Al-Kharaj: Journal of Islamic Economic and Business
Volume 8 (2), 2026
P-ISSN: 2686-262X; E-ISSN: 2685-9300

The Effect Of Board Diversity And Green Intellectual Capital On Financial Sustainability With Csr As A Moderating Variable (Empirical Study On Energy Companies For The Period 2020-2024)

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Keywords:
Board Diversity; Green Intellectual Capital; Corporate Social Responsibility; Financial Sustainability; Energy Sector

Abstract

With corporate social responsibility (CSR) acting as a moderating variable, this study attempts to examine the impact of board diversity and green intellectual capital on financial sustainability. The growing need for sustainability and good corporate governance, especially in businesses in the energy industry, is what spurred this study. Using secondary data from the annual reports and sustainability reports of energy sector businesses listed on the Indonesia Stock Exchange between 2020 and 2024, the study takes a quantitative approach. Gender, age, and educational background variety are used to gauge board diversity. Moderated Regression Analysis (MRA) is used to investigate the moderating function of CSR, whereas multiple regression analysis is used to look at the direct effects among factors. The findings suggest that financial sustainability is influenced by board diversity and green intellectual capital. Additionally, CSR improves the connection between financial sustainability and green intellectual capital, but its moderating influence on board diversity yields contradictory findings. It is anticipated that this research will offer theoretical insights and useful recommendations for developing businesses long-term financial sustainability plans.

INTRODUCTION

Because it provides the primary framework for transportation, industry, and domestic life, the energy sector is crucial to the country's economic growth. In 2023, Indonesia's energy industry made up around 10.5% of the country's GDP and is a major source of tax income for the government, royalties, and dividends from state-owned energy companies (Kementrian ESDM, 2024; S. Kustinah, 2025). However, global developments such as changes in energy prices, geopolitical pressures, and the acceleration of the transition to low-carbon energy have exposed this sector to increasingly complex business risks. Increased volatility in the global energy market has also been caused by supply shortages and geopolitical tensions following the COVID-19 outbreak. Research published in the Energy Economics Journal shows that geopolitical conflicts can increase oil price volatility by 35%–50% compared to normal situations, reflecting substantial pressure on global energy markets that are in the process of recovering after the pandemic (IEA, 2024; valbury, 2025).

This situation makes financial sustainability an important issue for energy companies. Financial sustainability indicates a company's ability to maintain profits, cash flow stability, and long-term investment capacity on an ongoing basis (Apriyani et al., 2024). In Indonesia's energy sector, profits calculated using Return on Assets (ROA) indicate significant fluctuations throughout 2023, influenced by commodity price volatility, increased operational costs, and changes in global energy demand (Kontan, 2024). These circumstances point to significant obstacles to long-term financial sustainability, necessitating that businesses maximize internal variables that affect financial performance. In this context, internal factors such as board diversity

and green intellectual capital management are seen as capable of improving decision-making effectiveness and company efficiency (Arenas-Torres et al., 2021; Wati et al., 2024).

One internal factor believed to influence financial sustainability is board diversity. Based on Upper Echelons Theory, the demographic characteristics and backgrounds of board members influence strategic decision-making processes and company policy directions (Hambrick, 1986). Several studies show that diversity in the board, in terms of gender, age, and educational background, can improve the quality of supervision, decision-making processes, and corporate financial resilience (Arenas-Torres et al., 2021; Kurniawati & Sriwati, 2023). However, other findings show that board diversity does not always improve a company's profitability or efficiency, as its impact is greatly influenced by organizational culture, governance structure, and industry dynamics (Kustinah et al., 2025; Murhadi & S, 2020).

In the context of the energy transition, Green Intellectual Capital (GIC) is emerging as a crucial strategic component alongside governance. According to the Resource-Based View, GIC has the potential to generate a long-term competitive advantage since it is an intangible resource that is precious, rare, and challenging to replicate (Barney, 1991). According to research, businesses may increase their operational effectiveness and financial performance by investing in green human capital, green structural capital, and green relational capital (Hulaemah & Mulyasari, 2024; Wati et al., 2024). However, because the advantages of GIC are only ideal in businesses that already have advanced technical preparedness and environmental policies, a number of studies find discrepancies (Napaky & Sastradipraja, 2025).

Additionally, using Corporate Social Responsibility (CSR) as a legitimization strategy may improve the connection between financial sustainability, GIC, and governance. By means of the Indonesian Sustainable Finance Taxonomy (TKBI) version 2 of 2025, the Financial Services Authority (OJK) in Indonesia highlights that the application of CSR and ESG principles is a crucial precondition for preserving business sustainability and gaining access to corporate funding (OJK, 2025). Nevertheless, empirical research on the function of CSR as a moderating variable continues to provide inconsistent findings, especially in the environmentally hazardous energy industry (Jiang et al., 2021).

