

CORPORATE GOVERNANCE MODERATING GREEN INTELLECTUAL CAPITAL AND BLUE ACCOUNTING DISCLOSURE EFFECTS ON SUSTAINABILITY PERFORMANCE

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Abstract

This study aimed to examine and analyze the role of corporate governance in moderating the influence of green intellectual capital and blue accounting disclosure on corporate sustainability performance. The study employed an associative quantitative approach. The population consisted of 91 energy sector companies listed on the Indonesia Stock Exchange during the 2020–2024 period, and a sample of 21 companies was selected through purposive sampling, resulting in 105 firm-year observations. Secondary data were obtained from annual reports, sustainability reports, and corporate governance reports. The data were analyzed using panel data regression and Moderated Regression Analysis with the assistance of EViews 13 software after descriptive statistics, model selection tests, and classical assumption tests were conducted. The results showed that green intellectual capital had no significant effect on sustainability performance, with a t-statistic of -1.855511 and a significance value of 0.0664. Blue accounting disclosure had a positive and significant effect on sustainability performance, with a t-statistic of 2.685552 and a significance value of 0.0085. Corporate governance significantly moderated the influence of green intellectual capital on sustainability performance, with a t-statistic of 2.044847 and a significance value of 0.0442. However, corporate governance did not moderate the influence of blue accounting disclosure on sustainability performance, with a t-statistic of -1.407638 and a significance value of 0.1632. These findings implied that environmentally oriented intangible resources alone were insufficient to enhance sustainability performance, while greater transparency in water and marine resource management improved sustainability performance, and effective governance enabled firms to better utilize green intellectual resources to achieve sustainability objectives.

Keywords: Green Intellectual Capital, Blue Accounting Disclosure, Sustainability Performance, Corporate Governance

1. Introduction

Sustainability performance has become a key concern in contemporary business due to increasing global pressure on environmental responsibility, social accountability, and economic resilience. Firms are no longer evaluated solely on financial performance but also on their Environmental, Social, and Governance (ESG) commitments. This expectation is aligned with the Sustainable Development Goals (SDGs), particularly SDG 12, SDG 13, and SDG 14, which emphasize responsible production, climate action, and marine ecosystem protection (OECD, 2015; Rahmayanti & Sari, 2023). In Indonesia, particularly in resource-intensive sectors, firms face increasing pressure to adopt sustainability-oriented strategies. However, sustainability implementation remains



uneven, especially in integrating environmental accounting practices that reflect both economic and ecological value. Green Intellectual Capital, which represents environmentally oriented knowledge, innovation, and organizational capabilities, is considered an important intangible resource for supporting sustainability. Nevertheless, prior studies report inconsistent findings regarding its impact on sustainability performance (Yusliza et al., 2020; Zuliansyah et al., 2025).

In addition, blue accounting disclosure has emerged as an extended form of environmental accounting that focuses on water and marine ecosystem reporting. This concept integrates ecological, social, and economic dimensions of marine resources (Arianto et al., 2024). It enhances transparency and accountability in environmental reporting and functions as a legitimacy mechanism for firms (Rahmayanti et al., 2023; Antong et al., 2024). However, empirical evidence on its relationship with sustainability performance remains limited. Corporate governance is expected to strengthen sustainability outcomes by ensuring transparency, accountability, and effective implementation of corporate strategies. In sustainability context, governance mechanisms may enhance the effectiveness of green intellectual capital and blue accounting disclosure in improving corporate sustainability performance (OECD, 2015; Hussain et al., 2018; Holiawati et al., 2025).

Data from the Indonesia Stock Exchange (IDX) show that 91 energy sector companies were listed during the 2020–2024 period. Although this number appears relatively large, not all companies consistently published complete annual reports, sustainability reports, and corporate governance reports during the observation period, indicating that sustainability implementation remains uneven across the sector. The highest concentration of complete sustainability disclosure occurred among large-cap energy companies, while smaller companies exhibited limited disclosure practices, reflecting increasing financial pressure and declining sustainability performance even before broader global economic disruptions intensified. This phenomenon shows that although the number of energy sector companies is relatively large, the consistency of sustainability disclosure remains a significant signal of sustainability performance in the capital market, highlighting the importance of early detection of sustainability practices through green intellectual capital, blue accounting disclosure, and corporate governance mechanisms.

The primary objective of a company is not only to generate profits but also to maintain its sustainability performance, which is essential for protecting stakeholder interests and ensuring long-term sustainability (Elkington, 1997; Freeman, 1984). A sustainability report serves as an important early warning signal, informing investors, creditors, and other stakeholders about substantial doubt regarding a firm's ability to continue operating in the foreseeable future (Suchman, 1995). During periods of economic uncertainty, the number of companies receiving going concern opinions tends to increase as financial distress weakens firms' operational and financial performance, requiring companies to adopt effective financial management, sound business strategies, and greater adaptability to sustain their operations (Suchman, 1995).

Several cases in Indonesia demonstrate the complexity of auditors' going concern assessments. PT Medco Energi Internasional Tbk. (MEDC) recorded the highest level of sustainability performance disclosure with 438 disclosed indicators, whereas PT Energi Mega Persada Tbk. (ENRG) reported the lowest disclosure with 360 indicators. PT ABM Investama Tbk. (ABMM) achieved the highest green intellectual capital disclosure with 85 indicators, whereas PT Bumi Resources Tbk. (BUMI) reported the lowest disclosure



with 48 indicators. These cases illustrate that sustainability performance judgments involve not only current financial conditions but also management's recovery strategies and future business prospects.

