

Board of Directors and Sustainability: Analysis of The Impact of Leadership Characteristics on Environmental Performance in Indonesia

Rista Bintara¹, Rieke Pernamasari^{2*}, Sri Purwaningsih³
^{1,2,3} Faculty of Economic and Business, Universitas Mercu Buana, Indonesia
*author e-mail: rieke.pernamasari@mercubuana.ac.id

Article Info	Abstract
Keywords: Environmental Performance; Board Size; Board Age; Board Tenure; Board Female;	This study examines the effect of structural and demographic diversity within boards of directors on corporate environmental performance in Indonesia. Board characteristics analyzed include size, female representation, nationality diversity, tenure, and average age. A quantitative method with panel data combining time-series and cross-sectional data was employed. Secondary data were collected from public companies listed on the Indonesia Stock Exchange (IDX) that published environmental performance reports from 2019 to 2022. A purposive sampling method was used to select firms that met specific criteria. Empirical results show that board characteristics overall significantly influence environmental performance. Specifically, board tenure negatively affects environmental performance, while female representation is positively associated with it. Board size and average age show no significant effect. These findings underscore the importance of board composition in shaping sustainable business practices. Companies are encouraged to align with global trends by embedding environmental considerations into strategic decisions. Boards should recognize the urgency of environmental issues, such as climate change, and integrate sustainability into governance frameworks to enhance long-term corporate performance.
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1. Introduction

Environmental conservation has been a major concern over the past decades, with companies facing increasing social pressure to reduce their environmental footprint (Utami *et al*, 2024). Legislative interventions worldwide aim to enhance corporate environmental sustainability and direct investment toward economic activities that significantly contribute to climate change mitigation and, more broadly, environmental protection. The literature also highlights the role of environmental operational practices in enhancing corporate competitive advantage (Gavana *et al*, 2023). Therefore, environmental engagement challenges corporate governance, as the board of directors plays a fundamental role in setting strategic objectives and is ultimately responsible for both financial performance and corporate social and environmental performance (Veltri *et al*, 2021).

Environmental performance is a relevant dimension of operational performance (Jimenez & Lorente, 2001), as it measures the impact of a company’s environmental strategy, including the reduction of natural resource consumption, emissions, and environmental costs to customers. Despite progress in understanding the impact of Corporate Governance (CG) characteristics on corporate sustainability, there is still room to further investigate this relationship (Wall *et al*, 2012).

Attaining a comprehensive understanding demands an in-depth investigation into the complex interplay between governance attributes and the multifaceted dimensions of sustainability, where board structures, leadership diversity, and strategic oversight converge to influence environmental stewardship, social responsibility, and ethical governance practices.

Corporate governance significantly influences the presence of sustainability reporting within companies. The board of directors, as the main governing body, plays a crucial role in ensuring the effective functioning of all business activities, as it determines the issuance of corporate sustainability reports (Post *et al*, 2011). The board of directors exhibits structural diversity, including board size, board independence, CEO duality, and tenure, as well as demographic attributes such as gender, age, education, and nationality. The literature distinguishes between "board diversity" when referring to structural board diversity and "diversity within the board" when considering the demographic diversity of directors (Veltri *et al*, 2021). Accordingly, research has underscored the importance of analyzing the effects of specific board characteristics on environmental performance (Hussain *et al*, 2018).

Previous studies have yielded conflicting results regarding the relationship between structural board diversity and environmental performance (Post *et al*, 2011; Hussain *et al*, 2018; de Villiers *et al*, 2011). Wall *et al* (2012) noted that companies with more independent boards and higher gender diversity exhibit superior environmental performance; however, their study focused solely on environmental dimensions. Few studies have analyzed the impact of board tenure on environmental performance (Gavana *et al*, 2023; de Villiers *et al*, 2011).

A larger board size may influence the presence of sustainability reporting, as a larger board can facilitate corporate operational activities and provide greater experience to assist in decision-making (Veltri *et al*, 2021; Husted & Sousa-Filho, 2019). Meanwhile, female board members contribute to prudent decision-making with lower risk levels. According to Manita *et al*, (2018), women tend to consider multiple aspects when making decisions, ensuring positive and beneficial outcomes for the company. Additionally, women are more likely to avoid risk in the workplace as they carefully assess various factors before making corporate decisions. Yadav & Prashar, (2023) further suggests that women tend to enforce regulations more strictly, ensuring that management adheres to sustainability reporting requirements.

