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CEO Characteristics and Carbon Disclosure in Energy Sector: Moderating Stakeholder Pressure

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Abstract

This study investigates the effect of CEO traits and stakeholder pressure Regarding the disclosure of carbon emissions in energy sector listed between 2020 and 2024 on the Indonesia Stock Exchange. Additionally, this study examines the moderating role of stakeholder pressure in the relationship between CEO characteristics as well as carbon emissions. Using a quantitative approach involving panel data regression and multiple linear regression with moderation analysis (MRA) to assess the moderating effect of stakeholder pressure by including an interaction term (CEO Characteristics × Stakeholder Pressure). this study analyzes 67 companies, resulting in 335 firm-year observations. The results show that CEO characteristics and stakeholder pressure have a positive and significant effect on carbon emission disclosure. However, stakeholder pressure does not moderate the relationship between CEO characteristics and carbon disclosure. The novelty of this study lies in integrating internal leadership factors and external stakeholder pressure within a moderating framework in the context of Indonesia's energy sector. The findings support Upper Echelons Theory, indicating that internal leadership factors are more dominant in determining corporate environmental transparency.

Keywords: CEO Characteristics, Carbon Emission Disclosure, Stakeholder Pressure, Energy Sector, Upper Echelon Theory.

Abstrak

Penelitian ini mengkaji pengaruh karakteristik CEO dan tekanan pemangku kepentingan terkait pengungkapan emisi karbon pada perusahaan-perusahaan sektor energi yang terdaftar di Bursa Efek Indonesia antara tahun 2020 dan 2024. Selain itu, penelitian ini menguji peran moderasi tekanan pemangku kepentingan dalam hubungan antara karakteristik CEO serta emisi karbon. Dengan menggunakan pendekatan kuantitatif yang melibatkan regresi data panel dan regresi linier berganda dengan analisis moderasi (MRA) untuk menilai efek moderasi tekanan pemangku kepentingan dengan memasukkan istilah interaksi (Karakteristik CEO × Tekanan Pemangku Kepentingan), penelitian ini menganalisis 67 perusahaan, yang menghasilkan 335 pengamatan perusahaan-tahun. Hasil menunjukkan bahwa karakteristik CEO dan tekanan pemangku kepentingan memiliki efek positif dan signifikan terhadap pengungkapan emisi karbon. Namun, tekanan pemangku kepentingan tidak memoderasi hubungan antara karakteristik CEO dan pengungkapan emisi karbon. Keunikan penelitian ini terletak pada integrasi faktor kepemimpinan internal dan tekanan pemangku kepentingan eksternal dalam kerangka moderasi di konteks sektor energi Indonesia. Temuan ini mendukung Teori Upper Echelons, yang menunjukkan bahwa faktor kepemimpinan internal lebih dominan dalam menentukan transparansi lingkungan korporat.

Keywords: *CEO Characteristics, Carbon Emission Disclosure, Stakeholder Pressure, Energy Sector, Upper Echelon Theory.*

INTRODUCTION

The greatest threat to sustainable development is climate change. The 2023 and 2024 reports from the Intergovernmental Panel on Climate Change (IPCC) state that more than 70% of global carbon emissions are caused by the industrial and energy sectors, as well as transportation and industrial activities. Consequently, the issues of carbon emissions and climate change have become a critical part of business decisions worldwide. To address these challenges, countries, including Indonesia, have committed to achieving Net Zero Emissions by 2060. This is a global commitment that encourages companies to enhance transparency in disclosing their emissions of carbon.

Carbon emission disclosure is an important part of corporate reporting on sustainability practices because it demonstrates The degree to which a business demonstrates Environmental and social aspects responsibility to its stakeholders Huang et al., (2024); Zhao et al., (2023). According to Wahyuningrum et al., (2024) carbon transparency is not merely an administrative obligation but a reputation strategy to build investor and public trust. The higher the transparency of reporting, the greater the company's social legitimacy as perceived by stakeholders Wardhani et al.,(2026).

Nevertheless, The ASEAN region's reporting of carbon emissions, including Indonesia, remains relatively low. Wahyuningrum et al., (2024); Dilling et al., (2024) note that most businesses only disclose carbon data in a descriptive manner without providing explanations regarding calculation methods or measurable emission reduction targets. This indicates that carbon emissions disclosure practices remain largely symbolic (serving as formal legitimization) and do not yet reflect a genuine commitment to the environment.

One of the internal factors influencing a company's strategic decisions regarding environmental transparency is the characteristics of the Chief Executive Officer (CEO). According to Hambrik & Mason (1982), Upper Echelons Theory, decisions made by an organization reflect the principles, experiences, and personal traits of its leaders. A study Kandil et al., (2025) found that CEO attributes, such as age, gender, international experience, and educationhave a substantial effect on a business's green investment policies and carbon emissions policies. Similarly, Mahran & Elamer (2024) demonstrate that, regarding reporting on energy efficiency and ESG (Environmental, Social, Governance), sustainability-oriented CEOs influence how companies act.

An external factor that often influences corporate decisions regarding environmental transparency is stakeholder pressure. According to Upper Echelons Theory Hambrik & Mason (1982), external conditions can either increase or decrease the effect of a CEO's characteristics on strategic decisions. For example. High stakeholder pressure (e.g., ESG reporting requirements from the OJK) will encourage CEOs to report carbon emissions with greater transparency. However, if external pressure is low, CEOs with a conservative disposition may choose not to disclose detailed carbon data. Sulemana et al., (2025). Bedi (2023) found conflicting results regarding whether pressure from shareholders and creditors influences carbon emissions disclosure. This suggests that not all stakeholder pressures yield the same results. Although there are some differences, pressure from the most dominant stakeholders primarily regulators and customers often compels businesses to increase carbon emissions disclosure.

