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The Effect of Green Accounting, Carbon Emission Disclosure, and Green Innovation on Financial Sustainability

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Abstract

This study examines the influence of green accounting, carbon emission disclosure, and green innovation on financial sustainability in 11 energy-sector companies listed on the Indonesia Stock Exchange during 2020–2024. Using quantitative methods and panel regression analysis, the results show that green accounting and carbon emission disclosure have no significant effect on financial sustainability, while green innovation has a significant positive effect. These findings indicate that environmental costs and disclosure practices have not yet contributed directly to financial outcomes, whereas innovation plays a more strategic role in enhancing long-term financial sustainability. This research provides empirical insights for companies and stakeholders regarding the importance of strengthening environmental innovation to support sustainable financial performance.

INTRODUCTION

Companies in the energy sector play a strategic role in supporting national economic growth by meeting energy demands across various sectors. However, their operational activities also contribute significantly to increased carbon emissions that drive climate change. This condition creates pressure for companies not only to focus on achieving profitability but also to implement business practices oriented toward sustainability. Consequently, a company's ability to maintain long-term financial stability (financial sustainability) has become increasingly important, as investors now assess corporate prospects not only based on profit performance but also on commitments to environmental and social responsibility as a form of accountability to stakeholders amid growing regulatory demands and global awareness of sustainability issues (Kustinah & Susyani, 2025).

Previous studies indicate that green accounting is part of corporate sustainability practices aimed at enhancing transparency in reporting environmental costs and activities. Several studies find that the implementation of green accounting can strengthen corporate image and increase investor trust; however, empirical results regarding its impact on financial sustainability remain inconsistent. Some studies show no significant effect on corporate financial performance (Mustika et al., 2025; Seviana & Sumarta, 2025). Meanwhile, Carbon Emission Disclosure is used to demonstrate a company's commitment to reducing carbon emissions, yet its benefits for financial sustainability are often not immediately apparent because disclosure practices tend to be oriented toward regulatory compliance rather than strategic corporate initiatives (Almaeda et al., 2023; Ramdani & Nugraha, 2022).

Green Innovation has also become a major focus in sustainability research, as it is believed to enhance operational efficiency, competitiveness, and long-term corporate value through environmentally friendly technologies. Nevertheless, empirical findings remain mixed, as the

impact of Green Innovation on financial sustainability generally emerges in the long term and is not directly reflected in current financial performance (Ahmed et al., 2023; Maghfuriyah et al., 2024). These inconsistencies in prior research findings indicate the need for further studies to better understand how green accounting, Carbon Emission Disclosure, and Green Innovation contribute to financial sustainability, particularly in Indonesia's energy sector, which faces high environmental risks and substantial pressure to transition toward more sustainable practices.

Studies on green accounting, Carbon Emission Disclosure, and Green Innovation suggest that these three practices can form an important part of a company's sustainability strategy. However, most existing research still emphasizes short-term financial performance. In the energy sector, companies face greater environmental pressures compared to other sectors. Therefore, understanding how sustainability practices support financial sustainability has become increasingly relevant for industry players and stakeholders.

In addition, there is still limited research that examines these three aspects simultaneously within a single analytical model. In practice, environmental reporting, emissions management, and green innovation often operate as an integrated set of corporate efforts to adapt to evolving regulations and public expectations. Based on these conditions, this study aims to analyze the effects of green accounting, Carbon Emission Disclosure, and Green Innovation, both partially and simultaneously, on financial sustainability in energy sector companies listed on the Indonesia Stock Exchange.

Green accounting contributes to improving the quality of information related to environmental activities and costs in corporate financial reports. This transparency is considered capable of strengthening investor confidence and supporting long-term financial stability. Several studies report that green accounting has a positive effect on financial performance and corporate sustainability, as it serves as a signal of environmental commitment (Mustika et al., 2025; Seviana & Sumarta, 2025). Based on this understanding, the following hypothesis is proposed:
H1: Green accounting has a positive effect on financial sustainability.

Carbon Emission Disclosure reflects the extent of a company's efforts to control carbon emissions in response to regulatory pressure and public transparency demands. Improved disclosure is believed to enhance corporate image in the eyes of investors, thereby helping to strengthen financial resilience. Several studies support the notion that Carbon Emission Disclosure is associated with improved financial performance and higher market valuation (Almaeda et al., 2023; Apriliani et al., 2024; Ramdani & Nugraha, 2022; Supriyanti & Wardhani, 2024). Therefore, the following hypothesis is formulated:
H2: Carbon Emission Disclosure has a positive effect on financial sustainability.

