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The Influence of Board Diversity on Carbon Emission Disclosure in Energy-Sector Firms

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Abstract

This research seeks to supply empirical proof regarding the impact of board diversity on carbon emissions reporting in energy-sector companies traded on the Indonesia Stock Exchange during the 2022–2024 timeframe. Using Upper Echelon Theory as the theoretical foundation, the characteristics of the board of commissioners and the board of directors are analyzed separately in this study, covering gender, age, nationality, and political connections. The research sample comprises 69 energy-sector firms, yielding 200 firm-year observations. Carbon emission disclosure is measured using 19 disclosure indicators related to carbon emissions based on the Global Reporting Initiative (GRI). The panel data regression analysis demonstrates that firms with a higher proportion of foreign commissioners practice greater carbon emissions disclosure. The panel data regression analysis indicates that firms with a higher proportion of foreign commissioners characterize firms with greater carbon emissions disclosure. However, the proportions of female commissioners, younger directors (under 40), foreign directors, and directors with political connections are negatively associated with carbon emissions disclosure. The results indicate that firms still perceive carbon emission disclosure as providing insignificant benefits. Instead, it is often viewed as a burden due to the high costs of carbon emissions disclosure.

Keywords: Board Diversity; Carbon Emission Disclosure; Energy Sector; Upper Echelon Theory

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INTRODUCTION

Indonesia, a country rich in resources, has significant potential for growth across multiple business sectors. This positive development coincides with the challenges of climate change driven by numerous economic activities, especially in the energy sector. The energy industry is the predominant source of greenhouse gas emissions worldwide, with 36% of total global emissions (Bapennas, 2024). Elevated greenhouse gas emissions have been a concern for the government in recent years. Government commitment to emission reduction in Indonesia is demonstrated through the implementation of Presidential Regulation No. 98 of 2021, by which the emission-reduction objective was revised from the initial 29% E-NDC target to 32% by 2030. (Kementrian ESDM, 2022). Carbon emission disclosure may serve as an instrument to facilitate carbon emission reduction. As a nationwide regulation, POJK No. 51/2017 has stipulated sustainability reporting, although carbon emissions disclosure has not yet been mandated.

In this respect, board members arguably exert significant influence over information disclosure in sustainability reports, including those related to carbon emissions (Chika & Widianingsih, 2024). Diverse board compositions could increase conflict due to divergent views but may also expand strategic options for solving problems (Yulia et al., 2022). Diverse boards also provide access to a range of resources that enhance understanding of emerging issues, including carbon emissions disclosure (Lahyani, 2022). The argument is consistent with the Upper Echelon theory, which is characterized by the premise that diverse values and understandings arising from boards' divergent demographic characteristics influence top managers' strategic decision-making processes. (Thambugala & Rathwatta, 2021).

More diverse board members will deliver broader perspectives that represent stakeholders' diverse characteristics (Lahyani, 2022). Board member diversity may include gender, age, nationality, and political connections. Female boards arguably encourage more extensive carbon emission disclosure due to feminine traits such as greater care, empathy, and social consciousness than their male counterparts (Putri et al., 2025). Age is crucial for one's working methods, as older individuals are arguably more cautious and experienced (Mardani & Kristanto, 2020). Further, the presence of foreign board members benefits firms as they tend to have broader perspectives and relations (Chika & Widianingsih, 2024). Firms' political connections will affect environmental disclosure compliance as they seek to preserve their political connections by improving regulatory compliance (Nugrahanti & Natasya, 2023).

