

Regulatory Pressure as a Moderator of the Effects of Environmental Performance, Environmental Costs, and Company Size on Financial Performance

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ABSTRACT

This study examines the effects of environmental performance, environmental expenditure, and firm size on the financial performance of mining companies listed on the Indonesia Stock Exchange between 2021 and 2023. It further considers the moderating role of regulatory pressure. Using purposive sampling, 32 companies were selected, yielding 96 firm-year observations. The proposed relationships were tested using moderated regression analysis. The findings indicate that environmental performance, environmental expenditure, and firm size are positively associated with financial performance. In addition, ISO 14001 certification, employed as a proxy for regulatory pressure, strengthens the positive associations between environmental performance and financial performance and between firm size and financial performance. However, regulatory pressure does not significantly moderate the relationship between environmental expenditure and financial performance. Overall, the findings suggest that compliance with recognised environmental standards may generate strategic and financial benefits, whereas environmental expenditure appears to remain primarily compliance-driven.

Keywords: Financial Performance; Environmental Performance; Environmental Costs; Regulatory Pressure; Company Size

Tekanan Regulasi sebagai Moderasi Kinerja Lingkungan, Biaya Lingkungan, dan Ukuran Perusahaan terhadap Kinerja Keuangan

ABSTRAK

Penelitian ini mengeksplorasi dampak kinerja lingkungan, pengeluaran lingkungan, dan ukuran perusahaan terhadap kinerja keuangan perusahaan pertambangan yang terdaftar di Bursa Efek Indonesia dari tahun 2021 hingga 2023, dengan tekanan regulasi dimasukkan sebagai faktor moderasi. Menggunakan pengambilan sampel bertujuan, penelitian ini memilih 32 perusahaan, menghasilkan 96 observasi perusahaan-tahun. Hubungan yang diusulkan diuji menggunakan Analisis Regresi Moderasi (MRA). Hasil empiris menunjukkan bahwa kinerja lingkungan, pengeluaran lingkungan, dan ukuran perusahaan secara signifikan meningkatkan kinerja keuangan. Selain itu, sertifikasi ISO 14001, yang digunakan sebagai indikator tekanan regulasi, memperkuat hubungan positif antara kinerja lingkungan, ukuran perusahaan, dan kinerja keuangan. Namun demikian, tekanan regulasi tidak secara signifikan memengaruhi hubungan antara pengeluaran lingkungan dan kinerja keuangan. Secara keseluruhan, temuan tersebut menyiratkan bahwa kepatuhan terhadap standar lingkungan dapat menghasilkan nilai strategis, sementara pengeluaran lingkungan sebagian besar tetap berorientasi pada kepatuhan.

Kata Kunci Kinerja Keuangan; Kinerja Lingkungan; Biaya Lingkungan; Tekanan Regulasi; Ukuran Perusahaan

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INTRODUCTION

The mining industry is a significant component of the Indonesian economy, contributing substantially to national economic development while generating considerable environmental and social consequences (PwC Indonesia, 2023). According to the PwC Indonesia Energy, Utilities & Mining Survey (2023), the sector's contribution to gross domestic product increased from 6.3% in 2021 to 9.2% in 2022, driven largely by higher global commodity prices and increased coal and nickel exports. This growth underscores the strategic role of the mining industry in supporting Indonesia's economic resilience during the post-pandemic recovery period (World Bank, 2023). However, the extractive nature of mining operations exposes firms to increasingly stringent environmental regulation and heightened stakeholder expectations concerning environmental and social accountability.

