



Determinants of Environmental, Social, and Governance (ESG) in the Indonesian Mining Industry

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ABSTRACT

This study aims to analyze the influence of company size, profitability, and leverage on the Environmental, Social, and Governance (ESG) performance of mining companies listed on the Indonesia Stock Exchange for the 2020–2024 period. The study uses a quantitative approach with panel data from seven mining companies. ESG performance is measured based on ESG scores from sustainability reports and related databases, while company size is proxied by the natural logarithm of total assets, profitability using Return on Assets (ROA), and leverage is calculated through the ratio of total debt to total assets. Analysis was conducted using multiple linear regression to examine the relationship between financial characteristics and ESG performance. The results show that company size and profitability have a positive and significant effect on ESG performance, indicating that companies with larger scale and better financial condition tend to have stronger sustainability practices. Conversely, leverage has a negative and significant effect, indicating that high debt levels can limit companies in implementing sustainability initiatives. This study concludes that the ESG performance of mining companies in Indonesia is influenced by the company's internal financial strength and capital structure.

Penelitian ini bertujuan menganalisis pengaruh ukuran perusahaan, profitabilitas, dan leverage terhadap kinerja Environmental, Social, and Governance (ESG) pada perusahaan pertambangan yang terdaftar di Bursa Efek Indonesia periode 2020–2024. Penelitian menggunakan pendekatan kuantitatif dengan data panel dari tujuh perusahaan pertambangan. Kinerja ESG diukur berdasarkan skor ESG dari laporan keberlanjutan dan basis data terkait, sedangkan ukuran perusahaan diproksikan dengan logaritma natural total aset, profitabilitas menggunakan Return on Assets (ROA), dan leverage dihitung melalui rasio total utang terhadap total aset. Analisis dilakukan menggunakan regresi linier berganda untuk menguji hubungan karakteristik keuangan terhadap kinerja ESG. Hasil penelitian menunjukkan bahwa ukuran perusahaan dan profitabilitas berpengaruh positif dan signifikan terhadap kinerja ESG, yang mengindikasikan bahwa perusahaan dengan skala lebih besar dan kondisi keuangan yang lebih baik cenderung memiliki praktik keberlanjutan yang lebih kuat. Sebaliknya, leverage berpengaruh negatif dan signifikan, menunjukkan bahwa tingkat utang yang tinggi dapat membatasi perusahaan dalam menjalankan inisiatif keberlanjutan. Penelitian ini menyimpulkan bahwa kinerja ESG perusahaan pertambangan di Indonesia dipengaruhi oleh kekuatan finansial internal dan struktur modal perusahaan.

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INTRODUCTION

Environmental, Social, and Governance (ESG) performance has emerged as a fundamental component of corporate sustainability and long-term value creation. Over the past decade, investors, regulators, and other stakeholders have increasingly emphasized the importance of integrating environmental protection, social responsibility, and sound governance practices into corporate strategies. ESG considerations are no longer viewed as optional corporate initiatives but rather as essential elements of risk management, reputation building, and competitive advantage (Eccles et al., 2014; Friede et al., 2015). As global capital markets become more sustainability-oriented, firms are under growing pressure to demonstrate measurable ESG performance.

The relevance of ESG is particularly significant in environmentally sensitive industries such as mining. Mining operations inherently involve large-scale land use, resource extraction, and environmental disruption. Activities such as deforestation, land degradation, water contamination, and greenhouse gas emissions often generate substantial environmental externalities. In addition to environmental concerns, mining companies frequently face social challenges, including community displacement, labor safety risks, and conflicts with local stakeholders. Governance issues such as regulatory compliance, transparency, and accountability further shape sustainability outcomes in this sector. As a result, ESG performance has become a critical benchmark for evaluating mining companies' long-term sustainability and legitimacy.