Various findings have been yielded by studies investigating the association between board diversity and disclosure, including carbon emissions. French nonfinancial firms are analyzed by Lahyani (2022), where it is documented that carbon emissions disclosure is used by more diverse board members—in terms of nationality, gender, independence, tenure, and age—to communicate with stakeholders. In other words, firms with more diverse board members will disclose carbon emissions more extensively. Energy-sector firms are focused on by Putri et al. (2025), who demonstrate that the extent of firms' carbon emission disclosure is positively affected by board gender diversity, profitability, and media exposure. Further, Chika & Widianingsih (2024) observe that board gender diversity in energy-sector and agricultural firms does not affect carbon emissions disclosure. Nonetheless, carbon emission disclosure is positively affected by board diversity in terms of nationality and independence. Sari & Nadhira (2023) highlight that Indonesian publicly listed

firms' board size and independence positively affect ESG disclosure, whereas board gender diversity and audit committee independence negatively affect it.

Previous research has shown uneven findings and has primarily focused on social responsibility disclosure in general (Bangun & Ridaryanto, 2021; Juwono & Mayangsari, 2022; Nugrahanti & Natasya, 2023; Sari & Nadhira, 2023). This paper conducts an empirical analysis of the effect of board diversity on carbon emission disclosure among IDX-listed energy-sector enterprises from 2022 to 2024. Board diversity is measured in terms of gender, age, nationality, and political ties. The study divides the corporate board into two sections: the board of commissioners and the board of directors, each with a distinct role, so that it is apparent which board is involved in carbon emissions disclosure. We focus on the energy sector because it contributes considerably to carbon emissions. As Presidential Regulation No. 98 of 2021 concerning the National Implementation of Carbon Economic Value and Greenhouse Gas Emission Control in National Development went into effect at the end of 2021, using the 2022-2024 period as the observation years may capture the regulation's effects on energy firms. Our work provides more empirical evidence on how Upper Echelon theory can be used to explain the effects of board diversity on carbon emissions disclosure in Indonesia, particularly among energy sector corporations.

LITERATURE REVIEW

Upper Echelon Theory

Upper Echelon Theory explains that top managers' characteristics reflect their firms' decisions (Hambrick & Mason, 1984). Further, it is posited by this theory that perceptions and decision-making processes will be affected by boards' diverse characteristics, such as age, experience, and personality. (Fitriasari & Soewarno, 2024). As firms' decisions are based on their board members' values, their conditions will reflect the characteristics of their board members (Hambrick, 2007). In this respect, board diversity will arguably offer more comprehensive decision considerations (Hidayah et al., 2024). Boards' various perspectives improve accountability and transparency in environmental responsibility disclosure (Lahyani, 2022). In line with this theory, board diversity will offer broader perspectives for analyzing emerging problems that affect the quality of decision-making processes.

Carbon Emission Disclosure

Carbon emission disclosure refers to historical and prospective reporting of a firm's carbon emission performance to provide transparent information to internal and external stakeholders as a form of its responsibility (Handayani et al., 2023). In Indonesia, carbon emission disclosure is not directly mandated. Presidential Regulation No. 98 of 2021 concerning the National Implementation of Carbon Economic Value and Greenhouse Gas Emission Control in National Development discusses emission-producing sectors, including the energy sector. Nonetheless, it has not specifically stipulated carbon emission disclosure. Accordingly, firms must consider nonfinancial aspects, including carbon emission disclosure, to maintain their reputations and long-term performance (Bedi & Singh, 2025). Carbon emission disclosure may serve as a communication channel to enhance firms' public value (Lahyani, 2022), improve corporate image

(Hapsoro, 2018), boost firms' competitive advantages, and mitigate information asymmetry between firms and their stakeholders (Rashid & Barokah, 2024).

Board Diversity

Board diversity reflects differences among board members' demographics, backgrounds, skills, experience, and competence as a collective unit (Akpan & Nkpodot, 2025). Board diversity reflects public diversity and mitigates the risk that decisions represent only certain groups, thereby improving the quality of corporate governance and strengthening social contract responsibility (Akpan & Nkpodot, 2025; Hidayah et al., 2024). Board diversity helps firms identify, improve, and utilize human resources effectively for decision-making processes (Yulia et al., 2022) and includes various characteristics, such as gender, age, nationality, and political connections.