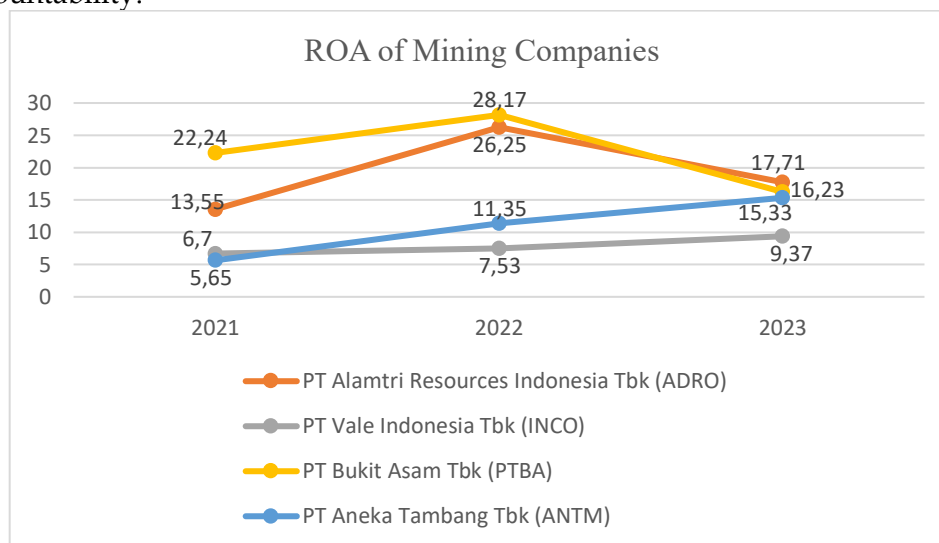


Figure 1. Company ROA Graph

Source: Annual Report

Despite favourable macroeconomic conditions, the annual reports of several major mining companies indicate a decline in profitability in 2023. For example, PT Alamtri Resources Indonesia Tbk reported a decrease in return on assets from 26.25% in 2022 to 17.71% in 2023, while PT Bukit Asam Tbk experienced a decline from 28.17% to 16.23%. These reductions were largely attributable to falling coal and nickel prices arising from the global economic slowdown and weaker post-pandemic energy demand (World Bank, 2023). Such pressures were not confined to individual companies but reflected broader challenges confronting mining firms listed on the Indonesia Stock Exchange (Putri & Aris, 2024).

Alongside commodity-price volatility, mining companies are subject to increasingly stringent environmental standards. For instance, PT Vale Indonesia allocated more than USD 20 million to environmental programmes in 2022 to meet regulatory requirements and sustainability commitments (Sustainability Report, 2022). Mining firms must therefore balance their environmental obligations against the need to maintain financial performance, particularly during periods of declining commodity prices (Fitriaty *et al.*, 2021). In this context, firm size may be

particularly important, as larger firms generally possess greater financial and operational capacity to absorb environmental expenditure through economies of scale and superior access to resources (Ananda & Hendrawaty, 2025). Environmental initiatives, including participation in PROPER and the adoption of ISO 14001 certification, may increase operating costs. However, non-compliance may expose firms to regulatory sanctions, reputational damage, and declining investor confidence (Fitriaty *et al.*, 2021). Accordingly, examining the effects of environmental performance, environmental expenditure, and firm size on financial performance, together with the moderating role of regulatory pressure, remains an important area of inquiry (Destiana & Simorangkir, 2024).

The relationships among these variables can be explained through legitimacy theory, stakeholder theory, and signalling theory. Legitimacy theory suggests that firms seek to align their activities with prevailing societal values and expectations to secure social acceptance and sustain their long-term operations (Gunawan & Dyiah Ayu, 2023). Firms with strong environmental performance may face lower litigation risk, fewer regulatory sanctions, and reduced environmental remediation costs, thereby protecting profitability. Effective environmental management may also promote more efficient use of energy, water, and raw materials while reducing operational disruptions arising from regulatory non-compliance or disputes with local communities. Consequently, higher PROPER ratings may improve financial performance by increasing resource efficiency and reducing operating risk, which may ultimately be reflected in higher return on assets (ROA).

Stakeholder theory further proposes that organisational success depends on a firm's ability to address the expectations of key stakeholders, including governments, investors, and local communities, through regulatory compliance and transparent sustainability reporting (Alifaliyudin & Purbasari, 2024). In Indonesia, PROPER serves as an official environmental performance assessment administered by the Ministry of Environment and Forestry and may therefore provide investors with a credible basis for evaluating firms' environmental risk. Superior environmental performance may consequently enhance investment attractiveness and contribute to stronger long-term financial performance.

From a signalling perspective, firms disclose non-financial information, including environmental performance and sustainability initiatives, to reduce information asymmetry and convey favourable information about their future prospects (Handojo *et al.*, 2021). In the Indonesian mining sector, a high PROPER rating may signal a firm's capacity to manage environmental risks and maintain the continuity of its operations. Such signals may strengthen stakeholder confidence and reduce reputational risks that could otherwise adversely affect financial performance (Suandewi & Sukartha, 2025).

Prior empirical research, however, reports mixed evidence concerning the relationships between environmental performance, environmental expenditure, firm size, and financial performance. Setiadi (2021) finds that environmental performance, measured using PROPER ratings, positively affects financial performance because firms that comply with environmental standards tend to experience lower operating risk and stronger stakeholder confidence. Similarly, Ou and Jiang (2023) report that environmental performance and environmental

expenditure contribute positively to financial outcomes by improving energy efficiency, reducing waste, strengthening corporate reputation, and mitigating environmental risk.