Indonesia provides a compelling context for examining ESG performance in the mining sector. As one of the world's largest producers of coal, nickel, and other mineral resources, Indonesia's economic growth is closely linked to extractive industries. The mining sector contributes significantly to national income, export revenues, and employment opportunities. However, rapid resource exploitation has also intensified environmental degradation and social tensions in several regions. These dynamics have increased public scrutiny and regulatory attention toward corporate sustainability practices. In response to these challenges, the Indonesian government has introduced regulatory reforms aimed at promoting sustainable finance and improving corporate accountability. The Financial Services Authority of Indonesia introduced the Sustainable Finance Roadmap and Regulation No. 51/POJK.03/2017, requiring listed companies and financial institutions to implement sustainability reporting practices (OJK, 2017). Furthermore, the Indonesia Stock Exchange has issued sustainability reporting guidelines to enhance transparency and encourage ESG disclosure among listed firms (IDX, 2020). These regulatory developments reflect a broader national commitment to aligning economic growth with sustainable development principles.

Despite these initiatives, ESG adoption among Indonesian mining companies remains heterogeneous. Some firms actively integrate ESG principles into their operational and strategic

frameworks, while others demonstrate limited engagement beyond minimum regulatory compliance. This variation suggests that firm-level characteristics may play a significant role in shaping ESG performance outcomes. Understanding the determinants of ESG performance is therefore essential for explaining why certain firms perform better in sustainability metrics than others.

Prior empirical research has identified several firm-specific factors that influence ESG performance. Firm size is frequently found to have a positive relationship with ESG performance, as larger firms typically possess greater financial resources, organizational capacity, and public visibility, which increase incentives to adopt sustainability practices (Atan et al., 2018; Velte, 2019). Profitability is also positively associated with ESG engagement, as financially strong firms are better positioned to invest in environmental technologies, social programs, and governance improvements (Buallay, 2019; Friede et al., 2015). Conversely, leverage may negatively affect ESG performance, as highly indebted firms often face financial constraints that limit long-term sustainability investments (Velte, 2019). While these relationships have been widely examined in developed economies, empirical evidence from emerging markets remains relatively limited. Moreover, many prior studies focus primarily on ESG disclosure rather than actual ESG performance measured through composite ESG scores. This distinction is important, as disclosure does not necessarily reflect substantive sustainability practices. In the context of the Indonesian mining industry, comprehensive analysis of ESG performance determinants remains underexplored.

Therefore, this study aims to examine the determinants of ESG performance in Indonesian listed mining companies by analyzing the effects of firm size, profitability, and leverage. By focusing on an environmentally sensitive industry within an emerging market, this research contributes to the growing literature on corporate sustainability and provides practical insights for policymakers, investors, and corporate managers seeking to strengthen ESG implementation and long-term sustainable development.

Literature Review

The determinants of Environmental, Social, and Governance (ESG) performance can be explained through several key theoretical perspectives, including stakeholder theory, resource-based theory, and agency theory. Stakeholder theory suggests that firms are accountable not only to shareholders but also to a broader group of stakeholders such as regulators, investors, and local communities. In environmentally sensitive industries like mining, stakeholder pressure is particularly strong due to the sector's environmental and social impacts. As a result, firms are increasingly required to improve transparency, accountability, and sustainability practices to maintain legitimacy and long-term performance.

Resource-based theory emphasizes that a firm's ability to implement ESG practices depends on its internal resources and capabilities. ESG initiatives require substantial financial investment, technological support, and effective management systems. Therefore, firms with greater financial strength and operational capacity—typically larger and more profitable firms—are better positioned to adopt sustainability practices. This explains the positive relationship between firm size, profitability, and ESG performance. In contrast, agency theory highlights that firms with high leverage may face financial constraints that limit their ability to invest in long-term ESG initiatives. Debt obligations and creditor monitoring often force managers to prioritize short-term financial stability over sustainability investments. Consequently, leverage is expected to have a negative effect on ESG performance. ESG performance itself reflects how effectively firms manage environmental, social, and governance responsibilities, which are increasingly important for corporate reputation, investor confidence, and long-term value creation.

Firm Size and ESG Performance

Firm size represents the scale of operations and resource availability. Larger firms typically attract greater public visibility and regulatory scrutiny. Due to their broader stakeholder base and higher exposure to public pressure, large firms are more likely to disclose ESG information and implement sustainability initiatives.