In general, Indonesia applies a two-tier system that separates the functions of supervisory and executive boards (commissioners and directors) (Lubis et al., 2022). Boards of directors are responsible for firms' executive functions and decision control, as stipulated by the Corporate Act No. 4 of 2007 (Novandri & Sunarjanto, 2016). Boards of commissioners are responsible for overseeing policies and operational activities and providing advice to the boards of directors during the decision-making processes for the firms' interests (Novandri & Sunarjanto, 2016). Accordingly, the characteristics of the boards of commissioners and directors are analyzed separately in this study to investigate their effects on carbon emission disclosure.

Board Members' Gender and Carbon Emission Disclosure

Board members' gender reflects the gender composition in board membership, as measured by the proportion of female members (Omenihu et al., 2025). The quality of firms' involvement in environmental information disclosure is arguably improved by the presence of female board members, either on boards of commissioners or directors, due to their greater focus on long-term prospects. (Sari & Nadhira, 2023). Female board members tend to be more cautious, empathetic, responsible, and socially conscious, which encourages greater corporate transparency in carbon emissions disclosure (Hadya & Susanto, 2018; Ummah & Setiawan, 2021; Sari & Nadhira, 2023; Putri et al., 2025). The presence of more socially and environmentally aware female board members likely motivates firms to increase nonfinancial transparency, including greater carbon emission disclosure and environmental awareness (Sánchez et al., 2024). Consistent with this argument, Saraswati et al. (2021) document that carbon emission disclosure is positively affected by the presence of female board members. The findings underscore that the presence of female board members increases firms' sensitivity toward social and environmental issues. Putri et al. (2025) and Hidayah et al. (2024) also support the findings. Based on these arguments, the following hypotheses are proposed:

H1a = The proportion of female commissioners positively affects carbon emission disclosure.

H1b = The proportion of female directors positively affects carbon emission disclosure.

Board Members' Age and Carbon Emission Disclosure

Board age diversity refers to age variance among a firm's board members (Akpan & Nkpodot, 2025). Board members are classified as young when they are under 40 years of age (Kusumastuti et al., 2007). Younger board members bring unique value by being more

environmentally responsible, using new management methods, and being more flexible. Firms with younger board members are arguably more willing to take risks and receptive to environmental disclosure issues (Hidayah et al., 2024). Akpan & Nkpodot (2025) explain that younger commissioners and directors are necessary to offer various perspectives and novel skills, including technological usage, to support environmental disclosure. The arguments lead to the following hypotheses:

H2a = The proportion of young commissioners positively affects carbon emission disclosure.

H2b = The proportion of young directors affects carbon emission disclosure.

Board Members' Nationality and Carbon Emission Disclosure

Nationality reflects people's initial identities, including their residences and birthplaces (Handayani et al., 2023), which are often classified as Indonesian or foreign. In terms of carbon emission disclosure, Indonesian policies have been less stringent and comprehensive than those in other nations, particularly industrialised ones. As a result, foreign board members may provide more extensive perspectives and experience in carbon emission disclosure, encouraging Indonesian companies to make more complete environmental disclosures. According to Estélyi and Nisar (2016) and Chika and Widianingsih (2024), the inclusion of foreign board members often provides varied viewpoints, broader professional networks, and more intense knowledge bases to promote better-quality decision-making processes. Foreign board members add value with their diverse international knowledge and perspectives (Lahyani, 2022). The presence of foreign board members increases board heterogeneity, ensuring stakeholder participation in decision-making processes (Chika & Widianingsih, 2024). Thambugala & Rathwatta (2021) and Chika & Widianingsih (2024) show that the participation of foreign board members improves carbon emission disclosure. Based on the arguments presented above, we propose the following hypotheses:

H3a = The proportion of foreign commissioners positively affects carbon emission disclosure.

H3b = The proportion of foreign directors positively affects carbon emission disclosure.

