

THE ROLE OF BOARD SIZE, ENVIRONMENTAL INDICATORS, AND CORPORATE REPUTATION ON ENVIRONMENTAL, SOCIAL, AND GOVERNANCE PERFORMANCE

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Abstract

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Anthropogenic climate change increases biodiversity risks, with projections indicating potential global-scale biodiversity loss. Greenhouse gas emissions also affect global energy stability, intensifying extreme weather such as heat waves, floods, and droughts. In response, sustainability reporting has become mandatory in many regions, including Indonesia, to support Nationally Determined Contribution (NDC) commitments and net-zero initiatives. This study investigates the determinants of environmental, social, and governance (ESG) performance using Bloomberg's ESG score, which evaluates the three pillars based on corporate disclosures. The sample includes 105 companies listed on the Indonesia Stock Exchange (IDX) from 2018 to 2022, generating 525 firm-year observations. Governance is measured by board size, environmental performance by carbon intensity and energy use, and the social pillar by corporate reputation from the IDX reputational index. Panel regression results show that board size positively and significantly affects ESG performance, suggesting larger boards improve decision-making (Albitar et al., 2020). By contrast, environmental performance has a significant but negative association with ESG performance (Chen et al., 2020; Kusumawati & Murwaningsari, 2023). These findings advance ESG research in emerging markets and provide practical insights for regulators, emphasizing the need for more targeted policies to enhance corporate roles in achieving climate change mitigation goals.

Keywords: Sustainability, ESG Performance, Board Size, Carbon Intensity, Energy Consumption

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1. INTRODUCTION

Developing countries have primarily concentrated on increasing industrial activity in the past few decades, which has created an overall increase in energy usage to support rapid production. Industrialization or modern society is established on energy usage, especially fossil fuels, which include petroleum, coal, and gas, because it is widely accessible and relatively inexpensive. The attempt to raise per capita income creates mass-scale exploitation of non-renewable energy, especially in developing countries, since they have relatively greater energy use to support infrastructures and developments (Hanif et al., 2019). Achieving the goals requires significant energy use that resulting in high carbon emission intensity and degrading both environmental and climatic quality (Alharthi et al., 2022). This disruption includes rising sea surface temperatures, the acidity of the ocean, higher Earth temperatures, and changes in other aspects of the climate.

According to the International Energy Agency (IEA, 2022b), the average worldwide carbon intensity is 0.26 tons of CO₂ per USD 1000 — it would not change even if the world's gross domestic product (GDP) grew in 2022. The increasing carbon is a driver that raises the carbon intensity. In 2021, Indonesia became the 9th largest carbon emitter in the world (IEA, 2022a). Within a year, Indonesia's ranking skyrocketed to become the 6th largest carbon emitter globally, with energy-related carbon emissions of 729 MtCO₂ in 2022¹. Based on these facts, Indonesia became the biggest carbon emitter in the Association of South-East Asian Nations (ASEAN), followed by Vietnam, Thailand, and Malaysia (IEA, 2022c; International Renewable Energy Agency [IRENA] & ASEAN Centre for Energy [ACE], 2022). These issues were caused by drastically increasing human activities, such as fossil fuel combustion and deforestation, which shift the situation and threaten the ability of ASEAN countries to achieve their emission reduction objectives (IRENA & ACE, 2022). In terms of energy that contributes to carbon emission in ASEAN, it is mainly from the industrial sector (23%), transportation sector (24%), and followed by the electricity and heat sectors (38%) (IRENA & ACE, 2022).

In response to this, international organizations launch numerous global initiatives and strategies to promote sustainability, such as Sustainable Development Goals (SDGs) and the Paris Agreement. By aligning the SDGs with environmental, social, and governance (ESG) scores, managers and boards will acquire a mechanism to measure and facilitates model to adopt sustainable practices (Perevoznic & Dragomir, 2024). Corporate organizations can contribute to accomplishing the SDGs by combining efforts to enhance social welfare, prevent pollution of the environment, initiatives to develop communities, and improve company performance (Rojek-Adamek, 2021). These contributions require collaboration in carbon management between stakeholders and policymakers to form pressure to reduce greenhouse gas emissions. Additionally, the United Nations' (UNs') Paris Agreement aims to decrease greenhouse gas emissions and keep temperature rises to 1.5°C. The chance of keeping the earth's temperature below 2°C is only 5% (Raftery et al., 2017). If all countries meet their Nationally Determined Contributions (NDCs) and

continue to reduce emissions at the same rate after 2030, the chance will increase to 26% (Liu & Raftery, 2021).