This new study was conducted to address the gap arising from the lack of integration between micro-individual aspects (CEO characteristics) and macro-institutional aspects (stakeholder pressures) in the specific context of climate reporting. Previous studies on CEO characteristics and disclosure have generally focused on emissions or environmental policies, and the importance of conducting research that links CEO characteristics to future business performance and outcomes Bedi (2023) notes that the innovation of this research lies in its approach to evaluating The methodology used to disclose carbon emissions is one of the elements influencing study in Indonesia through moderating variables, given that previous studies tended to be disjointed. Wahyuningrum et al., (2024) A literature review in Indonesia also indicates a need for more in-depth research regarding comprehensive disclosure determinants, as this topic is still relatively new in the Indonesian capital market Nilasakti et al., (2024).

Therefore, the inclusion of stakeholder pressure as a moderating variable in this study is strongly justified. First, based on Upper Echelons Theory, external conditions are expected to condition the extent to which CEO characteristics translate into strategic outcomes. This implies that the impact of CEO characteristics on carbon emission disclosure is not uniform but depends on the level of external pressure faced by the firm. Second, the inconsistency of prior empirical findings indicates that the

relationship between stakeholder pressure and carbon disclosure is complex and may not operate solely as a direct effect, but rather as a contingent (moderating) mechanism. Third, in the context of Indonesia as an emerging market with relatively weak regulatory enforcement, stakeholder pressure may play a critical role in amplifying or constraining managerial discretion in environmental reporting.

The situation in Indonesia indicates that carbon emissions disclosure practices remain relatively limited. A study by Nilasakti et al., (2024) found that only about 38% of companies listed on the Indonesia Stock Exchange have consistently disclosed carbon emissions information for three consecutive years. This low level of disclosure is attributed to several factors, including weak investor pressure, the absence of regulations mandating strict carbon reporting, and internal company factors that do not yet support a culture of sustainability.

This study emerged in response to inconsistent empirical findings (a research gap) Previous studies have examined the impact of internal and external factors on carbon emissions reporting methods. Furthermore, research generally focuses only on the influence of internal or external factors separately. Le et al., (2024) emphasize the importance of research linking CEO characteristics to a company's future sustainability performance. Meanwhile, Bedi (2023) suggests that future research should consider how corporate governance mechanisms can mitigate Stakeholder pressure's effect on carbon disclosure practices.

This study aims to investigate how CEO traits affect Indonesian energy sector companies' disclosure of carbon emissions.. Additionally, this study investigates how stakeholder pressure functions as a moderating variable in this relationship it is intended that this research will offer both theoretical and practical contributions. Theoretically, this study combines the perspectives of Upper Echelons Theory and stakeholder demands to explain corporate environmental transparency practices. This helps enrich the literature on carbon emissions disclosure. Practically, this study is expected to provide insights for companies, investors, and regulators regarding the importance of leadership characteristics and stakeholder pressure in enhancing the transparency of carbon emissions reporting.

LITERATURE REVIEW

Upper Echelons Theory

The Upper-Level Theory was first introduced and developed by Donald C. Hambrick and Phyllis A. Mason in 1984. who explained that the characteristics of top leaders (such as CEOs and senior managers) have a significant influence on strategic decisions and organizational performance. This theory posits that companies are not entities that act with perfect rationality, but rather organizations that reflect the values, experiences, and perspectives of the individuals who lead them. organizations reflect the values and decisions of top management in determining strategic policies such as environmental disclosure Saadah et al., (2024).

According to this theory, differences in perception, mindset, and strategic decision-making are influenced by value orientation, age, educational background, work experience, and gender. Therefore, corporate behavior and policy direction can be predicted from the CEO's profile Lunkes et al., (2019). Within the framework of this research. The measurement of CEO demographic characteristics such as gender is supported by empirical studies showing that women in leadership roles impact carbon emissions disclosure Saadah et al., (2024) he Upper Echelons Theory serves as the basis for elucidating the connection between CEO traits and carbon emissions disclosure, as well as how this relationship can be influenced by stakeholder pressure Arslan et al., (2022).

This theory assumes that complex strategic decisions, such as carbon emissions disclosure, are determined not only by formal corporate policies but also by the perspectives, moral values, and sustainability orientation of their leaders. Le et al., (2024) eveal that a CEO who is young, internationally educated, or has experience in sustainability tends to be more open to environmental issues and green innovation. Conversely, CEOs with a conservative financial background or who are older tend to prioritize short-term efficiency over environmental responsibility Lai et al., (2025).

CEO Characteristic

According to the Upper Echelons Theory, the individual characteristics of leaders are the primary source of differences in corporate strategy. In the area of carbon emissions disclosure, the theory explains that younger CEOs are more adaptable to changes in the business environment and more open to ESG issues. CEOs with higher education or an international academic background tend to

comprehend the significance of carbon transparency and sustainability. CEOs with extensive experience in the company have a better understanding of external pressures and legitimacy strategies to maintain the company's image Fuadi et al., (2024); Oyinlola, (2026).

