

THE INFLUENCE OF GREEN INNOVATION ON FINANCIAL PERFORMANCE MODERATED BY CHIEF EXECUTIVE OFFICER CHARACTERISTICS



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Abstract

This study aims to analyze the effect of green innovation on financial performance with the characteristics of the Chief Executive Officer (CEO) as a moderating variable in coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019–2024 period. Green innovation in this study consists of green product innovation and green process innovation. The research was conducted on 170 coal companies using a quantitative approach. The results show that both green product innovation and green process innovation have a positive effect on financial performance. However, CEO characteristics demonstrate different moderating roles. CEO education does not moderate the relationship between green product innovation and financial performance but does moderate the relationship between green process innovation and financial performance. Similarly, CEO experience does not moderate the relationship between green product innovation and financial performance but does moderate the relationship between green process innovation and financial performance. These findings emphasize that CEO characteristics, particularly education and experience, play a more significant role in strengthening the impact of green process innovation on improving company financial performance.

Keywords: Green Innovation, Green Product Innovation, Green Process Innovation, CEO Characteristics, Financial Performance

INTRODUCTION

The development of an increasingly tight economy can encourage a company to increase efficiency and competitiveness to remain relevant and competitive and attract the attention and trust of investors. Therefore, to be able to gain investor trust, companies need to demonstrate good performance (Freshillya & Luayyi, 2025). Financial performance is one way to determine whether a company has healthy finances or not. In addition, profit growth predictions are also a tool to assess the company's future profit prospects, which helps in making investment decisions in a company (Sudianto, 2023). In addition to profit growth measuring financial performance, green innovation is carried out by companies as one indicator to assess company performance as a form of concern for environmental issues such as climate companies.

PT Bukit Asam Tbk (PTBA), as part of the Mining SOE Holding, successfully recorded positive financial performance in the first quarter of 2025, with total revenue reaching IDR 9.96 trillion, net profit of IDR 391.48 billion, and EBITDA of IDR 1.05 trillion. The company's total assets also increased by 10 percent compared to the previous year, reaching IDR 42.26 trillion. This strong financial performance is accompanied by the company's green innovation strategies, such as developing wood pellets from *Caliandra merah* plants as an alternative fuel, constructing solar power plants (PLTS) at various sites, and advancing coal downstreaming into artificial graphite and anode sheets used in lithium-ion battery production. These initiatives indicate that green innovation impacts financial performance. However, the characteristics of top executives or CEOs may also influence a company's financial outcomes.

A CEO's experience is a crucial aspect for a company and has been linked to several factors, including financial performance and financial reporting quality (Jalal et al., 2022; Saleh et al., 2020). Sallemi and Zouari (2023) explain that a company's performance should correlate with its CEO's experience. A CEO needs professional expertise to integrate new technologies into the company, drawing on previous experiences to make better decisions (Suherman et al., 2023). Studies by Bouaziz et al. (2020) and Baatwah et al. (2015) show that CEOs with higher experience levels tend to apply more conservative accounting standards and produce more accurate earnings projections for their companies.

According to Sari (2024), aside from the experience and education of directors, another important factor that can affect company performance is green innovation, particularly green product innovation, as part of corporate concern toward global climate issues. Green product innovation can serve as a strategic solution to environmental problems that have gained increasing global attention. By developing environmentally friendly products, companies not only demonstrate their commitment to sustainability but also strengthen their market competitiveness. Such innovation enables firms to create added value through cleaner, safer, and more sustainable products, thereby enhancing competitiveness.

Green innovation is not merely about creating new products; it also involves transforming how companies operate, optimizing production processes, and innovating business models to reduce negative environmental impacts (Noor, 2025). It focuses not only on achieving efficiency and profitability but also on integrating environmental sustainability into every business process. Companies implementing green innovation typically undergo

significant changes in product design, production methods, resource management, and marketing strategies.