Green Innovation relates to corporate efforts to innovate in environmentally friendly processes and products to enhance efficiency and competitiveness. Such innovations can reduce long-term costs and increase market acceptance, thereby contributing to corporate financial sustainability. Empirical evidence shows that Green Innovation supports improvements in firm value and financial performance in line with rising sustainability demands in business (Ahmed et al., 2023; Astuti & Ahmar, 2025; Maghfuriyah et al., 2024; Seviana & Sumarta, 2025). Accordingly, the following hypothesis is proposed:
H3: Green Innovation has a positive effect on financial sustainability.

METHODS

This study employs secondary data obtained from the annual reports and sustainability reports of energy sector companies listed on the Indonesia Stock Exchange (IDX) through the official website www.idx.co.id for the period 2021–2024. The research data consist of environmental disclosure and economic disclosure information, which are subsequently processed to measure green accounting, Carbon Emission Disclosure, Green Innovation, and financial sustainability as the main variables in this study.

The study focuses on energy sector companies listed on the Indonesia Stock Exchange (IDX) during the 2021–2023 period. A purposive sampling technique is applied to determine the research sample based on predetermined criteria, namely companies that publish complete annual reports and sustainability reports throughout the observation period and provide measurable data for all research variables. The sample selection process is presented in Table 1 below.

Table 1. Research Sample Selection

No	Description	Total
1	Energy sector companies listed on the IDX for the 2020–2024 period	90
2	Companies that did not publish complete annual reports and sustainability reports	(69)
3	Companies that did not disclose green accounting	(8)
4	Companies that did not disclose carbon emissions (at least one GRI 305 item)	(0)
5	Companies that did not disclose Green Innovation	(2)
	Total sample companies used	**11**

Source: Research Data, 2025

The dependent variable used in this study is financial sustainability. The Return on Assets (ROA) ratio is employed as an indicator because it reflects a company's ability to generate profit from its total managed assets, thereby providing an overview of long-term financial resilience. ROA is calculated using the following formula:

$$ROA = \frac{Net\ Income}{Total\ Assets} \quad \text{.....(1)}$$

Green accounting is used as the first independent variable, as it represents an accounting approach that assesses the extent to which a company recognizes and reports environmental activities and costs in its official reports. Measurement is conducted using an environmental disclosure index calculated with the following formula:

$$GA = \frac{Environmental\ Disclosures}{Total\ Environmental\ Disclosure\ Items} \quad \text{.....(2)}$$

Carbon Emission Disclosure serves as the second independent variable. The use of this indicator is based on the urgency for companies to manage carbon emissions as part of their responsibility for environmental impacts. Disclosure is assessed using an index formulated as follows:

$$CED = \frac{Carbon\ Emission\ Disclosures}{Total\ Carbon\ Emission\ Disclosure\ Items} \quad \text{.....(3)}$$

Green Innovation is the third independent variable, reflecting a company's capability to create environmentally friendly innovations in its business operations. This indicator is measured using a green innovation disclosure index with the following formula:

$$GI = \frac{Green\ Innovation\ Disclosures}{Total\ Green\ Innovation\ Disclosure\ Items} \quad \text{.....(4)}$$

The research population includes all energy sector companies listed on the Indonesia Stock Exchange (IDX). Sample selection is conducted using purposive sampling based on the following criteria: energy sector companies listed on the IDX that consistently publish annual reports and sustainability reports during the 2021–2023 period and provide complete information for all research variables. Based on these criteria, nine companies are selected, resulting in a total of 27 observations.

Data analysis is performed using multiple linear regression to examine the effects of green accounting, Carbon Emission Disclosure, and Green Innovation on financial sustainability. The regression model is formulated as follows:

$$Y = \alpha + \beta1X1 + \beta2X2 + \beta3X3 + \varepsilon \quad \text{.....(5)}$$

The analytical techniques applied include descriptive statistics, classical assumption tests, partial significance testing of coefficients (t-test), and simultaneous significance testing (F-test) at a 5% significance level to ensure the adequacy of the model in explaining the relationships among variables in this study.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 2. Descriptive Statistics Results

	N	Minimum	Maximum	Mean	Std. Deviation
Green Accounting	55	0	1.802.048.505.000	168.239.374.426	350.926.841.744
Carbon Emission Disclosure	55	0,14	1,00	0,7427	0,24976
Green Innovation	55	0,25	0,75	0,5484	0,13691
Financial Sustainability	55	-0,10	0,28	0,0898	0,09507

Valid (listwise)	N	55

Source: Research Data, 2025

The results of the descriptive statistics presented in Table 2 illustrate the main characteristics of each research variable, based on 55 observations of energy sector companies during the observation period. Overall, these results provide an initial overview of data distribution through the minimum, maximum, mean, and standard deviation values of each variable used in the analysis.