Corporate governance is considered one of the most important determinants of sustainability performance because firms with strong governance mechanisms are generally perceived to possess greater transparency, accountability, and oversight capabilities in identifying material uncertainties related to business continuity (Holiawati et al., 2025; Hussain et al., 2018). Nevertheless, strong governance does not always guarantee superior sustainability performance. The case involving energy sector companies demonstrates that violations of sustainability reporting standards may still occur, ultimately resulting in regulatory sanctions and raising concerns regarding sustainability credibility. Empirical evidence regarding green intellectual capital remains inconclusive. Several studies report that green intellectual capital significantly influences sustainability performance (Zuliansyah et al., 2025), whereas others find insignificant or no relationship (Khotimah et al., 2024). Similar inconsistencies are also found in studies examining blue accounting disclosure. Greater transparency in environmental disclosure is generally believed to improve sustainability performance (Rahmayanti & Sari, 2023; Antong et al., 2024). However, previous findings remain inconsistent, with several studies reporting no significant effect, while others report significant positive effects.

Good Corporate Governance (GCG) is also expected to reduce sustainability risk by strengthening transparency, accountability, internal control, and corporate oversight (Holiawati et al., 2025; Hussain et al., 2018). The effectiveness of GCG mechanisms is reflected through institutional ownership, managerial ownership, audit committees, and independent commissioners (KNKG, 2019). Previous studies suggest that audit committees and independent commissioners can reduce the likelihood of receiving a going concern opinion by improving corporate monitoring (Holiawati et al., 2025). Conversely, other studies conclude that GCG mechanisms have no direct effect on sustainability performance, although they may indirectly improve business sustainability through better governance and risk management (Khotimah et al., 2024). Moreover, institutional ownership and managerial ownership have also been reported to negatively influence the likelihood of receiving a going concern opinion (Hidayah & Rachmadiyahana, 2024).

The urgency of this research is driven by several critical factors. First, sustainability performance has become a key concern in contemporary business due to increasing global pressure on environmental responsibility, social accountability, and economic resilience, yet empirical evidence on the determinants of sustainability performance remains inconsistent. Second, data from the Indonesia Stock Exchange show that 91 energy sector companies were listed during the 2020–2024 period, indicating financial pressure and declining sustainability performance across various sectors, yet the early detection of sustainability practices through green intellectual capital, blue accounting disclosure, and corporate governance mechanisms remains underexplored. Third, several cases in Indonesia demonstrate the complexity of sustainability performance assessments, where financial distress does not necessarily result in a going concern opinion, and companies facing substantial sustainability problems do not always receive such opinions. Fourth, empirical evidence regarding green intellectual capital, blue accounting disclosure, and corporate governance mechanisms remains inconclusive, with some studies reporting significant effects and others reporting insignificant or no relationship. Fifth, the energy sector during the 2020–2024 period represents a unique context characterized by



economic uncertainty and evolving governance practices, yet empirical evidence on the determinants of sustainability performance in this sector remains limited.

Previous research has shown significant but fragmented findings regarding the determinants of sustainability performance. Studies have demonstrated that green intellectual capital significantly influences sustainability performance, with environmentally oriented knowledge encouraging innovation and resource efficiency (Zuliansyah et al., 2025). Research has shown that blue accounting disclosure positively affects sustainability performance, with greater transparency regarding water resource management and environmental conservation enhancing sustainability performance (Rahmayanti & Sari, 2023; Antong et al., 2024). Research has also shown that corporate governance mechanisms can strengthen the relationship between green intellectual capital, blue accounting disclosure, and sustainability performance (Holiawati et al., 2025; Hussain et al., 2018). However, other studies have reported contradictory findings, indicating that green intellectual capital does not significantly influence sustainability performance (Khotimah et al., 2024), and that corporate governance mechanisms have no direct effect on sustainability performance (Khotimah et al., 2024). These inconsistencies suggest that the relationships among green intellectual capital, blue accounting disclosure, corporate governance, and sustainability performance remain underexplored, particularly in the context of energy sector companies in Indonesia.

The research gap in this study lies in the limited understanding of how green intellectual capital, blue accounting disclosure, and corporate governance mechanisms jointly influence sustainability performance, particularly in the energy sector in Indonesia. While individual studies have examined the direct effects of green intellectual capital, blue accounting disclosure, or GCG mechanisms on sustainability performance, the integrated framework connecting these factors remains underexplored (Zuliansyah et al., 2025; Khotimah et al., 2024; Rahmayanti & Sari, 2023; Antong et al., 2024; Holiawati et al., 2025). Additionally, most previous studies have focused on various sectors or other periods, leaving a significant gap in knowledge regarding the dynamics of sustainability performance in energy sector companies during the 2020–2024 period. Furthermore, empirical evidence on the determinants of sustainability performance in Indonesia remains limited, particularly in the context of increasing economic uncertainty and evolving governance practices.