Beyond product creation, green innovation reflects fundamental changes in how firms operate, including process optimization and business model transformation, with the primary goal of minimizing environmental harm and promoting sustainable development. Implementing green process innovation serves as an internal company resource. Such innovation accumulates knowledge about products and resource processing, enhancing financial performance by creating unique and valuable assets (Xie et al., 2019).

However, empirical findings show that green innovation does not always positively affect financial performance. While theoretically seen as a sustainable strategy that enhances efficiency and competitiveness, in practice, green innovation can lead to complex financial consequences if not properly managed, due to high implementation costs. Zhang et al. (2025) found that increasing the quantity of green innovation may actually reduce profitability—especially Return on Assets (ROA)—due to high investment costs, technology implementation risks, and market uncertainty toward eco-friendly products.

Therefore, companies must consider not only the quantity of green innovations but also their type, strategic relevance, and organizational readiness for adoption. Green innovation that is misaligned with core business strategies or implemented merely for symbolic purposes may become a financial burden instead of enhancing competitiveness. Thus, selectivity in innovation choice and strong integration with the company's long-term vision are crucial to avoiding trade-offs between sustainability and profitability.

Supporting this statement, Sari & Handayani (2020) found that green process innovation positively affects financial performance by reducing operational burdens through fuel, electricity, and machinery efficiency, leading to cost savings in manufacturing. In contrast, Sari (2024) reported that green process innovation negatively impacts financial performance due to high investment costs associated with adopting environmentally friendly technologies such as production machinery and pollution control systems. Although such innovations improve environmental performance, their substantial costs suppress Return on Assets (ROA) and Return on Equity (ROE), thus lowering overall net profit.

Previous research has also shown that corporate sustainability affects company performance when moderated by CEO characteristics. A higher level of CEO education strengthens the relationship between sustainability and performance due to better knowledge, perspective, and responsibility. Conversely, longer CEO tenure tends to weaken the relationship, while female CEO gender has no significant moderating effect, possibly due to a limited sample size (Rahmawati & Juliarto, 2024). In contrast, Nopiawati & Prasetyo (2024) found that CEO characteristics based on tenure did not moderate the relationship between environmental, social, or governance performance and financial performance.

LITERATURE REVIEW

Signal Theory

Spence (1973) defines a signal as an effort by the information provider to accurately convey information to other parties so that they are willing to invest despite existing uncertainties. With clear and credible signals, information recipients can make more confident decisions even in uncertain conditions.

Stakeholder Theory

Stakeholder theory was first introduced by Freeman (1984), who stated that stakeholders act as a group or individuals who can achieve common goals. In this theory, each stakeholder has an influence on organizational decisions and sustainability. Therefore, management is required to pay attention to and accommodate their needs and expectations. By understanding stakeholders' roles comprehensively, companies can develop more sustainable strategies and build harmonious relationships with various related parties.

Financial Performance

Financial performance is an analysis conducted to determine the extent to which a company has properly implemented financial management in accordance with established rules and standards (Hutabarat, 2020). A company's financial performance can be evaluated through various financial ratios that reflect aspects of profitability, liquidity, solvency, and activity.

CEO Characteristics

Characteristics can be defined as the overall aspects that reflect a person's morals, personality, behavior, temperament, nature, and disposition, forming an individual's complete identity (Sulaeman, 2024). Based on the previous explanation, characteristics encompass all aspects that mirror various elements such as morals, personality, behavior, character, traits, and individual disposition.

Green Innovation

Green innovation is divided into two forms: green product innovation and green process innovation (Zameer et al., 2021). According to Afum et al. (2021), green product innovation can positively influence green competitive advantage. Furthermore, green process innovation has also been shown to have a positive effect on green competitive advantage, as explained by Muisyo et al. (2022).

RESEARCH METHOD

Population and Sample

Population refers to the entire group of individuals or elements that are the focus of a study, encompassing objects or subjects that possess specific characteristics in accordance with the research objectives (Jusdienar, 2024).