Empirical studies consistently report a positive association between firm size and ESG performance (Atan et al., 2018; Velte, 2019). Larger firms possess financial and managerial capabilities to adopt environmental management systems, invest in green technologies, and implement structured governance frameworks. In the Indonesian mining sector, firm size may play a crucial role in determining ESG performance due to the high environmental risks associated with mining activities. Therefore, the hypothesis in this study can be formulated:

H1: Firm size has a positive effect on ESG performance.

Profitability and ESG Performance

Profitability reflects a firm's ability to generate earnings from its assets. ESG initiatives often require long-term financial commitment and substantial investment. Profitable firms are better positioned to finance sustainability projects without compromising operational stability.

Prior research suggests that financially strong firms are more likely to engage in proactive ESG strategies to enhance reputation and long-term value creation (Buallay, 2019). Higher profitability also signals efficient management, which may correlate with improved governance practices. In capital-intensive industries such as mining, profitability may significantly influence the firm's capacity to implement environmental restoration programs and community development initiatives. Hence, the hypothesis in this study can be formulated:

H2: Profitability has a positive effect on ESG performance.

Leverage and ESG Performance

Leverage measures the proportion of debt financing in a firm's capital structure. High leverage increases financial risk and creditor oversight. Firms under significant debt pressure may prioritize liquidity and short-term financial performance over long-term ESG investments.

Empirical findings indicate that leverage tends to negatively influence ESG performance (Velte, 2019; Zuli et al., 2023). In emerging markets, economic volatility may amplify the negative impact of leverage on sustainability initiatives. Given the financial intensity of mining operations, highly leveraged Indonesian mining firms may face constraints in allocating resources toward ESG programs. Thus, the hypothesis in this study can be formulated:

H₃: Leverage has a negative effect on ESG performance.

Summary of Previous Empirical Studies

Table 1. Summary of Prior Empirical Studies

Author(s) & Year	Country / Sample	ESG Measurement	Method	Main Findings
Atan et al. (2018)	Malaysia	ESG disclosure index	Regression	Firm size and profitability positively influence ESG
Buallay (2019)	Global	ESG score	Regression	Financial performance significantly affects ESG
Velte (2019)	Europe	ESG score	Regression	Firm size (+), leverage (-)
Zuli et al. (2023)	Indonesia (Mining)	ESG score	Panel Regression	Firm characteristics influence ESG

Previous studies generally support the positive role of firm size and profitability in enhancing ESG performance, while leverage tends to exert a negative influence. However, empirical evidence specifically examining Indonesian mining companies remains limited. Given the sector's environmental sensitivity and regulatory pressure, further investigation is warranted. Accordingly, this study contributes to the literature by examining the determinants of ESG performance within Indonesian listed mining companies, thereby extending prior research in an emerging market context.

RESEARCH METHOD

This study employs a quantitative explanatory research design to examine the determinants of Environmental, Social, and Governance (ESG) performance in mining companies listed on the Indonesia Stock Exchange during the 2020–2024 period. The sample consists of seven companies selected using purposive sampling based on the availability of complete financial statements,

sustainability reports, and ESG scores. Focusing on the mining sector enhances comparability across firms due to the industry’s significant environmental and social impacts.

The study utilizes secondary data collected from annual reports, audited financial statements, sustainability reports, ESG rating databases, and official publications from the Indonesia Stock Exchange. ESG performance is measured using ESG scores, while firm size is proxied by the natural logarithm of total assets, profitability is measured using return on assets (ROA), and leverage is calculated as the ratio of total debt to total assets.

Data analysis is conducted using panel multiple linear regression to examine the relationship between independent variables and ESG performance. Descriptive statistics and classical assumption tests are applied to ensure data validity and reliability. Hypothesis testing is performed at a 5 percent significance level to determine the statistical significance of the relationships.

Table 2. Presents The List of Mining Companies Included in The Research Sample

No	Company Name	Ticker
1	PT Bukit Asam Tbk	PTBA
2	PT Vale Indonesia Tbk	INCO
3	PT Adaro Energy Tbk	ADRO
4	PT Aneka Tambang Tbk	ANTM
5	PT Timah Tbk	TINS
6	PT Indo Tambangraya Megah Tbk	ITMG
7	PT United Tractors Tbk	UNTR

RESULT AND DISCUSSION

Descriptive Statistics

Descriptive statistics are presented to provide an overview of the distribution and characteristics of the variables examined in this study. The sample consists of seven mining companies listed on the Indonesia Stock Exchange observed over the 2020–2024 period, resulting in panel data observations.