Carbon Emissions Disclousure

According to this theory, the decision to disclose carbon emissions reflects the CEO's values and views regarding environmental responsibility. If a CEO has a vision for sustainability and a long-term orientation, they will promote the development of more comprehensive sustainability reports. Conversely, CEOs focused on short-term profitability may engage only in symbolic disclosure (reporting that is merely a formality without substance). Findings by Wahyuningrum et al., (2024) and Nilasakti et al., (2024) indicate that in Indonesia, the decision to disclose detailed carbon data is highly dependent on the CEO's personal commitment and their perception of the company's reputation.

Stakeholder Pressure

In practice, although this theory emphasizes the internal aspects of leadership, CEOs are also influenced by external factors from stakeholders such as regulators, investors, customers, and the media. Research by Bedi (2023) and Malik et al., (2025) found that pressure from regulators, customers, and the government has a favorable impact on businesses' carbon disclosure in developing countries. Additionally, Sulemana et al., (2025); Li & Rasiah, (2024) also proved that pressure from various stakeholder organizations, including the government, investors, and the public, significantly encourages companies to enhance their sustainability disclosures.

In addition, stakeholder pressure can also serve as a moderating factor that affects the strength of the connection between CEO characteristics and carbon emissions disclosure. As stated by the Upper Echelons Theory, external conditions can strengthen or weaken the impact of CEO traits on strategic decisions Santoso & Setiawan (2024). High stakeholder pressure regarding ESG reporting obligations from the OJK will encourage CEOs to report carbon emissions with greater transparency.However, if external pressure is low, CEOs with conservative traits may choose not to disclose carbon data in detail Malik et al., (2025).

HYPOTHESIS DEVELOPMENT

CEO Characteristics Influence Carbon Emissions Disclosure

CEO demographic and psychological factors, such as tenure, educational level, and international experience, influence how leaders view environmental issues and encourage more transparent disclosure practices. Le et al., (2024) also confirm that CEO age characteristics influence a company's environmental policies and emissions management. Furthermore, Santoso & Setiawan (2024) found that the presence of female CEOs and foreign CEOs contributes to increased corporate environmental disclosure. These results concur with the study conducted by Fuadi et al., (2024) which found that CEOs with higher education levels and strong professional backgrounds tend to promote more extensive disclosure of carbon practices in Indonesia. Mahran & Elamer (2024) also emphasize that sustainability-oriented CEOs significantly influence ESG reporting practices, particularly in improving the quality and transparency of environmental disclosures. The findings of this investigation show that CEO characteristics have a favorable and substantial influence on carbon emissions disclosure, meaning that the stronger the CEO's demographic and professional characteristics, the higher the transparency of the company in reporting carbon emissions.

H_1: CEO characteristics have a positive effect on carbon emissions disclosure

Stakeholder Pressure Influences Carbon Emissions Disclosure

The greater the pressure from external parties particularly foreign institutional investors the higher the level of corporate transparency in reporting carbon emissions. Research by Bedi (2023) indicates that pressure from governments and customers has the greatest and most positive influence on carbon disclosure in developing countries. Further evidence is provided by Malik et al., (2025), who found that stakeholder pressure not only increases the quantity of sustainability disclosures but also improves their quality, particularly when firms are exposed to global investors and international markets. Additionally, Sulemana et al., (2025) also found that various stakeholders, including governments, shareholders, and customers, have a significant influence on companies' sustainability disclosure practices. In the

Indonesian context, the results of this study also reinforce the findings of Nilasakti et al., (2024) who stated that companies tend to increase carbon emissions disclosure when facing higher external pressure, even though formal regulations are not yet fully stringent. Thus, stakeholder pressure functions as an external mechanism that drives increased transparency in carbon emissions disclosure

H_2: Stakeholder pressure has a positive effect on carbon emissions disclosure

Stakeholder Pressure Moderates CEO Characteristics and Carbon Emissions Disclosure

The test results indicate that stakeholder pressure does not moderate the connection between CEO characteristics and carbon emissions disclosure. These findings align with those of Santoso & Setiawan, (2024) who found that external governance variables do not always act as moderators in the relationship between CEO characteristics and environmental disclosure. However, these findings differ from those of Kandil et al., (2025) and Abdul Majid et al., (2023) who found that stakeholder pressure can strengthen the influence of leadership characteristics on environmental policies. These differing results may stem from variations in national context and industrial sectors, as Indonesia, being an emerging market, remains in the early stages of implementing mature ESG practices. Thus, this study enriches the literature by demonstrating that the moderating role of stakeholder pressure is context-dependent and does not always effectively amplify CEO characteristics' effects on carbon emissions disclosure, particularly within Indonesia's energy sector.

H_3 : Stakeholder Pressure Moderates CEO Characteristics and Carbon Emissions Disclosure

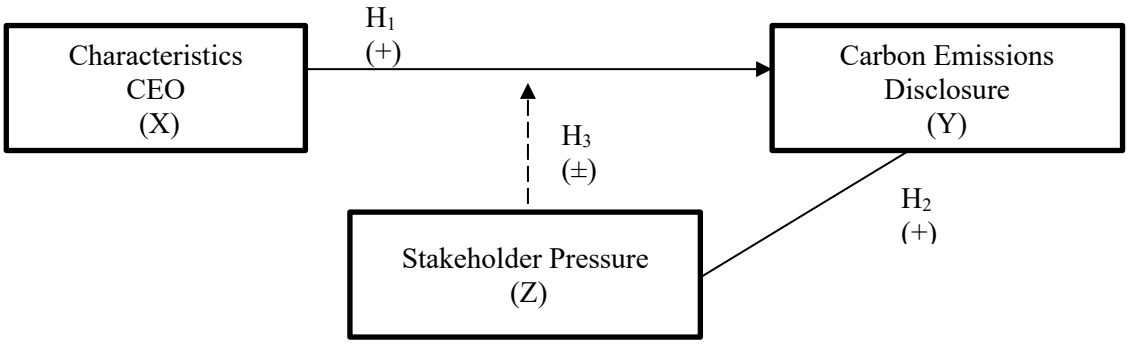


Figure 1. Research Framework

Explanation:

