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Exploring the Role of Board Diversity in Driving Sustainability Performance

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ABSTRACT	INFO ARTIKEL
<p>This research seeks to analyze the influence of female board directors, higher education boards, and the role of independent board members in shaping sustainability performance, analyzing their impact through control variables namely board size and company size. The methodology employed is a quantitative method, with data collected from the annual reports of Indonesian manufacturing firms traded on the Indonesia Stock Exchange (IDX) from 2019 to 2023. Researchers conducted descriptive statistical analysis, using bivariate examination and multivariate assessment. Results underscore the pivotal importance of governing body independence in enhancing sustainability outcomes, reinforcing the significance of effective organizational frameworks in advancing corporate sustainability. While gender diversity and educational qualifications of board members indicate positive tendencies, their influence appears to be context-dependent and may be shaped by other organizational or governance-related factors. These insights underscore the need for further exploration of board characteristics alongside corporate oversight systems in shaping sustainability outcomes.</p> <p>© 2025 Kantor Jurnal dan Publikasi UPI</p>	<p>Article History: <i>Submitted/Received 20 Oct 2025</i> <i>First Revised 10 Nov 2025</i> <i>Accepted 17 Nov 2025</i> <i>First Available online 28 Nov 2025</i> <i>Publication Date 13 Dec 2025</i></p> <hr/> <p>Keyword: <i>Carbon Emissions, Corporate Social Responsibility, ESG, Green Innovation, Research and Development (R&D)</i></p>

1. INTRODUCTION

As global demands for environmental sustainability in the business sector become more complex, the focus of corporate performance assessment is no longer limited to profitability (Garcia Martin & Herrero, 2020). Fulfilling social and environmental responsibilities is a strategy for organizational sustainability (Karina et al., 2023). This is due to the growing urgency of addressing global warming by reducing greenhouse gas emissions to ensure environmental health and the well-being of inhabitants (Kamarudin et al., 2024).

Global warming has affected all countries, including Indonesia, with extreme heat waves, floods, and fires (Pinontoan et al., 2022). In 2020, the World Meteorological Organization (WMO) stated that approximately 79% of disasters in the last half-century were closely related to water, weather, and climate (Antarissubhi et al., 2023). In recent decades, there has been an increased focus on enhancing corporate value through sustainability performance (Amaliani et al., 2020).

To improve sustainability performance and gain stakeholder support for environmental and social responsibilities, companies are required to publish sustainability reports (Garcia Martin & Herrero, 2020; Supriyanto et al., 2025). In Indonesia, the regulatory framework for corporate social and environmental responsibility is established under Government Regulation No. 47 of 2012 supports the implementation of sustainability, as does OJK Regulation No. 51/PJOK.03/2017, which supplements it by addressing the implementation of sustainable finance for issuers, financial services institutions, and public companies (Amaliani et al., 2020).

Three main factors influence sustainability performance: female board members, a higher educational background, and board independence (Kanakriyah, 2021). Although some companies have yet to recognize and implement it, women's participation on boards is considered more effective because women are more involved in corporate philanthropy related to social responsibility activities that align with stakeholders' interests (Latif et al., 2020). In this context, having the presence of female directors can result in better management of the company's sustainability performance. The company would focus not only on profit, but also demonstrate high concern for the environment (Chang et al., 2023).

In addition, the educational background of the board also has an important meaning for corporate governance (Chang et al., 2023). The deeper the board's understanding of economic and business activities, the better the governance. If the board has a high level of understanding of sustainability, they will be more focused on implementing corporate social responsibility (Aly et al., 2024; Almaqtari et al., 2024). The board's education also plays a role in encouraging innovation and more accurate decision-making (Kamarudin et al., 2024).

Similarly, board independence indicates the extent to which a company's board members are free from the influence of internal management and major shareholders (Kanadli et al., 2022). Independent boards tend to be more objective in decision-making and emphasize a focus on the company's long-term interests, which is considered effective in supporting the realization of sustainability performance (Kamarudin et al., 2024).

This study was motivated by inconsistencies in previous research findings regarding the factors that influence sustainability performance. For instance, Kamarudin et al. (2024) investigated the impact of board independence on sustainability performance but neglected to

consider the influence of female board members or higher educational attainment. Conversely, Chang et al. (2023) found that female board members and a higher educational background significantly influenced sustainability performance but did not discuss board independence. These inconsistencies indicate gaps in the research that need further exploration. Therefore, this study aims to address this gap by analyzing the influence of female board members, a higher educational background, and board independence on corporate sustainability performance.