Politically Connected Board Members and Carbon Emission Disclosure

Commissioners and directors with political connections maintain ties to government officials, political party officials, and other senior positions at both local and national levels (Juwono & Mayangsari, 2022). The presence of politically connected board members helps firms improve their performance through regulatory support, better access to government regulations, and enhanced public legitimacy (Muliawati & Hariyati, 2021). Such benefits motivate politically connected firms to disclose more environmental information to preserve their legitimacy, anticipating reciprocal benefits from regulatory authorities (Juwono & Mayangsari, 2022). Hence, board members' political connections could transform evaluations of stakeholders' interests and affect firms' social responsibility disclosure policies (Huang & Zhao, 2016). Nugrahanti & Natasya (2023), Juwono & Mayangsari (2022), and Huang & Zhao (2016) observe that firms' political connections positively affect environmental disclosure. The above arguments lead to the following hypotheses:

H4a = The proportion of politically connected commissioners positively affects carbon emission disclosure.

H4b = The proportion of politically connected directors positively affects carbon emission disclosure.

RESEARCH MODEL

The figure below illustrates our research conceptual framework, which examines how firms' board diversity—specifically gender diversity, age diversity, nationality diversity, and political connections—affects carbon emission disclosure, with gender diversity, age diversity, nationality diversity, and political connections being the independent variables and carbon emission disclosure as the dependent variable.