H_1 : CEO characteristics have a positive effect on carbon emissions disclosure
H_2 : Stakeholder pressure has a positive effect on carbon emissions disclosure
H_3 : takeholder pressure moderates the relationship between CEO characteristics and carbon emissions disclosure (it can strengthen or weaken this relationship)

RESEARCH METHODOLOGY

The total 67 energy businesses that were listed on the Indonesia Stock Exchange (IDX)made up the population, yielding 335 data points over the 2020–2024 observation period. To ensure that the collected data accurately reflected the variables under study, a purposive sampling method was employed, which entails choosing samples according to particular standards pertinent to the study. objectives to ensure that the collected data appropriately depicts the variables under study Khalid, (2024). The sampling criteria include: companies listed during the observation period in the Indonesia Stock Exchange's (IDX) energy sector; companies that publish sustainability reports or annual reports containing measurable information about their carbon emissions (CED); companies that have complete and detailed data on their CEO's characteristics, as well as data measuring stakeholder pressure during the study period, and companies that did not experience significant trading suspensions on the IDX during the observation period.

This research uses a quantitative methodology utilizing an exploratory research method that utilizes secondary data, including sustainability and annual reports, as well as data on CEO characteristics from the sampled companies. The use of secondary data and regression models is similar to that employed

by Bedi (2023) and Liu et al., (2023) in analyzing the relationship between external factors (stakeholders) and carbon disclosure.

Table 1. Operational Definitions of Variable

Research Variables	Variable Definitions	Indicators	Formulas	References
Characteristics CEO (X)	CEO characteristics refer to the demographic, background, experience, and psychological characteristics of the Chief Executive Officer (CEO) that influence strategic decisions and corporate environmental policies, including disclosure policies. Le et al., (2024) based on the Upper Echelons Theory, measured these independent variables using a composite index derived from data sources regarding the duration of the CEO's tenure, their international experience, and the CEO's highest level of formal education. All indicators were standardized using Z-scores before being combined into a single CEO characteristics index. Santoso & Setiawan (2024), Ulinnuha et al., (2024), Fuadi et al., (2024).	1. CEO Tenure (TENURE) 2. CEO Education Level (EDU) 3. International Experience (INTEXP)	CEO INDEX = (TENURE + EDU + INTEXP) / 3	Le et al., (2024), Santoso & Setiawan, (2024), Ulinnuha et al., (2024), Fuadi et al., (2024).
Stakeholder Pressure (Z)	Stakeholder Pressure (STAKE) and Foreign Institutional Ownership (FOI) are moderating variables in this study. FOI can be calculated quantitatively by determining the proportion of foreign institutional investors' shares to all existing shares at the end of the fiscal year Santoso & Setiawan, (2024).	1. Foreign Shareholding 2. Total Shares Outstanding	STAKE (FOI) = Number of shares held by foreign investors / Total number of shares outstanding × 100%	Santoso & Setiawan, (2024)

Carbon Emissions Disclosure (Y))	Carbon Emissions Disclosure (CED), which indicates how transparent and accountable a company is in communicating information to the general public about climate change and greenhouse gas (GHG) emissions issues, typically through annual reports or sustainability reports. Bedi, (2023), Le et al., (2024), Qalbielhaq, (2023).	1. Disclosure of Direct Carbon Emissions (Scope 1) 2. Disclosure of Indirect Carbon Emissions (Scope 2) 3. Disclosure of Other Indirect Carbon Emissions (Scope 3) 4. Disclosure of Carbon Emissions Intensity 5. Disclosure of Carbon Emissions Reductions 6. Disclosure of Ozone-Depleting Substance Emissions 7. Disclosure of Nitrogen Oxides (NOx), Sulfur Oxides (SOx), and Other Significant Air Emissions.	CED = Total Diclosure / Maximum Disclosure	Bedi, (2023), Le et al., (2024), Qalbielhaq, (2023).

Data Analysis Techniques

This study employed several stages of statistical testing to ensure that the research model met the criteria for valid and reliable analysis. The initial stage involved conducting classical assumption tests, including normality, multicollinearity, heteroskedasticity, and autocorrelation tests, to verify that the regression model satisfied the basic assumptions required for unbiased estimation results. The results of these tests indicate that the research model satisfies the classical assumption criteria and is therefore appropriate for use in regression analysis Irrawati & Mukaramah (2024).

Next, the research variables were examined using panel data regression., and to test the moderating effect of stakeholder pressure, this study employed Multiple Linear Regression with Moderation Regression Analysis (MRA) by including an interaction term between CEO characteristics and stakeholder pressure. The influence of each ndependent variable's impact on the dependent variable was examined individually using a t-test, while an F-test was used to determine whether all independent variables simultaneously influenced the dependent variable. Furthermore, the coefficient of

determination (R^2) was used to evaluate how well the independent factors accounted for the variation in the dependent variable within the research model. All data processing and statistical analysis in this study were performed using EViews version 12.