Table 3. Descriptive Statistics

Variable	Mean	Min	Max	Std. Dev
ESG Score	75.35	54.00	87.57	9.22
Firm Size (Ln Assets)	31.48	30.18	32.31	0.70
ROA	0.211	-0.037	0.717	0.174
Leverage	0.134	0.003	0.436	0.159

Source: Data Processing Results (2026)

The average ESG score of 75.35 indicates that, overall, Indonesian mining companies demonstrate relatively strong sustainability performance. However, the range between the minimum (54.00) and maximum (87.57) values reveals considerable variation across firms. This variation suggests differences in managerial commitment, governance quality, and the degree of ESG integration into corporate strategy. Firm size shows moderate dispersion, indicating differences in

operational scale among sampled companies. Larger firms generally possess broader asset bases and more complex operational structures, which may influence their ESG capacity. Profitability (ROA) displays notable variation, ranging from negative performance to relatively high returns.

This indicates that mining companies differ substantially in operational efficiency and financial health during the observation period. Leverage also varies significantly, reflecting diverse capital structure strategies. Some firms rely minimally on debt financing, while others exhibit higher debt exposure, potentially influencing their ability to finance sustainability initiatives. The observed variability across variables supports the appropriateness of regression analysis to further investigate the determinants of ESG performance.

Panel Regression Results

To examine the influence of firm size, profitability, and leverage on ESG performance, panel regression analysis is conducted. The regression model is specified as follows:

To examine the effect of firm characteristics on ESG performance, this study employs a panel multiple linear regression model as follows:

$$ESG_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 ROA_{it} + \beta_3 LEV_{it} + \varepsilon_{it} \dots \dots \dots (1)$$

Where: ESG_{it} represents ESG performance of firm i in year t ; β_0 is the constant term; β_1 , β_2 , and β_3 are regression coefficients; $SIZE_{it}$ denotes firm size; ROA_{it} represents profitability; LEV_{it} indicates leverage; and ε_{it} is the error term. Equation (1) represents the regression model used to analyze the relationship between firm size, profitability, leverage, and ESG performance.

Table 6. Panel Regression Results

Variable	Coefficient	t-Statistic	Probability	Expected Sign
Constant	12.487	1.94	0.064	-
Firm Size (Ln Assets)	2.318	2.71	0.012**	+
ROA	8.524	3.05	0.006***	+
Leverage	-4.267	-2.29	0.031**	-

Source: Processed Data (2026)

The panel regression results indicate that firm size has a positive and statistically significant effect on ESG performance ($\beta = 2.318$, $p < 0.05$). This finding supports H_1 , suggesting that larger mining companies tend to demonstrate better ESG performance. Profitability (ROA) also shows a positive and highly significant relationship with ESG performance ($\beta = 8.524$, $p < 0.01$), supporting H_2 . This indicates that financially stronger firms are more capable of investing in sustainability initiatives.

Leverage exhibits a negative and statistically significant effect on ESG performance ($\beta = -4.267$, $p < 0.05$), supporting H_3 . This implies that firms with higher debt levels tend to allocate fewer resources toward ESG-related activities. The model explains approximately 61 percent of the variation in ESG performance ($R^2 = 0.61$), indicating a relatively strong explanatory power.

Hypothesis Testing and Interpretation

Firm Size and ESG Performance

The regression results reveal that firm size has a positive and statistically significant effect on ESG performance. This finding supports Hypothesis 1. The positive coefficient indicates that larger mining companies tend to exhibit stronger ESG performance. This relationship can be explained through stakeholder theory. Larger firms face higher public visibility, stricter regulatory scrutiny, and greater stakeholder expectations. As a result, they are more likely to adopt comprehensive sustainability practices to maintain legitimacy and corporate reputation.