Considering the conflicting findings of empirical studies and the importance of maintaining the financial sustainability of energy companies in the face of ESG regulations and energy transition requirements. Using green intellectual capital as a moderating variable, Kustinah et al. (2025) study on the effect of board diversity on sustainable finance was replicated in this study for manufacturing companies listed on the Indonesia Stock Exchange between 2018 and 2022. In contrast to the earlier analysis, this one includes data from 2020–2024 and focuses on energy businesses. Because diverse board decisions and environmentally friendly intellectual capital management can be realized concretely in sustainability practices through the implementation and reporting of effective corporate social responsibility, this study replaces the moderating variable in the previous study, Green Intellectual Capital (GIC), with an independent variable and adds one independent variable, Corporate Social Responsibility (CSR). In the end, this improves the company's financial sustainability by enhancing the legitimacy, reputation, and confidence of stakeholders. This study looks at how board diversity and green intellectual capital affect financial sustainability in energy sector businesses that are under pressure from stakeholders' demands for sustainability, environmental concerns, and the energy transition. Board diversity is anticipated to improve the quality of decision-making processes through more diverse perspectives, while GIC represents the company's capacity to manage knowledge, innovation, and environmentally-oriented resources. This study also evaluates the function of CSR as a moderating variable that has the potential to strengthen or weaken the relationship between board diversity and green intellectual capital on financial sustainability. Effective CSR implementation is expected to increase the legitimacy and trust of stakeholders, thereby supporting the achievement of long-term financial sustainability for the company.

Using corporate social responsibility as a moderating variable, this study aims to investigate the effects of board diversity and green intellectual capital on financial sustainability in Indonesian energy sector companies between 2020 and 2024. This is done in light of the inconsistent empirical findings and limitations of the studies used as references, as well as the significance of preserving the financial sustainability of energy companies amidst the pressures of the energy transition and ESG regulations. It is expected that this research will empirically add to the body of knowledge on accounting and corporate governance and give management and regulators a basis for developing policies that support the energy sector's sustainability.

HYPOTHESIS DEVELOPMENT

The Influence of Board Gender Diversity on Financial Sustainability

Gender diversity on the board is said to improve the quality of the decision-making process since it permits a greater variety of viewpoints and awareness to sustainability issues. According to the Upper Echelons Theory, executive traits like gender diversity on the board of directors affect how executives see strategic difficulties and make organizational decisions.(Hambrick, 1986). Therefore, a more diverse board composition will result in a broader perspective in the decision-making process, thereby increasing its capacity to support corporate sustainability. Empirical research indicates that female participation on boards can increase transparency, oversight, and commitment to financial sustainability, thereby positively impacting financial performance (Ararat et al., 2021). Therefore, gender diversity is expected to have a positive effect on financial sustainability.

H1: Board Gender Diversity Has a Positive Effect on Financial Sustainability

The Influence of Board Age Diversity on Financial Sustainability

A combination of long-term strategic insights and a more flexible knowledge of innovation are provided by the board of directors' age diversity. Boards with a diverse age range are considered capable of producing more mature and innovative decisions through the integration of experience and new ideas (Jiang et al., 2021). According to empirical research, age diversity on boards enhances oversight efficacy and response to shifts in the business environment, including sustainability issues (Yopie & Aw, 2021). Age diversity is therefore expected to enhance financial sustainability.

H2: Board Age Diversity Positively Affects Financial Sustainability

The Influence of Educational Diversity on Financial Sustainability

The diversity of educational backgrounds among board members enables companies to gain the various scientific perspectives needed in business strategy management, innovation, and sustainability. Boards with diverse academic competencies are better able to comprehensively assess risks and opportunities and support information-based decision- making (Raza et al., 2025) Empirical studies show that educational diversity improves governance effectiveness and can strengthen financial performance by enhancing analytical and strategic capabilities (Kabara et al., 2022). Therefore, educational diversity is expected to have a positive effect on corporate financial sustainability.

H3: Educational Diversity Has a Positive Effect on Financial Sustainability

The Influence of Green Intellectual Capital on Financial Sustainability

According to the Resources Based-View (RBV), green intellectual capital is a strategic asset that is hard to replicate and may provide businesses a competitive edge (Wati et al., 2024). Green intellectual capital boosts business profitability by promoting eco-friendly innovation, operational effectiveness, and long-term cost reduction through the use of green technology (Liu et al., 2021). Due to the company's capacity to provide both economic and environmental value, empirical research indicates that investments in green intellectual capital improve financial performance

(Chaudhry & Chaudhry, 2022). Therefore, the more effectively green intellectual capital is managed, the more financially sustainable the business is.