Several empirical studies have revealed a positive relationship between female board representation and environmental performance. Women bring different skills and resources to the board, benefiting environmental performance, particularly in high-polluting industries where managing environmental impacts is more complex (Wang *et al*, 2023; Z. Li *et al*, 2022). Female directors enrich the board with diverse values, ideas, knowledge, and perspectives. They exhibit a broader range of thinking styles, are more inclined than men to address multiple stakeholder needs, and demonstrate a long-term orientation that enhances environmental performance (Nadeem *et al*, 2020). Women tend to be more empathetic than men, and among corporate stakeholders, female directors prioritize less powerful stakeholders, such as the environment (Fernandez-Feijoo *et al*, 2014). Increasing female representation on boards enhances the likelihood of forming sustainability-oriented alliances that benefit environmental performance Post *et al*, (2011), although research suggests that women can positively influence corporate environmental performance only when they reach a critical mass within the board.

Despite advancements in understanding the impact of corporate governance (CG) characteristics on corporate sustainability, there remains significant scope for further investigation into this relationship (Hussain *et al*, 2018). A comprehensive understanding necessitates a more detailed exploration of the link between governance characteristics and sustainability dimensions. While several studies have attempted to examine this relationship, no empirical contributions have fully considered all three dimensions of sustainability performance in this context.

Drawing from diverse and often competing theoretical perspectives, we refer to the mixed and inconclusive evidence in prior studies, where some research finds a positive association

between board diversity and environmental performance (Wall *et al*, 2012 ; Post *et al*, 2011), while other studies report no significant relationship or inconsistent results depending on the specific board attribute or industry context (de Villiers *et al*, 2011; Hussain *et al*, 2018). Thus, the contradictions arise from the variation in findings across different settings, board characteristics, and methodological approaches. Given these contrasting findings, further research is warranted to reassess the relationship between CG and environmental performance. This study aims to contribute to the decision-making process regarding sustainable investment by leveraging non-financial information, particularly environmental performance metrics. Consequently, the research seeks to address the following central question: "Do board characteristics influence environmental performance?"

Theoretical Framework

Agency Theory

Stewardship theory can be seen as a special case of Agency Theory, where the principal and agent share similar goals, thereby minimizing first-type agency conflicts (Liu & Song, 2007). According to stewardship theory, many leaders and executives are driven by more than just personal economic interests in their work; they often act altruistically toward the organization and its stakeholders due to emotional bonds (Caers *et al*, 2006).

According to agency theory, corporate engagement in stakeholder-supporting activities is linked to three types of agency conflicts. The first type concerns conflicts between owners and managers. The second type arises between majority and minority shareholders. The third type of agency conflict occurs between shareholders and lenders (Liu & Song, 2007). On the one hand, shareholders may expropriate lender wealth through asset substitution operations (Jensen & Meckling, 1976). On the other hand, lenders tend to mitigate these adverse effects by demanding higher returns and imposing costly monitoring measures on borrowers.

Regarding board demographic characteristics, the literature has explored the effects of gender diversity on environmental performance, yielding mixed findings. From the perspective of agency theory, female directors can mitigate agency conflicts to enhance CSR performance due to their superior monitoring capabilities and heightened sensitivity (Veltri *et al*, 2021), except when their appointments are based on formal criteria that limit their influence over strategic decision-making (Fernandez-Feijoo *et al*, 2014). Stewardship theory posits that board members support corporate management rather than simply monitoring its behavior (Donaldson & Davis, 1991). Directors and managers collaborate to ensure the business's long-term sustainability, and female presence fosters stewardship-oriented behavior toward stakeholders and the environment.

Environment Performance

Firms' environmental practices have gained growing attention as stakeholders demand greater accountability (Gavana *et al*, 2023). Strong environmental performance offers strategic benefits, such as reduced operational costs, lower legal risks, enhanced resource access, and increased market opportunities, especially with rising consumer demand for green products. Empirical evidence shows a positive link between good environmental performance and firm value, with firms adopting strict environmental standards achieving higher market valuations (de Villiers *et al*, 2011).

Boards of directors play a critical role in overseeing and guiding environmental strategies. Failures in board oversight, as seen in Gavana *et al*, (2023), environmental disasters, highlight the importance of board involvement in environmental management. However, previous studies linking board characteristics to environmental compliance are limited; they focus narrowly on

violations, small sample sizes, older data, and a restricted set of board attributes (de Villiers et al., 2011).