RESULTS

Descriptive Analysis

This study's descriptive analysis is shown based on the research variables used in the regression model, namely emissions of carbon disclosure as the dependent variable, CEO traits as the independent variable, stakeholder pressure as the independent variable, and the interaction variable as the moderator Blbas., (2024); Rahman & Mujiyati., (2024) CEO characteristics were measured by combining several standardized indicators; thus, the descriptive analysis focused on the index values of the variables Indriyani & Sudibyo, (2024).

Table 2. Results of the Descriptive Analysis

	Y	X	Z	XZ
Mean	0,016143	0,016724	-0,004095	1,011680
Median	-0,407458	-0,475274	-0,239816	0,586256
Maximum	3,078968	3,131278	11,05642	9,640257
Minimum	-1,181088	-1,010257	-0,455717	-1,163660
Std.Dev	1,016225	1,017233	0,941681	1,394043
Skewness	0,956594	0,992785	7,749250	2,813770
Kurtosis	2,746537	2,789043	79,00719	12,75668
Jarque-Bera	51,98823	55,65178	83991,64	1770,783
Probability	0,000000	0,000000	0,000000	0,000000
Sum	5,407745	5,602507	-1,371838	338,9128
Sum sq.Dev	344,9263	345,6109	296,1786	649,0810
Observation	335	335	335	335

Source : Data Process, 2026

The statistical descriptive findings analysis show that the carbon emissions disclosure variable has a mean of 0.016143, with a minimum of -1.181088 and a maximum of 3.078698, indicating that there is significant variation among companies. Since carbon disclosure practices are not yet standardized, the standard deviation of 1.016225 indicates that the data is widely dispersed. Skewness of 0.956594 and kurtosis of 2.746537, along with a Jarque–Bera Prob. of 0.0000, indicate that the data are not normally distributed, in line with the conclusions of Luo et al., (2023); Lestari et al., (2025) that carbon disclosure is influenced by a company's internal policies and external pressures. The CEO characteristic variable has a mean of 0.016724, a minimum of -1.016257, and a maximum of 3.131278, with a standard deviation of 1.017233, indicating heterogeneity in CEO characteristics based on tenure, education, and experience, which supports the Upper Echelons Theory that leadership characteristics influence corporate strategic decisions Abdul Majid et al., (2023); Harjito & Sutopo, (2024). Meanwhile, the interaction variable has a mean of 1.011680, a minimum of -1.163660, a maximum of 9.640257, and a standard deviation of 1.394043, with a skewness of 2.813770 and a kurtosis of 12.75668, indicating a highly skewed distribution and strong variation in stakeholder pressure's moderating impact on the connection between the traits of CEOs and the disclosure of carbon emissions, as found by Fuadi et al., (2024).

Chow Test

Table 3. Chow Test

Effect Test	Statistic	d.f	Prob
Cross-section F	0,820247	(66,265)	0,8308
Cross-section Chi-square	62,272658	66	0,6073

Source : Data Process, 2026

The Common Effects Model (CEM) or the Fixed Effects Model (FEM) is the panel data regression model that fits the data the best, according to the Chow test. The Cross-Section Effect Model (CEM) is used to accept H0 when the probability value is greater than 0.05, and the Fixed Effect Model (FEM) is used to reject H0 when the probability value is less than 0.05.

According to the test table above, the Cross-Section Chi-square statistic is 62.272658 with a probability of 0.6073 and the Cross-Section F statistic is 0.820247 with a probability of 0.8308. The 5% significance level (0.05) is exceeded by both probability values. This suggests that cross-sections (businesses) in the research model do not significantly differ from one another. As a result, H0 is accepted, and the Common Effects Model (CEM) is the proper panel data regression model.

Lagrange Multiplertesis Test

Table 4. Lagrange Multipler Test

	Cross-section	Test Hypotesis Time	Both
Bresuch-Pagan	1,72824 0,2099	1,458195 (0,2272)	3,030019 (0,0817)
Honda	-1,253724 (0,8950)	-1,207557 (0,8864)	-1,740389 (0,9591)
King-Wu	-1,253724 (0,8950	-1,207557 (0,8864)	-1,472246 (0,9295)
Standardized Honda	-1,073404 (0,8585)	-0,998745 (0,8410)	-7,717695 (1,0000)
Standardized King-Wu	-1,73404 (0,8585)	-0,998745 (0,8410)	-4,726476 (1,0000)
Gouneroux.et al	-	-	0,000000 (1,0000)

Source : Data Process, 2026

The Lagrange Multiplier (LM) test is conducted to determine whether the Random Effect Model provides a better estimation than the Common Effect Model by identifying the presence of unobserved individual or time-specific effects. If significant random effects exist, the REM is preferred; however, if they are not significant, the CEM is considered more suitable because it assumes homogeneity across cross-sectional units and time periods.

The Breusch–Pagan LM values for the cross-section effect are 1.571824 with a probability of 0.2099, for the time effect are 1.458195 with a probability of 0.2272, and for the combined effect are 3.030019 with a probability of 0.0817, based on the results of the Lagrange Multiplier (LM) test. All these values are more than the 5% significance level (0.05), suggesting that no significant random effects. Therefore, H0 is accepted as long as the Commont Effect Model (CEM) and Random Effect Model (REM) are not used.

Normality Test

Table 5. Results of the Normality Test

Mean	4,93e-18
Median	0,003188
Maximum	0,204017
Minimum	-0,173256
Std.Dev	0,051494
Skewnees	0,136123
Kurtosis	3,557494
Jarque-Bera	5,372797
Probability	0,068126

Source : Data Process, 2026

The purpose of the normality test is to confirm that the regression model's residuals have a normal distribution., which is an important assumption in classical linear regression analysis. This assumption

is necessary to ensure that the statistical tests, such as the t-test and F-test, produce valid and unbiased inferences.