H4: Board Green Intellectual Capital Has a Positive Effect on Financial Sustainability

The influence of board gender diversity on financial sustainability is moderated by corporate social responsibility

A gender-diverse board is more successful at boosting financial performance through improved reputation and stakeholder trust when a company's legitimacy and transparency are increased through Corporate Social Responsibility (CSR) (Xu & Liu, 2023). Jiang et al. (2021) discovered that by incorporating the ethical values, social concerns, and increased stakeholder focus of female directors into business policy, corporate social responsibility (CSR) increases the impact of gender diversity. Effective corporate CSR programs boost a company's legitimacy and repute, which amplifies the positive effect of board gender diversity on financial success. As a result, gender diversity has a greater effect on long-term financial viability when CSR is implemented.

H5: Corporate Social Responsibility (CSR) Moderates the Influence of Board Gender Diversity on Financial Sustainability

The influence of board age diversity on financial sustainability is moderated by corporate social responsibility

Comprehensive and well-organized Corporate Social Responsibility (CSR), which increases the effectiveness of decision-making by age-diverse boards in improving financial performance, demonstrates a company's long-term commitment to sustainability (Jiang et al., 2021). When it comes to decision-making, age variety fosters a blend of creativity and experience. In order to make board decisions more balanced and improve financial performance, corporate CSR serves as a strategic tool that incorporates the perspectives of the younger generation (innovation and sustainability) and the older generation (stability and caution) (Utama, 2022)

H6: Corporate Social Responsibility (CSR) Moderates the Influence of Board Age Diversity on Financial Sustainability

The influence of educational diversity on financial sustainability is moderated by corporate social responsibility

Because transparency and sustainability reporting offer more opportunities to apply multidisciplinary knowledge in environmental innovation and operational efficiency, corporate social responsibility (CSR) can boost the strategic value of educational diversity on the board of directors (Harymawan et al., 2021). According to Jiang et al. (2021) study, boards with a range of educational backgrounds significantly enhance business legitimacy and sustainable practices. It is therefore expected that CSR will strengthen the relationship between educational diversity and financial sustainability.

H7: Corporate Social Responsibility (CSR) Moderates the Influence of Educational Diversity on Financial Sustainability

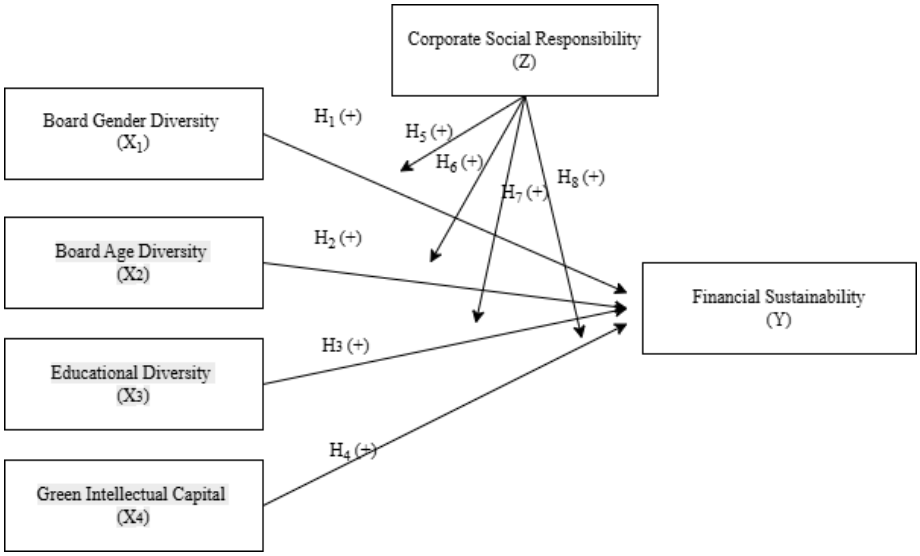
The influence of Green Intellectual Capital on Financial Sustainability is moderated by Corporate Social Responsibility

By improving stakeholder trust and business reputation, corporate social responsibility (CSR) can raise the economic value of investments in green intellectual capital (Hasan et al., 2024). CSR disclosure strengthens the effect of green intellectual capital on profitability by enabling businesses to show the outcomes of green innovation and implementation in a more quantifiable manner. According to empirical research, including sustainability transparency and green intellectual capital can enhance financial performance by boosting investor preference and

legitimacy (Hasan et al., 2024). As a result, the connection between green intellectual capital and financial sustainability is strengthened via GRI-based CSR.

