4,888.674 and a Std. Dev of 16,107.98, with a range spanning from 0.000 to 162,529.0. The Carbon Performance (CP) variable exhibits an average of 9.819, a Std. Dev of 4.675, a min. of 0.000, and a high of 17.564. The Independent Commissioner (IC) variable has a mean of 0.428, a Std. Dev of 0.136, a min. value of 0.000, and a max. value of 1.000.

Table 4.
Regression Model Selection

Method	Criteria	Test	Value	The Result
Chow Test	p-value < 0,05	Fixed Effect Vs Common Effect	0.0000 < 0.05	FEM
Hausman Test	p-value <0,05	Fixed Effect Vs Random Effect	0,4965 < 0,05	REM
Lagrange Multiplier Test	p-value < 0,05	Random Effect Vs Common Effect	0.0000 < 0,05	REM

Source: Created by the author (2025)

The FEM is more suited than the CEM, in accordance with the Chow Test results, which produced a probability value below 0.05. With a probability value of 0.4965, which is more than 0.05 in accordance with the Hausman test, the REM is preferable to the FEM. Based on the results of the LM test, which show a probability value less than 0.05, it seems that the REM is more suited than the CEM. The REM for panel data was used as the regression model in this investigation.

Table 5.
Data Analysis Results for Testing Hypotheses

Variable	Coefficient	Prob.	Result
C	0.467076	0.0000	-
GI	2.449671	0.6866	H1 Rejected
CP	0.030088	0.0037	H2 Accepted
IC	0.278067	0.3078	-
IC_GI	-6.149675	0.7246	H3 Rejected
IC_CP	0.016166	0.0462	H4 Accepted
R-*squared*	0.288671	*Adjusted R-squared*	0.261727
F-*statistic*	10.71362	*Durbin-Watson Stat*	1.764981
Prob(F-statistic)	0.000000		

Source: Created by the author (2025)

Table 5 presents the equation for the regression analysis as follows:

CED = 0.467 + .449*GI + 0.030*CP + 0.278*IC – 6.149*IC_GI + 0.016*IC_CP

This research employs a Random Effect Model for its regression analysis, therefore negating the necessity for validating classical assumptions. This pertains to (Gujarati & Porter, 2009), which asserts that REM is approximated utilizing the Generalized Least Squares (GLS) approach. The Generalized Least Squares technique is an equation that fulfills the classical assumption test, in contrast to the CEM and FEM, which employ Ordinary Least Squares (Gujarati & Porter, 2009), When evaluating regressions with many independent variables, multicollinearity is considered to be absent if the correlation coefficient among these variables is less than 0.80. Estimators that meet the Best Linear Unbiased Estimator (BLUE) criteria may be obtained using the GLS approach, which eliminates the need to test for heteroscedasticity (Gujarati & Porter, 2009)., The combined implication of all

independent variables on the dependent variable is large, as shown by Table 5's F-statistic of 10.713 and probability of 0.000, which is less than 0.05. A total of 6.27% of the variance in the dependent variable can be explained by the independent variables in the model, in accordance with the Adjusted R-Squared score of 0.262. The remaining 73.83% may be explained by factors beyond the scope of this research.

GI does not have a significant implication on CED, as shown in Table 5, where the coefficient is.449 and the probability is 0.687 (>0.05). Additionally, the hypothesis about CP is supported by the data, which shows that CP has a significant and positive implication on CED, a coefficient of 0.030 and a probability value of 0.004 (<0.05). The research's results show that IC does not moderate the implication of GI on CED; hence, the null hypothesis is rejected. The coefficient for the relationship between GI and CED is -6.149, and the probability is 0.725 (>0.05). This hypothesis is supported by the data showing that IC has a moderating effect on CP and CED. The coefficient value is 0.016, and the probability is 0.046 (<0.05), which means that IC enhances the implication of CP on CED.

The Effect of Green Investment on Carbon Emission Disclosure

The conclusions indicate that Green Investment exerts no substantial influence on Carbon Emission Disclosure. This outcome does not fully align with the initial hypothesis, which posited that an increase in Green Investment would lead corporations to publish greater carbon emission statistics as a means of environmental legitimacy. The negligible implication of Green Investment suggests that corporations have not uniformly prioritized Green Investment as a fundamental component of their Carbon Emission Disclosure strategies.

This result corresponds with the findings of Citra & Sastradipraja (2025), which assert that environmental expenditure has not significantly influenced Carbon Emission Disclosure, as Green Investment predominantly affects external reactions, such as heightened public awareness, rather than directly promoting emission transparency. Consequently, in Indonesia's energy sector, Green Investment has not emerged as a significant catalyst for Carbon Emission Disclosure policies, but rather serves a more symbolic role in enhancing the company's environmental reputation.

The Effect of Carbon Performance on Carbon Emission Disclosure

The conclusions indicate that Carbon Performance exerts a positive and significant influence on Carbon Emission Disclosure. This research corroborates the basic idea that firms exhibiting strong Carbon Performance will demonstrate greater transparency in disclosing carbon emission data. Organizations exhibiting superior Carbon Performance are motivated to offer more extensive disclosures about carbon emissions, as they frequently encounter requests for information from diverse stakeholders. In accordance with stakeholder theory (Freeman, 1984), enterprises must fulfill the informational needs of stakeholders, such as investors, regulators, and the public, who want transparency in the company's environmental management practices.