According to research by Peng & Chandarasupsang (2023), female representation in corporate leadership positively impacts corporate sustainability performance. Their findings confirm a notable correlation between gender diversity in corporate leadership and sustainability organizational outcomes. Chang et al. (2023) found similar results and concluded that the presence of women at the board level positively impacts sustainability achievements. Research by Peng & Chandarasupsang (2023) shows that the presence of women on the board of directors contributes positively to corporate sustainability performance. Their findings confirm a meaningful connection between gender-diverse leadership members as a predictor variable while sustainability performance as a dependent variable. Similar results were also found by Chang et al. (2023), who concluded that the presence of women at the board level has a constructive impact on sustainability achievements.

Research by Aabo & Giorici (2023) reinforces this view by identifying a positive correlation between female board members and ESG (Environmental, Social, and Governance) aspects, highlighting the strategic role of female leadership in improving sustainability performance. Meanwhile, Le & Ngo (2024) revealed that high gender diversity in directors impacts the integration of sustainability goals into executive compensation systems, both conceptually and empirically. Romano & Cirillo (2020) demonstrate that empirical evidence supports the hypothesis that female participation on boards improves sustainability performance scores. Meanwhile, Yadav & Prashar (2023) dan Karina et al. (2023) found that a small number of women on the board did not have a significant impact, but the presence of at least three female members had a stronger effect. Galletta et al. (2022) also found that women's participation on boards contributes to improved sustainability performance. Similarly, Shakil et al. (2020) noted that, despite the limited proportion of women on US bank boards, they significantly promote sustainability practices, particularly through commitments to ethics and environmental issues. Le & Ngo (2024) reiterate that female board members play an important role in advancing overall sustainability performance. Based on these findings, the the following hypothesis is formulated:

H1: Board female has a significant beneficial impact towards sustainability performance.

Oehoedoe et al. (2023) revealed that higher education in accounting has a positive correlation with sustainability performance. This study contradicts previous research showing that a CEO's higher education in fields such as business, economics, engineering, or natural sciences does not significantly affect sustainability performance results. Tjahjadi (2021) emphasized that board educational background has a positive and significant correlation with sustainability performance. Their findings indicate that increasing diversity within a company's structure can enhance sustainable performance. Their research comprehensively indicates that both the CEO's educational qualifications and diversity within corporate leadership are crucial for improving sustainability performance metrics. This underscores the importance of building a diverse and highly educated leadership team to enhance sustainability performance.

Additionally, research by Chen & Hao (2022) reinforces previous findings, showing that CEOs with a formal education in environmental or sustainability studies are more likely to adopt environmentally friendly policies and corporate social responsibility (CSR) programs. Their study shows that leaders with such backgrounds who have an understanding of sustainability issues, both technical and conceptual, significantly contribute to improved sustainability performance. Companies led by individuals with interdisciplinary educational backgrounds (e.g., social sciences and engineering) are better able to adapt to external sustainability-related demands and design inclusive long-term strategies (Al Amosh & Khatib, 2022). Similarly, Aly et al. (2024) emphasize that educational diversity in management improves sustainability performance and increases company competitiveness through sustainable innovation and holistic decision-making. Based on these findings, the following hypothesis is formulated:

H2: Board higher education has a beneficial impact influence towards sustainability performance.

Pham & Ho (2024) show that the coefficient of the Independent Board Member (IBM) variable is statistically significant and has a positive effect on sustainability performance indicators. Lin & Ho (2024) also show that board independence has a significant positive impact on sustainability performance results. Similarly, research by Al Amosh & Khatib (2022) highlights the important role of board independence, revealing that foreign ownership has a positive impact on the quality of sustainability performance disclosure.

Salehnezhad et al. (2023), Butar-Butar et al. (2024), and Kanadli et al. (2022). explain that board independence enhances a company's technical efficiency. In addition, stronger legal and judicial protection also positively influences this effect by safeguarding private benefits for internal groups. As a result, the overall positive effect of board independence on efficiency increases in environments where the legal and judicial framework is stronger and well enforced. Specifically, a study conducted by Pham & Ho (2024) shows that the variable of board independence has statistical significance and a positive effect on environmental, governance, and social pillars, as well as various other sustainability performance indicators. These findings emphasize the importance of having educated and independent board members in promoting sustainable business practices that are aligned with sustainability performance principles. Therefore, the researchers' hypothesis is:

H3: Board independence has a beneficial impact influence towards sustainability performance.