H8: Corporate Social Responsibility (CSR) Moderates the Influence of Green Intellectual capital on Financial Sutainability

Research Model



Picture 1. Research Model

METHOD

In order to develop hypotheses based on the trends and gaps identified, the research technique comprised a thorough literature analysis of sustainability and annual reports. Purposive sampling was used to collect a total of 12 samples, which were subsequently subjected to multiple regression analysis and moderating regression analysis (MRA). This method was used to assess how variable X (gender and age diversity on the board, educational diversity, and green intellectual capital) influences variable Y (financial sustainability) and a moderating variable Z (corporate social responsibility). The 91 energy-related businesses that were listed on the Indonesia Stock Exchange (IDX) between 2020 and 2024 made up the research population. Sample preparation is carried out using the following criteria:

1. Energy firms that were listed between 2020 and 2024 on the Indonesia Stock Exchange
2. Energy firms that, between 2020 and 2024, did not participate in an IPO on the Indonesia Stock Exchange (IDX)
3. Businesses with comprehensive annual reports, sustainability reports, and financial statements for the study observation year
4. Businesses with comprehensive data for the study variable

Table 1. Research Sample

No	Code	Company
1	AKRA	AKR Corporindo Tbk.
2	BUMI	Bumi Resources Tbk.
3	DEWA	Darma Henwa Tbk
4	DSSA	Dian Swastatika Sentosa Tbk
5	INDY	Indika Energy Tbk.
6	ITMG	Indo Tambangraya Megah Tbk.
7	MBSS	Mitrabahtera Segara Sejati Tbk
8	MEDC	Medco Energi Internasional Tbk
9	PGAS	Perusahaan Gas Negara Tbk.
10	PTBA	Bukit Asam Tbk.
11	PTRO	Petrosea Tbk.
12	ENRG	Energi Mega Persada Tbk.

Table 2. Variable Masurement

Variabel	Konsep	Indikator	Skala
Variabel Independen (X1) Board Diversity	Diversity at the board level (gender, age, educational or professional background, nationality, cross-functional expertise) that enhances decision-making quality, legitimacy, and governance orientation towards sustainability (EmadEldeen et al., 2025)	$BGD = \frac{\Sigma \text{ Female board member}}{\Sigma \text{ Board Member}} \times 100\%$ (Khoir & Wafiroh, 2024) $BAD = \frac{\Sigma \text{ Age of board member } \geq 40 \text{ tahun}}{\Sigma \text{Board Member}} \times 100\%$ (EmadEldeen et al., 2025) $ED = \frac{\Sigma \text{ Board with economic education}}{\Sigma \text{ Board Member}} \times 100\%$ (Fitriasari & Soewarno, 2024)	Rasio
Variabel Independen (X2) Green Intelectual Capital	Green Intellectual Capital is a collection of knowledge-based capabilities and intellectual resources that are environmentally friendly and support green innovation, ecological impact mitigation, and resource efficiency. (Chaudhry & Chaudhry, 2022)	VAIC™: Green Capital Employed Efficiency + Green Human Capital Coefficient + Green Structural Capital Coefficient (Liu et al., 2021)	Rasio

Variabel Moderasi Corporate Social Responsibility (CSR)	Companies that deliberately incorporate social and environmental issues into their business operations and stakeholder interactions are said to be practicing corporate social responsibility, or CSR. CSR has developed from simple charity to a crucial component of business plans to generate long-term value (Retnoningsih et al., 2024)	Perusahaan mengungkapkan jumlah item GRI yang dibagi dengan total jumlah item yang seharusnya diungkapkan (Tricahya Avilya & Ghozali, 2022)	Rasio
Variabel Dependen (Y1) Financial sustainability	Financial performance describes the achievements of program or policy implementation in achieving the goals, targets, mission, and vision of an organization. (Renaldo & Augustine, 2022)	$ROA = \frac{\text{Net Income}}{\text{Total Assets}} \times 100\%$ (Soemantri et al., 2023)	Rasio

Data analysis techniques

The data was examined using descriptive statistics to give a thorough explanation of the characteristics of the research variables. This study further included traditional assumption tests, such as autocorrelation, heteroscedasticity, multicollinearity, and normality tests, to satisfy the requirements for using econometric models.

Moderated Regression Analysis (MRA) Test

The main data analysis technique used to test the hypothesis and ascertain how independent factors impact dependent variables and interact with moderating variables is multiple linear regression with Moderated Regression Analysis (MRA)..