The novelty of this research lies in several aspects. First, this study focuses on energy sector companies listed on the Indonesia Stock Exchange during the 2020–2024 period, representing a unique context characterized by economic uncertainty and evolving governance practices. Second, this study develops an integrative model that simultaneously examines the influence of green intellectual capital, blue accounting disclosure, and corporate governance mechanisms on sustainability performance, providing a more comprehensive understanding of the determinants of sustainability performance in the energy sector. Third, this study contributes to the limited empirical evidence on sustainability performance in the energy sector, providing insights into how green intellectual capital, blue accounting disclosure, and GCG mechanisms collectively influence sustainability performance. Fourth, this study extends the application of Stakeholder Theory and Legitimacy Theory to the context of sustainability performance in Indonesia, validating theoretical predictions in an under-researched institutional context. Fifth, this study provides actionable insights for investors, company management, regulators, and academics in designing effective strategies to detect sustainability practices and maintain business continuity.



The purpose of this study is to examine the effect of green intellectual capital, blue accounting disclosure, and corporate governance mechanisms on sustainability performance in energy sector companies listed on the Indonesia Stock Exchange during the 2020–2024 period. Specifically, this research aims to analyze the effect of green intellectual capital on sustainability performance, analyze the effect of blue accounting disclosure on sustainability performance, and analyze the moderating role of corporate governance in the relationship between green intellectual capital, blue accounting disclosure, and sustainability performance. The choice of this goal was driven by the limited understanding of how green intellectual capital, blue accounting disclosure, and GCG mechanisms collectively influence sustainability performance and the need for empirical evidence that can inform investors, company management, regulators, and academics in designing effective strategies to detect sustainability practices and maintain business continuity.

The contribution of this research is multifaceted. From a theoretical perspective, this research contributes to the enrichment of literature on sustainability accounting and corporate governance by proposing and testing an integrative model that links green intellectual capital, blue accounting disclosure, and corporate governance mechanisms with sustainability performance, extending the application of Stakeholder Theory and Legitimacy Theory to the context of sustainability performance in Indonesia. The findings contribute to the understanding of how green intellectual capital, blue accounting disclosure, and GCG mechanisms influence sustainability performance, providing a more nuanced theoretical framework for analyzing sustainability performance in the energy sector. From a practical perspective, this study provides actionable insights for investors, company management, regulators, and academics in assessing and managing sustainability performance. For investors, the findings provide guidance on which factors should be considered in evaluating the likelihood of a company achieving sustainability performance. For company management, the results offer insights into the factors affecting their sustainability performance and the importance of green intellectual capital in detecting financial distress. For regulators, this study provides empirical evidence to support the development of policies to maintain market stability and protect investor interests. For academics, this study contributes to the growing body of literature on sustainability accounting and corporate governance, providing a foundation for future research on green intellectual capital, blue accounting disclosure, GCG mechanisms, and sustainability performance.

2. Theoretical Background

2.1 Stakeholder Theory

Stakeholder Theory explains that companies are responsible not only to shareholders but also to a broader range of stakeholders, including employees, customers, governments, communities, and the natural environment (Freeman, 1984). In this study, green intellectual capital and blue accounting disclosure function as mechanisms to reduce information asymmetry between management and stakeholders through greater transparency and accountability. According to Freeman (1984), corporate success depends on the organization's ability to balance the interests of various stakeholder groups. Companies that effectively address stakeholder expectations are more likely to achieve sustainable competitive advantages and maintain long-term organizational performance. In the context of sustainability, stakeholder expectations have expanded beyond financial performance to include environmental responsibility and social



accountability. Consequently, organizations are increasingly encouraged to invest in environmentally oriented knowledge, innovation, and transparent sustainability reporting. Green intellectual capital represents the internal capability that enables organizations to develop environmentally friendly innovations, whereas blue accounting disclosure demonstrates accountability for marine and water-related environmental resources. Through these practices, firms can strengthen stakeholder trust and improve sustainability performance. Therefore, Stakeholder Theory provides an important theoretical foundation for explaining the relationships between Green Intellectual Capital, Blue Accounting Disclosure, and Sustainability Performance.

2.2 Legitimacy Theory

Legitimacy Theory explains that companies seek social acceptance by ensuring that their operations conform to prevailing social norms, values, and expectations (Suchman, 1995). Companies that demonstrate environmental responsibility through transparent reporting are more likely to gain public acceptance and maintain their social license to operate. Blue accounting disclosure represents one mechanism through which organizations communicate their commitment to protecting marine ecosystems and water resources. Transparent disclosure regarding environmental investments, conservation programs, and water resource management enhances corporate legitimacy and strengthens stakeholder confidence (Rahmayanti & Sari, 2023). Similarly, Green Intellectual Capital supports legitimacy by enabling firms to develop environmentally responsible innovations and sustainable business practices.

2.3 Green Intellectual Capital

Green intellectual capital refers to environmentally oriented intangible resources that consist of green human capital, green structural capital, and green relational capital (Chen, 2008; Ulum, 2017). These resources facilitate the development of environmental innovation, operational efficiency, and sustainable organizational capabilities. Previous studies have produced inconsistent findings regarding the relationship between GIC and Sustainability Performance. Zuliansyah et al. (2025) reported that Green Intellectual Capital positively affects sustainability performance because environmentally oriented knowledge encourages innovation and resource efficiency. Conversely, Khotimah et al. (2024) found no significant relationship, indicating that environmental knowledge alone may not improve sustainability performance without effective organizational implementation. These inconsistent findings indicate the need for additional factors that may strengthen or weaken this relationship, such as corporate governance.