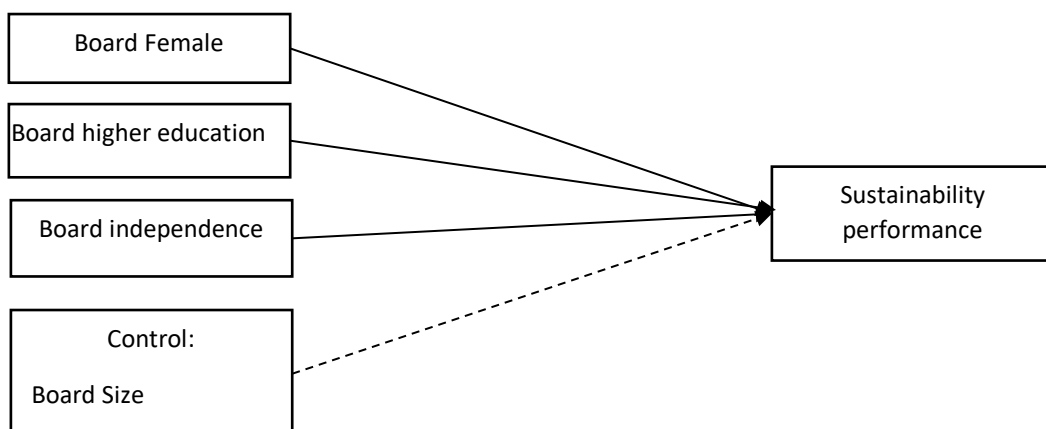


Chart 1. Study Framework

2. METHODOLOGY

Sample and Data

This study is a quantitative study, using data from sustainability reports and annual annual documentation of Indonesian manufacturing firms traded on the Indonesia Stock Exchange (IDX) during 2019 to 2023. This study focuses on the manufacturing industry because it is one of the most polluting industries in Indonesia and faces strong pressure to develop much better sustainability practices (Ali et al., 2021).

This study applies the purposive sampling method, which is a sampling technique based on certain considerations or criteria relevant to the research objectives (Thomas, 2022). The criteria for selecting the study sample comprises business entities that were part of the manufacturing sector listed on the IDX, declared active for at least the observation period (2019–2023), to ensure consistency in reporting and data availability, and have sustainability reports and/or annual reports published openly during that period. This approach aims to capture the diversity of organizational structures and understand how diverse board characteristics can influence sustainability performance in various manufacturing company contexts.

Sustainability performance data is largely sourced from the Global Reporting Initiative database, an internationally accepted framework that is considered to provide assurance that sustainability performance metrics are measured and presented in a reliable and consistent manner. Additional financial and governance data is taken from corporate entities' annual reports. Annual reports provide substantial information on board composition, among other aspects of corporate governance. Further confirmation of the accuracy of these values is obtained by cross-checking with disclosures made to the Indonesia Stock Exchange, as well as audited financial statements where available.

Variable and Measurement

Table 1. Research Measurement Indicators

Category	Measure	Mnemonic	Definition	Reference
Dependent	<i>Sustainability Performance</i>	GRI	GRI formulates CSR disclosure using the GRI index by dividing the amount disclosed by the company by the maximum CSR disclosure score.	Galletta et al. (2022)
Independent	<i>Board Independence</i>	IND	Percentage of independent board members relative to the total number of directors	Kanadli et al. (2022)
	<i>Board Higher Skills Education</i>		Percentage of board members with industry experience or a strong financial	Oehoedoe et al. (2023)

Category	Measure	Mnemonic	Definition	Reference
			background in the field of economics	
	<i>Board female</i>	BGD	Percentage of female members on the board	Galletta et al. (2022)
Controls	<i>Board Size</i>	BOS	Number of Council Members	Kamarudin et al. (2024)
	<i>Firm Size</i>	FIS	Total company assets	Githaiga et al. (2022)

Source: Authors own work.

Data Analysis

This research employs descriptive statistics, correlation analysis, and multiple regression techniques to draw conclusions regarding its stated objectives. These research goals include testing the impact of corporate board structure on environmental and social performance, along with determining the effect of corporate governance composition on sustainability performance of economic, societal, and ecological companies. In this context, the researcher conducts descriptive and inferential statistical analyses. Descriptive statistical analysis is an analytical approach that organizes, summarizes, and presents information in an informative manner, based on its basic characteristics (Murria et al., 2023). This approach determines minimum, maximum, mean, and standard deviation values. Statistical inference techniques was conducted using Chow, Hausman, multicollinearity, and heteroscedasticity tests, followed by individual hypothesis testing (t-tests) and comprehensive hypothesis testing (F-test).