Equation model for multiple linear regression analysis:

$$Y = \alpha + \beta_1 BD_1 + \beta_2 BD_2 + \beta_3 BD_3 + \beta_4 GIC_+ \varepsilon$$

MRA equation model:

$$Y = \alpha + \beta_1 BD_1 + \beta_2 BD_2 + \beta_3 BD_3 + \beta_4 X_4 + \beta_5 CSR + \beta_6 (BD_1 CSR) + \beta_7 (BD_2 CSR) + \beta_8 (BD_3 CSR) + \beta_9 (GIC\ CSR) + \varepsilon$$

Description :

BD1 : *Board Gender Diversity*
BD2 : *Board Age Diversity*
BD3 : *Educational Diversity*
GIC : *Green Intellectual Capital*
CSR : *Corporate Social Responsibility*
α/β_0 : *Intercept*
β_{0-9} : Estimated coefficient for each variable
ε : *Error*

RESULTS AND DISCUSSION

Descriptive Statistic

The properties of the data under study are described and a preliminary understanding is given through descriptive statistical analysis. The mean, standard deviation, minimum value, and maximum value are among the metrics employed in this study as part of the descriptive statistical analysis process (Ghozali, 2018):

Table 3. Descriptive Statistic Results

	N	Minimum	Maximum	Mean	Std. Deviation
BD1	60	.000	.500	.134	.115
BD2	60	.818	1.000	.966	.055
BD3	60	.083	.995	.516	.221
GIC	60	-.361	19.789	8.605	5.936
CSR	60	.086	.974	.565	.299
FS	60	-.098	.285	.071	.083
Valid N (listwise)	60				

Source: Data Analysis using SPSS 27

With the lowest value of 0.00 and the highest value of 0.500, the Board Gender Diversity (BDI) variable was measured. The BD1 variable's average value throughout the entire data set is 0.134, with a standard deviation of 0.115. The Board Age Diversity (BD2) variable has a standard deviation of 0.055, an average of 0.966, and a minimum value of 0.818 to 1.000. The Educational Diversity (BD3) variable has an average of 0.516, a standard deviation of 0.221, a minimum value of 0.083, and a maximum value of 0.995. Values for the Green Intellectual Capital (GIC) variable range from -0.361 to 19.789, with an average of 8.605 and a standard deviation of 5.936. With an average of 0.565 and a standard deviation of 0.299, the Corporate Social Responsibility (CSR) variable ranges from -0.086 to 0.974. With an average of 0.071 and a standard deviation of 0.083, the Financial Sustainability variable has the lowest value of -0.098 and the largest of 0.285

Classical Assumption Test

Normality Test

Table 4. Normality Test

		Unstandardized Residual
N		60
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	.07568147
Most Extreme Differences	Absolute	.092
	Positive	.092
	Negative	-.082
Test Statistic		.092
Asymp. Sig. (2-tailed)[c]		.200[d]

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

Source: Data Analysis using SPSS 27

Based on the given table, the results of the Kolmogorov-Smirnov normalcy test show that the Asymp. Sig. value is 0.200. The regression model's residuals appear to be normally distributed because the significance value is greater than 0.05.

Multicollinearity Test

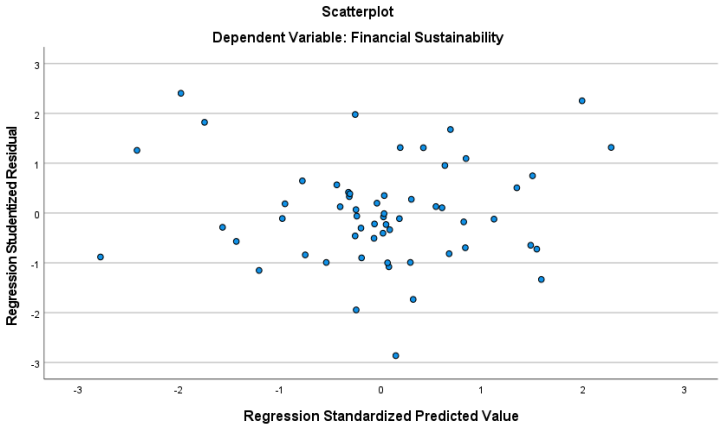
Table 5. Multicollinearity Test

Variable	Tolerance	VIF
Board Gender Diversity	.970	1.031
Board Age Diversity	.885	1.130
Educational Diversity	.902	1.109
Green Intellectual Capital	.933	1.072
Corporate Social Responsibility	.883	1.133

Source: Data Analysis using SPSS 27

Based on Table 5 above, it can be seen that the tolerance value for Board Gender Diversity (BD1) is 0.970, Board Age Diversity (BD2) is 0.885, Educational Diversity (BD3) is 0.902, Green Intellectual Capital (GIC) is 0.933, and Corporate Social Responsibility (CSR) is 0.883. The tolerance values of the two independent variables and one moderating variable have met the tolerance threshold, which is > 0.10. Furthermore, the VIF values for Board Gender Diversity (BD1) are 1.031, Board Age Diversity (BD2) are 1.130, Educational Diversity (BD3) are 1.109, Green Intellectual Capital (GIC) are 1.072, and Corporate Social Responsibility (CSR) are 1.133. The VIF values of these five variables also meet the VIF threshold, which is < 10. Based on these findings, it can be concluded that the data in this study does not experience multicollinearity.