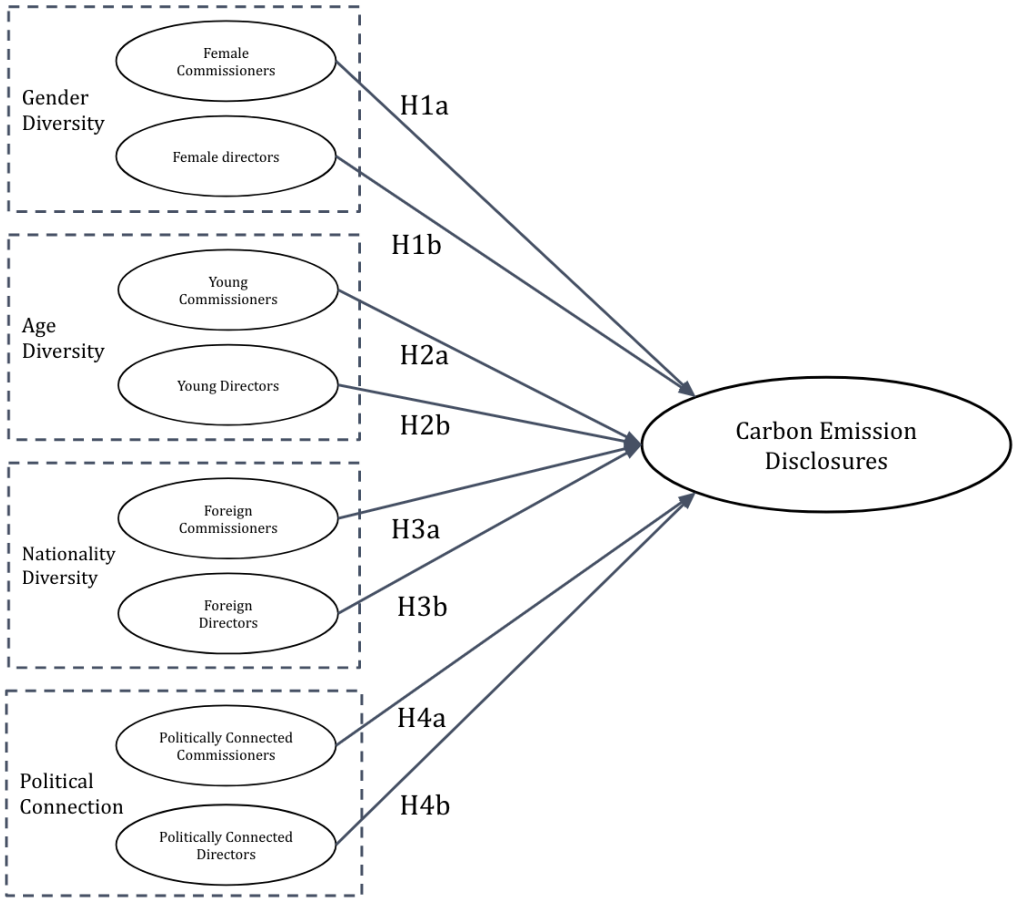


Figure 1. Research Conceptual Framework

RESEARCH METHODS

The research samples consist of 69 energy-sector firms listed on the Indonesian Stock Exchange (IDX) from 2022 to 2024, giving 200 firm-year observations. The researchers collected secondary data from the annual reports of the sample firms, which they obtained from the official websites of either IDX or the firms.

VARIABLE MEASUREMENT

The dependent variable in this study is carbon emission disclosure (CED). This is operationalized using content analysis, which involves identifying documents and texts and then measuring their contents using specific indices. The measurement is based on the Global Reporting Initiative (GRI) 305 as part of the GRI Series 300 (environmental aspects). The carbon emission indicators are broken down into six categories: (1) Managerial disclosure (GRI 103), (2) GRI 305-1, (3) GRI 305-2, (4) GRI 305-3, (5) GRI 305-4 (carbon emission intensity), and (6) GRI 305-5 (carbon emission reduction). These six categories of carbon emission disclosure comprise 19 disclosure items (see Appendix 1). Each disclosure item is scored 1. Carbon emission disclosure is calculated as the ratio of the disclosed items to the total number of required disclosure items.

The proportion of board members classified by gender, age, nationality, and political ties serves as the independent variable for board diversity. Gender is determined by the proportion of female commissioners (GDK) or directors (GDD) to total board members (Saraswati et al., 2021). AGEK and AGED are board member ages calculated as the fraction of board members under 40 years old to the total number of board members (Lubis et al., 2022). We measure nationality (ORGK, ORGD) using the ratio of foreign board members to total board members (Yulia et al., 2022). Political connections (POLK and POLD) are calculated as the ratio of politically linked commissioners or directors to the total number of board members. We follow Supatmi (2020) in defining political relationships using Faccio (2006), Faccio et al. (2006), Habib et al. (2017), and Wu et al. (2012). Political connections on the board: Company board members are considered to have political ties if they are or have been heads of state, ministerial officials, members of parliamentary institutions, military officials, leaders of other government institutions, or regional leaders, or if they have close relationships (such as family connections) with parties or politicians. We also refer to past research. The board qualifies as politically linked if it meets any of the following criteria. If the board's profile meets any of these requirements, it is deemed politically connected. We also calculate the proportion of politically linked board members by dividing the number of politically connected board members by the total number of board members in the company.

This study utilizes three control variables: firm size, profitability, and leverage. The natural logarithm of total assets is used to measure firm size (SIZE); the division of after-tax net profits by total assets calculates profitability (ROA) as Return on Assets; and the Debt to Equity Ratio, obtained by dividing total debt by total equity, operationalizes leverage levels (LEV).

RESULT

The following table presents the descriptive statistics for our research variables, including the maximum, minimum, mean, and standard deviation.