The population in this study consists of all coal sub-sector energy companies listed on the Indonesia Stock Exchange (IDX). The selection of this population is based on its relevance to the energy sector, particularly the coal sub-sector, which, according to data from the Ministry of Energy and Mineral Resources (ESDM) in 2024, experienced an increase in production. This condition highlights the importance of addressing sustainability issues, as well as the availability of data related to CEO characteristics, green innovation practices, and the financial performance of companies. This population is considered representative for examining how leadership roles and green innovation practices influence the financial performance of companies within the industry.

From this population, the researcher employs a purposive sampling technique with the following criteria:

1. Coal sub-sector companies that publish annual reports from 2019 to 2024.

2. Coal sub-sector companies that plan and implement green processes in the form of environmental costs, including expenditures used to prevent, reduce, and mitigate the environmental impacts of operations—such as land reclamation costs, waste management, environmental quality monitoring, and the provision of environmentally friendly equipment.

A sample is a subset of the population that represents it, sharing the same characteristics as the larger group. It serves as a representative portion selected to reflect the entire population in the research. A properly chosen and representative sample is crucial to ensure accurate analysis and generalizable results (Jusdienar et al., 2024). Therefore, the sample in this study includes all coal sub-sector energy companies listed on the Indonesia Stock Exchange (IDX) that meet the aforementioned criteria.

Research Design

This study employs a quantitative research design as it focuses on measuring the relationship between CEO characteristics, green innovation, and the financial performance of coal sub-sector companies listed on the Indonesia Stock Exchange (IDX). Quantitative data allow for objective and measurable analysis of information such as CEO experience, educational background, green innovation ratios, and financial indicators such as Return on Assets (ROA) or Return on Equity (ROE). This approach enables statistical testing to determine the extent to which independent variables influence the dependent variable, ensuring that the results are reliable, comparable, and generalizable to similar populations of companies.

Quantitative research is inferential in nature, meaning that conclusions are drawn based on statistical hypothesis testing using empirical data obtained through measurement (Djaali, 2021). Therefore, quantitative research can be defined as a type of research aimed at drawing conclusions based on the results of statistically computed data analysis.

In this study, data are collected through numerical measurements and then statistically tested to determine whether the proposed hypotheses are supported. Through this approach, the researcher can identify patterns or relationships among variables and derive conclusions that can be applied more broadly across similar research contexts.

RESULT AND DISCUSSION

Data Analysis

Classical Assumption Test

Normality Test

The normality test aims to determine whether residual data in a study is normally distributed. The normality test in this study uses a statistical approach with the One-Sample Kolmogorov-Smirnov test. A research model with an Asymp. Sig. value > 0.05 can be interpreted as having normally distributed residual data (Ghozali, 2021).

The following are the results of the normality test in this study.

Table 1.
Normality Test Results

Description	Unstandardized Residual
N	170

Asymp. Sig. (2-tailed)	0.107 ^{c,d}
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Source: Secondary Data, processed (2025)

Table 1 shows that the Asymp. Sig. (2-tailed) value is 0.107. Because this significance value is greater than 0.05, it can be concluded that the residual data in this study is normally distributed.

Multicollinearity Test

The multicollinearity test aims to determine whether there is a high correlation between the independent variables in a multiple linear regression model. If there is a high correlation between the independent variables, the relationship between the independent and dependent variables will be disrupted.

The criterion for detecting multicollinearity in a model is the VIF. If the VIF is not more than 10 and the tolerance is not less than 0.1, the model can be said to be free from multicollinearity (Kurniawan, 2019). The following are the results of the multicollinearity test in this study:

Table 2.
Multicollinearity Test Results

Independent Variables	Tolerance	VIF	Description
Green Products	0,842	1,188	No multicollinearity
Green Process	0,896	1,116	No multicollinearity
CEO Education	0,940	1,064	No multicollinearity
CEO Experience	0,937	1,067	No multicollinearity
Current Ratio (CR)	0,961	1,040	No multicollinearity

Source: Secondary Data, processed (2025)

Table 2 shows that the VIF values for all independent variables are below 10 and the tolerance value is greater than 0.1. Thus, it can be concluded that the regression model used does not experience multicollinearity among the independent variables.