3. RESULT AND DISCUSSION

According to Table 2, the descriptive statistical analysis reveals significant variation in governance and sustainability practices. The mean value of the board female parameter stands at 0.145, showing a standard deviation of 0.168, indicating moderate dispersion. Meanwhile, sustainability performance has a higher mean value of the 0.395, showing a standard deviation of 0.201, suggesting considerable variation in disclosure practices among companies. Board independence has the lowest average (0.054) and standard deviation (0.096), reflecting a relatively low proportion of independent commissioners. Meanwhile, the average for board higher education is 0.368, showing a standard deviation of 0.167, suggesting moderate dispersion. Board size has a mean of 5.748 with a standard deviation measuring 2.227; firm size has a mean of 30.130 and a standard deviation of 2.025. Overall, this data provides an initial overview of company characteristics before further analysis is conducted.

Table 2. Descriptive Statistics

Variable	Min	Mean	Max	Std.Dev
Board Female	0	0.1451	0.9	0.1617533
Sustainability Performance	0.0561798	0.3950787	0.9775281	0.2013708
Board Independence	0	0.0534583	0.5	0.0956448
Board Higher Education	0	0.36708	1	0.1669816
Board Size	2	5.748	15	2.226749
Firm Size	19.78334	30.12976	34.8422	2.025427

Source: Authors own work.

To select the most optimal model in this study, the author conducted two tests as shown in the following table.

Table 3. Chow Test

Effects Test	Probability
Prob>Chi2	0.0000

Source: Authors own work.

According to the results of the Chow test in Table 3, the Prob > Chi² value is 0.0000, which is less than the 5% significance level. This suggests that the fixed effects model is a better fit than the pooled OLS model (Nyaga & Arbyn, 2022). In other words, the model must consider specific differences in company characteristics.

Table 4. Hausman Test

Effects Test	Probability
Cross Section Random	0.7458

Source: Authors own work.

Furthermore, from the Hausman test in Table 4, the Prob > Chi² value is 0.7458, which is much greater than 0.05. This indicates that there is no significant difference between the Fixed Effect and Random Effect models, so according to Hausman's testing theory, the Random Effect model is more recommended for use (Nyaga & Arbyn, 2022).

Table 5. Multicollinearity Test

Variable	VIF	1/VIF
Board Female	1.00	0.996550
Board Higher Education	1.00	0.997599
Board Independence	1.00	0.997623
Mean VIF	1.00	

Source: Authors own work.

According to the findings from the multicollinearity analysis presented in Table 5, which was conducted employing the variance inflation factor (VIF) approach, it can be concluded that all variables, including sustainability performance, female director representation, board member composition with higher education, and board independence, are free from multicollinearity because their VIF values are 1. Multicollinearity occurs if the value is above 1.

Table 6. Heteroscedasticity Test

Variable	Probability
chi2(1)	8.52
Prob > chi2	0.0035

Source: Authors own work.

According to the findings from the heteroscedasticity analysis presented in Table 6, the analysis indicates that heteroscedasticity still occurs in the regression model, because the probability value is $0.0035 < 0.05$. This is consistent with the theory of Bersvendsen & Ditzen (2021), which states that if the probability is below 0.05, it means there is heteroscedasticity in the regression model, and vice versa

Table 7. T Test

Variabel	COEF	T statistic	Prob (p- values)
Board female	.03934	0.71	0.477
Board Higher Education	.0644218	1.20	0.230
Board Independence	.0640309	3.20	0.001

Source: Authors own work.

Based on the findings presented in Table 7, the empirical findings suggest that female board representation demonstrates a positive direction of effect on sustainability performance; however, this association fails to reach statistical significance. The T-statistic value of 0.71, which falls below the critical threshold of 1.96, together with p-values exceeding 0.05, leads to the rejection of H1. Consequently, the present study is unable to corroborate the conclusions of Peng & Chandarasupsang (2023); Ramadana et al. (2024); Aabo & Giorici (2023); dan Chang et al. (2023) who collectively argue that female leadership at the board level enhances Environmental, Social, and Governance (ESG) practices and yields a positive effect on sustainability outcomes. The discrepancy may be attributable to contextual limitations such as the relatively small sample size, heterogeneity across industry sectors, variations in organizational culture, and differences in governance systems. Moreover, the existence of female representation on boards does not inherently guarantee substantial influence in sustainability-related strategic decision-making, particularly when such representation remains symbolic or confined to limited roles within governance structures.