Aside from Indonesia, publicly listed companies operating in ASEAN-6 nations — Singapore, Malaysia, Thailand, Vietnam, and the Philippines — are mandatory to disclose sustainability reports (Linnenluecke, 2022). However, Indonesia, Thailand, and Vietnam still have an ESG framework at an early stage, alongside Russia and Nigeria (Singhania & Saini, 2022). Malaysia's score is the highest in sustainability disclosure rate (64.5%) among ASEAN nations, followed by Singapore (61.7%), Thailand (60%), the Philippines (56.3%), and Indonesia (53.6%) (Ismail et al., 2022). This figure shows that Indonesia disclosed a lack of ESG data compared to other ASEAN nations.

Companies utilize ESG measurements as a standard to evaluate performance in financial and sustainability reporting or other separate documentation, which evaluates performance alignment toward sustainable transition (Daugaard & Ding, 2022). These reports, scores, and ratings are transparent initiatives to assess, lower risk, and provide investors with long-term returns. This score is crucial in providing fundamental information to investors concerning the firm's performance and influencing investment decisions. Analyzing and monitoring an organization's ESG performance determines ESG scores, which could improve its corporate social and environmental performance to achieve goals for the SDGs and net-zero initiatives (Sadiq et al., 2023). Thus, ESG reporting is in high demand, encouraging firms to determine standalone initiatives to fulfill ESG criteria.

This research contributes to the gap in previous literature, as the majority of them focus mainly on a few or single determinants — focus on ESG performance influenced by environmental determinant (He & Wang, 2025; Zhu et al., 2025), social determinant (He et al., 2024; Kwilinski et al., 2024), and governance determinant (Agnese et al., 2024; Oyinlola, 2025). Also, this research contributes by utilizing data observations in various kinds of sectors, as the majority of the earlier literature mostly concentrated on a limited industrial scope (Khan et al., 2024; Bandeira Pinheiro et al., 2024).

Furthermore, many of the previous studies on a similar topic have shown inconsistency in their findings, which contradict each other. In terms of the governance pillar, some authors recognize that board size significantly positive impact on ESG performance (Abdelazim & Abu Khalaf, 2024; Jeyhunov et al., 2025). On the other hand, others have highlighted the negative impact of board size on ESG performance (Shu et al., 2024) and even the relatively unimportance of its role (Ding et al., 2024). Similarly, the environmental performances reflected by the generated carbon intensity and energy consumed show various findings within the literature. Wang and Li (2024) concluded that energy input-carbon emission significantly enhances the cumulative ESG performance instead of improving just a single performance category. On the contrary, Shu and Tan (2023) concluded that carbon control-related regulation has a negative impact on ESG performance. Literature on energy consumption also concluded incoherent findings,

¹ <https://globalcarbonatlas.org/emissions/carbon-emissions/>

ranging from studies that highlighted the positive impact (Sun et al., 2024; Yang et al., 2022), as well as those with a negative impact (Chen et al., 2020; Zheng et al., 2022).

Hence, researchers are interested in testing variables that may influence ESG performances, especially those that cover all three ESG paradigms. This research also utilizes control variables, namely the firm's size, return on assets (ROA), and financial leverage. The object of research is publicly listed companies within the Indonesia Stock Exchange (IDX) that published sustainability reports between the period of 2018 to 2022, as well as obtained ESG scores from Bloomberg's database. Findings within this study aim to provide in-depth insight into the variables that may be influencing ESG performances, especially in the Indonesian context, helping companies in making sustainable strategic decisions as well as assisting regulators in enhancing regulatory quality to support the net-zero initiatives related to carbon emission reduction and energy consumption.

The study is structured in the following way. Section 2 presents the theoretical framework and hypotheses development. Section 3 explains the research methodology, which includes data samples, variables, and regression models. Section 4 overviews the results. Section 5 discusses the main findings of the study. Section 6 provides the conclusions of results, limitations, and recommendations.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Accounting theory

2.1.1. Neo-institutional theory

The neo-institutional theory argues that companies must follow and adapt to environmental forces to survive and compete (Chan & Ananthram, 2020; DiMaggio & Powell, 1983). This force is referred to as institutional isomorphism (DiMaggio & Powell, 1983) — one of the institutional pressures is coercive isomorphism that can be in the form of regulations that encourage companies to engage in corporate social responsibility (CSR) activities. Based on neo-institutional theory, the government has coercive power through laws, standards, and guidelines that encourage and determine corporate behaviour. Pressure through regulations and institutional codes of ethics motivates companies to prepare disclosures (DiMaggio & Powell, 1983; Jahid et al., 2023).