2.4 Blue Accounting Disclosure

Blue Accounting Disclosure is an environmental reporting approach focusing on corporate accountability for marine and water-resource management. It provides information regarding water conservation, pollution control, coastal ecosystem protection, and investments related to marine sustainability (Rahmayanti & Sari, 2023). Blue accounting disclosure reflects corporate transparency and accountability toward stakeholders while supporting Sustainable Development Goal 14 (Life Below Water). Previous research suggests that transparent environmental disclosure enhances corporate reputation and stakeholder trust (Antong et al., 2024). Nevertheless, empirical evidence regarding its influence on Sustainability Performance remains relatively limited, particularly in developing countries. Therefore, further investigation is necessary.



2.5 Corporate Governance

Corporate governance refers to the system of principles, structures, and mechanisms used to direct and control organizational activities while ensuring accountability, transparency, responsibility, fairness, and independence (OECD, 2015). In sustainability research, corporate governance is frequently considered a strategic mechanism that strengthens organizational decision-making and environmental accountability. Effective governance encourages firms to implement environmental innovations, improve disclosure quality, and allocate resources efficiently toward sustainability objectives (Holiawati et al., 2025). Consequently, this study positions corporate governance as a moderating variable that strengthens the effects of green intellectual capital and blue accounting disclosure on sustainability performance.

2.6 Sustainability Performance

Sustainability performance refers to an organization's ability to generate long-term economic, environmental, and social value simultaneously. It reflects the implementation of sustainable business practices based on the Triple Bottom Line concept, encompassing profit, people, and planet (Elkington, 1997). In this study, Sustainability Performance is measured using the Sustainability Reporting Disclosure Index (SRDI), which evaluates the extent to which companies disclose sustainability-related information according to recognized reporting standards. Higher sustainability performance indicates stronger organizational commitment to balancing financial objectives with environmental protection and social responsibility.

2.7 Green Intellectual Capital, Sustainability Performance

Green intellectual capital provides firms with environmentally oriented knowledge, innovation, and organizational capabilities that improve operational efficiency and environmental performance. Based on Stakeholder Theory, firms that effectively utilize green knowledge are better positioned to satisfy stakeholder expectations and enhance sustainability performance. Previous studies by Zuliansyah et al. (2025) support this positive relationship, although inconsistent findings reported by Khotimah et al. (2024) indicate the need for further investigation. Based on the theoretical explanation and empirical findings, the hypothesis proposed in this study is as follows:

H1: Green Intellectual Capital positively affects Sustainability Performance.

2.8 Blue Accounting Disclosure, Sustainability Performance

According to Legitimacy Theory, organizations improve public acceptance through transparent environmental reporting. Blue accounting disclosure enhances corporate accountability regarding marine and water-resource management, thereby strengthening stakeholder confidence and corporate reputation. Previous studies have demonstrated that environmental disclosure contributes positively to sustainability outcomes (Rahmayanti & Sari, 2023; Antong et al., 2024). Based on the theoretical explanation and empirical findings, the hypothesis proposed in this study is as follows:

H2: Blue Accounting Disclosure positively affects Sustainability Performance.

2.9 Corporate Governance Moderates the Relationship between Green Intellectual Capital and Sustainability Performance

Corporate governance strengthens the credibility and effectiveness of environmental disclosure by ensuring transparency, accountability, and compliance with sustainability



principles. Consequently, firms with stronger governance are expected to obtain greater sustainability benefits from green intellectual capital. Based on the theoretical explanation and empirical findings, the hypothesis proposed in this study is as follows:

H3: Corporate Governance positively moderates the relationship between Green Intellectual Capital and Sustainability Performance.

2.10 Corporate Governance Moderates the Relationship between Blue Accounting Disclosure and Sustainability Performance

Corporate governance strengthens the credibility and effectiveness of environmental disclosure by ensuring transparency, accountability, and compliance with sustainability principles. Consequently, firms with stronger governance are expected to obtain greater sustainability benefits from blue accounting disclosure. Based on the theoretical explanation and empirical findings, the hypothesis proposed in this study is as follows:

H4: Corporate Governance positively moderates the relationship between Blue Accounting Disclosure and Sustainability Performance.

3. Methods

3.1 Research Design

This study employs a quantitative approach with an associative design to examine the effect of green intellectual capital, blue accounting disclosure, and corporate governance mechanisms on sustainability performance in energy sector companies listed on the Indonesia Stock Exchange (IDX) during the 2020–2024 period. The quantitative approach is considered appropriate because the study aims to empirically test the proposed hypotheses using statistical analysis of numerical data derived from annual reports, sustainability reports, and corporate governance reports. The associative research design enables the examination of causal relationships between independent variables (Green Intellectual Capital and Blue Accounting Disclosure), moderating variable (Corporate Governance), and dependent variable (Sustainability Performance). This study is descriptive and explanatory in nature, explaining the relationships between variables and the extent to which these variables influence each other. The type of data used is secondary data, including annual report data, sustainability report data, and corporate governance report data obtained from official sources and capital market research institutions.

3.2 Population and Sample

The population in this study consists of all energy sector companies listed on the Indonesia Stock Exchange (IDX) during the 2020–2024 period, totaling 91 companies. The energy sector was selected due to its significant contribution to the economy, its sensitivity to environmental and social issues, and its relevance to sustainability assessment. The sample was selected using purposive sampling with the following criteria: (1) energy sector companies listed on the IDX during the 2020–2024 period; (2) companies that consistently published complete annual reports during the 2020–2024 period; (3) companies that consistently published complete sustainability reports during the 2020–2024 period; (4) companies with complete data on green intellectual capital, blue accounting disclosure, and corporate governance mechanisms; (5) companies that were not delisted during the observation period; and (6) companies with complete data for all research variables. Based on these criteria, the final sample includes 21 companies, resulting in 105 observations (21 companies × 5 years), as presented in **Table 1**.



