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The Effect of Strategic Leadership and Environmental Management on Firm Performance Mediated by Competitive Advantage in The Mining Industry

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Abstract: This study aims to investigate and analyze the impact of strategic leadership and environmental management on competitive advantage, and the effect of strategic leadership and environmental management on firm performance mediated by competitive advantage within the mining industry in Indonesia. Data for this research were collected from a population of 90 respondents who work in the mining sector and possess a Mining Business License (IUP) as well as are members of the Indonesia Mining Association (IMA). The sample includes business owners, mining contractors, mining consultants, traders, and beneficiation plant operators. This study analyzed the effects of Strategic Leadership and Environmental Management on Competitive Advantage and Firm Performance in the mining industry using Structural Equation Modeling (SEM) with Partial Least Squares (PLS). The findings reveal that Strategic Leadership and Environmental Management significantly enhance Competitive Advantage. However, their direct effects on Firm Performance are not significant, suggesting their impact is mediated through Competitive Advantage. Notably, Competitive Advantage strongly drives Firm Performance. These results highlight the critical roles of strategic leadership and sustainable practices in fostering competitive strengths, ultimately leading to superior performance outcomes. Mining companies should focus on these areas to achieve and sustain competitive advantages. Future research should explore additional mediating factors and examine these relationships in various contexts to deepen the understanding of these dynamics within the mining sector.

Keyword: Strategic Leadership, Environmental Management, Competitive Advantage, Firm Performance, Mining Industry

INTRODUCTION

Indonesia is renowned for its rich natural resources, including oil, natural gas, geothermal energy, minerals, and coal. This abundance has fostered a thriving mining industry in the country. In 2023, the mining sector contributed 10.52% to Indonesia's Gross Domestic Product (GDP), making it one of the largest economic sectors (Figure 1). According to Law No. 4/2009 on Mineral and Coal Mining, mining encompasses various stages, including exploration, feasibility studies, construction, extraction, processing, transportation, and post-mining activities.

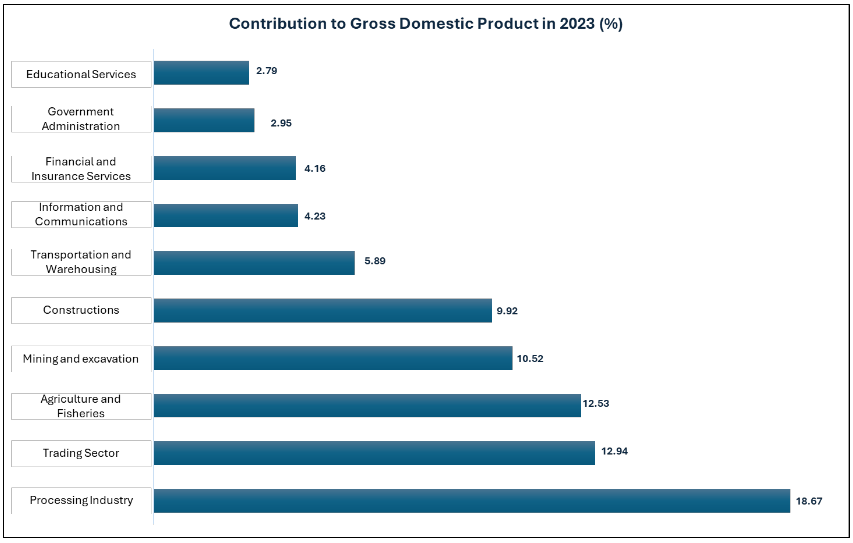

Figure 1. Ten Largest Business Sectors and Their Contribution to Indonesia's GDP in 2023

The mining industry in Indonesia comprises various types of businesses, including holders of Mining Business Licenses (IUP), mining contractors, exploration consultants, feasibility study consultants, mining consultants, processing and refining consultants, transportation service providers, post-mining service providers, and traders of minerals and coal. The sector's contribution to GDP has been steadily increasing from 2015 to 2023, despite a slight decline during the early COVID-19 pandemic. This growth has been supported by government initiatives aimed at enhancing value addition through downstream activities (Figure 2).