Environmental expenditure may nevertheless impose additional operating costs that reduce short-term profitability. Consistent with this argument, Putri and Aris (2024) document a negative association between environmental expenditure and financial performance. Ananda and Hendrawaty (2025) similarly find that environmental performance and environmental expenditure adversely affect financial performance. Within the mining industry, however, environmental expenditure may generate longer-term economic benefits because of the sector's substantial exposure to environmental risk. Expenditure on land reclamation, waste treatment, pollution mitigation, and regulatory compliance may therefore be viewed not merely as a compliance cost, but also as a strategic investment intended to preserve organisational legitimacy, minimise regulatory sanctions, maintain operating licences, and strengthen investor confidence. By contrast, firm size has generally been associated positively with financial performance, as larger firms possess greater resources and organisational capacity to manage environmental risks and comply with regulatory requirements.

The mixed findings reported in prior research reveal an important gap concerning the moderating role of regulatory pressure in the relationships between environmental performance, environmental expenditure, firm size, and financial performance. Although previous studies, including Setiadi (2021), Putri and Aris (2024), and Ananda & Hendrawaty (2025), have predominantly examined the direct effects of these factors, limited attention has been given to whether regulatory pressure conditions these relationships.

In this study, ISO 14001 certification is employed as a proxy for regulatory pressure. Although ISO 14001 is formally classified as a voluntary environmental management standard rather than a mandatory regulatory requirement, its adoption may reflect a firm's responsiveness to regulatory expectations. Certification requires firms to identify and comply with applicable environmental legislation, establish formal environmental management procedures, and undertake continuous evaluation of their environmental performance. Firms holding ISO 14001 certification may therefore demonstrate a stronger commitment to regulatory compliance, government oversight, and stakeholder expectations than non-certified firms.

ISO 14001 certification also provides a standardised and comparable measure across firms because it indicates the existence of a formally documented and independently audited environmental management system. This is particularly important because alternative measures of regulatory pressure are often unavailable or inconsistently disclosed in corporate reports. Accordingly, this study employs moderated regression analysis to examine whether ISO 14001 certification strengthens or weakens the relationships between environmental performance, environmental expenditure, firm size, and return on assets (ROA) among Indonesian mining companies.

The mining industry provides an appropriate setting for this investigation because of its substantial environmental impacts, intensive government oversight, and significant contribution to the Indonesian economy. The 2021–2023

observation period further captures the post-pandemic recovery phase, during which corporate sustainability practices received heightened attention from regulators, investors, and wider society.

Stakeholder theory proposes that firms are accountable not only to shareholders but also to groups affected by their operations, including governments, employees, local communities, and the natural environment (Awa et al., 2024). In the context of environmental management, fulfilling these broader responsibilities and adopting effective environmental standards may enhance stakeholder trust, strengthen corporate reputation, and support sustainable financial performance (Yousefian et al., 2024). Environmental compliance and sustainability disclosure should therefore be viewed not merely as legal obligations, but also as strategic managerial practices through which firms address stakeholder interests and support long-term business sustainability (Darmawati et al., 2025).

Legitimacy theory similarly suggests that organisations operate within a social framework shaped by prevailing values, norms, and expectations and must align their activities with these standards to maintain legitimacy (Chairunnisa et al., 2025). Firms that engage actively in sustainability initiatives and maintain effective environmental governance are more likely to secure social acceptance, strengthen their corporate image, and obtain stakeholder support (Lestari & Sinta, 2024). Conversely, failure to comply with environmental regulations or societal expectations may undermine organisational legitimacy, damage corporate reputation, and adversely affect financial performance (Handayani et al., 2024). These considerations are particularly important in the mining industry, where operations generate substantial environmental consequences and continued business activity often depends on regulatory approval and community acceptance (Putriningtyas et al., 2024). ISO 14001 certification and environmental disclosure may therefore represent concrete mechanisms through which mining firms demonstrate transparent and effective environmental management and preserve organisational legitimacy (Soleman et al., 2023).

Signalling theory provides a further explanation for the financial consequences of environmental management. Firms disclose financial and non-financial information, including environmental performance and sustainability initiatives, to reduce information asymmetry between management and investors and to convey information about their future prospects (Nilawati & Arizah, 2025). Within the mining industry, strong environmental performance and adherence to recognised environmental standards may signal effective risk management and a capacity to sustain operations over the longer term. Such signals may strengthen investor confidence, reduce perceived risk, and contribute to improved financial performance (Suandewi & Sukartha, 2025).

Taken together, legitimacy theory, stakeholder theory, and signalling theory suggest that the financial performance of mining companies is determined not only by internal economic characteristics but also by environmental management practices and external institutional pressures. The mixed evidence in prior research further indicates that these relationships may be context-dependent and vary according to the strength of regulatory pressure. Accordingly, this study incorporates ISO 14001 certification as a moderating variable to examine whether

regulatory pressure conditions the relationships between environmental performance, environmental expenditure, firm size, and ROA, as presented in the proposed research framework.