Table 1. Descriptive Statistics of Research Variables

Research Variable	Mean	Maximum	Minimum	Std. Dev
CED	0.418	0.945	0.105	0.225

GDK	0.107	0.667	0.000	0.170
GDD	0.119	0.667	0.000	0.175
AGEK	0.047	0.500	0.000	0.116
AGED	0.118	1.000	0.000	0.238
ORGK	0.077	1.000	0.000	0.181
ORGD	0.113	1.000	0.000	0.199
POLK	0.213	1.000	0.000	0.285
POLD	0.011	0.500	0.000	0.058
SIZE	28.826	32.752	24.577	1.848
ROA	0.048	0.590	-6.173	0.466
LEV	1.221	35.328	-9.001	3.298

Source: Processed Secondary Data (2026)

Note: CED = Carbon Emission Disclosure; GDK = Female Boards of Commissioners; GDD = Female Boards of Directors; AGEK = Young Boards of Commissioners; AGED = Young Boards of Directors; ORGK = Foreign Boards of Commissioners; ORGD = Foreign Boards of Directors; POLK = Politically Connected Boards of Commissioners; POLD = Politically Connected Boards of Directors; SIZE = Firm Size; ROA = Returns on Assets; LEV = Leverage

The descriptive statistics reveal that the level of carbon emission disclosure among energy-sector firms averages 41.8%, or only about 8 of 19 disclosure items. The figure indicates that, in general, firms have initiated disclosing carbon emissions, but only to a limited extent. For the gender diversity variable, the average proportions of female commissioners and directors are relatively low, as evidenced by data showing that, out of 69 firms, 41 have no female commissioners and 39 have no female directors. The average percentage of young commissioners and directors (under 40) is comparatively low, indicating limited age diversity. This suggests that senior individuals continue to dominate the boards of energy firms. Likewise, regarding national diversity and political affiliations, energy-sector firms possess a limited number of foreign nationals or politically linked individuals on their boards of commissioners and directors. For the control variables, the mean firm size is 28.826, equivalent to Rp 3,320 billion, indicating that our sample firms are relatively large. The profitability variable, measured by ROA, averages 4.8%, implying that energy-sector firms generate net profits on their total assets. Lastly, the mean leverage, measured using DER, is 1.221, suggesting that the sample firms are highly leveraged.

Before hypothesis testing, we run the classical assumption tests and panel data regression estimation tests. Table 2 presents the summarized classical assumption tests.

Table 2. Results of Classical Assumption Tests

Normality Test (Prob. Jarque-Bera)	Heteroskedasticity Test (Breusch-Pagan)	Multicollinearity Test (1<VIF<10)	Autocorrelation Test
1.157 (Normal)	0.2266 (No heteroskedasticity)	No multicollinearity	Positive autocorrelation

Source: Processed Secondary Data (2026)

The classical assumption tests suggest that our data meet the normality, heteroscedasticity, and multicollinearity assumptions but still exhibit positive autocorrelation. Gujarati and Porter (2009) assert that the estimation of the panel data model via the random effect approach is executed using the Generalized Least Squares (GLS) method. This method theoretically resolves concerns of autocorrelation and heteroscedasticity, resulting in an estimator that is BLUE (Best Linear Unbiased Estimator), as evidenced by the results of the panel data regression estimation model test in Table 3.

Table 3. Tests on Panel Data Regression Estimation Model

Chow test (Cross-section Chi-square)	Hausman Test (Cross-section random)	Lagrange Test (Breusch- Pagan, Both)	Appropriate Model
132.031***	9.296**	7.336***	Random Effect Model

*Note: *, **, ***) significant at a 10%, 5%, 1% significance level, respectively*

Source: Processed Secondary Data (2026)

Next, Table 4 presents the summarized results of hypothesis testing using panel data regression analysis.

Table 4. Results of Hypothesis Testing

Research Variable	Coefficient	Prob
Constant	-1.481	0.000
GDK	-0.195	0.008
GDD	0.056	0.243
AGEK	0.025	0.421
AGED	-0.155	0.005
ORGK	0.125	0.062
ORGD	-0.128	0.058
POLK	0.038	0.247
POLD	-0.435	0.032
SIZE	0.066	0.000
ROA	0.040	0.075
LEV	0.004	0.148
R^2	0.374	
Adjusted R^2	0.337	
F-statistic	10.181	0.000

Note: see Table 1

Source: Processed Secondary Data (2026)

An adjusted R^2 of 0.337 is yielded by the analysis, by which it is implied that 33.7% of the variance in the dependent variable is explained by the independent variables in the model. In

comparison, other variables not included in the research model account for the remaining 66.3%. The F-test yields 10.181 (significant at the 1% level), implying that both regression models meet the criteria for hypothesis testing.