Table 1. Sample Determination

No	Criteria	Quantity
1	Energy Sector Companies listed on the IDX for the 2020–2024 Period	91
2	Companies that did not consistently publish complete annual reports	-35
3	Companies that did not consistently publish complete sustainability reports	-28
4	Companies with incomplete data on all research variables	-7
5	Number of Sample Companies during the study period (2020–2024)	21
6	Company that meets the criteria: (5 Years × 21)	105

Source: Processed data (2026)

3.3 Data Collection Techniques

This study uses secondary data obtained from various official sources. Data were collected from the Indonesia Stock Exchange (IDX), company annual reports, sustainability reports, corporate governance reports, and other relevant official sources. The data collection procedure involved several sequential steps: (1) identification of energy sector companies listed on the IDX during the 2020–2024 period; (2) selection of companies meeting the predetermined purposive sampling criteria; (3) collection of sustainability performance data from sustainability reports based on GRI Standards; (4) collection of green intellectual capital data from annual reports and sustainability reports, specifically green human capital, green structural capital, and green relational capital; (5) collection of blue accounting disclosure data from sustainability reports, specifically water conservation, pollution control, coastal ecosystem protection, and investments related to marine sustainability; (6) collection of corporate governance data from annual reports, including independent commissioners, audit committees, and institutional ownership; and (7) documentation of all extracted data systematically organized into a panel dataset suitable for statistical analysis. The secondary data sources employed in this research are considered reliable as they represent official publications from authorized institutions and established data providers.

3.4 Operational Definition of Variables

Table 2. Operational Definition and Measurement of Variables

Variable	Definition	Measurement	Scale	Source
Sustainability Performance (Y)	An organization's ability to generate long-term economic, environmental, and social value simultaneously	$SRDI = (\sum X_i) / N$	Ratio	GRI (2021); Elkington (1997)
Green Intellectual Capital (X_1)	Environmentally oriented intangible resources that consist of green human capital, green structural capital, and green relational capital	$GICI = (\sum X_i) / 17$	Ratio	Chen (2008); Ulum (2017)



Variable	Definition	Measurement	Scale	Source
Blue Accounting Disclosure (X_2)	The extent to which companies disclose information regarding the management and conservation of marine and water resources	$BADI = (\sum X_i) / N$	Ratio	Rahmayanti & Sari (2023); Antong et al. (2024)
Corporate Governance (Z)	The system of principles and mechanisms that direct and control corporate activities to ensure accountability, transparency, responsibility, independence, and fairness	$CGI = (\sum X_i) / N$	Ratio	OECD (2015); KNKG (2019)

Source: Developed for this research (2026)

3.5 Data Analysis Techniques

Data analysis in this study was conducted using panel data regression and Moderated Regression Analysis (MRA) with the assistance of EViews 13 software. The analysis stages included descriptive statistics, panel data model selection, classical assumption tests, panel data regression analysis, moderated regression analysis, and hypothesis testing. Descriptive statistics were employed to describe the characteristics of the research data, including mean, maximum, minimum, and kurtosis for all variables examined in the study.

The selection of the appropriate panel data regression model was carried out through three main stages. First, the Chow test was conducted to compare whether the Common Effect Model (CEM) or Fixed Effect Model (FEM) was the better model to use; if the probability value was less than 0.05, FEM was selected over CEM. Second, the Hausman test was conducted to determine whether the best model was FEM or Random Effect Model (REM); if the probability value was less than 0.05, FEM was selected over REM. Third, the Lagrange Multiplier test was conducted to confirm whether REM was more appropriate than CEM; if the probability value was less than 0.05, REM was selected over CEM.

Prior to hypothesis testing, classical assumption tests were conducted to ensure that the regression model satisfied the required assumptions so that the estimation results were more reliable. The tests included the normality test using Jarque-Bera to examine whether residuals were normally distributed, where a probability value greater than 0.05 indicated a normal distribution; the multicollinearity test using the correlation matrix to detect high correlations among independent variables, where a correlation coefficient less than 0.90 indicated no multicollinearity; the heteroscedasticity test using the Breusch Pagan Godfrey test to examine whether residuals had constant variance, where a probability value greater than 0.05 indicated no heteroscedasticity; and the autocorrelation test using the Durbin-Watson statistic to detect serial correlation, where values close to two indicated no autocorrelation.



Panel data regression analysis was conducted to examine the effect of green intellectual capital and blue accounting disclosure on sustainability performance. The regression model used in this study was formulated as:

$$SP = \alpha + \beta_1 GIC + \beta_2 BAD + \beta_3 CG + \beta_4 (GIC \times CG) + \beta_5 (BAD \times CG) + \varepsilon$$

Where:

SP = Sustainability Performance

α = Constant

β_1 – β_5 = Regression coefficients

GIC = Green Intellectual Capital

BAD = Blue Accounting Disclosure

CG = Corporate Governance

GIC×CG = Interaction between Green Intellectual Capital and Corporate Governance

BAD×CG = Interaction between Blue Accounting Disclosure and Corporate Governance

ε = Error term

Hypothesis testing was conducted using several methods. The t-test was used to determine the partial effect of each independent variable on sustainability performance. The F-test was used to examine the simultaneous effect of independent variables on sustainability performance. The coefficient of determination (R^2) was used to determine the model's ability to explain variations in sustainability performance. All hypothesis tests were conducted at a significance level of 5% ($p < 0.05$).