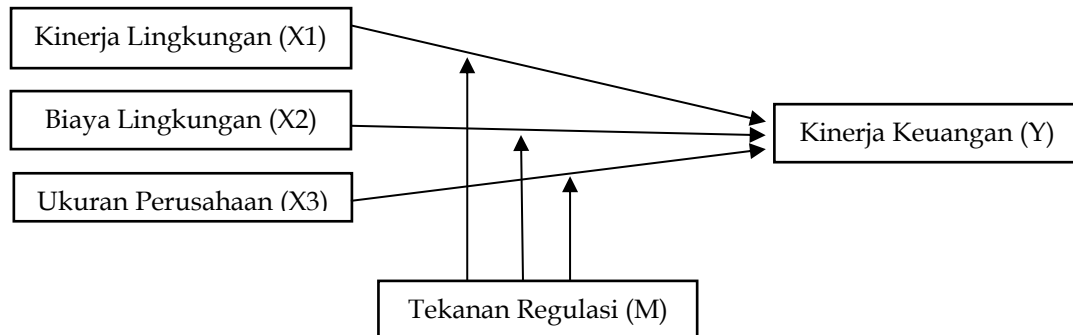


Figure 2. Research Model

Source: Research Data, 2022

Environmental performance reflects a firm's effectiveness in responsibly managing and minimising the environmental consequences of its operations. In the mining industry, it represents an important indicator of organisational legitimacy and stakeholder confidence (Siregar et al., 2022). Firms with favourable PROPER ratings demonstrate not only compliance with environmental regulations but also a commitment to sustainable business practices (Setiadi, 2021). From the perspectives of legitimacy and signalling theories, superior environmental performance conveys positive information to investors and wider society regarding a firm's capacity to manage environmental risks. This capacity may reduce operational uncertainty, strengthen corporate reputation, and enhance investment attractiveness (Suandewi & Sukartha, 2025). These benefits may, in turn, support more efficient asset utilisation and improve profitability (Ogunode, 2022). Consistent with this reasoning, Setiadi (2021) reports that environmental performance improves financial outcomes by reducing operating risk, while Ou and Jiang (2023) find that stronger environmental performance enhances financial efficiency and stability. Ahmad et al. (2024) and Vitale & Cupertino (2023) provide further evidence that effective environmental management contributes positively to financial performance. Accordingly, the following hypothesis is proposed:

H₁: Environmental performance has a positive effect on financial performance.

Environmental costs comprise expenditures incurred to prevent, control, and remediate the environmental impacts arising from a firm's activities (Destiana & Simorangkir, 2024). From stakeholder and signalling perspectives, these expenditures should not be regarded merely as operating burdens, but also as strategic investments through which firms maintain their relationships with regulators, investors, local communities, and wider society (Fitriaty et al., 2021). Effective management of environmental expenditure may reduce regulatory sanctions, minimise social conflict, limit unexpected future liabilities, and improve both operational efficiency and corporate reputation (Ou & Jiang, 2023). Although such expenditure may reduce profitability in the short term, it may generate longer-term financial benefits by strengthening stakeholder confidence and supporting the continuity of business operations (Awa et al., 2024). Consistent with this argument, Ou and Jiang (2023) and Darmawati et al. (2025) provide

empirical evidence that environmental expenditure contributes positively to financial performance through improvements in productivity, resource utilisation, and energy efficiency. Accordingly, the following hypothesis is proposed:

H₂: Environmental costs have a positive effect on financial performance.

Firm size reflects the scale of a firm's operations, the resources available to it, and its financial capacity to undertake business activities and respond to environmental challenges (Cintra et al., 2023). In the mining industry, which is characterised by high capital intensity and substantial operational risk, larger firms may benefit from economies of scale that enable them to use assets and production facilities more efficiently. They may also have broader access to external finance at relatively lower cost because investors and creditors often perceive them as more stable and less risky (Ananda & Hendrawaty, 2025). Their greater resource capacity further enables investment in advanced technology, environmental management systems, and operational innovation, thereby supporting productivity and facilitating compliance with environmental requirements. From a stakeholder perspective, firms with sufficient resources to address stakeholder expectations may strengthen their legitimacy, reduce business risk, and improve their competitive position. Firm size therefore reflects not only the magnitude of corporate assets but also the organisational capacity to achieve operational efficiency and sustain competitive advantage. Consistent with this reasoning, Ananda and Hendrawaty (2025) and Ontorael et al. (2024) find that larger firms generally achieve stronger financial performance because of their superior access to resources and greater capacity to manage those resources effectively. Accordingly, the following hypothesis is proposed:

H₃: Firm size has a positive effect on financial performance.