Financial Sustainability has a minimum value of –0.10 and a maximum value of 0.28, with a mean of 0.0898 and a standard deviation of 0.09507. The mean value, which is relatively close to the minimum value, along with a standard deviation within a similar range to the mean, indicates that the data distribution is centered around the mean while still exhibiting moderate variation across firms. The relatively narrow data range suggests that most observations are clustered within a similar value range.

Green Accounting shows a very wide data range, with a minimum value of 0 and a maximum value of 1,802,048,505,000. The mean value of IDR 168,239,374,426 and a standard deviation of IDR 350,926,841,744 indicate extremely high dispersion, where the standard deviation substantially exceeds the mean. This condition highlights significant differences in the scale or intensity of environmental cost disclosures among the sampled companies. Some firms report very large values, while others disclose minimal values or none at all.

Carbon Emission Disclosure has a minimum value of 0.14 and a maximum value of 1.00, with a mean of 0.7427 and a standard deviation of 0.24976. This range reflects a relatively wide distribution of data, although the mean value remains at a relatively high level. This finding indicates that most companies have achieved carbon emission disclosure scores above the medium category. A standard deviation smaller than the mean suggests that the data are fairly concentrated around the central value despite some variation among observations.

Green Innovation has a minimum value of 0.25 and a maximum value of 0.75. The mean value of 0.5484 and a standard deviation of 0.13691 indicate relatively low variation, reflecting a fairly even distribution of data within this range. The mean value located near the midpoint of the range suggests that most observations are concentrated at a moderate level of innovation, with no dominant extreme deviations.

Overall, the descriptive statistical results show that each variable exhibits a distinct distribution pattern. Green Accounting demonstrates a very high level of data variability, while Green Innovation displays a more stable distribution. Meanwhile, Financial Sustainability and Carbon Emission Disclosure show moderate levels of data dispersion. This overview serves as a basis for confirming data readiness prior to proceeding with regression analysis and hypothesis testing.

Normality Test

Table 3. Normality Test

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		55
Normal Parameters[a,b]	Mean	0,0000000
	Std. Deviation	0,08763404
Most Extreme Differences	Absolute	0,101

	Positive	0,101
	Negative	-0,065
Test Statistic		0,101
Asymp. Sig. (2-tailed)		0,200[c,d]

Source: Research Data, 2025

The normality test is conducted to ensure that the residuals in the regression model follow an approximately normal distribution. Based on the Kolmogorov–Smirnov test results presented in Table 2, the significance value (Asymp. Sig. 2-tailed) exceeds the 0.05 significance level. This result indicates that the residuals are normally distributed and do not exhibit significant deviations from normality.

With the normality assumption satisfied, the regression analysis can proceed to the next stage, as the model meets one of the fundamental requirements of parametric statistical analysis. This finding also suggests that the residual variation is reasonably distributed and does not show extreme skewness toward either side of the distribution curve.

Multicollinearity Test

Table 4. Multicollinearity Test

	Collinearity Statistics	
Model	Tolerance	VIF
1 (Constant)		
Green Accounting	0,860	1,162
Carbon Emission Disclosure	0,880	1,137
Green Innovation	0,969	1,032

Source: Research Data, 2025

The multicollinearity test is conducted to determine whether high correlations exist among the independent variables in the regression model. Based on the results presented in Table 3, all independent variables have tolerance values above 0.10 and Variance Inflation Factor (VIF) values below 10. These results indicate that there is no evidence of multicollinearity in the regression model used in this study.

Under these conditions, all independent variables meet the criteria for inclusion in the regression model, as none exhibit strong interdependence that could compromise the stability of coefficient estimates. Therefore, the regression analysis can be continued without removing or modifying the predefined independent variables.

Heteroskedasticity Test

Table 5. Heteroskedasticity Test

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,047	,037		1,250	,217
	Green Accounting	9,583E-15	,000	,066	,446	,658
	Carbon Emission Disclosure	,031	,030	,155	1,054	,297
	Green Innovation	-,002	,052	-,004	-,031	,975

a. Dependent Variable: Abs_RES

Source: Research Data, 2025

The heteroskedasticity test is conducted to determine whether the regression model exhibits unequal residual variances across observations. The results presented in Table 4 show

that all independent variables have significance values greater than 0.05. This indicates that the regression model does not suffer from heteroskedasticity.