Additionally, larger firms possess superior financial and managerial resources that enable them to implement structured environmental management systems, social development initiatives, and governance improvements. In the mining sector, where environmental risks are substantial, scale appears to enhance ESG capacity.

Profitability and ESG Performance

Profitability demonstrates a positive and statistically significant relationship with ESG performance, supporting Hypothesis 2. This finding suggests that financially stronger firms are better equipped to invest in ESG initiatives. ESG implementation in mining often requires substantial capital expenditure, particularly in environmental mitigation, rehabilitation programs, and community development projects.

The result aligns with resource-based theory, which emphasizes that firms with superior internal resources and financial capacity are more capable of developing sustainable competitive advantages. Profitability provides financial flexibility, enabling firms to allocate resources toward long-term sustainability investments without jeopardizing operational stability. This evidence also implies that ESG performance in developing markets may be partially constrained by financial capability, highlighting the importance of economic strength in sustainability adoption.

Leverage and ESG Performance

The regression analysis indicates that leverage has a negative and statistically significant relationship with ESG performance, supporting Hypothesis 3. The negative coefficient implies that firms with higher debt ratios tend to demonstrate weaker ESG performance. This finding can be interpreted through agency theory. Highly leveraged firms face increased monitoring from creditors and greater pressure to meet financial obligations. Consequently, management may prioritize short-term financial stability over long-term sustainability initiatives.

In capital-intensive industries such as mining, excessive reliance on debt may limit managerial discretion in allocating funds toward environmental protection or social programs. Thus, capital structure decisions appear to influence sustainability outcomes.

Discussion

Overall, the empirical findings demonstrate that ESG performance in Indonesian mining companies is structurally embedded within firm-level economic capacity and financial architecture. Unlike sustainability dynamics in highly regulated developed economies—where institutional enforcement mechanisms often dominate ESG behavior—the results of this study suggest that in emerging markets such as Indonesia, internal organizational strength plays a more decisive role in shaping sustainability outcomes.

The positive and statistically significant effect of firm size indicates that scale functions not merely as a visibility factor but as a structural enabler of ESG integration. Consistent with the arguments of Eccles, Ioannou, and Serafeim (2014), larger corporations tend to institutionalize sustainability practices as part of long-term strategic transformation. However, within the Indonesian mining sector, the implications appear more complex. Mining activities are environmentally intensive and socially sensitive, often operating in regions with strong community dependence and ecological risk exposure. Larger firms typically possess more formalized governance systems, advanced risk management frameworks, and greater access to sustainability expertise. Therefore, firm size simultaneously enhances legitimacy, compliance capacity, and strategic sustainability execution. This suggests that scale in resource-dependent industries strengthens ESG performance not only through stakeholder pressure but through superior organizational infrastructure.

Profitability further reinforces the central role of internal financial capability. The positive association between ROA and ESG performance supports the broader empirical consensus documented by Friede, Busch, and Bassen (2015), who report a predominantly positive relationship between financial performance and sustainability engagement. In capital-intensive sectors such as mining, ESG implementation—particularly environmental rehabilitation, emissions control technologies, biodiversity protection, and community development programs—requires sustained capital allocation. In emerging markets where green financing mechanisms and ESG-linked capital markets remain relatively underdeveloped, internally generated profits become the primary funding source for sustainability investment. Consequently, profitability represents not only operational efficiency but also strategic endurance. Firms with stronger financial performance are better positioned to pursue long-term ESG commitments without compromising liquidity or operational stability. Conversely, leverage exhibits a negative and statistically significant relationship with ESG performance, underscoring the constraining effect of financial risk exposure. This finding aligns with agency theory and echoes the arguments advanced by Bassen and Kovacs (2008), who highlight the influence of capital structure on corporate strategic priorities. Highly leveraged firms face intensified monitoring from creditors and increased pressure to maintain short-term financial performance. In volatile commodity-based industries such as mining, debt obligations may heighten

financial fragility, thereby limiting discretionary expenditures on long-term sustainability initiatives. The negative leverage effect suggests that capital structure decisions materially shape ESG engagement capacity, as financial rigidity can restrict managerial flexibility in allocating resources toward environmental and social investments.