Environmental regulation requires firms to continually improve their environmental management practices to maintain legitimacy and reduce exposure to regulatory sanctions (Ou & Jiang, 2023). Regulatory pressure may also encourage firms to adopt innovative environmental strategies that improve operational efficiency and financial outcomes (Maulita, 2022). Under more stringent regulatory conditions, environmental performance becomes a strategic concern, prompting firms to integrate environmental considerations into their core activities rather than treat them merely as compliance obligations. From a legitimacy perspective, stronger regulatory pressure may increase the alignment between corporate activities and societal expectations, thereby enhancing the financial benefits associated with superior environmental performance (Ou & Jiang, 2023). Stakeholder theory similarly suggests that firms demonstrating compliance with environmental requirements are more likely to secure support from regulators, investors, and other stakeholders, which may contribute to stronger financial performance (Fitriaty et al., 2021). Consistent with these arguments, L. Chen (2023) finds that environmental regulation encourages the adoption of green financial management practices, thereby improving financial performance. X. Chen et al. (2024) further report that regulatory requirements stimulate green investment and greater transparency in pollution disclosure, resulting in improved environmental and economic outcomes. Accordingly, stronger regulatory pressure is expected to reinforce the positive relationship between environmental performance and financial performance.

H₄: Regulatory pressure strengthens the positive relationship between environmental performance and financial performance.

Increasingly stringent environmental requirements may transform environmental expenditure from an unavoidable compliance cost into a strategic investment capable of generating longer-term benefits (Destiana & Simorangkir, 2024). Under stronger regulatory pressure, firms may be encouraged to allocate and manage environmental expenditure more efficiently and strategically (S. Chen et al., 2023). Investment in environmental protection may reduce exposure to future sanctions, strengthen corporate reputation, and support the development of environmentally responsible technologies and pollution-control systems. These benefits may, in turn, contribute positively to profitability and return on assets (Ou & Jiang, 2023). Legitimacy theory suggests that environmental expenditure represents an organisational response to societal and governmental expectations, through which firms maintain legitimacy and support financial performance (Ogunode, 2022). Maulita (2022) and L. Chen (2023) further indicate that regulatory pressure may enhance the financial benefits of environmental expenditure by encouraging firms to adopt more disciplined compliance practices and use their environmental investments more effectively. Accordingly, regulatory pressure is expected to strengthen the positive relationship between environmental expenditure and financial performance.

H₅: Regulatory pressure strengthens the positive relationship between environmental expenditure and financial performance.

Larger firms generally possess greater financial resources, technological capabilities, and managerial expertise, enabling them to respond more effectively to environmental requirements than smaller firms (Yanti & Annisa, 2023). Their greater resource capacity allows them to allocate larger budgets to compliance activities, employ specialised environmental personnel, and implement more sophisticated environmental risk-management systems (Ogunode, 2022). As regulatory pressure increases, these advantages may enable larger firms to comply more effectively while simultaneously strengthening their credibility and corporate reputation. Greater credibility may attract investment, reduce perceived risk, and contribute to improved financial performance (Alifaliyudin & Purbasari, 2024). From a stakeholder perspective, larger firms are better positioned to address the expectations of regulators, investors, and wider society, thereby securing stronger legitimacy and stakeholder support (Cintra et al., 2023). Consistent with this reasoning, Yanti and Annisa (2023) find that larger firms possess greater capacity to respond to environmental pressures and comply with regulatory requirements, which subsequently supports financial performance. Ou and Jiang (2023) similarly report that regulatory pressure encourages larger firms to pursue production efficiency and green innovation, making the financial consequences of environmental regulation more favourable for firms with greater resources. Accordingly, regulatory pressure is expected to strengthen the positive relationship between firm size and financial performance.

H₆: Regulatory pressure strengthens the positive relationship between firm size and financial performance.

RESEARCH METHOD

This study adopts a quantitative research design using secondary data obtained from the annual and sustainability reports of mining companies listed on the Indonesia Stock Exchange (IDX) between 2021 and 2023. Using purposive sampling, 32 companies met the specified selection criteria, yielding 96 firm-year observations.

Table 1. Sampling Techniques

No.	Criteria	Company
1.	Mining companies listed on the Indonesia Stock Exchange (IDX) for the 2021–2023 period.	155
2.	Mining companies without a PROPER rating.	(117)
3.	Mining companies with PROPER ratings.	38
4.	The company does not incur environmental expenses.	(7)
	Number of companies	32

Source: Research Data, 2026

Environmental performance represents a firm's capability to implement environmentally responsible practices within its operational activities (Setiadi, 2021). PROPER rankings were operationalized using a scoring scale from one to five, with higher values signifying superior environmental performance (Subakhtiar et al., 2022).