2.1.2. Agency theory

According to Jensen and Meckling (1976), moral hazard can emerge as a result of information asymmetry, in which management, as agents, has more insight into company information but opts to conceal this information from shareholders as the principals. Through ESG disclosure, companies can minimize agency problems such as information asymmetry and agency costs. According to Zumente and Bistrova (2021), companies may reinforce shareholder trust in their companies by disclosing information, particularly non-financial information related to ESG, which has a significant impact on the company's long-term value.

2.1.3. Stakeholder theory

Stakeholder theory suggests that companies have broad obligations to stakeholders, not just the interests of their shareholders. This theory provides a perspective on the shared goal of generating shared values between stakeholders and the company, resulting in strong value creation. Value creation must be mutually beneficial for all parties involved to ensure its legitimacy, namely, to ensure that value is created jointly and is intended for various stakeholders. Through the information companies disclose to stakeholders, stakeholders can decide whether to contribute resources, labour, and knowledge (Hörisch et al., 2020). It is important for companies to consider stakeholder needs in their reporting, as this can increase the completeness and credibility of the quality of reporting transparency.

2.2. Hypotheses development

2.2.1. Carbon intensity

According to Hoffmann and Busch (2008), carbon intensity is an indicator of carbon performance associated with business metrics and is measured based on the quantity of carbon a company generates. The increasing carbon emission creates pressure on carbon intensity. ESG performance, particularly in the environmental pillar, is expected to decline as carbon intensity increases. This is because carbon performance and carbon intensity have an inverse relationship (Busch et al., 2022; Yan et al., 2022). In accordance with neo-institutional theory, regulations and standards intended to support sustainability objectives initiate institutional pressure for companies to adapt and remain competitive. This pressure motivates companies to provide more non-financial data, such as sustainability information related to environmental performance, such as carbon emissions.

Several studies have examined carbon emissions' implications on ESG performance (Alandejani & Al-Shaer, 2023; Albitar et al., 2023; Alkurdi et al., 2024). However, most research is limited to specific topics, such as the influence of carbon emission on corporate financial performance (Busch et al., 2022; Yan et al., 2022) and carbon disclosure influence on corporate reporting (Setiawan & Iswati, 2019). Carbon emissions tend to be better disclosed by companies in sectors with high carbon intensity (Ovina & Meiden, 2023). On the contrary, companies that generate higher carbon emissions tend to produce limited information that discloses specific actions (Pitrakkos & Maroun, 2020). In terms of carbon intensity, a study conducted by Kusumawati and Murwaningsari (2023) finds that carbon intensity negatively influences firms' performance. Given this, the hypothesis developed as follows:

H1: Carbon intensity has a significantly negative influence on ESG performance.

2.2.2. Energy consumption

Several studies show that increasing the scale of economic activity drives the energy demand, which will produce an ecological footprint and affect environmental sustainability (Dogan et al., 2020). This is because substantial energy consumption is essential to supply initiatives to develop economic,

social, and technological matters (Alharthi et al., 2022) in influencing the country's monetary performance. Energy consumption patterns contribute to improving environmental sustainability performance due to industrialization and production processes, resulting in carbon emissions and forming environmental pressures. To mitigate climate change, energy efficiency can be a cost-effective way to reduce energy usage and carbon emissions. Thus, transition and efficiency in energy consumption are necessary as they play a critical role in sustainability success, measured through ESG.

Based on neo-institutional theory, institutional pressures form reactions that drive rationality to achieve companies' legitimacy (Chan & Ananthram, 2020). Several past studies have analyzed the influence of energy consumption on sustainability (Khan et al., 2021; Miao et al., 2022; Nathaniel & Adeleye, 2021). According to Nathaniel and Adeleye (2021), energy consumption has significantly influenced environmental degradation and threatens sustainability. Zheng et al. (2022) find that energy consumption negatively influences ESG performance and suggest that companies with high energy usage tend to generate worse ESG performance. Similarly, Chen et al. (2020) found negative implications for energy consumption toward economic development if the consumption is lower than the threshold level. Thus, we hypothesize the link between energy consumption and ESG performance as follows:

H2: Energy consumption has a negative influence on ESG performance.

2.2.3. Corporate reputation

Social responsibility information has the ability to influence stakeholders' perceptions, which could enhance a business's competitiveness and reputation. Companies that voluntarily engage in sustainability initiatives can gain trust and a good reputation. Reputable companies are perceived to acquire greater stakeholder trust by providing relevant information (Abeysekera et al., 2021). Through socially responsible decision-making, companies will form a positive image projection (Kim et al., 2020). Companies tend to execute effective ESG initiatives when they receive societal pressure from publicity and exposure, which can enhance their ESG performance (Zhao et al., 2023). Stakeholder theory implies that businesses must fulfill their responsibilities to stakeholders that influence the company and are influenced by the management's decision-making (Dmytriiev et al., 2021).