This study addresses those gaps by examining how board characteristics influence environmental performance more broadly. Guided by Hillman and Dalziel's (2003) framework, it considers two board functions: (1) monitoring management (agency theory) and (2) providing access to resources (resource dependence theory). Independent, incentivized, and resource-rich directors can better monitor environmental risks and enhance firms' environmental strategies by offering valuable expertise, advice, and connections.

Board Director

According to Dienes *et al.*, (2016), corporate governance describes how businesses are run and how managers are answerable to the stakeholders. Governance considers all the interests that have an impact on an organization's competency, moral integrity, and viability. Furthermore, a number of interconnected characteristics lead to the corporate governance system Erin *et al.*, (2022), all of which are necessary to provide healthy governance. Corporate governance structure affects sustainability disclosure, according to the theory that corporate governance encompasses a number of overlapping mechanisms (Husted & Sousa-Filho, 2019; Erin *et al.*, 2022).

In order to monitor how the business is being conducted, the board of directors is one of the most crucial components of the corporate governance process (Tarmuji *et al.*, 2016). Attracting and keeping executives and board members requires competitive and equitable management compensation, which is a best practice of corporate governance principles. There should be equal treatment and privileges for the stockholders. All stakeholders are given access to the strategy and vision, and it is integrated into daily decision-making processes along with economic (financial), social, and environmental metrics.

2. Research Method

To address the conceptual issue, a hypothesis development can be formulated, as illustrated in the following theoretical framework:

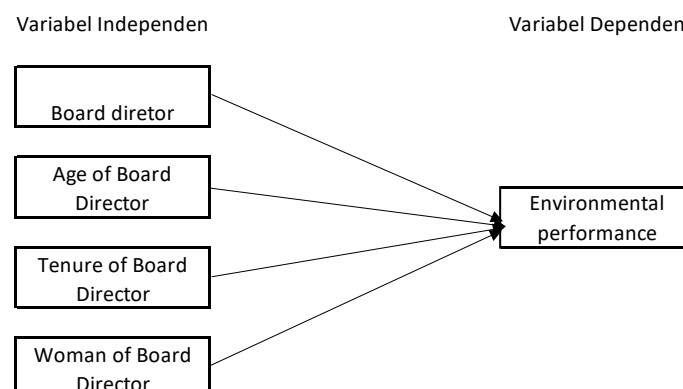


Figure 1. Conceptual Framework

The literature on corporate governance (CG) almost unanimously agrees on the fact that the commitment to enhancing accountability and transparency in corporate activities, beyond just economic and financial activities, has grown rapidly among large companies and has become a relevant topic in corporate management. From the perspective of agency theory, the following hypotheses are proposed:

H1: The size of the board of directors has a positive effect on environmental performance.

H2: The age of the board of directors has a positive effect on environmental performance.

H3: The tenure of the board of directors has a positive effect on environmental performance.

H4: Female board members have a positive effect on environmental performance.

Population and Sample

The population of this research consists of companies listed on the Indonesia Stock Exchange (IDX). The sample for this study includes companies listed on the IDX that have environmental performance records for the period of 2019-2022 in Bloomberg database. The 2019–2022 period was chosen to capture corporate environmental performance both before and during the COVID-19 pandemic, allowing analysis under normal and disrupted conditions. This timeframe also reflects recent developments, including companies' adaptations to growing global and domestic focus on sustainability and Indonesia's strengthened environmental disclosure and ESG reporting regulations.

This research employs panel data analysis to capture both cross-sectional and time-series variations in leadership characteristics and environmental performance. Panel data offers a richer understanding of how board attributes influence sustainability outcomes over time. It accounts for the gradual evolution of governance structures and the annual fluctuations in environmental performance driven by regulatory or market changes. Moreover, panel models control for unobserved firm-specific factors, such as corporate culture, that remain constant but could bias results. This approach enhances the robustness and reliability of the analysis, making it well-suited for studying governance impacts in Indonesia's dynamic business environment.

The sampling technique used in this research is purposive sampling, where samples are selected based on the suitability of characteristics with predetermined criteria to ensure a representative sample. Based on the sample size, 25 companies with environmental performance were identified, resulting in 100 observable data points.

The sample criteria used are as follows:

1. Companies listed on the IDX during the observation period of 2019-2022.
2. Companies that have environmental performance reports during the observation period of 2019-2022.