Rank	Description	Score
Gold	Very Good	5
Green	Good	4
Blue	Fair	3
Red	Poor	2
Black	Very Poor	1

Source: Ministry of Environment and Forestry of the Republic of Indonesia, 2023

Environmental costs refer to expenditures incurred by firms to prevent, control, and remediate environmental impacts arising from their operational activities (Ananda & Hendrawaty, 2025). In this research, environmental costs were measured by comparing total environmental expenditures related to environmental management, prevention, control, and restoration activities with net income (Subakhtiar et al., 2022). Following Siregar & Zuwina (2022), environmental costs were calculated using the following formula:

$$\text{Environmental Costs} = \frac{\text{Environmental Expenses}}{\text{Net Income}} \dots\dots\dots (1)$$

According to Setiadi (2021), reflects the scope of a company's operational and business activities. Consistent with prior studies, this variable is measured using the natural logarithm of total assets, where higher values indicate greater operational capacity. The formula used to calculate firm size is presented as follows:

$$\text{Company Size} = \ln(\text{total assets}) \dots\dots\dots (2)$$

According to Maulita (2022), regulatory pressure refers to external requirements imposed by governmental and regulatory bodies that encourage firms to comply with environmental policies and management standards. In the present study, regulatory pressure served as a moderating variable, as it is expected to alter the associations among environmental performance, environmental costs, firm size, and ROA (Ou & Jiang, 2023). ISO 14001

certification status was used as a proxy for regulatory pressure because it indicates a firm's adherence to internationally accepted environmental management standards.

Table 2. Formula

Value	Description
0	If the company does not yet have ISO 14001 certification.
1	If a company has ISO 14001 certification.

Source: Research Data, 2026

In this study, financial performance was evaluated through Return on Assets (ROA), which indicates how efficiently a firm converts its total assets into profits. ROA is widely employed as a measure of corporate financial performance, as it reflects management's capability to utilize available resources effectively in generating income (Handojo et al., 2021). The ROA formula is shown below (Setiadi, 2021).

$$\text{Return On Asset} = \frac{\text{Net Income}}{\text{Total Assets}} \dots\dots\dots (3)$$

Quantitative data analysis was performed using Moderated Regression Analysis (MRA) with the assistance of the SPSS. This method was applied to examine the direct effects between the independent variables and financial performance, as well as to assess whether regulatory pressure acts as a moderating variable in these relationships. The regression model used in this study is formulated as follows:

$$Y_{t+1,\dots} = \beta_0 + \beta_1 X_{1,t} + \beta_2 X_{2,t} + \beta_3 X_{3,t} + \beta_4 M_t + \beta_5 (X_{1,t} \times M) + \beta_6 (X_{2,t} \times M) + \beta_7 (X_{3,t} \times M) + \varepsilon \dots\dots\dots (4)$$

Where :

Y_{t+1}	= The company's financial performance for the next period
$X_{1,t}$	= Environmental Performance for period t.
$X_{2,t}$	= Environmental Cost for period t.
$X_{3,t}$	= Company Size for period t.
M_t	= Regulatory Pressure during period t.
β_0	= Constant
$\beta_1-\beta_7$	= Regression coefficient
$X_{1,t} \times M, X_{2,t} \times M, X_{3,t} \times M$	= Interaction of Moderating Variables
ε	= Error

The analysis was supported by descriptive statistical analysis, tests of classical assumptions, ANOVA, tests of the coefficient of determination, and t-tests as the basis for hypothesis testing.

RESULTS AND DISCUSSION

Table 3. Results of Descriptive Statistical Tests

Model	N	Minimum	Maximum	Mean	Std. Deviation
Environmental Performance	96	2	5	3,65	0,951
Environmental Costs	96	0,001	0,151	0,031	0,034
Company Size	96	23,12	33,83	29,802	2,377
Financial Performance	96	1	37	11,73	7,947
Regulatory Pressure	96	0	1	0,65	0,481
Valid N (listwise)	96				

Source: Research Data, 2026

The descriptive statistics indicate that the mining companies in the sample generally demonstrate satisfactory environmental performance, although considerable variation is evident in environmental expenditure, firm size, financial performance, and regulatory pressure. A substantial proportion of the firms operate within a formal environmental management framework, as reflected in their environmental certification. Nevertheless, the extent to which environmental practices are implemented differs across firms. The predominance of large companies in the sample is consistent with the capital-intensive nature of the mining industry. Considerable variation in financial performance further suggests that profitability within the sector may reflect not only differences in managerial and operational efficiency but also external conditions, particularly fluctuations in global commodity prices. Overall, the descriptive evidence suggests that environmental management among mining firms remains largely compliance-driven and that the potential economic benefits of environmental investment may not yet have been fully realised.

Table 4. Results of the Normality Test

Description	Unstandardized Residual
N	96
Test Statistic	0,070
Asymp, Sig, (2-tailed) ^c	0,200 ^d
Monte Carlo Sig,	0,301

Source: Research Data, 2026

The normality test indicates that the regression residuals are approximately normally distributed, suggesting no material violation of the normality assumption. This result supports the validity of the subsequent statistical inferences and hypothesis tests.