Accordingly, the residual distribution in the model is considered homoscedastic and does not display any specific patterns that could undermine the validity of coefficient estimation. Therefore, the regression model is suitable for further analysis without requiring data transformation or alternative estimation techniques.

Multiple Linear Regression Analysis

Table 5. Multiple Linear Regression Analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,010	,021		-,508	,613
	Green Accounting	-3,912E-14	,000	-,188	-1,428	,160
	Carbon Emission Disclosure	-,003	,044	-,008	-,062	,951
	Green Innovation	,230	,064	,475	3,614	,001

Source: Research Data, 2025

The results of the multiple linear regression analysis indicate that the research model is appropriate for use after fulfilling the classical assumption tests. The model is proven to be free from heteroskedasticity, as indicated by the significance values of all variables exceeding 0.05. This finding suggests that the error variance in the model is homogeneous, allowing the estimated coefficients to be interpreted more reliably (Imam Ghozali, 2018).

DISCUSSION

The Effect of Green Accounting on Financial Sustainability

Green accounting is an accounting approach that emphasizes the recognition, measurement, and disclosure of environmental costs arising from a company's operational activities. The implementation of green accounting enables companies to systematically identify environmental costs such as waste management, pollution control, and the use of natural resources, thereby supporting managerial decision-making that simultaneously considers economic and environmental aspects (Anggraini & Widhiastuti, 2020; Surianti & Hutagalung, 2025).

Green accounting can be explained through Stakeholder Theory, which posits that companies have a responsibility to fulfill the information needs of all stakeholders, including information related to the environmental impacts of corporate activities. The management and disclosure of environmental costs through green accounting represent a corporate response to stakeholder demands for transparency and accountability. Meeting these demands can enhance stakeholder trust and reduce risks that may potentially disrupt financial stability; therefore, green accounting is expected to influence corporate financial sustainability (Christiaan, 2022; Shofia & Anisah, 2020).

The research results indicate that Green Accounting does not have a significant effect on Financial Sustainability. This is evidenced by a significance level of 0.160, which is greater than the confidence level of 0.05, leading to the rejection of Hypothesis H1. Thus, it can be concluded that the implementation of Green Accounting has not been able to enhance the financial

sustainability of companies in this study. This finding is consistent with the research conducted by (Seviana & Sumarta, 2025), which states that Green Accounting does not have a significant effect on corporate financial performance.

Based on these findings, it can be concluded that activities related to the recording and reporting of environmental costs are not yet considered factors that provide direct financial benefits to companies. Green Accounting is still perceived as a reporting obligation that may lead to additional costs, so its impact on company profitability is not evident in the short term. Moreover, the benefits of implementing Green Accounting tend to be long-term in nature, meaning they have not yet become a primary consideration in evaluating corporate financial performance.

The results of this study are in line with the findings of (Ningsi et al., 2024) and (Husna et al., 2025), which state that Green Accounting does not have a significant influence on a company's financial condition. However, these findings are not consistent with the study by (Anisah et al., 2024), which suggests that environmental accounting practices can have a positive impact on financial performance by increasing stakeholder trust and enhancing corporate reputation.

The Effect of Carbon Emission Disclosure on Financial Sustainability

Carbon Emission Disclosure refers to corporate disclosure related to carbon emissions generated from operational activities, as well as policies and efforts undertaken to reduce such emissions. This disclosure reflects the level of corporate transparency regarding environmental impacts and serves as an important source of information for stakeholders in assessing a company's environmental risk (Pangestu & Ayuningsasi, 2024; Ramdani & Nugraha, 2022).

Carbon Emission Disclosure can be explained through Legitimacy Theory, which suggests that companies seek to obtain and maintain social legitimacy by aligning their activities and disclosures with prevailing societal values and norms. Transparency in carbon emission disclosure represents a company's effort to demonstrate environmental concern and responsibility. Such efforts can strengthen public and investor trust and help preserve corporate legitimacy, which ultimately supports the sustainability of a company's financial performance (Apriliani et al., 2024; Gleißner et al., 2022).

The research results indicate that Carbon Emission Disclosure does not have a significant effect on Financial Sustainability. This is evidenced by a significance level of 0.951, which is greater than the confidence level of 0.05, leading to the rejection of Hypothesis H2. Thus, an increase in carbon emission disclosure by companies has not been able to generate an impact on financial sustainability. This finding is consistent with the study conducted by (Fauziah & Puspita, 2024), which states that carbon emission disclosure does not have a significant effect on corporate performance or financial sustainability.

Based on these results, it can be inferred that information related to carbon emissions disclosed in sustainability reports is still viewed primarily as part of transparency and social responsibility compliance, rather than as a key factor in investors' and stakeholders' assessments of a company's financial condition. In addition, carbon emission disclosure is not directly associated with profit enhancement, causing its economic benefits to be less immediately observable.