The operational variables in this research consist of the independent variable, which is the characteristics of the board of directors, and the dependent variable, which is environmental performance. The following table presents the operational variables.:

Table 1. Operational Variable

Variable Type	Variable	Measurement	Source
Dependent	Environmental performance	Environmental performance pillar score	Bloomberg
Independent	Board size	Size of board members	CG Report
Independent	Board age	Average age of board members	CG Report
Independent	Board tenure	Average tenure of board members	CG Report
Independent	Female board members	Ratio of female board members to total board members	CG Report

Analysis Method

The basic model we estimate to analyze the impact of demographic and structural diversity within the board on environmental performance for companies in Indonesia is as follows.

Descriptive Statistical Analysis

According to Ghozali (2021), descriptive statistics provide an overview of data based on values such as the mean, standard deviation, variance, maximum, minimum, sum, range, kurtosis, and skewness (distribution skewness). In this study, descriptive statistics offer an overview of the data, which includes environmental performance and board characteristics.

Panel Data Regression Analysis

Data Analysis Technique

The data analysis technique used in this research involves statistical data management. Therefore, the statistical method employed is multiple linear regression, processed using the EViews 12 software. The research model structure for this study is as follows.

$$EP = \alpha + \beta_1 BS + \beta_2 BA + \beta_3 BT + \beta_4 BF + \varepsilon$$

Information:

EP : Environmental performance
 BS : Board Size
 BA : Board Age
 BT : Board tenure
 BF : Board Female

3. Results and Discussions

Statistical Test Results

Table 2. Descriptive Test Results.

	EP	BS	BA	BT	BF
Mean	36.57	6.3	61.74	5.81	0.07
Maximum	63.18	13.00	73.67	8.58	0.66
Minimum	0.48	4.00	51.00	3.64	0.00
Std. Dev.	18.38	1.64	5.81	1.42	0.15
Observations	100	100	100	100	100

Source: Eviews 12

The results of the descriptive test show that the average environmental performance score is 36.57. Although there are companies with a score below 1%, on average, companies in Indonesia have an environmental performance above 30%, indicating that companies are beginning to focus on environmental issues, even though it is still voluntary. The first characteristic of the board of directors is the size of the board. The descriptive test results show that the average number of board members is six, although some companies still have only four members. A larger board size is expected to provide better consideration and decision-making regarding the company's environmental performance.

Next, the average age of the board of directors is 61 years, indicating that board members in Indonesia are approaching retirement age, with some being over 70 years old. The average tenure of board members in Indonesian companies is 5-6 years, which is due to varying rules from General Shareholders' Meetings (RUPS), but most commonly, the tenure is 5-6 years per term. A longer tenure is expected to provide more effective contributions to the company's environmental performance.

Lastly, the average number of women on the board of directors is one, with many companies having no female board members. This shows that the presence of women in board positions is still limited, meaning their input in decision-making and company policy is minimal.

Model Selection Test Results

Before testing the hypotheses, a panel data regression model selection was performed between the CEM, FEM, and REM models. In this study, the CEM model was found to be the best, followed by classical assumption testing. The normality test in this study resulted in a value of 0.04, indicating non-normality. However Hair *et al*, (2010), in panel data, the normality and heteroscedasticity tests can still be considered BLUE (Best Linear Unbiased Estimator). The multicollinearity test results showed that all relationships between the variables X1, X2, X3, and X4 were less than 90, meaning all variables are free from multicollinearity.

Table 3. Model Fit Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	77.04519	19.17024	4.019000	0.0001
BS	-1.174971	1.523473	-0.771245	0.4425
BA	-0.202992	0.348347	-0.582730	0.5615
BT	-3.254123	1.649937	-1.972271	0.0505*
BF	20.28472	11.78882	1.720674	0.0886**

R-squared: 0.142984
Adjusted R-squared: 0.106899
Prob(F-statistic): 0.005112
sig : *5%. **10%

Source: Eviews 12

Based on the hypothesis test table and the regression estimation results of the common effect model, the panel data regression is as follows:

$$Y = 77.04519 - 1.174971BS - 0.202992BA - 3.254123BT - 20.28472BF$$

The regression model results show a constant value of 77.04519. If all independent variables are zero, the environmental performance would be 77.04%.

Hypothesis Result

Coefficient of Determination (R^2)

The hypothesis test results show a coefficient of determination (R^2) value of 0.106899 or 10.68%. This indicates that the independent variables, which are the characteristics of the board of directors measured by board size, average age of the board, average tenure, and the number of women on the board, explain 10.68% of the dependent variable, which is environmental performance. The remaining 89.32% is influenced by other variables not included in this study.