Our hypothesis testing reveals that only foreign commissioners positively affect carbon emission disclosure among energy-sector firms. The results support H3a. Other hypotheses are not supported. Nonetheless, gender diversity (the proportion of female commissioners), young directors, foreign directors, and politically connected directors negatively affect carbon emission disclosure. For the control variables, firm size and profitability positively affect carbon emission disclosure, while leverage is not significant.

DISCUSSION

Gender Diversity and Carbon Emission Disclosure

This study demonstrates that the gender diversity of boards of commissioners negatively affects carbon emissions disclosure. Accordingly, practices for disclosing carbon emissions are reduced by a greater proportion of women serving on boards of commissioners. The Upper Echelon Theory supports the findings, suggesting that the demographic characteristics of top leaders influence organizational preferences and decisions. In this context, female commissioners tend not to prioritize carbon emission disclosure, especially when relevant regulations remain lax. Female commissioners say companies avoid extensive or complete carbon emission disclosure because it is not yet mandatory. Additionally, carbon emission disclosure is costly, encouraging commissioners to emphasize efficiency and cost control, which highlights that a heightened proportion of female commissioners is followed by reduced carbon emission disclosure (Anggraini et al., 2024).

For boards of directors, carbon emission disclosure is not affected by the proportion of female directors. Women's greater social sensitivity and environmental concerns do not automatically result in their influence on sustainability aspects such as carbon emissions (Chika & Widianingsih, 2024). Low women's representation arguably limits female directors' ability to influence firms' strategic policies. The findings are consistent with Chika & Widianingsih (2024) and Mardani & Kristanto (2020), who explain that the presence of female boards on corporate governance does not significantly increase environmental information disclosure.

Board Age and Carbon Emission Disclosure

Carbon emissions disclosure is not affected by the proportion of young commissioners; in fact, a negative effect is exerted by a higher proportion of young commissioners. The upper echelon theory explains that age, as one of the leaders' demographic characteristics, shapes organizational orientation and strategic preferences. Nonetheless, disclosure policies do not necessarily reflect the age of the commissioners. In this respect, younger directors tend not to encourage their firms to disclose carbon emissions more extensively. Young directors see carbon emission disclosure, which is still voluntary, as a non-strategic choice for the company, and the benefits of carbon emission disclosure remain unclear. Thus, they prioritize efficiency and short-term financial performance. Consequently, as individuals directly involved in operational decision-making processes, they tend to emphasize cost factors in their decisions, while carbon emission disclosure is frequently

considered costly (Novandri & Sunarjanto, 2016) and therefore deemed less important. The findings are inconsistent with Bangun & Ridaryanto (2021) and Kusumastuti et al. (2007), who demonstrate that senior boards dominate firms' decision-making processes. More mature board members are considered wiser in making decisions, which will affect firms' performance and decisions (Lubis et al., 2022).

Board Nationality and Carbon Emission Disclosure

The diversity of nationalities on boards of commissioners positively influences carbon emissions disclosure. Thus, firms with a greater proportion of foreign commissioners disclose carbon emissions more extensively. The findings support the upper echelon theory that emphasizes that top leaders' characteristics affect firms' policies. Foreign commissioners typically have greater exposure to international governance standards and sustainability practices, leading to more progressive views on environmental issues. The findings are consistent with Thambugala & Rathwatta (2021) and Chika & Widianingsih (2024), who demonstrate that boards' nationalities and backgrounds positively affect carbon emission disclosure. Nonetheless, the diversity of nationalities on boards of directors does not even harm carbon emission disclosure. Foreign directors may have more diverse business experience, but they may be less sensitive to emissions reporting issues within the domestic regulatory context. Different influences of foreign commissioners and directors may be attributable to different authorities between commissioners as supervisors and directors as operational executives (Novandri & Sunarjanto, 2016). Boards of directors play more dominant roles in firms' strategic and operational decisions, and carbon emission disclosure, which is still voluntary, is not considered a strategic choice for the company. This leads them to focus more on cost efficiency, which in turn demonstrates their performance.