Heteroscedasticity Test

The heteroscedasticity test in this study aims to determine whether there is inequality in variance from one residual to another observation (Kurniawan, 2019). The heteroscedasticity test in this study uses the Glejser test. A research model with an Asymp Sig. value above 5% alpha is considered free from heteroscedasticity (Kurniawan, 2019).

The following are the results of the heteroscedasticity test in this study:

Table 3.
Heteroscedasticity Test Results

Variable	Sig.	Alpha	Description
Green Products	0,255	0,05	No Heteroscedasticity
Green Process	0,247	0,05	No Heteroscedasticity
CEO Education	0,170	0,05	No Heteroscedasticity
CEO Experience	0,116	0,05	No Heteroscedasticity
Current Ratio (CR)	0,496	0,05	No Heteroscedasticity

Source: Secondary Data, processed (2025)

Based on the test results in Table 3, all variables showed a significance value greater than alpha 0.05 (>0.05). This indicates that the regression model used in this study does not experience heteroscedasticity issues.

Autocorrelation Test

The autocorrelation test is used to determine whether errors in the base year t-1 occur in subsequent years. This allows us to determine the validity of the autocorrelation test for time series data. The autocorrelation test in this study uses the Durbin-Watson (dw) value, so it can be considered free of autocorrelation if it conforms to the equation $du < dw < 4-du$ (Ghozali, 2021). The results of the autocorrelation test can be seen in the SPSS version 22 output table below:

Table 3.
Decision-Making Table

Null hypothesis	Decision	If
No Positive Correlation	Reject	$0 < d < dl$
No Positive Correlation	No decision	$dl < d < du$
No Negative Correlation	Reject	$4 - dl < d < 4$
No negative Correlation	No decision	$4 - du \leq d \leq 4 - dl$
No Autocorrelation, Positive or Negative	No. Reject	$du < d < 4 - du$

Table 4.
Autocorrelation Test Results

Model	Durbin-Watson (d)	Du	DI	4-du	Description
1	1,993	1,7975	1,7012	2,2025	No. Autocorelations

Source: Secondary data, Processed (2025)

Based on Table 4, $du < DW < 4-du$, i.e., $1.7975 < 1.993 < 2.2025$. This indicates no autocorrelation.

Moderated Regression Analysis (MRA) Test

According to Ghozali (2021), moderated regression analysis, or interaction testing, is a special form of linear regression in which the regression equation includes a multiplication element between two or more independent variables. In this study, this approach was used to test the direct effect of green innovation, consisting of green products (X1) and green processes (X2), on company financial performance (Y), and to assess the role of education (Z1) and experience (Z2) as moderating variables that have the potential to strengthen or weaken this relationship. The applied Moderated Regression Analysis model refers to the concept proposed by Baron and Kenny. The following is a multiple regression analysis using SPSS 22:

Table 5.
MRA Results

Variable	Equation I		Equation II		Equation III	
	Coefficient	Sig	Coefficient	Sig	Coefficient	Sig
Green Product (PDH)	-0.050	0.049	-0.041	0.106	0.016	0.856
Green Process (PSH)	0.011	0.028	0.011	0.024	0.017	0.015
CEO Education			0.049	0.009	0.083	0.003
CEO Experience			0.000	0.842	-0.003	0.606
CEO Education Moderates Green Product on Financial Performance (PDH_EDU)					-0.033	0.453
CEO Education Moderates Green Process on Financial Performance (PSH_EDU)					-8.444E-9	0.031
CEO Experience Moderates Green Product on Financial Performance (PDH_EXP)					0.002	0.791
CEO Experience Moderates Green Process on Financial Performance (PSH_EXP)					1.136E-9	0.046
Constant	-	0.029	-	0.113	-	0.220
F Significance		0.000		0.000		0.000
Adjusted R Square		0.152		0.194		0.215