Based on the output of the table above regarding the Normality Test, the Jarque-Bera test findings show a Jarque-Bera value of 5.372797 with a probability of 0.068126. This indicates that the probability value is greater than the 5% significance level (α = 0.05). Therefore, the residuals in the panel data regression under the Commont Effect Model (CEM) satisfy the normality assumption.

Multicollinearity Test

Table 6. Results of the Multicollinearity Test

	X	Z	XZ	VIF
X	1	0,02	0,74	2,21
Z	0,02	1	0,05	1,00
XZ	0,74	0,05	1	2,21

Source : Data Process, 2026

Multicollinearity can be assessed using shareholder pressure's moderating influence on the connection between; correlation values between variables should be less than 0.80. The results of the correlation matrix in the table above show that the highest correlation value is 0.74, while the correlation between variables X and Z is only 0.02, which is significantly smaller than the critical threshold of 0.80. Furthermore, according to the Variance Inflation Factor (VIF) calculations, a VIF value of 2.21 was obtained for the variable with the highest correlation, which remains below the general threshold of 10. The absence of dominant linear correlations among the independent variables confirms that this model is free from multicollinearity bias. Thus, this study is valid because there is no data redundancy among the variables.

Heteroskedasticity Test

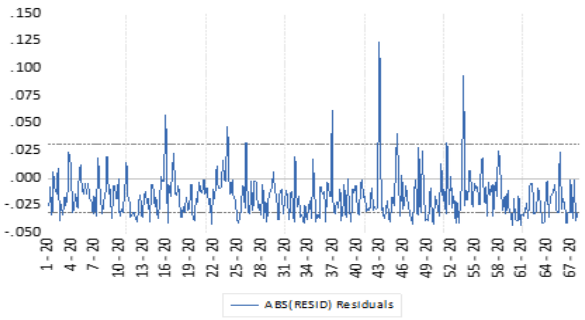


Figure 2. Results of the Heteroscedasticity Test
Source: Data Process, 2026

In order to identify heteroskedasticity, this investigation employs a graphical method by analyzing the ABS(RESID) plot, which represents the absolute values of the regression residuals. This method is used to visually examine whether the residuals' variance remains constant across observations. Heteroskedasticity occurs when the residuals exhibit a systematic pattern, such as forming a funnel shape (widening or narrowing), a wave-like pattern, or any clear structure that indicates non-constant variance. Conversely, If the residuals are dispersed at random around zero line without forming any specific pattern, it indicates that the variance is constant (homoskedastic).

Based on the ABS (RESID) plot, the residuals are randomly distributed around the zero line and do not form any clear pattern, such as converging or diverging shapes. Additionally, the spread of the residual values appears relatively consistent across observations, indicating no significant variation in variance. Therefore, Thus, it may be said that the regression model is not affected by heteroskedasticity and satisfies the assumption of homoskedasticity, meaning that the estimation results are reliable and suitable for further statistical analysis.

Autocorrelation Test

Table 7. Results of the Autocorrelation Test

Mean dependent var	0,016143
S.D. dependent var	1,016225
Akaike info criterion	-3,077945
Schwarz criterion	-3,043789
Hannan-Quinn criter	-3064328
Durbin-Watson stat	2,156535

Source : Data Process, 2026

An autocorrelation test is necessary to determine whether residuals from one time period are correlated with residuals from another period, which often occurs in panel data due to the presence of time and cross-firm elements Baltagi et al., (2007); Born & Breitung, (2016). The Durbin–Watson statistic ranges between 0 and 4. A value close to 2 indicates no autocorrelation, while values significantly below 2 suggest positive autocorrelation and values above 2 indicate negative autocorrelation. Based on the estimation results, The results of the Durbin Watson value is displayed using the autocorrelation test of 2.156535, indicating that there is neither positive nor negative autocorrelation. Therefore, the residuals across time periods in the panel data model are not correlated with one another. Consequently, the regression parameter estimates can be considered valid and do not violate the classical assumptions.

Uji F

Table 8. Results of the F-Test

R-squared	0,997432
Adjusted R-squared	0,997409
S.E. of regression	0,051727
Sum squared resid	0,885650
Log likelihood	518,8625
F-statistic	42860,20
Prob (F-statistic)	0,000000

Source : Data Process, 2026

The F-test results show that the p-value (0.000000) is less than 0.05 and the computed F-value (4286020) is higher than the crucial F-value (3.02). This suggests that CEO characteristics, stakeholder pressure, and their combined impact on the carbon emissions disclosure is substantial.. Furthermore, The computed F-value, which is much larger than the critical F-value (3.02), indicates that the model has strong statistical power. Consequently, this research model can be considered suitable for further analysis, whether in testing partial hypotheses (t-tests) or interpreting relationships among variables.

Uji t

Table 9. Results of the t-test

Variabel	t-Statistic	Prob
X	236,3637	0,0000
Z	66,50727	0,0000
XZ	-0,778861	0,4366
C	0,685828	0,4933

Source : Data Process, 2026

H1: The characteristics of CEOs, such as educational level, experience, and tenure, have a calculated t-value of 236.3637, This is greater than the crucial t-value of 1.96, and a significance level of 0.0000 < 0.05. These results indicate that the characteristics of CEOs have a substantial impact on carbon emissions disclosure, with H0 rejected and H1 accepted. These results indicate that the better the CEO's demographic and professional characteristics such as educational level, experience, and tenure the higher The degree of openness of the company in disclosing carbon emissions. This finding

aligns with the Upper Echelons theory, according to which a company's strategic decisions reflect the values, experience, and orientation of top leadership.