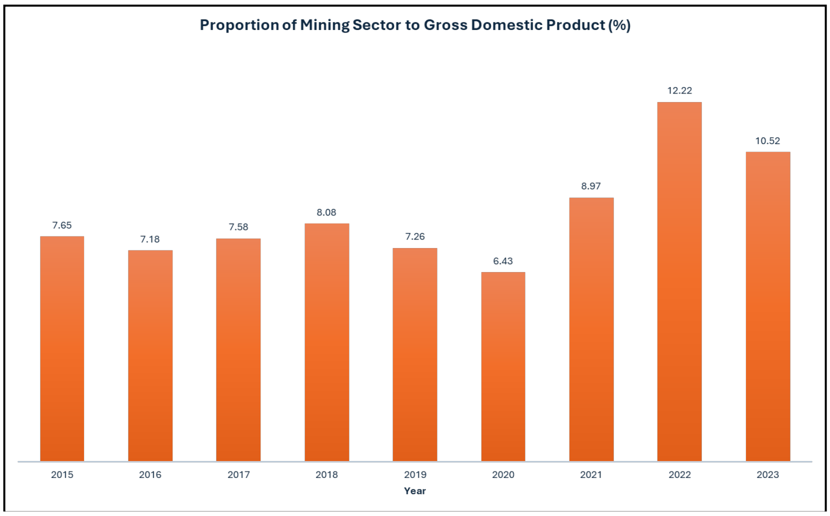

Figure 2. Proportion of Mining Sector to National GDP 2015-2023

Mining activities globally have led to significant pollution and environmental degradation, though many sites have been successfully reclaimed or restored. Effective leadership and environmental stewardship are crucial for advancing companies and mitigating negative environmental impacts. Research by Collier & Evans (2020) highlights that effective strategic leadership is essential for enhancing societal well-being and achieving sustainability across economic, environmental, and social dimensions. Sustainable practices can lead to job creation, improved public health, and environmental protection (O'Shannassy, 2021).

Studies have shown that strategic leadership significantly influences business performance, with increased strategic leadership correlating with improved performance

(Priadana et al., 2021). However, other research, such as Hendrata et al. (2023), suggests that while strategic, transformational, and visionary leadership positively impact organizational performance, strategic leadership alone does not necessarily correlate with performance outcomes.

The role of environmental management and green innovation is also vital. Siswoyo et al. (2020) found that environmental management and green innovation are crucial for enhancing competitive advantage and firm performance, especially in Indonesian village-owned enterprises (BUMDes). Similarly, Potrich et al. (2019) demonstrated that proactive environmental management positively moderates the relationship between environmental product innovation and market performance. Conversely, Rezende et al. (2019) found that the financial benefits of green innovation may take time to materialize.

Despite these insights, there is a gap in research connecting strategic leadership and environmental management with firm performance, particularly within the mining industry in Indonesia. Existing studies primarily focus on micro, small, and medium enterprises (MSMEs), village-owned enterprises, naval academies, service industries, automotive sectors, and multinational companies. This research aims to bridge this gap by examining the relationships among strategic leadership, environmental management, firm performance, and competitive advantage within the Indonesian mining sector, offering new insights into these dynamics.

Mining activities have significantly impacted the surrounding environment. Mining companies holding Mining Business Permits in Indonesia are required to implement a Mining Safety Management System (SMKP), which integrates management, workers, and the work environment. There is also an increasing trend in Environmental, Social, and Governance (ESG) standards. Mining companies with higher ESG ratings tend to outperform the market, indicating that the influence of a company's leadership affects its development and performance.

Previous research has primarily focused on sectors such as SMEs, Village-Owned Enterprises (BUMDes), Naval Academies, the service industry, the automotive industry, and multinational companies. However, there is a lack of research on the mining industry in Indonesia. Additionally, previous studies have shown inconsistent results regarding the impact of Strategic Leadership and Environmental Management on Firm Performance. These identified gaps and inconsistencies in the existing literature underscore the need for this study to explore the mining industry in Indonesia, focusing on the interplay between strategic leadership, environmental management, and firm performance.

METHOD

Research design is a blueprint or plan for collecting, measuring, and analyzing data to address empirical research questions. Key considerations in research design include the choice of research strategy (e.g., experiment, survey, case study), the degree of researcher manipulation and control, the research environment, the level of analysis, the data to be examined, and the time frame (Bougie & Sekaran, 2020).