The effects of information disclosure on a company's reputation have been examined in numerous studies (Pérez-Cornejo et al., 2020; Zhang et al., 2021). According to Winit et al. (2023), firms' reputations positively influence ESG performance and argue that companies with high sustainability performance acquire better reputation, trust, and satisfaction than firms with low sustainability performance. Supporting this argument, Maaloul et al. (2023) argue that firms that disclose detailed information regarding ESG issues perceive a better firm reputation. In addition, Uyar et al. (2022) suggest that social reputation requires commitment in all dimensions of the ESG pillars' performance. Numerous studies that examine a company's reputation for sustainability and ESG performance provide evidence in favour of

this assumption (Uyar et al., 2022; Winit et al., 2023). Therefore, the hypothesis developed as follows:

H3: Firms' reputation has a positive influence on ESG performance.

2.2.4. Board size

According to agency theory, the board plays a significant role in representing shareholders and overseeing management's strategic decisions. Companies with a larger board might enhance their financial performance by offering enhanced monitoring procedures (Albitar et al., 2020). Linked to agency problems, a large board could increase attention to detail in management operations (Pucheta-Martínez & Gallego-Álvarez, 2020). ESG performance measurement can be supported with larger boards, as it has more structured management and reporting that provides data access and sufficient resources.

Based on stakeholder theory and agency theory, companies must adapt to a sustainable long-term view because stakeholders pay attention to the company's ESG factors to understand the company's investment activities and how the company runs its business (Albitar et al., 2020). In addition, disclosing more information on governance pillars can provide confidence and certainty regarding the company's commitment to maintaining its value, especially for shareholders (Setyahuni & Handayani, 2020). Additionally, ESG disclosure can minimize agency problems such as agency cost and information asymmetry, which can enhance shareholders' trust (Alsayegh et al., 2020).

Although a larger board tends to achieve less efficiency in decision-making and a lack of managerial authority control (Husted & de Sousa-Filho, 2019), prior studies have found a significant positive relationship between board size and ESG disclosure (Birindelli et al., 2018). According to Husted and de Sousa-Filho (2019), greater board size generates a richer view of the decision-making process because it requires more negotiation to reach an agreement with a lower likelihood of making significantly divergent decisions. It also provides a variety of competencies and experiences, which positively affect the company's image and reputation (Rossi et al., 2021). Given this, the hypothesis developed as follows:

H4: Board size has a positive influence on ESG performance.

3. RESEARCH METHODOLOGY

3.1. Sample and data

This research uses publicly listed companies in the IDX during the period 2018 to 2022 as the population. The sample within this research was selected purposively with specific criteria, which are:

1) publicly listed companies listed in IDX under 5 years, 2018 to 2022;

2) companies that have ESG scores issued by the Bloomberg database.

This study was conducted with secondary data support retrieved from issued annual and sustainability reports, along with data obtained from the Bloomberg database. 105 out of 825 companies met the criteria and were selected as a sample, resulting in 525 data observations.

3.2. Variable measurement

The dependent variable within this study was ESG performance, measured through Bloomberg's ESG score. It estimates the ESG score by calculating 120 ESG metrics that contain ESG indicators. This study includes four independent variables. Carbon intensity was measured by totaling carbon emission scopes 1 and 2, deflated by total assets (Khalil & Nimmanunta, 2023). Energy consumption was proxied by the total renewable and non-renewable energy usage (Zheng et al., 2022).

The firm's reputation variable is measured through Brahmana et al.' (2022) method to quantify the sample's reputation. The study gave a score of 1 to companies listed under Kompas100, indicating that this company is reputable. On the contrary, it assigned a score of 0 to companies that did not make it to the list. Kompas100 indicates reputation because it reflects companies with significant liquidity and market capitalization. The Kompas100 index has selected 100 stocks annually within the IDX composite by limiting the weight of its