H2: Stakeholder pressure yielded a t-statistic of 66.50727, which surpasses the 1.96 threshold value at a significance level of 0.0000 < 0.05. This suggests that disclosure of carbon emissions is significantly impacted by stakeholder demand. This implies that businesses are more driven to increase the openness of their carbon reporting the more pressure they face from outside sources like investors, authorities, and the general public.

H3: For the interaction variable, the t-value that was computed was -0.778861, which is smaller than the critical t-value of 1.96, and the significance level was 0.4366 > 0.05. Therefore, The association between CEO traits and carbon emissions disclosure is not moderated by the interaction variable, as indicated by the acceptance of H0 and rejection of H3. These findings indicate that although stakeholder pressure has a direct effect, it neither strengthens nor weakens the influence of CEO characteristics; consequently, decisions regarding carbon emissions disclosure are predominantly determined by internal company factors, particularly top management characteristics.

Test of the Coefficient of Determination R²

Table 10. Results of the Test of the Coefficient of Determination R²

R-squared	0,997432
Adjusted R-squared	0,997409
S.E. of regression	0,051727
Sum squared resid	0,885650
Log likelihood	518,8625
F-statistic	42860,20
Prob (F-statistic)	0,000000

Source : Data Process, 2026

The R-squared value after adjustment is 0.0997409, or 0.997409%. This coefficient of determination shows that the variables comprising CEO characteristics explain 0.997412% of the carbon emissions disclosure variable, whereas other factors not included in this model account for the remaining 99.002591% (100-Adjusted R-squared value).

Hypothesis Testing

Table 11. Results of Hypothesis Testing

Variabel	Coefficient	Std.Error	t-Statistic	Prob
X	0,987988	0,004180	236,3637	0,0000
Z	0,200181	0,003010	66,50727	0,0000
XZ	-0,002378	0,003053	-0,778861	0,4366
C	0,002845	0,004148	0,685828	0,4933

Source : Data Process, 2026

Multiple linear regression analysis using Moderated Regression Analysis (MRA) is used in this work by including an interaction term (CEO × stakeholder pressure) to test the moderating effect.

Y = 0.987988233648*X + 0.20018132799*Z - 0.00237776613375*XZ + 0.00284479283633

The estimation findings show that the CEO characteristic variable has a positive and significant effect on carbon emissions disclosure, with a regression coefficient of 0.987988 and a p-value of 0.0000. With other variables held constant, this positive coefficient shows that constant the degree of disclosure of carbon emissions will increase by 0.987988 per unit. The stakeholder pressure variable has a p-value of 0.0000 and a regression coefficient of 0.200181, suggesting that stakeholder pressure has a positive and significant effect on carbon emissions disclosure. In other words, Stakeholder pressure increases a company's likelihood of disclosing additional carbon emissions.

The outcomes of the interaction test between CEO characteristics and stakeholder pressure show a coefficient of regression of −0.002378 with a p-value of 0.4366, indicating that the result is not

statistically significant. This finding indicates that stakeholder pressure is unable to moderate how CEO traits affect he revelation of carbon emissions. The constant value in the regression model of 0.002845 Having a value of probability of 0.4933 indicates that when the variables of CEO characteristics, stakeholder pressure, and their interaction are zero, the baseline level of carbon emissions disclosure is very low. This indicates that carbon emissions disclosure is not an automatic practice but is highly dependent on the presence of internal leadership factors and external stakeholder pressure Desai, (2022).

DISCUSSION

Characteristics of Carbon Emissions Disclosure

This study shows that CEO characteristics have a positive effect on carbon emissions disclosure. These findings The Upper Echelons Theory explains, proposed by Hambrik & Mason, (1982), which states that a company's strategic decisions reflect the values, experiences, and backgrounds of its top executives. In this context, decisions regarding carbon emissions disclosure as a non-financial strategy are heavily influenced by the CEO's sustainability orientation. Therefore, it can be concluded that Upper Echelons Theory is supported (accepted) in this study. CEOs with stronger demographic and professional characteristics such as higher education, international experience, and sustainability awareness tend to promote greater transparency in carbon emissions reporting.

Empirically, (Aljughaiman et al., 2024; Kandil et al., 2025; Latif et al., 2023) explain that CEO attributes such as age, education, and international experience shape managerial preferences toward green investments and environmental policies, thereby driving increased corporate transparency. Furthermore. The study by (Fuadi et al., 2024; Harjito & Sutopo, 2024; Shahrour et al., 2024) confirms that CEOs with high levels of education and strong professional competencies are able to encourage companies to adopt more comprehensive carbon reporting practices. Furthermore, Saadah et al., (2024) demonstrate that diversity in CEO characteristics, including gender and sustainability perspectives, positively contributes to corporate environmental transparency. Thus, all of these prior findings consistently indicate that CEO characteristics are key determinants in enhancing carbon emissions disclosure.

Stakeholder Pressure for Carbon Emissions Disclosure

According to this study, disclosure of carbon emissions is positively impacted by stakeholder pressure. This result is explicable by Stakeholder Theory, which emphasizes that businesses need to expectations different stakeholders in order to maintain their legitimacy and business sustainability. Thus, it can be said that this study supports (accepts) stakeholder theory. The findings imply that increased stakeholder pressure translates in increased corporate openness in carbon emissions disclosure as businesses work to close legitimacy gaps and match their practices with stakeholder expectations. In this regard, Bedi, (2023) explains that pressure from regulators and customers is the strongest external factor in encouraging companies to improve carbon disclosure, particularly in developing countries. Furthermore, (Arsylia & Suhartini, 2025; Boadi et al., 2025; Sulemana et al., 2025) found that stakeholders like the government, investors, and the public have a significant influence on sustainability disclosure practices, as companies strive to maintain their reputation and public trust.