Source: Secondary Data, processed (2025)

Based on the test results in Table 5, using Moderated Regression Analysis to examine the effect of the independent variables on the dependent variable, the data processing results using SPSS produced the following regression equation:

$$ROA = -0,220 + 0,016 PDH + 0,017 PSH - 0,033 PDH_{PDK} + 0,002 PDH_{PGL} - 0,000000008444PSH_{PDK} - 0,000000001136PSH_{PGL}$$

These results can be explained as follows:

- The constant value of -0.220 indicates no influence from the independent variables used in this study. The financial performance value is -0.220.
- The green product coefficient is 0.016, meaning that every one (1) unit increase in green product will increase financial performance by 0.016, assuming other variables are held constant.

- c. The green process coefficient is 0.017, meaning that every one (1) unit increase in the green process will increase financial performance by 0.017, assuming other variables are held constant.

Hypothesis Testing

Coefficient of Determination (R²)

The coefficient of determination test is a value that describes how much change or variation in the dependent variable can be explained by changes or variations in the independent variable (Kurniawan, 2019). The coefficient of determination test (R²) essentially measures the model's ability to explain variation in the dependent variable. The coefficient of determination test in this study uses the Adjusted R Square value multiplied by 100 to determine the ability of the independent variable to explain the dependent variable.

Table 6.
Coefficient of Determination Test

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,534 ^a	0,286	0,215	0,113106
a. Predictors: (Constant), CR, Produk Hijau, PSH_PDK, Pengalaman CEO, Pendidikan CEO, PSH_PGL, PDH_PGL, PDH_PDK, Proses Hijau				

Source: Secondary Data, processed (2025)

Based on SPSS output, the coefficient of determination (Adjusted R Square) was 0.215. This indicates that the independent variables in the study are able to explain 21.5% of ROA, while the remaining 78.5% is influenced by factors outside the research model.

Simultaneous Significance Test (F-Statistic Test)

The F-test is a statistical method used to compare variability between and within groups to determine whether there are significant differences between the means of several groups (Halimah et al., 2024). A significant F-test is measured by a significant F-value, so a simultaneous effect is considered if the F-value is significant <0.05.

Table 7.
F-Tests

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0,465	9	0,052	4,042	.000 ^b
	Residual	1,164	91	0,013		
	Total	1,630	100			
a. Dependent Variable: ROA						
b. Predictors: (Constant), CR, Produk Hijau, PSH_PDK, Pengalaman CEO, Pendidikan CEO, PSH_PGL, PDH_PGL, PDH_PDK, Proses Hijau						

Source: Secondary Data, processed (2025)

Based on the regression results shown in the table, a significance value (F-statistic) of 0.000 was obtained. Because this value is less than the alpha value of 0.05, it can be concluded that the independent variables jointly influence the dependent variable.

Individual Parameter Significance Test (t-Statistic Test)

The t-test is a tool for examining the difference in means between two or more groups (Badrudin, 2024). In other words, the t-test aims to determine the effect of the independent variable on the dependent variable individually or partially. Therefore, if the calculated t-value > t-table or the p-value < 0.05, then the independent variable influences the dependent variable. The following are the results of the t-test in this study:

Table 8.
T-Test

Variable	Coefficient	Significance	Alpha	Decision
Green Product (PDH)	-0.050	0.049	0.05	H1 Supported
Green Process (PSH)	0.011	0.028	0.05	H2 Supported
CEO Education Moderates Green Product on Financial Performance (PDH EDU)	-0.033	0.453	0.05	H3 Not Supported
CEO Education Moderates Green Process on Financial Performance (PSH EDU)	-8.444E-9	0.031	0.05	H4 Supported
CEO Experience Moderates Green Product on Financial Performance (PDH EXP)	0.002	0.791	0.05	H5 Not Supported
CEO Experience Moderates Green Process on Financial Performance (PSH EXP)	1.136E-9	0.046	0.05	H6 Supported