Heteroscedasticity Test



Source: Data Analysis using SPSS 27

Figure 2. Scatterplot of Heteroscedasticity Test

Figure 1 shows that there is no discernible distribution pattern, with the data points distributed uniformly and not significantly concentrated in any one area. Therefore, it may be concluded that the data does not exhibit heteroscedasticity.

Autocorrelation Test

Table 6. Autocorrelation Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.692[a]	.478	.428	.06053	1.918

Source: Data Analysis using SPSS 27

According to the preceding table, a Durbin-Watson (DW) statistical value of 1.918 was achieved following intervention using the Cochrane-Orcutt approach. The following is an explanation of the Durbin-Watson value that was discovered:

dU<dw<4-dU

1,7671<1,918<4-1,7671

1,7671<1,918<2,233

These computations show that there is neither positive nor negative autocorrelation in this study, and the choice to accept the hypothesis suggests that there is no autocorrelation in this investigation.

F Test Results (Simultaneous) Model 1

Table 7. F Test Results (Simultaneous) Model 1

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.124	4	.031	6.827	.000[b]
	Residual	.241	53	.005		
	Total	.365	57			

Source: Data Analysis using SPSS 27

Model 1's F test findings show that, with a simultaneous significance level of 0.000, which is less than 0.05, the calculated F value for all variables is 6.827, exceeding 2.901 (table F value). This indicates that the alternative hypothesis (H) is accepted and the null hypothesis (Ho) is rejected. These results show that the dependent variable, financial sustainability, is significantly

impacted by the variables of board gender diversity, board age diversity, educational diversity, and green intellectual capital.

The Adjusted R Square value of 0.290 indicates that the independent variables may explain 29% of the variation in the dependent variable, as assessed by ROA. However, the remaining 71% are affected by other factors that are not included of this study model.

F Test Results (Simultaneous) Model 2

Table 8. F Test Results (Simultaneous) Model 2

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.192	8	.024	6.763	.000[b]
	Residual	.174	49	.004		
	Total	.365	57			

Source: Data Analysis using SPSS 27

The F-calculated value for all variables reached 6.763, above 2.901, with a simultaneous significance level of 0.000, which is less than 0.05, according to the data in Table 8. This indicates that the alternative hypothesis (H_2) is accepted and the null hypothesis (Ho) is rejected. According to these results, the dependent variable of financial sustainability can concurrently be influenced by the corporate social responsibility variable in order to modify the association between board gender diversity, board age diversity, educational diversity, and green intellectual capital.

When the corporate social responsibility variable was added as a moderator, the coefficient of determination (R Square) increased from 0.290, or 29%, to 0.447, or 44.7%. This increase suggests that 44.7% of the variability in the dependent variable as measured by ROA is explained by the independent factors and their interaction with the moderator variable. In the meantime, the remaining 55.3% are affected by external factors that are not part of the research model.

T-Test Results (partial) Model 1

Table 9. T-Test Results (partial) Model 1

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.012	.053		.220	.827
	Board Gender Diversity	.208	.125	.198	1.667	.101
	Board Age Diversity	-.094	.176	-.060	-.531	.598
	Educational Diversity	.069	.055	.147	1.245	.219
	Green Intellectual Capital	.008	.002	.492	4.348	.000

a. Dependent Variable: Financial Sustainability

Source: Data Analysis using SPSS 27

For the board gender diversity variable, the results indicate that the t-value is 1.667, which is less than the t-table value of 2.00665, or 1.667 <2.00665. This suggests that gender diversity on boards has no discernible effect on financial sustainability, with a significance level of 0.101 above 0.05. The board age diversity variable's t-value is 0.531, which is less than the value of 2.00665, or 0.531 < 2.00665. The significance level of 0.598, which is more than 0.05, suggests that there is no discernible effect of board age diversity on financial sustainability.

The educational diversity variable's t-value is 1.245, which is less than the t-table value of 2.00665, or 1.245 <2.00665. This suggests that educational diversity has no discernible effect on financial sustainability, with a significance level of 0.219 above 0.05. The t-value of 2.00665 is less than the 1-value for the green intellectual capital variable, which is 4.348, meaning that 4.348 > 2.00665. This suggests that green intellectual capital significantly affects financial sustainability, with a significance level of 0.000, which is less than 0.05.