Meanwhile, in the Indonesian context, Nilasakti et al., (2024) explain that increasing external pressure, although not yet accompanied by strict regulations, continues to encourage companies to improve Transparency in carbon emissions as a means of gaining societal acceptance. Thus, these studies consistently show that stakeholder pressure acts as an outside force that strengthens environmental disclosure regulations.

The Moderating Effect of Stakeholder Pressure on CEO Characteristics and Carbon Emissions Disclosure

The study indicates that stakeholder pressure doesn't control the connection between CEO characteristics and carbon emission disclosure. After a theoretical perspective, this outcome demonstrates that stakeholder pressure does not act considered a moderating factor in this investigation. According to the Upper Echelons Theory, corporate choices are mostly impacted by the traits, values, and experiences of top executives. In this case, the findings indicate that CEO characteristics have a strong and dominant influence on carbon emissions disclosure.Stakeholder pressure has no effect on the connection between CEO characteristics and carbon emissions disclosure since there is no

moderating effect. In other words, CEOs with strong personal and professional characteristics will continue to decide the extent to which a company reports its carbon emissions regardless of the degree of external pressure.

This result is consistent with Santoso & Setiawan, (2024) who explain that because internal organizational considerations continue to dominate strategic decisions, external governance mechanisms are not always successful in enhancing the association between leadership characteristics and environmental policies. These findings, however, are different from those of Kandil et al., (2025) who claim that by raising corporate accountability, stakeholder pressure can increase the impact of CEO characteristics on environmental policy. In addition, (Abdul Majid et al., 2023; David et al., 2024; Hermiyetti & Usmar, 2025) also found that external pressure can strengthen this relationship in countries with stricter regulations. These differences suggest that the effectiveness of stakeholder pressure as a moderator depends heavily on the institutional context and the level of maturity of ESG practices in a country. In the Indonesian context, The findings of this investigation show that stakeholder pressure is not yet strong enough to influence the CEO's relationship with characteristics and carbon emissions disclosure.

CONCLUSION

The impact of CEO traits and stakeholder pressure on carbon emissions transparansi pada perusahaan-perusahaan yang terdaftar di Bursa Efek Indonesia (IDX) di sektor energi between 2020 and 2024 is examined in this study. The findings show that stakeholder pressure and CEO traits both significantly and favorably affect carbon emissions disclosure. According to this research, businesses are more likely to increase environmental reporting openness when their CEOs have strong professional and demographic qualities and when they are under more external pressure. From an interpretive standpoint, the findings support the idea that company decisions about sustainability disclosure are largely influenced by internal leadership factors, as described by Upper Echelons Theory. The association between CEO traits and carbon emissions disclosure is not strengthened or weakened by shareholder pressure, despite the fact that it also helps to increase transparency. This suggests that corporate environmental disclosure is still mostly driven by the independent influence of CEO traits.

However, there are a number of drawbacks to this study. First, the study is restricted to Indonesian energy corporations, which may limit the findings' applicability to other industries or nations. Second, only a few proxies are used to measure stakeholder pressure, which might not adequately account for the complexity of outside factors. Third, robustness testing and alternate model specifications, which could improve the results' dependability, are absent from this study.

SUGESSION

Practical

In order to ensure that carbon emissions disclosure is more transparent, quantifiable, and compliant with international standards, it is advised that businesses, especially those in the energy sector, enhance leadership quality by considering internal policies and training programs related to ESG and sustainability reporting. This is significant since the study demonstrates that CEO traits are crucial to enhancing carbon disclosure procedures. Strengthening and standardizing carbon emission reporting standards is advised for regulators. This can be done, for instance, by creating required disclosure frameworks, measurable emission indicators, and explicit reporting guidelines. To guarantee compliance, regulators might also strengthen enforcement and monitoring systems. This is required because, in the absence of robust regulatory support, stakeholder pressure is insufficient to affect business conduct.

It is advised that investors use ESG indicators, especially carbon disclosure quality, while analyzing and making decisions about investments. to promote more transparency, investors can also use active ownership techniques like interacting with management or endorsing sustainability projects. This is significant since the long-term viability of the company performance and risk management are reflected in its carbon disclosure.to increase the results' validity and generalizability, it is advised that future research broaden the study's scope to include other industries or nations, using different proxies for stakeholder pressure, and include robustness testing or other analytical techniques.

Theoretical

Future research is encouraged can create a more thorough model by adding more pertinent variables, like corporate governance mechanisms, organizational culture, or institutional factors that may influence carbon emissions disclosure. Additionally, Future research could broaden this focus to include other industrial sectors or compare developing and developed countries to examine contextual differences in the implementation of ESG practices. It is advised that more research be done to examine other moderating variables, such as regulatory quality, ownership by institutions, or Sustainability of the company committees, as the study's conclusions demonstrate that stakeholder pressure is not a moderating factor.The objective goal this research is to better comprehend the factors that can strengthen or weaken the relationship between CEO attributes and the disclosure of carbon emissions. consequently, future research is anticipated to expand the corpus of work on the theory of top-level integration and stakeholder theory in environmental accounting

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