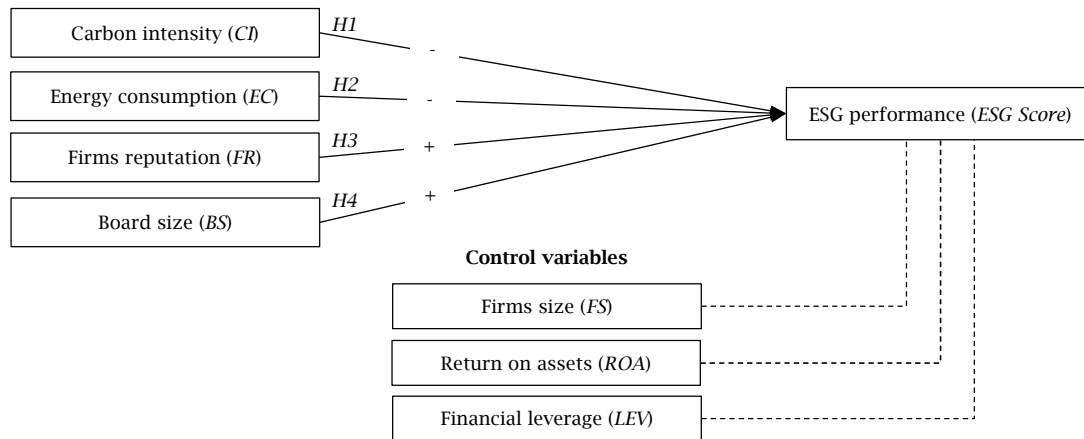
constituents to 9% (IDX, 2025), which was lower than another index within the IDX. Board size is proxied by the number of boards that oversee the company's management and its business activities (Drempetic et al., 2020; Rossi et al., 2021)

This study also deploys three control variables: firm size (*FS*), return on assets (*ROA*), and financial leverage (*LEV*). *FS* is proxied by counting the number of employees within the company (Khalil & Nimmanunta, 2023; Ting, 2021). *ROA* was used to quantify a company's ability to generate profits by allocating its assets, measured by deflating net profit with total assets (Albitar et al., 2023; Hoang, 2022). *LEV* was proxied by total debt deflated by total assets (Hoang, 2022).

3.3. Framework model

To provide a theoretical or conceptual foundation of the research, the framework model illustrates the relationship between variables to ensure clarity and coherence in the analysis and interpretation (see Figure 1).

Figure 1. Model illustration



3.4. Model development

This study tested the hypothesis using a quantitative method and employed ordinary least squares (OLS) regression with EViews statistical software. To ensure that OLS regression is accurate, consistent, and unbiased, the regression model must be devoid of classical assumptions; in other words,

it must be the best linear unbiased estimator (BLUE) model. After deploying a serial set of classical assumptions, the model within this research is normally distributed and free of heteroscedasticity, multicollinearity, and autocorrelation problems. Hence, the empirical model was constructed as follows:

$$ESG\ Score_{it} = \alpha + \beta_1 CI_{it} + \beta_2 EC_{it} + \beta_3 FR_{it} + \beta_4 BS_{it} + \beta_5 FS_{it} + \beta_6 ROA_{it} + \beta_7 LEV_{it} + \varepsilon_{it} \quad (1)$$

3.5. Alternative research method

An alternative method can be conducted by utilizing the structural equation modelling (SEM). SEM is frequently used to analyze both direct and indirect links between the variables, as the technique helps to capture intricate interactions between the variables within the research. SEM offers deeper modelling flexibility for latent characteristics and interconnected pathways than panel regression, thereby making it a common approach in corporate governance and sustainability research.

4. RESEARCH RESULTS

4.1. Descriptive statistics and correlation

Table 1 represents the result of descriptive statistics, which consists of the minimum value, maximum value, mean, and standard deviation of each variable within the model.

Table 1. Descriptive statistics results

Variable	Obs.	Min	Max	Mean	Std. deviation
ESG Score	525	17.946	73.866	41.260	10.658
CI	525	0.0000007597	0.0005516	0.00002728	0.00006834
EC	525	0.378	199714	8332.985	20012.769
BS	525	2	14	5.4914	1.8806
FS	525	42	150705	11548	18883.778
ROA	525	-109.156	55.734	4.605	10.408
LEV	525	1.081	17.710	3.351	2.438

Based on the analysis, Indonesian companies' average overall ESG scores are relatively low, with an average score of 41.26%. The highest ESG pillar score is governance disclosure, with a 72.31% score. The score indicates that governance disclosure performance is relatively higher than other pillars, which cover matters such as management-related information, executive compensation, independence and diversity on the board, voting, shareholder rights, and others. However, the performance of the social and environmental pillars is relatively deficient, with an average ESG pillar score of 28.47% and 22.47%, respectively. Both of these scores reflect the facts that there is a lack of information disclosure related to the social pillar — such as diversity, human rights, and relations with stakeholders; as well as information related to the environmental pillar — such as environmental impacts caused by the business process, such as carbon emissions, pollution, waste management, energy use, and other related information.