The findings of this study are in line with the research of (Dewi, 2025) dan (Ladista et al., 2023), which state that carbon emission disclosure has not been able to drive significant changes

in corporate financial performance. However, these results are inconsistent with the study by (Murtanto & Putri, 2023), which argues that carbon emission transparency can enhance stakeholder trust and positively affect a company's financial sustainability.

The Effect of Green Innovation on Financial Sustainability

Green Innovation reflects a company's capability to develop environmentally friendly product, process, and technological innovations. These innovations aim to reduce negative environmental impacts while simultaneously enhancing resource-use efficiency in corporate operations (Maghfuriyah et al., 2024).

Green Innovation can be explained through the Resource-Based View (RBV), which emphasizes that a company's competitive advantage is derived from its internal capabilities in effectively managing resources. Environmentally friendly innovation is viewed as a strategic resource that can improve operational efficiency, strengthen competitiveness, and create long-term corporate value. The utilization of such innovation as an internal resource is expected to support financial stability and business sustainability; therefore, Green Innovation is anticipated to influence a company's financial sustainability (Cheng et al., 2025; Maghfuriyah et al., 2024).

The research results indicate that Green Innovation has a positive and significant effect on Financial Sustainability. This is evidenced by a significance level of 0.001, which is lower than the confidence level of 0.05, leading to the acceptance of Hypothesis H3. Thus, it can be concluded that the implementation of Green Innovation by companies is able to enhance financial sustainability. This finding is consistent with the study conducted by (Maghfuriyah et al., 2024), which states that green innovation has a positive effect on improving corporate financial performance.

Based on these findings, it is evident that corporate efforts to develop environmentally friendly products or processes can improve operational efficiency and reduce long-term costs. In addition, environmentally based innovation enhances a company's image in the eyes of stakeholders, thereby contributing to increased profitability and business sustainability. Through green innovation, companies are able to create economic value while simultaneously preserving environmental sustainability.

The results of this study are in line with the research conducted by Tuti et al. (2025) and (Tuti et al., 2025) and (Saputra et al., 2023), which state that Green Innovation has a positive and significant effect on corporate financial performance and sustainability. However, these findings are not consistent with the study by (Munawaroh & Kurniawati, 2025), which suggests that green innovation does not always provide a significant impact on financial performance.

The Effect of Green Accounting, Carbon Emission Disclosure, and Green Innovation on Financial Sustainability

The F-statistical test was conducted to examine whether Green Accounting, Carbon Emission Disclosure, and Green Innovation simultaneously affect Financial Sustainability. The results show that the calculated F-value is 4.610 with a significance value of 0.006, which is lower than the significance level of 0.05.

These results indicate that Green Accounting, Carbon Emission Disclosure, and Green Innovation simultaneously have a significant effect on Financial Sustainability. This finding suggests that financial sustainability in energy sector companies is influenced by the combined implementation of environmental accounting practices, transparency in carbon emission

disclosure, and the adoption of environmentally friendly innovations.

Although the partial test results show that Green Accounting and Carbon Emission Disclosure do not have a significant individual effect on Financial Sustainability, their implementation remains important as part of an integrated sustainability strategy. When combined with Green Innovation, these variables contribute to improving operational efficiency, strengthening stakeholder trust, and supporting long-term financial sustainability.

CONCLUSION

Based on the research objectives examining the effect of green accounting, carbon emission disclosure, and green innovation on financial sustainability in energy sector companies listed on the Indonesia Stock Exchange during the 2020–2024 period, this study finds that green accounting and carbon emission disclosure do not have a significant effect on financial sustainability, while green innovation has a positive and significant effect. In addition, the simultaneous test results indicate that green accounting, carbon emission disclosure, and green innovation jointly have a significant effect on financial sustainability, suggesting that an integrated implementation of environmental practices and innovation plays an important role in supporting long-term financial sustainability.

This study has several limitations, particularly the sample scope, which is limited to energy sector companies, meaning that the results cannot be generalized to all industrial sectors. Furthermore, the study is limited by the use of only three environmental sustainability variables. In addition, the measurement of certain variables, such as green accounting and carbon emission disclosure, relies heavily on the level of corporate transparency, which may lead to potential bias. Therefore, future research is recommended to expand the range of industrial sectors and observation periods, include additional sustainability variables such as environmental performance or ESG ratings, and apply more comprehensive measurement methods to provide a more holistic and accurate understanding of the factors influencing financial sustainability.

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