Research conducted by Mardini & Lahyani (2023) corroborates this conclusion, indicating that firms with superior Carbon Performance are more inclined to enhance Carbon Emission Disclosure in order to meet the expectations of diverse stakeholders. The conclusions of this research demonstrate that Carbon Performance significantly influences Carbon Emission Disclosure, particularly within the Indonesian energy industry, where stakeholders advocate for enhanced transparency in environmental management by firms.

Independent Commissioners in the relationship between Green Investment and Carbon Emission Disclosure

This research demonstrates that Independent Commissioners cannot moderate Green Investment on Carbon Emission Disclosure. The data suggest that the presence of Independent Commissioners fails to strengthen the relationship between Green Investment and the openness of corporate Carbon Emission Disclosure. From Freeman (1984) in accordance with stakeholder theory, Independent Commissioners function as a governance tool designed to safeguard the interests of non-managerial stakeholders, such as the community and the environment, by enhancing corporate accountability and transparency. Theoretically, the presence of Independent Commissioners is anticipated to motivate management to guarantee that Green Investment encompasses not only operational activities but also entails more extensive Carbon Emission Disclosure as a means of accountability to stakeholders.

Nonetheless, the conclusions of this research indicate that this position has been ineffective. A primary issue is that Green Investment often focuses on influencing the company's external response, cultivating an ecologically good image, and garnering public attention, rather than serving as a direct catalyst for transparency in Carbon Emission Disclosure (Septa et al., 2024). Consequently, although corporations participate in Green Investment, these initiatives are not inherently incorporated into more transparent and quantifiable carbon emission reporting standards. The failure of Independent Commissioners to enhance the connection between Green Investment and Carbon Emission Disclosure might be attributed to the constraints of their structural and substantive functions. Independent Commissioners who are only based on proportional numbers do not fully reflect the effectiveness of supervision, such as active involvement, meeting intensity, and competence in sustainability issues, so that the existence of Independent Commissioners tends to be formal and does not function optimally in overseeing Carbon Emission Disclosure policies.

Furthermore, the characteristics of the sample companies in this research indicate that the number of commissioners is relatively constrained, hence diminishing the fraction of Independent Commissioners and further restricting their implication on the company's strategic decision-making process (Edinov et al., 2022). This constraint inhibits Independent Commissioners from enhancing the connection between Green Investment and Carbon Emission Disclosure, resulting in company Green Investments not being effectively utilized to improve the transparency of Carbon Emission Disclosure.

Independent Commissioners in the relationship between Carbon Performance and Carbon Emission Disclosure

This research demonstrates that Independent Commissioners can strengthen the relationship between Carbon Performance on Carbon Emission Disclosure. In accordance with Freeman (1984) stakeholder theory posits that enterprises must meet the informational needs of stakeholders, particularly about the environmental consequences of their operational actions. Effective Carbon Performance signifies a company's dedication to proficiently controlling carbon emissions, hence heightening stakeholder expectations for enhanced transparency in Carbon Emission Disclosure. The presence of Independent Commissioners enhances this relationship by enforcing tougher scrutiny of carbon emissions management and corporate communications.

Independent Commissioners, by their neutrality and autonomy, promote corporate emphasis on Carbon Performance and guarantee transparent disclosure of emissions data to

stakeholders. This enhances corporate responsibility and fortifies the openness of carbon emissions reporting (Mardini & Lahyani, 2023). Thus, the combination of good Carbon Performance and oversight by Independent Commissioners creates a stronger incentive for management to meet stakeholder expectations. This leads to broader and higher-quality Carbon Emission Disclosure practices, which not only enhance corporate accountability but also create additional value for stakeholders.

CONCLUSION

Research conducted on the energy sector of the IDX from 2022 to 2024, utilizing 138 samples, revealed that Green Investment has not appreciable implication Carbon Emission Disclosure. This demonstrates that even though companies invest in green initiatives, this does not directly encourage increased Carbon Emission Disclosure. Conversely, Carbon Performance considerably affects Carbon Emission Disclosure, indicating that firms with enhanced Carbon Performance exhibit greater transparency in disclosing their carbon emissions. In addition, this research indicates that Independent Commissioners do not enhance the relationship between Green Investment and Carbon Emission Disclosure. Independent Commissioners have been shown to strengthen between Carbon Performance and Carbon Emission Disclosure, indicating that a more robust supervisory role can promote greater transparency in companies' disclosures regarding carbon emissions, particularly when the company demonstrates strong performance in carbon management. The constraints of this investigation reside in the measurement of Green Investment, which is still limited to environmental expenditure costs, which may not fully describe the Green Investment initiatives undertaken by companies.

In addition, the measurement of Independent Commissioners, which is only based on the proportion of the number, cannot yet reflect their effectiveness in more substantial and active supervision. A recommendation for more research is to employ a more extensive metric for Green Investment, such as classification in accordance with the Rating Assessment Program (PROPER) level, which can yield a more precise assessment of a company's dedication to environmental stewardship and sustainability. Furthermore, future research should evaluate Independent Commissioners not only based on their number, but also considering other aspects such as their level of involvement in meetings, their competence in sustainability issues, and their experience and influence in decision-making related to corporate environmental policies. Subsequent research should incorporate additional characteristics that may affect Carbon Emission Disclosure, including Green Innovation, CSO presence, gender diversity, and other relevant criteria. Thus, more representative research results can be obtained, providing deeper insights into Carbon Emission Disclosure practices in companies.

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