The average carbon intensity (CI) is 0.00002728, indicating that Indonesia's average company produces 0.00002728 carbon emissions per total asset. According to the carbon intensity data, sectors that dominate carbon intensity production are infrastructure and industry, basic materials, as well as cyclical and non-cyclical sectors. Since carbon

intensity is the inverse of carbon performance, sectors that produce high carbon intensity reflect lower carbon performance. In contrast, sectors that generate less carbon intensity reflect outstanding carbon performance. Regarding energy consumption (EC), the average of both renewable and non-renewable energy is 8332.985 MWh, which the infrastructure and industry sector, as well as the basic materials sector.

The descriptive statistics table shows that the average board size (BS) in Indonesian companies is 5.492, indicating that at least five board members oversee most companies. Companies with a greater number of board members tend to perceive a greater monitoring function that can affect the quality of information disclosed by the companies. With an average firm size (FS) of 11548 as measured by the number of employees, the average ROA of the sample within this research is 4.60%. Additionally, return on asset ratios considered good have to reach 5% or above. This indicates that companies within this study cannot fully generate profits through assets owned by the companies. However, the financial leverage (LEV) shows an average of 3.35. This number is relatively lower because a higher financial risk is associated with the risk of default.

Table 2. Firm's reputation variable frequency table

Description	Score	Data observation		No. of company	
		Frequency	Percentage	Frequency	Percentage
Company is listed under the Kompas100 index	0	231	44%	77	77.33%
Company that are not listed under the Kompas100 index	1	294	56%	28	26.67%
Total		525	100%	105	100%

Based on the frequency table that describes the corporate reputation variable, 77 companies out of 105 samples (77.33%) have been part of the Kompas100 index during the period 2018 to 2022. Meanwhile, 28 companies or 26.67% of the other samples are not part of the Kompas100 index. These percentages indicate that most of the samples within this research are assumed to be companies with a fairly good reputation because they are part of the Kompas100 index. It shows that most of these companies have undergone several steps of selection conducted by the IDX to be

included within the index, with specific criteria such as significant liquidity and market capitalization compared to other companies.

After conducting the classical assumption test, the dataset shows a normal distribution with no heteroscedasticity and no autocorrelation problem. The Pearson correlation in Table 3 shows that ESG performance (ESG Score) and ROA have the highest correlation, with a coefficient value of 0.333. Moreover, multicollinearity issues are not found, as no correlation values are over 0.70.

Table 3. Correlation matrix

Variable	ESG Score	CI	EC	FR	BS	FS	ROA	LEV
ESG Score	1	-0.104*	-0.109*	0.246**	0.150**	0.124**	0.333**	0.037
CI	-0.104*	1	0.013	-0.031	0.044	-0.036	-0.037	-0.001
EC	-0.109*	0.013	1	-0.089*	0.001	-0.074	0.047	-0.023
FR	0.246**	-0.031	-0.089*	1	0.030	-0.060	0.055	-0.030
BS	0.150**	0.044	0.001	0.030	1	0.040	0.157**	0.109*
FS	0.124**	-0.036	-0.074	-0.060	0.040	1	0.046	0.216**
ROA	0.333**	-0.037	0.047	0.055	0.157**	0.046	1	0.16
LEV	0.037	-0.001	-0.023	-0.030	0.109*	0.216**	0.016	1

Note: * Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

4.2. Regression results

There are three types of approaches in conducting data panel regression, namely the random effect model (REM), the fixed effect model (FEM), and the common effect model (CEM). This research selects the regression model using several test methods, namely the Chow test, the Breusch-Pagan Lagrange multiplier (LM) test, and the Hausman test,

to ensure that the most appropriate model was chosen for testing the hypothesis based on data characteristics. For these tests, the null hypothesis (H_0) represents the statistical analysis's baseline assumption, positing no significant relationship, difference, or effect between examined variables. Rejection of H_0 indicates an alternative explanation, while failure to reject it suggests insufficient evidence to claim an effect.

Table 4. Results of Chow and Breusch-Pagan tests

Panel A: Chow test			
Effect test		Statistics	
Cross-section F		0.3601	
Cross-section Chi-squared		0.0946	
Test results:			
H_0 = CEM; $H1$ = FEM			
The probability value is 0.0946 (> 0.05), meaning that the most appropriate regression model for testing hypotheses is the CEM.			
Panel B: Breusch-Pagan LM test			
Effect test	Cross-section	Time	Both
Breusch-Pagan	0.053084	0.560077	0.613160
Chi-squared	0.8178	0.4542	0.4336
Test results:			
H_0 = CEM; $H1$ = REM			
The probability value is 0.8178 (> 0.05), meaning that the most appropriate regression model for testing the hypothesis is the CEM.			