Political Connections and Carbon Emission Disclosure

Boards of commissioners' political connections do not affect carbon emission disclosure. Nonetheless, the proportion of politically connected directors even harms carbon emissions disclosure. Hence, firms with a greater proportion of politically connected directors even reduce their carbon emission disclosure. The findings demonstrate that top managers' social networks and backgrounds likely shape strategic preferences in decision-making processes. Upper-echelon theory suggests that firms often avoid carbon emission disclosure, viewing it as a non-strategic option for enhancing company performance. The negative effect of political connections is attributable to politically connected firms' lower regulatory pressures, which mitigate drivers of environmental disclosure (Muttakin et al., 2018). Politically connected directors may consider carbon emissions disclosure a lower priority, especially when operational stability and regulatory support are secured through political connections. The results of this study contradict Nugrahanti & Natasya (2023), Juwono & Mayangsari (2022), and Huang & Zhao (2016), who document that firms' political connections positively affect environmental disclosure. In the energy sector, political connections arguably serve more to secure regulatory access and operational stability than to enable more extensive public disclosure, rendering them insignificant in explaining firms' disclosure policies.

CONCLUSION

This study seeks to empirically demonstrate the effect of board diversity (gender, age, nationality, and political connections) on carbon emission disclosure among energy-sector firms listed on the Indonesian Stock Exchange in 2022-2024. The results reveal significant differences between the boards of directors and the boards of commissioners. More particularly, firms with a higher proportion of foreign commissioners disclose carbon emissions more comprehensively. Nonetheless, the proportion of female commissioners, young directors (under 40), foreign directors, and politically connected directors encourages firms to disclose carbon emissions less extensively. The results demonstrate that the energy sector has not yet considered carbon emission disclosure beneficial; these firms even perceive it as costly.

Theoretically, this study provides additional empirical evidence regarding the application of the Upper Echelon Theory in explaining how board characteristics and diversity affect disclosure in energy sector companies in Indonesia, indicating that not all forms of board diversity have a positive impact on carbon emission disclosure. For female commissioners, young directors, foreign directors, and politically connected directors, carbon emission disclosure seems not a strategic choice to improve company performance but rather a waste of money. As a practical implication, the results of this study can be used as study material for energy sector companies when they want to disclose carbon emissions because directors tend to avoid it. For regulators, the research findings can be considered in evaluating POJK No. 51/2017 concerning the implementation of sustainable finance for financial services institutions, issuers, and public companies, which has mandated sustainability reports but not yet mandatory carbon emission disclosure.

LIMITATION

Several limitations are associated with this study. First, carbon emission disclosure is measured dichotomously (i.e., yes or no), thereby limiting the assessment of the quality and depth of such disclosure. Second, our carbon emissions disclosure indicator refers to an international standard (the GRI standard), which may include several indicators that do not align with the Indonesian energy sector. For instance, only 4 out of 69 sample firms disclose an indicator concerning indirect emissions under GRI 305 (indirect carbon emissions based on market energy in CO_2-equivalent metric tons). Future research is recommended to develop measurement methods that utilize more than just a dummy approach, but also consider the quality and depth of disclosure to more comprehensively represent a company's level of transparency. Furthermore, future research could consider adjusting or developing indicators that better align with regulatory conditions and reporting practices in Indonesia, if any. Expanding the research object to other sectors is also recommended to increase the generalizability of the results.

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