Table 5. Results of the Heteroscedasticity Test

Model	Sig
Environmental Performance	0,377
Environmental Costs	0,917
Company Size	0,603

Source: Research Data, 2026

The Glejser test results show that the significance values for all explanatory variables exceed the specified threshold, indicating no evidence of heteroscedasticity. The regression residuals may therefore be regarded as having

approximately constant variance, supporting the efficiency of the coefficient estimates and the validity of the subsequent statistical inferences.

Table 6. Results of the Multicollinearity Test

Model	Tolerance	VIF
Environmental Performance	0,951	1.052
Environmental Costs	0,932	1.073
Company Size	0,925	1.081
Regulatory Pressure	0,979	1.021

Source: Research Data, 2026

Similarly, the multicollinearity test indicates no evidence of problematic correlations among the explanatory variables. This result suggests that the estimated coefficients are not materially affected by excessive intercorrelations among the predictors, thereby supporting a clearer interpretation of the individual effects of each explanatory variable.

Table 7. Results of the Autocorrelation Test

<i>Test Value^a</i>	-0,57210
<i>Cases < Test Value</i>	48
<i>Cases >= Test Value</i>	48
<i>Total Cases</i>	96
<i>Number of Runs</i>	43
<i>Z</i>	-1,231
<i>Asymp. Sig. (2-tailed)</i>	0,218

Source: Research Data, 2026

The autocorrelation test indicates no evidence of serial correlation in the regression residuals. This result suggests that the estimated relationships are not materially affected by systematic dependence across observations, thereby supporting the reliability of the coefficient estimates and subsequent statistical inferences.

Table 8. Results of the F-Test

Model	df	Mean Square	F	Sig.
Regression	7	496.528	17.309	<0,001
Residual	88	28.686		
Total	95			

Source: Research Data, 2026

The F-test results indicate that environmental performance, environmental expenditure, firm size, and regulatory pressure are jointly associated with the financial performance of mining companies. This finding suggests that profitability in the extractive sector is shaped not only by conventional financial considerations, such as operational efficiency and organisational scale, but also by environmental and regulatory factors. Given the capital-intensive nature of mining operations and their substantial environmental exposure, environmental management has become an important component of corporate performance. Environmental practices may affect operating costs, access to finance, business continuity, and stakeholder perceptions. Financial performance in the mining industry should therefore be understood as a multidimensional outcome arising

from the interaction between economic characteristics and sustainability-related considerations.

Table 9. Results of the Coefficient of Determination Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	0,761	0,579	0,546	5,355

Source: Research Data, 2026

The coefficient of determination indicates that the variables included in the model explain a substantial proportion of the variation in financial performance. However, the adjusted R-squared value also suggests that profitability is influenced by factors outside the model. The relationship between environmental factors and financial performance is therefore not deterministic, as profitability is shaped by a wider range of economic and organisational conditions, including commodity-price fluctuations, capital structure, operational efficiency, corporate governance, and macroeconomic conditions. In the short term, these factors may exert a stronger influence on profitability than environmental initiatives.

Table 10. Results of the t-test

Model	B	Std. Error	t	Sig
(Constant)	-29,406	7,406	-3,970	<0,001
Environmental Performance	1,517	0,618	2,455	0,016
Environmental Costs	38,670	17,561	2,202	0,030
Company Size	0,962	0,251	3,839	0,001
Regulatory Pressure*Environmental Performance	2,593	1,284	2,020	0,046
Regulatory Pressure*Environmental Costs	8,341	35,940	0,232	0,817
Regulatory Pressure*Company Size	1,249	0,506	2,469	0,016

Source: Research Data, 2026

The findings indicate that environmental performance is positively associated with financial performance. Firms with higher PROPER ratings tend to report stronger return on assets (ROA), suggesting that environmental performance extends beyond regulatory compliance and may serve as a strategic source of economic value. Effective environmental management enables firms to use resources more efficiently, particularly in relation to energy consumption and waste management, thereby improving productivity and operational efficiency. The positive effect on profitability may also arise from lower business risk, greater organisational efficiency, and improved access to capital. Firms with stronger environmental performance are less likely to incur regulatory sanctions or reputational damage, which may enhance stakeholder confidence and support sustainable profitability. These findings are consistent with Broadstock et al., (2021) and Buallay (2018), who show that environmental disclosure and ESG initiatives may improve financial performance through increased transparency and reduced risk exposure. However, Dechezlepretre & Sato (2017) emphasise that environmental initiatives are more likely to generate economic benefits when supported by technological innovation rather than undertaken solely to satisfy compliance requirements.