4. Results and Discussion

4.1 Panel Data Model Selection

Table 3. Panel Data Model Selection Results

No	Test	Test Result	Chi-Square	Selected Model
1	Chow Test	Prob < 0.05 = FEM	0.0000	FEM
2	Hausman Test	Prob > 0.05 = REM	0.3789	REM
3	Lagrange Multiplier	Prob < 0.05 = REM	0.0000	REM

Source: Processed data (2026)

Table 3 shows the results of a series of panel data model selection tests. Based on the Chow test ($0.0000 < 0.05$), the Fixed Effect Model (FEM) is preferred over the Common Effect Model. However, the Hausman test ($0.3789 > 0.05$) indicates that the Random Effect Model (REM) is more appropriate than FEM, and the Lagrange Multiplier test ($0.0000 < 0.05$) confirms that REM is preferred over CEM. Considering the overall results of the model selection tests, this study concludes that the Random Effect Model (REM) is the most appropriate estimation model and is used for further analysis.

Table 4. Panel Data Model Moderated Regression Analysis

No	Test	Test Result	Chi-Square	Selected Model
1	Chow Test	Prob < 0.05 = FEM	0.0000	FEM
2	Hausman Test	Prob < 0.05 = FEM	0.0024	FEM

Source: Processed data (2026)

Table 4 shows the results of the panel data model selection tests for the Moderated Regression Analysis. The Chow test produced a probability value of 0.0000, while the Hausman test yielded a probability value of 0.0024, both of which are lower than the significance level of 0.05. These results indicate that the Fixed Effect Model (FEM) is the most appropriate estimation model. Therefore, the Fixed Effect Model (FEM) was employed to estimate the effects of Green Intellectual Capital, Blue Accounting Disclosure, and the moderating role of Corporate Governance on Sustainability Performance.



4.2 Descriptive Statistics

Table 5. Descriptive Statistics of Research Variables

	Sustainability Performance	Green Intellectual Capital	Blue Accounting Disclosure
Mean	0.745704	0.924370	0.935238
Maximum	0.967033	1.000000	1.000000
Minimum	0.397802	0.764706	0.000000
Kurtosis	2.009181	2.489389	16.14029
Jarque-Bera	7.672282	7.527142	966.8522
Probability	0.021577	0.023201	0.000000
Observations	105	105	105

Source: Processed data (2026)

Table 5 presents the descriptive statistics for all research variables. The data shows that sustainability performance has a mean value of 0.745704, indicating that, on average, companies disclosed 74.57% of the sustainability reporting indicators. The maximum value is 0.967033, while the minimum value is 0.397802, indicating a considerable variation in sustainability disclosure among the sampled companies. PT Medco Energi Internasional Tbk. (MEDC) recorded the highest level of sustainability performance disclosure with 438 disclosed indicators, whereas PT Energi Mega Persada Tbk. (ENRG) reported the lowest disclosure with 360 indicators. The Green Intellectual Capital variable has a mean value of 0.924370, indicating that, on average, companies disclosed 92.44% of the green intellectual capital indicators. The maximum value is 1.000000, while the minimum value is 0.764706, suggesting that most companies reported a high level of green intellectual capital disclosure. PT ABM Investama Tbk. (ABMM) achieved the highest disclosure with 85 indicators, whereas PT Bumi Resources Tbk. (BUMI) reported the lowest disclosure with 48 indicators. The descriptive statistics also show that blue accounting disclosure has a mean value of 0.935238, indicating that companies disclosed, on average, 93.52% of the Blue Accounting Disclosure indicators. The maximum value is 1.000000, demonstrating full disclosure by several companies, while the minimum value indicates that all sampled companies disclosed Blue Accounting information, although at varying levels.

4.3 Classical Assumption Tests

Table 6. Classical Assumption Test Results

Assumption Test	Indicator	Result	Criteria	Conclusion
Normality (Main Effects Model)	Jarque-Bera Sig.	0.040612	> 0.05	Not Normal
Normality (MRA Model)	Jarque-Bera Sig.	0.055272	> 0.05	Normal
Multicollinearity	Correlation (GIC-BAD)	0.097196	< 0.90	No Multicollinearity
Autocorrelation (Main Effects)	Obs*R-squared Sig.	0.0000	-	Autocorrelation
Autocorrelation (MRA)	Obs*R-squared Sig.	0.0000	-	Autocorrelation
Heteroscedasticity (Main Effects)	Obs*R-squared Sig.	0.5002	> 0.05	No Heteroscedasticity
Heteroscedasticity (MRA)	Obs*R-squared Sig.	0.4753	> 0.05	No Heteroscedasticity

Source: Processed data (2026)