Similarly, the results regarding board members' academic qualifications show a positive correlation with sustainability performance, though this too is statistically insignificant. The corresponding T-statistic of 1.20, which is below the critical value of 1.96, alongside a p-value of 0.230 (> 0.05), necessitates the rejection of H2. These findings contrast with prior evidence documented by Oehoedoe et al. (2023), who reported a positive correlation between CEOs' accounting educational background and sustainability performance, as well as Tjahjadi (2021) dan Chen & Hao (2022), who demonstrated that educational diversity in leadership is positively associated with improved sustainability outcomes. Their results reinforce the notion that enhanced diversity within corporate structures contributes to more effective social and environmental performance. The current evidence, however, indicates that although educational qualifications and leadership diversity are theoretically recognized as important drivers of sustainability, in practice, their impact may be constrained by other dominant factors—such as corporate culture, institutional practices, or the extent of decision-making authority granted to individuals. This interpretation is further supported by Aly et al. (2024) dan Gold et al. (2021), who caution that formal education alone does not necessarily reflect the

capacity to shape strategic policies, particularly when women or highly educated members on boards are not vested with significant decision-making power.

In contrast, the findings regarding board independence demonstrate a statistically significant and favorable connection with sustainability performance. With a T-statistic of 3.20, which exceeds the 1.96 threshold, and a p-value of 0.001 (< 0.05), H3 is accepted. This evidence aligns with the research of Pham & Ho (2024); Lin et al. (2024); Al Amoush & Khatib (2022), all of whom report that independent board members exert a significant positive effect on sustainability performance indicators. Lin et al. (2024) further substantiate that board independence strengthens sustainability outcomes by fostering effective monitoring and accountability mechanisms. From a broader perspective, independent directors contribute to enhancing the efficiency of corporate operations, particularly when reinforced by strong legal and judicial protections. Such governance structures safeguard shareholder and stakeholder interests, mitigate potential managerial opportunism, and create conditions conducive to generating positive environmental and sustainability impacts (Kanadli et al., 2022; Salehnezhad et al., 2023).

Table 8. F Test

Variabel	F statistic	Prob (p-values)
Board female, board higher education, board independence -> sustainability performance	4.05	0.0074

Source: Authors own work.

According to Ditzen et al. (2021), the simultaneous influence of multiple independent variables on a dependent variable is considered statistically significant when the F-statistic exceeds the critical threshold of 1.96 and the associated probability value falls below 0.05. Referring to the F-test results reported in Table 8, the analysis demonstrates that the calculated F-statistic of 4.05 surpasses the corresponding F-table value, while the probability value of 0.0074 lies well below the 0.05 significance level. These findings provide empirical evidence that the variables of female board representation, higher education among board members, and board independence collectively exert a significant simultaneous influence on corporate sustainability performance.

4. CONCLUSION

Drawing from the findings and discussions outlined above, it can be inferred that neither gender diversity on the board nor higher educational qualifications of board members exhibit a statistically significant impact on corporate sustainability performance. Although both factors demonstrate a positive directional trend, the magnitude of their effect does not reach the level of statistical significance. This suggests that the mere presence of female directors or highly educated board members does not, in itself, translate into measurable improvements in sustainability outcomes. By contrast, the results highlight that board independence exerts a significant and positive contribution, indicating that the inclusion of independent directors fosters stronger governance practices that are conducive to advancing sustainability performance. Nevertheless, in interpreting these findings, it is also essential to account for control variables such as board size and firm size, which may shape the robustness of the observed relationships.

Despite these contributions, this research has certain limitations. First, the examination is constrained by its focus on gender and educational dimensions of board composition without assessing the extent to which female and highly educated members actively participate in, or exert influence over, strategic decision-making processes, particularly in sustainability-related policies. Second, the absence of mediating or moderating variables such as professional experience, leadership style, or the degree of commitment to Environmental, Social, and Governance (ESG) metrics principles may restrict the explanatory power of the model. Moreover, the limited sample scope and focus on specific industries and firm sizes limit the generalizability of the findings.

Considering these constraints, subsequent studies is strongly encouraged to adopt a more comprehensive framework that incorporates potential mediating and moderating mechanisms to better capture the complex dynamics between governance attributes and sustainability performance. Expanding the dataset to include a larger and more heterogeneous sample across industries and geographic contexts would enhance the external validity of the results. Furthermore, time-series analyses could yield more comprehensive understanding of how changes in board structure over time influence sustainability trajectories. Finally, qualitative approaches such as case studies or interviews could complement quantitative findings by uncovering the nuanced ways in which board members particularly women and highly educated individuals shape corporate strategies and sustainability policies beyond their formal positions.

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