F-Test

Based on the hypothesis test table, the probability value of the F-statistic is 0.005112. This shows that the probability (F-statistic) is less than 0.05, meaning H_0 is rejected, and H_1 is accepted. Thus, it can be concluded that all the board characteristics measured by board

size, board age, board tenure, and board female have a simultaneous effect on environmental performance in companies in Indonesia for the period 2019-2022.

t-Test

Based on the hypothesis test table, it can be concluded that the size of board members has a probability value greater than 10% (0.4425), with a negative regression coefficient of -1.174971, indicating that H1 is rejected. The average age of the board members has a probability value greater than 10% (0.5615) with a negative regression coefficient of -0.202992, indicating that H2 is rejected.

Meanwhile, the average tenure of board members has a probability value less than 10% (0.0515) with a negative regression coefficient of 3.254123, indicating that H3 is rejected. Additionally, female board members have a probability value less than 10% (0.0886) with a negative regression coefficient of 20.28472, indicating that H4 is accepted.

Discussion

Board Size and Environmental Performance

The hypothesis test results show that board size does not significantly affect environmental performance. This suggests that the lack of environmental specialization within the board of directors may limit their ability to provide input on decisions that would enhance the company's environmental performance. Another reason could be that the company's primary focus may be on other issues, making environmental performance less of a priority for the board, regardless of the number of its members. Factors such as leadership quality, organizational priorities, and corporate culture play a more significant role in determining how the company manages its environmental responsibilities (Lavin & Montecinos-Pearce, 2021 Samaha et al., 2015).

Board Age and Environmental Performance

The hypothesis test results show that the age of the board members does not significantly affect environmental performance. This indicates that environmental performance depends more on personal interests and values than on age. Additionally, a board member's adaptation and learning about environmental issues require time, training, and consultation with experts. As noted by Post *et al*, (2011) and Sulisty & Hatane, (2020), younger board members may focus more on technological innovation or business aspects. Another possibility is that environmental performance reports are not yet mandatory in Indonesia.

Board Tenure and Environmental Performance

The hypothesis test results show that longer board tenure has a significant negative impact on environmental performance. This could be due to several factors, including resistance to change, especially changes that involve adopting new practices focused on environmental performance. The longer the tenure, the more comfortable board members become with traditional methods and short-term goals. As a result, longer tenure may cause board members to become less adaptive, innovative, and focused only on old strategies. As noted by Post *et al*, (2011) other studies, longer tenure, especially in family-owned businesses

or companies with family connections, tends to prioritize profit-oriented business goals over trendy or sustainable issues.

Female Board Members and Environmental Performance

The results of the hypothesis test show that female board members have a significant positive influence on environmental performance. These results indicate that women tend to have a higher level of concern for the interests of various stakeholders, including the environment. They are also known to be more careful in decision-making, which can reduce the tendency of companies to engage in environmentally damaging business practices. Several studies have shown that the presence of women on the board of directors has a positive impact on environmental performance and corporate social responsibility, because women are more sensitive and critical to these issues (Ahmad *et al*, 2018); Li *et al*, 2017; Nadeem *et al*, 2020).

4. Conclusions

Overall, these findings underscore the importance of specific dimensions of board diversity in shaping corporate environmental strategies. While board size and age do not emerge as key determinants, extended board tenure may hinder environmental progress, whereas greater female representation significantly enhances environmental performance. These insights suggest that companies should deliberately integrate leadership profiles that combine gender diversity, shorter or periodically refreshed board tenures, and members with demonstrated expertise or experience in environmental sustainability into their corporate governance structures. Specifically, appointing female directors with sustainability-related backgrounds and ensuring periodic renewal of board members can introduce fresh perspectives and stronger commitments to environmental initiatives. This targeted approach to board composition can strengthen strategic decision-making and drive more meaningful and sustained environmental outcomes.

Recommendations

Based on the findings of this study, several areas warrant further investigation to enhance the understanding of the relationship between board characteristics and environmental performance. Future research may consider the following recommendations:

1. **Incorporating Environmental Expertise on the Board.**
This study suggests that board size does not significantly impact environmental performance, possibly due to a lack of specialized environmental knowledge among board members. Future research could examine how the presence of board members with environmental expertise or sustainability committees influences corporate environmental strategies.
2. **Longitudinal Analysis of Board Characteristics and Sustainability Trends.**
Given that environmental reporting is not yet mandatory in Indonesia, future studies could track the impact of board characteristics over time as environmental regulations evolve. A longitudinal study could assess how corporate governance adapts to changing sustainability expectations and regulatory frameworks.

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