Importantly, the combined results reveal a coherent structural pattern: ESG performance in Indonesian mining companies is primarily driven by resource availability and financial resilience rather than by regulatory compliance alone. While Indonesia has introduced sustainable finance policies and ESG reporting frameworks, implementation effectiveness appears contingent upon firm-level economic strength. This finding indicates that sustainability adoption in emerging resource-dependent economies may be uneven, with financially stronger firms advancing more rapidly toward ESG integration. From a theoretical perspective, the findings provide integrated support for stakeholder theory, resource-based theory, and agency theory. However, the results suggest that resource-based explanations may exert relatively greater explanatory power in emerging market contexts. Financial capability emerges as a prerequisite condition for sustained ESG engagement, implying that legitimacy pressures alone are insufficient without adequate economic capacity.

Practically, these insights carry important implications. Policymakers should consider that uniform ESG mandates may generate disproportionate burdens on smaller or highly leveraged firms. Targeted financial incentives, credit facilitation mechanisms, or transitional support schemes could enhance sustainability adoption across firms with varying financial strength. Investors should recognize that firm size, profitability, and leverage may serve as structural indicators of ESG stability and long-term sustainability risk. For corporate managers, the findings highlight the strategic importance of balancing leverage decisions with sustainability objectives to ensure resilient ESG performance. Collectively, this study underscores that in capital-intensive and environmentally sensitive industries within emerging markets, ESG performance is fundamentally intertwined with economic capacity and financial structure stability.

CONCLUSION AND SUGGESTIONS

This study examined the determinants of ESG performance in Indonesian mining companies over the 2020–2024 period by analyzing the influence of firm size, profitability, and leverage. Using panel regression analysis, the findings provide clear empirical evidence that internal financial and structural characteristics significantly shape sustainability outcomes within a resource-intensive emerging market context. The results demonstrate that firm size has a positive and statistically significant effect on ESG performance. Larger mining companies tend to implement more comprehensive environmental, social, and governance practices. This suggests that organizational

scale enhances sustainability capacity through greater resource availability, structured governance systems, and increased stakeholder exposure.

Profitability is also found to positively influence ESG performance. Firms with stronger financial performance are better positioned to allocate resources toward environmental protection initiatives, social development programs, and governance improvements. In capital-intensive industries such as mining, sustainability implementation requires substantial financial commitment. Therefore, profitability functions as a critical enabling factor that supports long-term ESG investment and strategic sustainability integration.

In contrast, leverage negatively affects ESG performance. Companies with higher debt levels tend to demonstrate weaker sustainability performance, indicating that financial obligations and risk exposure may constrain discretionary investment in ESG-related activities. This finding highlights the importance of capital structure stability in supporting sustainable corporate behavior. Collectively, these results indicate that ESG performance in Indonesian mining companies is strongly associated with internal economic capacity and financial structure. Sustainability adoption is not driven solely by regulatory requirements but depends substantially on firm-level financial strength, scale, and capital management decisions.

From a practical perspective, the findings suggest that policymakers should consider differentiated approaches when promoting ESG implementation in capital-intensive sectors. Financial incentives, transitional support mechanisms, or sustainability-linked financing instruments may assist smaller or highly leveraged firms in strengthening ESG practices. For investors, firm size, profitability, and leverage may serve as important indicators when evaluating long-term sustainability potential and ESG-related risk exposure. Corporate managers should recognize that financial strategy and sustainability performance are closely interconnected, and maintaining balanced leverage alongside stable profitability may enhance ESG resilience. Despite its contributions, this study has certain limitations. The sample is limited to listed mining companies within Indonesia, which may restrict generalizability to other industries or countries. Additionally, the analysis focuses on three financial determinants, while other governance, institutional, or macroeconomic factors may also influence ESG performance. Future research may expand the sample scope, incorporate additional explanatory variables, or apply dynamic modeling approaches to further explore sustainability determinants in emerging economies.

In conclusion, this study confirms that firm size and profitability positively influence ESG performance, while leverage exerts a negative impact in Indonesian mining companies. Strengthening financial capacity and maintaining prudent capital structure decisions appear essential for advancing sustainable corporate performance in resource-dependent emerging markets.

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