Source: Secondary Data, processed (2025)

Based on the test results in Table 8 above, the t-statistics between the independent and dependent variables are as follows:

- a. The green product variable has a coefficient value of -0.050 and a significance value of 0.049. This value is less than the alpha value of 0.05, indicating that H1 is supported, thus indicating that green product innovation influences financial performance.
- b. The green process variable has a coefficient value of 0.011 and a significance value of 0.028. This value is less than the alpha value of 0.05. This indicates that H2 is supported, thus indicating that green process innovation influences financial performance.
- c. The chief executive officer's education variable moderates green product innovation on financial performance, with a significance value of 0.453. This value is greater than the alpha value of 0.05. This indicates that H3 is not supported, thus indicating that chief executive officer education does not moderate the effect of green product innovation on financial performance.
- d. The chief executive officer's education variable moderates green process innovation on financial performance with a significance value of 0.031 and a coefficient value of -8.444. This value is less than the alpha value of 0.05. This indicates that H4 is supported, thus it can be concluded that the chief executive officer's education variable moderates the effect of green process innovation on financial performance.
- e. The chief executive officer's experience variable moderates the effect of green product innovation on financial performance with a significance value of 0.791. This value is

greater than the alpha value of 0.05. This indicates that H5 is not supported, thus it can be concluded that the chief executive officer's experience variable does not moderate the effect of green product innovation on financial performance.

- f. The chief executive officer's experience variable moderates the effect of green process innovation on financial performance with a significance value of 0.046. This value is less than the alpha value of 0.005. This indicates that H6 is supported, thus it can be concluded that the chief executive officer's education variable moderates the effect of green process innovation on financial performance.

The Effect of Green Product Innovation on Financial Performance

Based on the results of the moderated regression test, H1 was supported. This indicates the influence of green products on the financial performance of 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019–2024 period. Increasing consumer awareness of environmentally friendly products can encourage companies to implement green innovation, for example by introducing more energy-efficient products and using environmentally friendly raw materials. This innovation not only provides added value for consumers but also has the potential to reduce production costs through operational efficiency. This efficiency and increased customer value can ultimately drive increased profitability and be reflected in improved company financial performance, for example through Return on Assets (ROA). This is in line with research (Amalia, 2023) which states that green product innovation has a positive effect on profitability, because the implementation of green innovation can influence customer value, such as purchasing interest in environmentally friendly products, which ultimately impacts profitability and financial performance.

The Effect of Green Process Innovation on Financial Performance

Based on the results of the moderated regression test, H2 was supported. This indicates the influence of green processes on financial performance in 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019–2024 period. Optimal implementation of green process innovation will strengthen green competitive advantages, allowing companies to focus more on improving environmentally-based competitiveness. This is in line with research by Wedari & Alfian (2024), who found that green process innovation has been shown to have a significant positive impact on company profitability because its implementation can create process efficiencies and reduce resource consumption, resulting in cost savings that positively impact financial performance. This is also consistent with research by Lestari & Soewarno (2024), who analyzed the influence of green innovation, divided into green process innovation and green product innovation, on company performance. The results showed that green innovation has an impact on company performance.

CEO Education Moderates the Effect of Green Product Innovation on Company Financial Performance

Based on the results of the moderated regression test, H3 was not supported. This indicates that the Chief Executive Officer's education level does not moderate the effect of green product innovation on company financial performance in 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019–2024 period. Chief Executive Officers with higher levels of education do not necessarily have a strong concern for environmental issues, as the company's strategic decisions regarding green innovation are more influenced

by external factors, such as government regulations, investor pressure, and industry competition. Therefore, the CEO's education level is not a primary factor in enhancing a company's ability to implement green innovation. This contrasts with research by Zhang et al. (2022), which found that the Chief Executive Officer's education level played a role in enhancing a company's ability to implement green innovation.