Environmental expenditure is also positively associated with financial performance, indicating that such expenditure may extend beyond a compliance cost and generate longer-term economic value. Investment in environmental activities may improve operational efficiency, reduce resource inefficiencies, and limit waste. It may also help firms avoid operational disruptions, legal sanctions, and conflicts with local communities arising from environmental damage. Greater allocation of resources to environmental management may further signal a strong commitment to sustainability, thereby strengthening the confidence of investors and creditors. Environmental expenditure may consequently enhance both corporate reputation and financial performance. These findings support Shahab et al. (2020), who argue that environmental investment may improve profitability through efficiency gains and reputational benefits. Similar evidence is reported by Buallay (2018), who finds that sustainability initiatives contribute to improved operational outcomes.

The findings further show that firm size is positively associated with financial performance. Firms with larger asset bases are generally better positioned to deploy their resources efficiently and generate higher profits. In the mining industry, larger firms may benefit from economies of scale, greater operational stability, and increased financial flexibility, enabling them to undertake productive investments while meeting both operational and environmental obligations. These advantages may reduce business risk and improve the efficiency of asset utilisation, ultimately increasing ROA. From signalling and legitimacy perspectives, larger firms may also be perceived as having greater capacity to sustain their operations and respond to stakeholder expectations. The findings are consistent with Ananda and Hendrawaty (2025), who identify resource capacity and operational scale as important determinants of profitability in industries characterised by high capital requirements and substantial barriers to entry.

The results also indicate that regulatory pressure strengthens the positive relationship between environmental performance and financial performance. More specifically, firms with stronger environmental performance appear to derive greater financial benefits when they operate within a formal environmental management framework represented by ISO 14001 certification. Certification may encourage more structured environmental practices, improve operational efficiency, reduce environmental exposure, and strengthen stakeholder confidence. Under these conditions, firms may obtain greater economic value from their environmental performance, thereby improving profitability. This evidence is consistent with Shahab et al., (2020) and Broadstock et al., (2021), who highlight the role of external institutional pressure in strengthening the financial consequences of environmental practices. Dechezlepretre & Sato (2017) similarly suggest that environmental standards may improve organisational reputation and operational performance when accompanied by effective managerial and technological responses.

Although environmental regulation is expected to transform environmental expenditure into a value-generating investment, the results show that regulatory pressure does not significantly moderate the relationship between environmental expenditure and financial performance. This finding suggests that environmental expenditure among mining firms remains primarily compliance-

driven rather than strategically directed towards value creation. Such expenditure may continue to be regarded as an unavoidable cost incurred to satisfy regulatory requirements and avoid sanctions. Although ISO 14001 certification may strengthen legitimacy and stakeholder acceptance, these benefits do not appear to generate additional financial gains sufficient to improve profitability. This interpretation is consistent with the argument that environmental regulation may increase operating costs when compliance expenditure is not accompanied by innovation, technological development, or broader strategic integration (Shahab et al., 2020). Regulatory pressure may therefore fail to generate additional economic value when environmental expenditure remains detached from firms' operational and competitive strategies.

Finally, regulatory pressure strengthens the positive relationship between firm size and financial performance. This finding indicates that larger firms benefit not only from their greater asset base but also from their superior capacity to respond to environmental requirements. Their financial, technological, and managerial resources enable them to comply more effectively with environmental standards and invest in initiatives that improve efficiency and support long-term sustainability. ISO 14001 certification may further enhance stakeholder confidence, corporate reputation, access to finance, and competitive advantage, allowing larger firms to translate their resource capacity into stronger financial performance. This finding supports Broadstock et al., (2021), who identify organisational capability as an important factor in strengthening corporate resilience under regulatory and market pressures.

CONCLUSION

This study finds that environmental performance, environmental expenditure, and firm size are important determinants of the financial performance of mining companies listed on the Indonesia Stock Exchange between 2021 and 2023. The results suggest that corporate profitability is shaped not only by conventional financial considerations but also by environmental management practices and organisational resource capacity. Regulatory pressure, proxied by ISO 14001 certification, strengthens the positive relationships between environmental performance and ROA and between firm size and ROA. This evidence indicates that formal environmental management systems may enhance operational efficiency and strengthen stakeholder confidence. However, regulatory pressure does not significantly moderate the relationship between environmental expenditure and financial performance, suggesting that such expenditure remains largely compliance-driven rather than strategically directed towards value creation.

These findings are consistent with stakeholder, signalling, and legitimacy theories, which suggest that environmental responsibility may strengthen corporate reputation, stakeholder support, and organisational legitimacy. Nevertheless, the study is subject to several limitations. In particular, ISO 14001 certification is used as the sole proxy for regulatory pressure, while the relatively short observation period may restrict the generalisability of the findings. Future research could therefore employ broader measures of regulatory pressure, extend

the analysis to other industry settings, and use a longer observation period to provide more robust and generalisable evidence.

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