This study employs hypothesis testing to explore relationships, differences, or independence between variables. The research focuses on four main variables: Strategic Leadership, Environmental Management, Competitive Advantage, and Firm Performance. The study uses a quantitative approach, chosen for its accuracy and measurability compared to qualitative methods. Data collection will be conducted through surveys using questionnaires to obtain natural data from specific locations, with researcher intervention in data collection (Sugiyono, 2022).

The data source for this study is primary, gathered via questionnaire distribution. Sampling will utilize purposive sampling, selecting samples based on specific criteria to ensure they are representative of the population (Sugiyono, 2022). The research model involves Structural Equation Modeling (SEM) analyzed using SMART-PLS software. The population for this study encompasses the mining industry across Indonesia. Due to the vast scope of the industry, the research focuses on specific categories of businesses, including mining license holders, mining contractors, and mining consulting firms. To determine the sample, purposive sampling is employed, with the selection criteria including: (a) being a registered member of the Indonesia Mining Association (IMA) and (b) holding an active and valid Mining Business License (IUP) in Indonesia.

The sample size, which represents the number of individuals or elements chosen from the population, is calculated using Slovin's formula (1960). For a population of 900 and a margin of error of 10%, the calculation yields a sample size of 90. Respondents are selected based on specific criteria, including having a direct supervisor, and other factors such as gender, educational level, job location, type of business, length of employment, employment status, job position, and age. The final sample for the study consists of 90 respondents. Responses to each indicator and item on the questionnaire will be measured using a five-point Likert scale: Strongly Disagree (SD), Disagree (D), Neutral (N), Agree (A), and Strongly Agree (SA).

After collecting and editing the data for analysis preparation, the next step involves analyzing the data obtained from the questionnaires. This study employs Structural Equation Modeling (SEM) with the assistance of the SMART PLS software, utilizing both descriptive and inferential statistical methods.

SEM allows researchers to model and estimate complex relationships between multiple dependent and independent variables simultaneously. The concepts considered in SEM are typically latent and measured indirectly through several indicators. SEM accounts for measurement errors in the observed variables, resulting in more accurate measurement of theoretical concepts (Cole & Preacher, 2014; Hair et al., 2021). Two main approaches to SEM are used: covariance-based SEM (CB-SEM) and partial least squares SEM (PLS-SEM). CB-SEM is primarily used to confirm or reject underlying theories and hypotheses by determining how well the theoretical model reproduces the covariance matrix of the observed data sample. In contrast, PLS-SEM is a "causal-predictive" approach that focuses on explaining the variance in the dependent variables (Jöreskog & Wold, 1982; Chin et al., 2020). The PLS path model comprises two elements: the structural model, which connects constructs and shows the relationships between them, and the measurement model, which displays the relationships between constructs and their indicators (Hair et al., 2021).

The SEM analysis using SMART PLS involves several key steps. First, the validity and reliability of the questionnaire data are tested. Next, the structural model is developed, followed by an evaluation of the model's goodness of fit. This structured approach ensures a robust and accurate analysis of the data, facilitating a better understanding of the relationships between the variables under study.

RESULTS AND DISCUSSION

The assessment of the measurement model involves evaluating the validity and reliability of the constructs used in the study. This ensures that the constructs accurately measure what they are intended to and that the measurements are consistent across different items. To assess the validity of the constructs, we conducted both convergent and discriminant validity tests. Convergent validity was evaluated by examining the Average Variance Extracted (AVE) for each construct, with values greater than 0.50 indicating adequate convergent validity. Discriminant validity was assessed using the Fornell-Larcker criterion, ensuring that the square root of the AVE for each construct was greater than its highest correlation with any other construct.

Reliability was evaluated using Composite Reliability (CR) and Cronbach's Alpha. Composite Reliability values greater than 0.70 and Cronbach's Alpha values above 0.70 indicate good reliability.

Table 1. Validity and Reliability

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Competitive Advantage	0.785	0.795	0.853	0.539
Environmental Management	0.908	0.919	0.924	0.549
Firm Performance	0.865	0.866	0.894	0.514
Strategic Leadership	0.819	0.834	0.867	0.521

Reliability was evaluated using Composite Reliability (CR) and Cronbach's Alpha. The Composite Reliability values for all constructs—Competitive Advantage (0.853), Environmental Management (0.924), Firm Performance (0.894), and Strategic Leadership (0.867)—exceed the recommended threshold of 0.70, indicating good reliability. Similarly, the Cronbach's Alpha values for Competitive Advantage (0.785), Environmental Management (0.908), Firm Performance (0.865), and Strategic Leadership (0.819) also surpass the threshold of 0.70, further confirming the reliability of the constructs.