Table 6 presents the classical assumption test results. The normality test for the main effects model indicates that the Jarque–Bera probability value is 0.040612, which is lower than the significance level of 0.05 (Jarque–Bera = 6.407404; $p = 0.040612$). Therefore, the residuals are not normally distributed. However, according to the Central Limit Theorem, the normality assumption may be relaxed when the sample size is sufficiently large ($n > 30$) (Gujarati, 2010). Since this study comprises 105 firm-year observations from 21 companies, the sample size is considered adequate, and the data are assumed to approximate a normal distribution. The normality test for the MRA model produced a probability value of 0.055272, which is greater than 0.05, indicating that the residuals are normally distributed. The multicollinearity test results indicate that the correlation coefficient between Green Intellectual Capital and Blue Accounting Disclosure is 0.097196. Since the correlation coefficient is below the threshold value of 0.90, it can be concluded that there is no multicollinearity problem among the independent variables. The multicollinearity test for the MRA model also shows that the correlation coefficients among the independent variables are all below the threshold of 0.90. The autocorrelation test shows that the probability value for ObsR-squared is 0.0000, which is less than 0.05; therefore, this study is subject to the issue of autocorrelation. Despite the presence of autocorrelation, the researcher may proceed to the subsequent test. This is supported by Mahyus Eka (2016), who explains that the autocorrelation test can be disregarded in panel data regression because the test yields only a single value for the entire regression model. The heteroscedasticity test shows that the probability value for ObsR-squared is 0.5002 (main effects model) and 0.4753 (MRA model), both exceeding the 0.05 significance level, indicating that the model does not exhibit heteroskedasticity.

4.4 Hypothesis Testing

Table 7. Hypothesis Testing Results

Hypothesis	Path Relationship	Coefficient	t-Statistic	Sig.	Result
H1	GIC → SP	-1.855511	-1.855511	0.0664	Rejected
H2	BAD → SP	2.685552	2.685552	0.0085	Accepted
H3	GIC × CG → SP	2.044847	2.044847	0.0442	Accepted
H4	BAD × CG → SP	-1.407638	-1.407638	0.1632	Rejected

Source: Processed data (2026)

Table 7 presents the hypothesis testing results. Based on the t-test results, green intellectual capital has a t-statistic of -1.855511 with a probability value of 0.0664, which is greater than 0.05. Therefore, green intellectual capital has no significant effect on sustainability performance, and H1 is rejected. The t-test results show that blue accounting disclosure has a t-statistic of 2.685552 with a probability value of 0.0085, which is less than 0.05. Therefore, H2 is accepted, indicating that blue accounting disclosure has a positive and significant effect on sustainability performance. Based on the MRA results, the interaction between green intellectual capital and corporate governance has a t-statistic of 2.044847 with a probability value of 0.0442, which is below 0.05. Therefore, H3 is accepted, indicating that corporate governance significantly moderates the relationship between Green Intellectual Capital and sustainability performance. The interaction between blue accounting disclosure and corporate governance has a t-statistic of -1.407638 with a probability value of 0.1632, which exceeds 0.05. Therefore, H4 is rejected, indicating that corporate governance does not moderate the relationship between blue accounting disclosure and sustainability performance.



4.5 Discussion

4.5.1 The Effect of Green Intellectual Capital on Sustainability Performance

The results show that green intellectual capital has no significant effect on sustainability performance ($t = -1.855511$; $p = 0.0664$), indicating that environmentally oriented knowledge and organizational capabilities alone are insufficient to improve sustainability performance without effective implementation. This finding is consistent with Stakeholder Theory, which emphasizes that corporate resources must be effectively managed to create value for stakeholders (Freeman, 1984). The findings are consistent with Khotimah et al. (2024) but differ from Zuliansyah et al. (2025), who found a significant positive relationship between Green Intellectual Capital and Sustainability Performance.

4.5.2 The Effect of Blue Accounting Disclosure on Sustainability Performance

The results show that blue accounting disclosure has a positive and significant effect on sustainability performance ($t = 2.685552$; $p = 0.0085$), indicating that greater transparency regarding water resource management and environmental conservation enhances sustainability performance by strengthening stakeholder trust and corporate legitimacy. This finding supports Legitimacy Theory (Suchman, 1995) and is consistent with the findings of Rahmayanti and Sari (2023) and Antong et al. (2024), who highlighted the importance of blue accounting disclosure in promoting environmental accountability and sustainable corporate practices.

4.5.3 The Moderating Role of Corporate Governance on the Relationship between Green Intellectual Capital and Sustainability Performance

The results show that corporate governance significantly moderates the relationship between Green Intellectual Capital and sustainability performance ($t = 2.044847$; $p = 0.0442$), indicating that effective corporate governance strengthens the ability of companies to utilize environmentally oriented knowledge and capabilities to achieve better sustainability performance. This finding supports Stakeholder Theory, which emphasizes the importance of governance in ensuring that corporate resources are effectively managed to meet stakeholder expectations. These findings are consistent with Holiawati et al. (2025) and Hussain et al. (2018), who reported that effective Corporate Governance enhances the implementation of sustainability initiatives.

4.5.4 The Moderating Role of Corporate Governance on the Relationship between Blue Accounting Disclosure and Sustainability Performance

The results show that corporate governance does not moderate the relationship between blue accounting disclosure and sustainability performance ($t = -1.407638$; $p = 0.1632$), indicating that the positive contribution of blue accounting disclosure to sustainability performance is independent of corporate governance quality. Although environmental disclosure improves transparency and accountability, its impact on sustainability performance is not strengthened by corporate governance. This result indicates that blue accounting disclosure independently contributes to sustainability performance and differs from previous studies that reported a significant moderating role of corporate governance.



5. Conclusion

This study aimed to examine the effect of green intellectual capital and blue accounting disclosure on sustainability performance, as well as the moderating role of corporate governance in energy sector companies listed on the Indonesia Stock Exchange during the 2020–2024 period. Using a quantitative approach with an associative design on 105 observations from 21 companies selected through purposive sampling, the study successfully tested the proposed hypotheses through panel data regression and Moderated Regression Analysis.