CEO Education Moderates the Effect of Green Process Innovation on Company Financial Performance

Based on the results of the moderation regression test, H4 was supported. This indicates that the Chief Executive Officer's education level moderates the effect of green process innovation on company financial performance in 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019–2024 period. The higher the CEO's education level, the greater the company's incentive to adopt environmentally friendly practices. This is particularly evident in companies with a strong commitment to social responsibility, where leaders with higher educational backgrounds generally have a deeper understanding of social values. Awareness of the importance of environmental stewardship has become part of their managerial practices, thus encouraging strategic decision-making oriented toward green innovation. This contrasts with the findings of research by Rahmawati and Juliarto (2024), which stated that a higher level of CEO education can actually strengthen the impact of sustainability practices on company performance, as education provides knowledge, a broader perspective, and a more mature sense of responsibility in strategic decision-making.

CEO Experience Moderates the Effect of Green Product Innovation on Company Financial Performance

Based on the results of the moderation regression test, H5 was not supported. This indicates that the level of Chief Executive Officer experience moderates the effect of green products on company financial performance in 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019–2024 period. Tenure is an important characteristic of a CEO that can influence the direction of company policy, including the implementation of green innovation. CEOs with shorter tenures generally tend to access broader information sources, are more responsive to the dynamics of changes in the business environment, and are more open to implementing innovative competitive strategies. This makes them more effective in optimizing the contribution of green innovation to improving company performance. Conversely, CEOs with relatively long tenures tend to rely on past experience, maintain existing policy patterns, and are less open to new strategies, potentially weakening the relationship between green innovation and company performance. This is inconsistent with the research findings of Lestari & Soewarno (2024), which found that longer CEO tenure actually had a negative moderating effect on the relationship between green innovation and financial performance.

CEO Experience Moderates the Effect of Green Process Innovation on Company Financial Performance

Based on the results of the moderated regression test, it was found that H6 is supported. This indicates that the level of the Chief Executive Officer's experience moderates the effect of green process on the financial performance of the company in 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019–2024 period. This finding suggests that a CEO's experience can strengthen the effectiveness of implementing green process innovations in improving company financial performance. This means that

extensive work experience allows a CEO to direct green process innovations to not only be oriented towards environmental compliance, but also towards achieving better financial performance. With this experience, the CEO is able to identify opportunities and risks from implementing green strategies, and utilize company resources optimally to achieve operational efficiency and a positive reputation in the eyes of stakeholders. The results of this study differ from the findings of Nopiawati & Prasetyono (2024), which stated that CEO characteristics based on tenure do not moderate the effect of environmental performance or social performance on financial performance. This difference is likely due to the different indicators of CEO characteristics used, where this study uses experience as a measure of involvement and adaptive ability towards sustainability strategies, while the previous study assessed CEO characteristics based on the length of tenure which does not necessarily reflect the level of experience and ability in managing green innovations.

CONCLUSION

Based on research conducted on financial performance, the following conclusions can be drawn:

1. Green product innovation impacts the financial performance of 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019-2024 period.
2. Green process innovation impacts the financial performance of 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019-2024 period.
3. Chief Executive Officer education does not moderate the effect of green product innovation on financial performance of 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019-2024 period.
4. Chief Executive Officer education moderates the effect of green process innovation on financial performance of 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019-2024 period.
5. Chief Executive Officer experience does not moderate the effect of green product innovation on financial performance in 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019-2024 period.
6. Chief Executive Officer experience moderates the effect of green process innovation on financial performance in 170 coal companies listed on the Indonesia Stock Exchange (IDX) for the 2019-2024 period.

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