The factor loadings for each indicator were examined to ensure they met the acceptable threshold of 0.70. Indicators with factor loadings below this threshold were considered for removal to improve the overall model fit. All constructs and their corresponding indicators showed satisfactory factor loadings, confirming that each indicator significantly contributes to its respective construct.

Table 2. Outer Loadings

	Competitive Advantage	Environmental Management	Firm Performance	Strategic Leadership
CA1	0.806			
CA2	0.760			
CA3	0.745			
CA4	0.733			
CA5	0.612			
EM1		0.809		
EM10		0.803		
EM2		0.766		
EM3		0.748		
EM4		0.754		
EM5		0.612		
EM6		0.705		
EM7		0.663		
EM8		0.842		
EM9		0.676		
FP1			0.732	
FP2			0.735	
FP3			0.686	
FP4			0.619	
FP5			0.758	
FP6			0.740	
FP7			0.757	
FP8			0.699	
SL1				0.704
SL2				0.651
SL3				0.675

	Competitive Advantage	Environmental Management	Firm Performance	Strategic Leadership
SL5				0.735
SL6				0.806
SL7				0.750

The evaluation of the measurement model includes an analysis of the outer loadings to confirm that each indicator adequately represents its corresponding construct. Factor loadings above the threshold of 0.60 are considered acceptable, indicating a strong relationship between the indicators and their respective constructs.

The factor loadings for the indicators of each construct are as follows:

- Competitive Advantage: The loadings range from 0.612 to 0.806. Indicators CA1 (0.806), CA2 (0.760), CA3 (0.745), and CA4 (0.733) exhibit strong loadings, while CA5 (0.612) also meets the acceptable threshold.
- Environmental Management: The loadings are generally strong, with EM1 (0.809), EM10 (0.803), EM2 (0.766), EM3 (0.748), EM4 (0.754), EM6 (0.705), EM8 (0.842), and EM9 (0.676) all exceeding or nearing the threshold. Indicators EM5 (0.612) and EM7 (0.663) are slightly below but still acceptable.
- Firm Performance: The loadings for Firm Performance indicators are FP1 (0.732), FP2 (0.735), FP6 (0.740), FP7 (0.757), and FP8 (0.699) all exhibit strong loadings. FP3 (0.686), FP4 (0.619), and FP5 (0.758) also meet the acceptable threshold.
- Strategic Leadership: The loadings for Strategic Leadership indicators are SL1 (0.704), SL2 (0.651), SL3 (0.675), SL4 (0.735), SL5 (0.806), SL6 (0.750), and SL7 (0.750), all demonstrating satisfactory loadings.

Overall, the majority of indicators demonstrate satisfactory factor loadings, confirming their significant contribution to their respective constructs. Indicators with loadings slightly above 0.60 were retained based on their theoretical importance and overall contribution to the model's reliability and validity. These results reinforce the robustness of the measurement model, ensuring that the constructs are reliably and validly measured.

To further ensure the robustness of the measurement model, the Variance Inflation Factor (VIF) values were analyzed for each indicator. The VIF values help detect multicollinearity issues, with values below 5 indicating no significant multicollinearity.

Table 3. Variance Inflation Factor (VIF)

	VIF
CA1	1.842
CA2	1.811
CA3	1.627
CA4	1.858
CA5	1.523
EM1	2.749
EM10	2.338
EM2	2.644
EM3	2.108
EM4	2.177
EM5	1.504
EM6	1.893
EM7	1.694
EM8	2.790
EM9	1.685
FP1	1.727
FP2	1.846
FP3	1.592
FP4	1.503
FP5	2.682

	VIF
FP6	2.478
FP7	2.296
FP8	1.610
SL1	1.431
SL2	1.525
SL3	1.508
SL5	1.906
SL6	2.026
SL7	1.548

The VIF analysis confirmed that multicollinearity is not a concern in this model. These results reinforce the robustness of the measurement model, ensuring that the constructs are reliably and validly measured.