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Table 10. T-Test Results (partial) Model 2

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.001	.050		.028	.978
	Board Gender Diversity	.117	.127	.112	.925	.359
	Board Age Diversity	-.105	.171	-.067	-.616	.541
	Educational Diversity	.037	.054	.079	.683	.498
	Green Intellectual Capital	.007	.002	.423	3.926	.000
	Board Gender Diversity*Corporate Social Responsibility	.470	.487	.121	.965	.339
	Board Age Diversity*Corporate Social Responsibility	.195	.156	.187	1.250	.217
	Educational Diversity*Corporate Social Responsibility	.103	.186	.082	.557	.580
	Green Intellectual Capital*Corporate Social Responsibility	.009	.005	.213	1.748	.087

a. Dependent Variable: Financial Sustainability

Source: Data Analysis using SPSS 27

According to Table 10's findings, the t-value for the interaction variable between corporate social responsibility and board gender diversity was 0.965, which is less than the t-value of 2.00665. The alternative hypothesis (H1) is rejected and the null hypothesis (Ho) is accepted at a significance level of 0.339, which is more than 0.05. This suggests that the association between board gender diversity and financial sustainability is not moderated by corporate social responsibility. The interaction variable between corporate social responsibility and board age diversity has a t-value of 1.250, which is less than the t-value of 2.00665. The alternative hypothesis (Hi) is rejected and the null hypothesis (Ho) is accepted at a significance level of 0.217 above 0.05. This suggests that the association between board age diversity and financial sustainability is not moderated by corporate social responsibility.

The moderation variable between corporate social responsibility and educational diversity has a t-value of 0.557, which is smaller than the t-value of 2.00665. The alternative hypothesis (H1) is rejected and the null hypothesis (Ho) is accepted with a probability value of 0.580, which is more than 0.05. This result suggests that the connection between educational diversity and financial sustainability cannot be moderated by corporate social responsibility. The moderating relationship between corporate social responsibility and green intellectual capital has a t-value of 1.748, which is lower than the t-value of 2.00665. The alternative hypothesis (Hi) is rejected and the null hypothesis (Ho) is accepted when the probability value of 0.087 is greater than 0.05. This result

demonstrates that the connection between green intellectual capital and financial sustainability cannot be moderated by corporate social responsibility.

DISCUSSION

The Influence of Board Gender Diversity on Financial Sustainability

The results show that there is no connection between financial viability and gender diversity on the board. These results run counter to a research by Ararat et al. (2021) that suggests female participation could improve monitoring quality and supervision effectiveness. The results, however, are in line with studies by Abbas & Frihatni (2023) and Wijaya et al. (2022), which found that the impact of gender diversity on financial performance is weak or insignificant because women's participation on the board is still low and the board is still dominated by men, meaning that women's positive traits—like thoroughness and efficiency in supervision—have not been fully utilized. Furthermore, women's contributions to the board are often symbolic rather than strategic, meaning they have little direct influence on the financial decision-making process. Furthermore, the impact of gender diversity is not statistically significant since other financial factors, such as debt levels, have a greater influence on a company's success. This suggests that the attainment of sustainable financial performance has not been fully impacted by the participation of women on boards, particularly in the energy industry, which has high technical needs and complicated risk management. Companies with high and low levels of gender diversity have comparatively comparable Return on Assets (ROA) variance patterns, according to data tabulation. This situation demonstrates that gender disparities have not made a substantial contribution to enhancing businesses' financial stability.

The Influence of Board Age Diversity on Financial Sustainability

The results of the investigation also show that financial sustainability is not significantly impacted by board age diversity. According to Jiang et al. (2021) and Yopie & Aw (2021), age diversity on the board combines the knowledge of senior members with the creativity and ideas of younger members, leading to more balanced decisions, better supervision, and more flexible strategies that ultimately boost the company's financial performance. This finding contradicts their claims. On the other hand, Kustinah & Susyani's study from 2025 demonstrates that variations in age traits may result in variations in risk preferences, which can hinder the alignment of company strategy and financial sustainability, which is more dominated by other variables, including management strategy, industry conditions, market dynamics, and regulatory provisions. Further support comes from Murhadi & S (2020), who found that age diversity has not been able to have a positive impact on financial performance in Indonesian companies because age is only a demographic attribute and does not guarantee the effectiveness, capability, or quality of the board of directors' supervision in the business entity's decision-making process. From a data tabulation perspective, companies with high age heterogeneity show fluctuating and unstable ROA patterns. This indicates that coordination difficulties and differences in experience may hinder the effectiveness of strategy management, so that age diversity has not contributed optimally to financial sustainability.