The results indicate that green intellectual capital does not significantly affect sustainability performance, with a t-statistic of -1.855511 and a significance value of 0.0664, indicating that H1 is rejected. Environmentally oriented intangible resources alone are insufficient to enhance corporate sustainability performance without effective implementation. This finding is consistent with Stakeholder Theory, which emphasizes that corporate resources must be effectively managed to create value for stakeholders (Freeman, 1984). The findings are consistent with Khotimah et al. (2024) but differ from Zuliansyah et al. (2025), who found a significant positive relationship between Green Intellectual Capital and Sustainability Performance. In contrast, blue accounting disclosure has a positive and significant effect on sustainability performance, with a t-statistic of 2.685552 and a significance value of 0.0085, indicating that H2 is accepted. Greater transparency in environmental disclosure, particularly related to water and marine resource management, improves sustainability performance. This finding supports Legitimacy Theory (Suchman, 1995) and is consistent with the findings of Rahmayanti and Sari (2023) and Antong et al. (2024).

Furthermore, corporate governance strengthens the relationship between Green Intellectual Capital and sustainability performance, with a t-statistic of 2.044847 and a significance value of 0.0442, indicating that H3 is accepted. Effective governance enables firms to better utilize green intellectual resources to achieve sustainability objectives. This finding supports Stakeholder Theory, which emphasizes the importance of governance in ensuring that corporate resources are effectively managed to meet stakeholder expectations. These findings are consistent with Holiawati et al. (2025) and Hussain et al. (2018), who reported that effective Corporate Governance enhances the implementation of sustainability initiatives. However, corporate governance does not moderate the relationship between blue accounting disclosure and sustainability performance, with a t-statistic of -1.407638 and a significance value of 0.1632, indicating that H4 is rejected. The effect of environmental disclosure on sustainability performance is independent of governance quality. This result indicates that blue accounting disclosure independently contributes to sustainability performance and differs from previous studies that reported a significant moderating role of corporate governance.

The theoretical implications of this study extend the application of Stakeholder Theory and Legitimacy Theory to the context of sustainability performance in Indonesia. The finding that green intellectual capital does not significantly influence sustainability performance challenges Stakeholder Theory's assumption that corporate resources always create value for stakeholders (Freeman, 1984). The finding that blue accounting disclosure significantly influences sustainability performance supports Legitimacy Theory's emphasis on the role of transparent environmental reporting in enhancing corporate legitimacy (Suchman, 1995). The finding that corporate governance significantly moderates the relationship between green intellectual capital and sustainability performance supports Stakeholder Theory's emphasis on the role of



governance in ensuring that corporate resources are effectively managed to meet stakeholder expectations. This study also contributes to the limited empirical evidence on the determinants of sustainability performance in the energy sector, providing insights into how green intellectual capital, blue accounting disclosure, and GCG mechanisms collectively influence sustainability performance.

Based on these findings, several recommendations can be proposed. Company management should strengthen green intellectual capital implementation by ensuring that environmentally oriented knowledge and capabilities are effectively integrated into business strategies and operations. Companies should also enhance blue accounting disclosure by improving transparency regarding water and marine resource management to strengthen stakeholder trust and corporate legitimacy. Regulators should continue to strengthen oversight of green intellectual capital and blue accounting disclosure practices to maintain market stability and protect stakeholder interests. Investors should consider green intellectual capital, blue accounting disclosure, and corporate governance mechanisms as important indicators when assessing the likelihood of a company achieving sustainability performance.

This study has several limitations that should be acknowledged. First, the study focuses only on energy sector companies listed on the Indonesia Stock Exchange, which may limit the generalizability of the findings to other sectors or industries. Second, the study uses a quantitative approach with panel data regression and MRA, which limits the ability to capture the complexity of sustainability performance assessments. Third, the study relies on secondary data from annual reports, sustainability reports, and corporate governance reports, which may be subject to reporting limitations and data availability constraints. Fourth, the model's explanatory power is moderate, with an R-squared value of 0.515, indicating that other factors not included in the model may still influence sustainability performance. Fifth, the study examines only green intellectual capital, blue accounting disclosure, and corporate governance as determinants of sustainability performance, without considering other potential determinants such as financial distress, audit tenure, or industry characteristics.

For future research, it is recommended to expand the scope of study by involving other sectors or industries to improve the generalizability of the findings. Future studies may also incorporate additional variables, such as financial distress, audit tenure, auditor industry specialization, and corporate governance indices, to provide a more comprehensive understanding of the factors affecting sustainability performance. Additionally, qualitative or mixed-method approaches may be employed to gain deeper insights into the challenges and effectiveness of green intellectual capital, blue accounting disclosure, and corporate governance in shaping sustainability performance. Researchers should also employ longitudinal designs to examine how sustainability performance evolves over time as economic conditions and corporate governance practices develop.

In conclusion, this study contributes to the growing body of literature on sustainability accounting and corporate governance by providing empirical evidence on the determinants of sustainability performance in energy sector companies in Indonesia. The findings suggest that green intellectual capital does not significantly influence sustainability performance, while blue accounting disclosure significantly influences sustainability performance. Corporate governance significantly moderates the relationship between green intellectual capital and sustainability performance, but does not moderate the relationship between blue accounting disclosure and sustainability performance. As Indonesia continues to strengthen its capital market and corporate



governance practices, understanding these factors becomes increasingly important for developing effective strategies to enhance sustainability performance, strengthen corporate governance, and protect stakeholder interests.

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