The results show that the CEM is the most appropriate regression model for this research. This model assumes that there is no difference between the intercept value and the slope value

in the regression results, either on an individual basis or across time. The following are the results of panel data regression using the CEM (see Table 5)

Table 5. Regression results

Variable	Coefficient	Std. error	t-statistic	Significance	Hypothesis results
ESG Score	34.190930	1.470632	23.249130	0.0000	-
CI	-0.126665	0.058605	-2.161327	0.0311	$H1$ accepted
EC	-0.000050	0.000021	-2.369783	0.0182	$H2$ accepted
FR	4.773216	0.850461	5.612507	0.0000	$H3$ accepted
BS	0.540559	0.277170	2.379538	0.0177	$H4$ accepted
FS	0.000061	0.000023	2.686775	0.0074	-
ROA	0.308894	0.040929	7.547075	0.0000	-
LEV	0.012320	0.176935	0.069631	0.9445	-
R-squared					0.202116
Adjusted R-squared					0.191313

The adjusted R-squared value is 0.191313, indicating that 19.13% of the dependent variable ESG performance (*ESG Score*) is explained by the independent variables within this research, namely *CI*, *EC*, *FR*, *BS*, *FS*, *ROA*, and *LEV*. Meanwhile, the remaining 80.87% explained by other variables not examined in this study (the error component).

The carbon intensity (*CI*) variable shows a negative coefficient of -0.126665 and a significant value of 0.0311 (< 0.05), which indicates that $H1$ is accepted. This finding aligns with research conducted by Kusumawati and Murwaningsari (2023) that carbon intensity negatively influences ESG performance. Thus, it provides evidence that increased carbon intensity can decrease ESG performance.

The second independent variable is energy consumption (*EC*), which shows a negative coefficient of -0.000050 and a significant value of 0.0182 (< 0.05), meaning that $H2$ is accepted. This finding aligns with research conducted by Zheng et al. (2022) and Chen et al. (2020), who find that energy consumption negatively impacts ESG performance. On the contrary, this finding is not in line with studies conducted by Sun et al. (2024) and Yang et al. (2022), which argue that energy consumption positively influences ESG performance.

The firm's reputation (*FR*) variable shows a positive coefficient of 4.773216 and a significance

value of 0.0182 (< 0.05), indicating that $H3$ is accepted. These findings align with several previous studies by Maaloul et al. (2023) and Winit et al. (2023), which found that firms' reputations positively influence ESG performance. A reputable image creates pressure that leads to sustainable activities within the firm, which enhances ESG performance through how the company carries out and presents the information (Zhao et al., 2023).

Board size (*BS*) shows a positive coefficient of 0.540559 and a significant value of 0.0177 (< 0.05), meaning that $H4$ is accepted. This result is consistent with research conducted by Rossi et al. (2021). A large board size will be able to provide more oversight to management so that management will make decisions more carefully, which can influence information disclosure and ESG performance produced by the company (Albitar et al., 2020).

5. DISCUSSION

5.1. The effect of environmental determinants on ESG performance

The results suggest that carbon intensity has a significantly negative influence on ESG performance. Enterprises with increasing carbon

production are often perceived as less environmentally responsible due to their more substantial contribution to emissions and climate change. The empirical evidence suggests that the ESG performance, particularly for the environmental pillar, decreases alongside the company's increasing carbon intensity. This is due to the inverse characteristics of carbon intensity and carbon performance (Busch et al., 2022); companies with relatively low carbon intensity, such as those in Indonesia, will possess higher carbon performance.

As each nation prioritizes achieving the NDC by reducing carbon emissions through net-zero initiatives, companies that emit high carbon intensity can enhance the progress. According to this research's statistics, infrastructure, basic materials, and energy sectors dominate as high-emitter companies. Although these sectors tend to achieve better carbon intensity, they also produce a tremendous amount of carbon, generating greater environmental risk. Moreover, these companies tend to achieve lower ESG performance, indicating that they did not provide sufficient information related to ESG concerns that arise from decision-making, especially related to their environmental impacts.

In order to stimulate market prices that can reduce carbon emissions and work as institutional pressure, it is crucial for the government to issue initiatives to lower carbon limits, such as through carbon exchange and carbon unit ownership policies. Companies with decreasing emission activities can trade carbon credits (credit mechanism), and entities with increasing emissions need to buy emission permits from entities with fewer emissions. This regulation also regulates non-trading activities, such as imposing a carbon tax on activities that produce carbon (carbon tax) and payments for reducing emissions (result-based payment).