The Influence of Educational Diversity on Financial Sustainability

Based on the results of the study, financial sustainability is unaffected by educational diversity. This result contradicts the claims made by Kabara et al. (2022) and Akram et al. (2020) that diversity in educational backgrounds can boost long-term financial success and creativity. However, these research results are in line with several studies in which educational background does not affect financial sustainability because formal education does not always reflect managerial capacity and the quality of decision-making processes that directly affect financial performance. Furthermore, the impact of education is indirect and more efficient when integrated into overall board diversity, rather than as a single factor. Other elements such as governance, professional

background, and macroeconomic conditions have a greater influence on the financial performance of business entities (Ningrum, 2024). This reinforces the view that educational diversity is not always a determining factor in strategic decision-making, especially in industrial sectors that tend to be more influenced by technical and operational factors than formal academic competence. From a data tabulation perspective, variations in ROA among companies with high and low levels of educational diversity show patterns that are not significantly different. This reflects that diversity in competencies has not made a significant contribution to supporting the stability of a company's financial performance.

The Influence of Green Intellectual Capital on Financial Sustainability

The study's findings demonstrate the beneficial effects of green intellectual capital (GIC) on financial sustainability. These results are consistent with studies that argue that environment-based intellectual capabilities create operational efficiencies and competitive advantages that are difficult to replicate, and that the ability of business entities to manage and utilize assets, including technology, information systems, and intellectual property, drives improved financial performance and attracts investor attention (Nurmalasari et al., 2024; Wati et al., 2024). Other studies show that GIC significantly increases a company's capacity to maintain long-term profitability, with human resources equipped with sustainable competencies capable of supporting increased profitability of business entities, while investment allocation in organizational architecture needs to be carefully regulated to avoid a decline in financial performance (Badriah Iis et al., 2025). Data tabulation shows that companies with high GIC values tend to provide more stable ROA performance, indicating that companies have been able to manage environmentally friendly knowledge and innovation assets to support financial sustainability. Thus, GIC is one of the strategic factors in driving sustainable performance in the energy sector.

The Influence of Board Diversity and Green Intellectual Capital on Financial Sustainability Moderated by Corporate Social Responsibility

The results of the moderated regression analysis (MRA) show that the empirical study indicates that Corporate Social Responsibility (CSR) cannot support the influence of board age, gender, or educational diversity on financial sustainability. This requirement aligns with the perspective of Jiang et al. (2021), who assert that the degree to which corporate social responsibility (CSR) is integrated into corporate strategy determines its effectiveness. If CSR is merely implemented symbolically or to satisfy regulatory requirements, it is insufficient to enhance the impact of board diversity on financial performance. The data tabulation pattern in the context of energy businesses demonstrates that CSR is mostly implemented as a statutory requirement, hence ignoring the impact of age, gender, and educational diversity on ROA. As a result, CSR is not yet a supporting mechanism that can boost a diverse board's ability to advance the company's financial sustainability.

The moderation analysis's findings demonstrate that the influence of Green Intellectual Capital (GIC) on financial sustainability may be reinforced by Corporate Social Responsibility (CSR). This finding implies that when businesses demonstrate high levels of CSR implementation and openness, the positive effects of GIC on financial performance increase. CSR acts as a channel for the company's green capabilities to be communicated to stakeholders through transparent operations and open reporting (Yusoff et al., 2019).

Companies can communicate the value of GIC to investors, regulators, and the public more easily when they execute CSR effectively, which improves the organization's legitimacy and image. This situation enhances long-term growth possibilities, increases access to finance sources, and fosters stakeholder confidence (García-Sánchez et al., 2021). The economic benefits of green intellectual capital management are thereby amplified by CSR. These results demonstrate that GIC's capacity to enhance financial sustainability is contingent upon both the degree of integration

of green intellectual assets into long-term value creation-focused CSR initiatives and the ownership of such assets.

CONCLUSION

Simultaneously, board diversity and Green Intellectual Capital (GIC) influence financial sustainability, and Corporate Social Responsibility (CSR) can moderate this relationship. However, partially, board diversity, which includes gender, age, and educational background (economics and business), has not had a direct impact on financial sustainability, and CSR has not been able to moderate the association between board diversity and financial sustainability, suggesting that board diversity and CSR policies are still not strategically integrated in energy businesses. The achievement of sustainable financial performance, however, is more dependent on the organization's green capabilities and their integration into a CSR strategy that emphasizes long-term value creationThis is due to the fact that CSR can increase the beneficial effects of Green Intellectual Capital on financial sustainability..

This research has a number of shortcomings, including the fact that it only examines the energy industry, uses only six variables, has a relatively short research duration, and still uses dummy variables to measure board diversity. Therefore, it is recommended that future research include other industries, as the low Adjusted R^2 value indicates the need for additional variables to explain the relationship more comprehensively, and it is recommended not to use dummy variable measurements.

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