The assessment of the structural model involves evaluating the goodness-of-fit indices and the variance explained by the independent variables. To confirm that the model is a good fit for the data, we examined several goodness-of-fit indices. These indices include the Standardized Root Mean Square Residual (SRMR), the Normed Fit Index (NFI), and the Chi-Square (χ^2). The SRMR value should be below 0.09, indicating a good fit. The NFI value should be close to 1, and a non-significant χ^2 value indicates an adequate model fit.

Table 4. Model Fit

	Saturated model	Estimated model
SRMR	0.088	0.088
d_ULS	3.357	3.357
d_G	1.426	1.426
Chi-square	612.936	612.936
NFI	0.640	0.640

Overall, the model fit indices indicate that while there are some areas for improvement, the model provides a reasonable fit to the data. The SRMR value being slightly close the threshold suggests that the model could be refined further for better fit, and the NFI value also suggests room for improvement. These results provide a basis for the subsequent analysis of path coefficients and the variance explained by the independent variables.

The R^2 values for Firm Performance and Competitive Advantage were reported to show the amount of variance explained by the independent variables. The R^2 value indicates the proportion of variance in the dependent variable that is predictable from the independent variables. Higher R^2 values suggest that the model explains a substantial portion of the variance in the dependent variables.

Table 5. R-square

	R-square	R-square adjusted
Competitive Advantage	0.517	0.506
Firm Performance	0.536	0.520

The R-square (R^2) values for Competitive Advantage and Firm Performance provide insight into the predictive power of the model. The R^2 value for Competitive Advantage is 0.517, and the adjusted R^2 is 0.506. This indicates that approximately 51.7% of the variance in Competitive Advantage is explained by the independent variables in the model, and after adjusting for the number of predictors, the explained variance is 50.6%. For Firm Performance, the R^2 value is 0.536, and the adjusted R^2 is 0.520. This means that approximately 53.6% of the variance in Firm Performance is accounted for by the independent variables, with the adjusted variance explained being 52.0%.

Overall, these R^2 values suggest that the model has a moderate to substantial explanatory power for both Competitive Advantage and Firm Performance. The adjusted R^2 values, which account for the number of predictors in the model, also support the robustness of these findings. These results indicate that the independent variables in the study significantly contribute to explaining the variance in the key dependent variables, Competitive Advantage and Firm Performance.

The hypothesis testing involves evaluating the proposed relationships between the independent and dependent variables in the study. This is done by analyzing the path coefficients and their significance levels. The following table provides a summary of all the hypotheses tested, indicating which were supported and which were not. Each hypothesis was evaluated based on the path coefficients and their corresponding p-values to determine statistical significance.

Table 6. Direct Effects

	Original sample (O)	T statistics (|O/STDEV|)	P values
Competitive Advantage -> Firm Performance	0.669	7.005	0.000
Environmental Management -> Competitive Advantage	0.411	2.583	0.010
Environmental Management -> Firm Performance	0.000	0.002	0.999
Strategic Leadership -> Competitive Advantage	0.373	2.571	0.010
Strategic Leadership -> Firm Performance	0.091	0.821	0.412

The hypothesis testing results for the direct effects between the variables provide several key insights into the relationships within the structural model. The interpretation of these findings is summarized as follows:

The relationship between Competitive Advantage and Firm Performance shows a strong and significant positive effect, with a path coefficient of 0.669, a t-statistic of 7.005, and a p-value of 0.000. This supports the hypothesis that Competitive Advantage positively influences Firm Performance, highlighting the importance of achieving a competitive edge to enhance overall firm performance in the mining industry.

Environmental Management positively influences Competitive Advantage, as indicated by a path coefficient of 0.411, a t-statistic of 2.583, and a p-value of 0.010. This significant positive relationship supports the hypothesis, demonstrating that sustainable practices contribute to gaining a competitive advantage. However, the direct effect of Environmental Management on Firm Performance is not significant, with a path coefficient of 0.000, a t-statistic of 0.002, and a p-value of 0.999. This finding suggests that the impact of Environmental Management on Firm Performance may be mediated through other variables such as Competitive Advantage.

Strategic Leadership has a significant positive effect on Competitive Advantage, with a path coefficient of 0.373, a t-statistic of 2.571, and a p-value of 0.010. This supports the hypothesis that Strategic Leadership positively influences Competitive Advantage, indicating the role of effective leadership in fostering competitive strengths. However, the direct effect of Strategic Leadership on Firm Performance is not significant, as indicated by a path coefficient of 0.091, a t-statistic of 0.821, and a p-value of 0.412. This suggests that the influence of Strategic Leadership on Firm Performance may be indirect, possibly mediated through Competitive Advantage.