Similarly, this study also found that energy consumption has a significantly negative effect on ESG performance. Companies that show higher energy consumption have lower ESG performance. Meanwhile, companies with lower energy usage or environmentally friendly companies show greater ESG performance. To support energy efficiency transition, adaptation can be in the form of changes in energy consumption. It is possible through institutional pressure from the government in the form of regulations that enhance renewable energy usage rather than non-renewable energy. Substitution between non-renewable and renewable energy utilization is necessary due to the negative influence of non-renewable energy on short-term economic development.

5.2. The effect of a firm's reputation and board size on ESG performance

According to the findings, our research shows that reputable businesses with high market capitalization and liquidity typically perform better in disclosing ESG information, which is reflected through high ESG performance. Due to emerging reputation risk issues, stakeholders emphasize the accountability of reputable companies regarding disclosed information (Zhang & Wong, 2022). As a result, reputable firms tend to make strategic decisions with more careful consideration. Therefore, they typically exhibit strong ESG performance, reflected

in outstanding ESG scores. Furthermore, as qualified and experienced organizations determine rating agencies' ratings and scores, users consider them as a highly reliable indicator to assess the performance of a firm (Baumgartner et al., 2022; Winit et al., 2023).

This study also found that companies with more significant board sizes tend to have excellent ESG performance, indicating that the company shows better ESG information disclosure. This could be because large board members carry out better responsibilities within the oversight function, which improves the company's strategic decisions and provides an objective perspective that encourages management to boost its transparency. According to the stakeholder theory, it is crucial for the management to consider stakeholder needs in reporting because it can increase the completeness, credibility, as well as transparency of the reports. The presence of a large board size encourages companies to provide better ESG information within the companies' sustainability reporting, improving ESG performance. This is due to the pressure to protect the interests of stakeholders at large. Therefore, this supports the finding that large board size has a significant positive effect on ESG performance (Albitar et al., 2020; Birindelli et al., 2018).

5.3. Theoretical and practical implications

The empirical results of this study provide implications that encouraging companies to improve the quality of their ESG performance, which can be established by incorporating all of the ESG factors into sustainability initiatives and disclosures. In order to improve resilience and competitiveness, this study emphasizes how crucial it is for management to include ESG factors into long-term strategy planning. Firms that manage carbon intensity and energy consumption not only reduce environmental concerns but also strengthen their ESG credibility in the eyes of stakeholders.

While corporate reputation serves as a strategic asset that reinforces credibility and stakeholder trust, the findings within this study also highlight the critical role of board size, whereas broader expertise and oversight can drive stronger ESG performance. Instead of considering reputation management as a byproduct of financial success, companies ought to consider it as an essential component of their sustainability strategy. Policymakers are urged to advance governance frameworks that compel companies to include considerations regarding climate issues and incorporate them into their decision-making processes that influence strategic decisions. This includes incentives for transparent carbon reporting, sustainable energy initiatives, and active board involvement in ESG initiatives.

6. CONCLUSION

This study aims to determine the influence of carbon intensity, energy consumption, firms' reputation, and board size on the ESG performance of publicly listed companies in Indonesia. This study concludes that both carbon intensity and energy consumption can significantly and negatively influence ESG performance. Corporations with greater carbon intensity indicate that they emit

an extensive amount of carbon during their operations and tend to execute less responsible strategic decisions that impact environmental concerns. Companies with greater energy consumption are associated with lower ESG performance. Non-renewable energy could generate higher carbon emissions that threaten the environment. On the other hand, high renewable energy usage may decrease carbon emissions and improve environmental quality, as reflected in greater ESG disclosure.

This research also finds that firm reputation and board size positively influence ESG performance. Reputable companies often disclose better ESG information. This is because shareholders and stakeholders have encouraged firms with a solid reputation to disclose more ESG data, develop deliberate strategic decisions, and implement environmentally responsible activities. Moreover, the company's board impacts management's strategic decision-making and plays a crucial role in oversight, which affects the firm's ESG disclosure. A significant number of boards can imply effective

and efficient management supervisory functions, resulting in higher-quality and more transparent ESG information.

There are some limitations to this study. First, the number of companies that have used the ESG score to measure their sustainability actions is limited. Second, not all companies have disclosed sustainability reports that include carbon emissions and energy consumption data. This is because these two variables are not mandatory to disclose. As a result of these two limitations, insufficient data may not be able to describe the actual condition.

Thus, future research could expand the scope of research with more diverse variables and proxies that may affect ESG performance, such as matters about mandatory carbon disclosure (Jiang & Tang, 2023), green energy usage (Mneimneh et al., 2023), board characteristic such as gender diversity (Bhatia & Marwaha, 2022), as well as greenwashing behaviour (Yu et al., 2020). Therefore, future studies can explain other factors that influence ESG in a broader context and provide better and higher-quality research.

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