The hypothesis testing results for the indirect effects between the variables reveal several key insights into the relationships within the structural model. The interpretation of these findings is summarized as follows:

	Original sample (O)	T statistics (|O/STDEV|)	P values
Environmental Management -> Competitive Advantage -> Firm Performance	0.275	2.855	0.004
Strategic Leadership -> Competitive Advantage -> Firm Performance	0.250	2.151	0.032

The relationship between Competitive Advantage and Firm Performance shows a strong and significant positive effect, with a path coefficient of 0.669, a t-statistic of 7.005, and a p-value of 0.000. This finding supports the hypothesis that Competitive Advantage positively influences Firm Performance, highlighting the critical role of competitive advantage in driving overall firm performance in the mining industry.

Environmental Management positively influences Competitive Advantage, as evidenced by a path coefficient of 0.411, a t-statistic of 2.583, and a p-value of 0.010. This significant positive relationship supports the hypothesis that Environmental Management enhances Competitive Advantage, indicating that sustainable practices contribute to strengthening a firm's competitive position. However, the direct effect of Environmental Management on Firm Performance is not significant, with a path coefficient of 0.000, a t-statistic of 0.002, and a p-value of 0.999. This result rejects the hypothesis that Environmental Management directly influences Firm Performance, suggesting that its impact is likely mediated through other variables such as Competitive Advantage.

Strategic Leadership has a significant positive effect on Competitive Advantage, with a path coefficient of 0.373, a t-statistic of 2.571, and a p-value of 0.010. This supports the hypothesis that Strategic Leadership positively influences Competitive Advantage, emphasizing the importance of effective leadership in fostering competitive strengths. However, the direct effect of Strategic Leadership on Firm Performance is not significant, as indicated by a path coefficient of 0.091, a t-statistic of 0.821, and a p-value of 0.412. This finding rejects the hypothesis that Strategic Leadership directly influences Firm Performance, indicating that the influence of strategic leadership on performance is likely indirect, possibly mediated through Competitive Advantage.

CONCLUSION

This study aimed to analyze the effects of Strategic Leadership and Environmental Management on Competitive Advantage and Firm Performance in the mining industry. The objectives were to assess the direct and indirect relationships among these constructs using Structural Equation Modeling (SEM) with Partial Least Squares (PLS).

First, the analysis confirmed that Strategic Leadership has a significant positive effect on Competitive Advantage. This finding underscores the importance of effective leadership in fostering competitive strengths within mining companies. Leaders who are strategic in their approach can enhance their firm's competitive position, ultimately contributing to better overall performance. Second, Environmental Management was found to have a significant positive influence on Competitive Advantage. This result highlights the critical role of sustainable practices in building and maintaining a competitive edge. Mining companies that prioritize environmental sustainability are better positioned to strengthen their competitive advantages, which, in turn, can lead to improved performance outcomes.

Third, the direct effect of Strategic Leadership on Firm Performance was not found to be significant. This suggests that while strategic leadership is crucial for competitive advantage, its direct impact on performance may be limited. Instead, the influence of strategic leadership on performance appears to be mediated through Competitive Advantage, indicating that effective leadership contributes to performance by first enhancing competitive strengths. Fourth, Environmental Management did not show a significant direct effect on Firm Performance. This implies that the benefits of environmental sustainability practices on performance are realized indirectly through their impact on Competitive Advantage. Thus, while direct improvements in performance from environmental management may not be evident, its role in fostering competitive advantage is crucial.

Finally, the relationship between Competitive Advantage and Firm Performance was found to be strong and significant. This finding confirms that competitive advantage is a key driver of firm performance in the mining industry. Companies that successfully develop and maintain competitive advantages are more likely to achieve superior performance outcomes.

In summary, the results of this study emphasize the pivotal roles of Strategic Leadership and Environmental Management in enhancing Competitive Advantage, which in turn drives Firm Performance. Mining companies should focus on strategic leadership and sustainable environmental practices as pathways to achieving and sustaining competitive advantages, ultimately leading to improved firm performance. Future research could explore additional mediating factors and examine these relationships in different contexts to gain a deeper understanding of the dynamics within the mining sector.

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