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Evaluation of Carbon Emission Disclosure with Media Moderation Variables Exposure (Empirical Study on Mining Companies Listed on the Indonesia Stock Exchange 2020-2022)

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A B S T R A C T
The research examines how carbon emissions in Indonesian mining companies are influenced by three key factors: financial metrics, organizational scale, and oversight through independent commissioners. The analysis focuses on companies registered with the Indonesian Stock Exchange during 2020-2022. Using a numerical-based quantitative approach, the research draws from secondary sources, including corporate annual reports and sustainability documents available through official company websites and the Indonesian Stock Exchange portal. From a total population of 61 listed mining companies, the researchers employed purposive sampling to select 30 companies, yielding 90 data points for analysis. The investigation utilized multiple linear regression techniques, processed through SPSS 26.0 windows software. The findings reveal that neither financial performance nor independent commissioners significantly impact carbon emission levels. However, organizational scale demonstrates a significant inverse relationship with emissions. Regarding media exposure's moderating role, it shows no significant effect on the relationship between financial metrics or organizational scale and carbon emissions. Interestingly, media coverage does moderate the relationship between independent commissioners and emission levels.

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INTRODUCTION

The Global challenges such as poverty rates, natural disasters, climate change, and financial crises, sustainable development issues that emphasize the integration of economic development and protection are serious challenges for policy makers in every country. The exploitation of natural resources for economic growth, when conducted without considering environmental sustainability, will eventually lead to adverse environmental consequences. This occurs because natural resources and ecosystems inherently have finite capacities to sustain such activities. When economic advancement fails to account for these natural limitations and environmental thresholds, it inevitably results in various developmental challenges and setbacks (AH, 2016). Indonesia's greenhouse gas emissions in 2022 were the highest since 1990. The volume of greenhouse gases reached 1.24 gigatons of carbon dioxide equivalent (Gt CO2e) or increased by 10% compared to the previous year (year-on-year). This annual increase percentage is the largest compared to other countries (Crippa et al., 2023).

Mining operations are under increasing scrutiny to lower their carbon footprint as stakeholders, including state authorities, financial backers, and community members, demand action. The industry's contribution to worldwide greenhouse gas output currently stands between 4 and 7 percent of total emissions (Delevingne et al., 2020). Research by Nurdiawansyah (2017), Nastiti & Hardiningsih (2022) financial performance, company size and media have an influence on carbon emissions. Independent board of commissioners has an influence on carbon emissions (Zada & Sari, 2024). While company size and financial performance have no influence on carbon emissions (Septriyawati & Anisah, 2019). Independent board of commissioners has no influence on carbon emissions (Wijaya, 2020).

Previous studies have shown varying results regarding the relationship between carbon emissions and factors such as financial performance, organizational scale, and the composition of independent commissioners. Building upon these inconsistent findings, this study aims to examine the determinants of carbon emissions while introducing media exposure as a moderating factor.

LITERATURE REVIEW

Legitimacy theory

Theory legitimacy, organizations must align their operations with societal expectations and values to gain community acceptance. This includes adhering to environmental protection standards, as maintaining ecological responsibility is crucial for companies to establish their legitimacy within the social framework they operate in (Amaliyah & Solikhah, 2019).

Theory Stackeholder

Theory Stakeholder Theory explain corporate behavior (corporate behavior) and its social performance (Freeman, 1984). Stakeholder theory states that companies in carrying out their operations should not only be concerned with themselves, but should also provide benefits to stakeholders. Stakeholders,

such as shareholders, creditors, consumers, suppliers, government, society, and other stakeholders (Pratiwi & Sari, 2016).

Sustainability Development

Sustainability Development Sustainability Developmentaccording to the UN is "Sustainable development has been defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs"which means The concept of sustainable growth balances current needs with the preservation of resources, allowing future societies to thrive and meet their own demands (United Nation, 2022).

Substainability Report

The regulatory framework established by the Financial Services Authority through Regulation 51/PJOK.03/2017 defines a sustainability report as a publicly disclosed document that outlines how financial institutions, issuers, and public companies integrate economic, financial, environmental, and social aspects into their business operations to ensure long-term sustainability.

Financial Performance

Financial performance is a measure of a company's performance during a certain period that reflects its financial health through measurements of capital, liquidity, and profitability((Mulyadi, 2007).

Company Size

Brigham & Houston (2011) said that a business's scale can be evaluated using several financial measurements, including its revenue streams, the sum of its assets, and its total shareholder equity, which together indicate its relative size classification.

Independent Board of Commissioners

Law Number 40 of 2007 states that the supervisory body known as the Board of Commissioners oversees both broad and targeted aspects of company operations, as outlined in the corporate charter, while also serving in an advisory capacity to guide the Board of Directors in their decision-making process.

A company's financial capacity plays a crucial role in supporting various environmental initiatives aimed at reducing carbon footprint. These efforts may involve upgrading to eco-friendly equipment and machinery, as well as implementing nature-based solutions like reforestation programs to enhance carbon dioxide sequestration (Nurdiawansyah, 2017). Kawedar (2020) stated that profitability has a significant influence on carbon emission disclosure, meaning that the better a company's carbon performance, the greater its contribution to the company's profit.
H1: financial performance has an effect on carbon emissions

Larger companies will be more compliant with regulations and report better carbon emissions to gain legitimacy (Rusdianti, 2024). Sekarini & Setiadi

(2022) stated that company size has an influence on carbon emissions. This proves that companies with high assets will try to disclose carbon emissions.
H2: Company size influences carbon emissions

Zada & Sari, (2024) in their research stated that independent boards of commissioners have an influence on carbon emissions. Independent boards of commissioners cannot encourage companies to make policies but can only provide policies to encourage companies to disclose carbon emissions.
H3: Independent board of commissioners has an effect on carbon emissions

Website media will be a very important media for a company because it plays an important role in describing the value of a company (Situmorang & Yanti, 2020). Strategic media engagement plays a vital role in enhancing corporate image among stakeholders. The media's extensive reach and influence can serve as a powerful tool for businesses to transparently share their carbon emission data, as it effectively bridges the information gap between companies and the general public.
H4: media exposure moderates the effect of financial performance on carbon emissions.

Larger companies carry out more activities and thus have a greater influence on society (Nur & Priantinah, 2012). Large public companies have greater responsibilities not only to society. But also to the government, creditors, and shareholders or investors.
H5: media exposure moderates the effect of firm size on carbon emissions

Under media oversight, businesses are compelled to demonstrate their dedication to societal and ecological obligations (Febrianto et al., 2022). Strategic policy guidance from the commissioners' board prioritizes addressing the needs of external stakeholders rather than focusing solely on internal management concerns.
H6: Media exposure moderates the influence of independent board of commissioners on carbon emissions

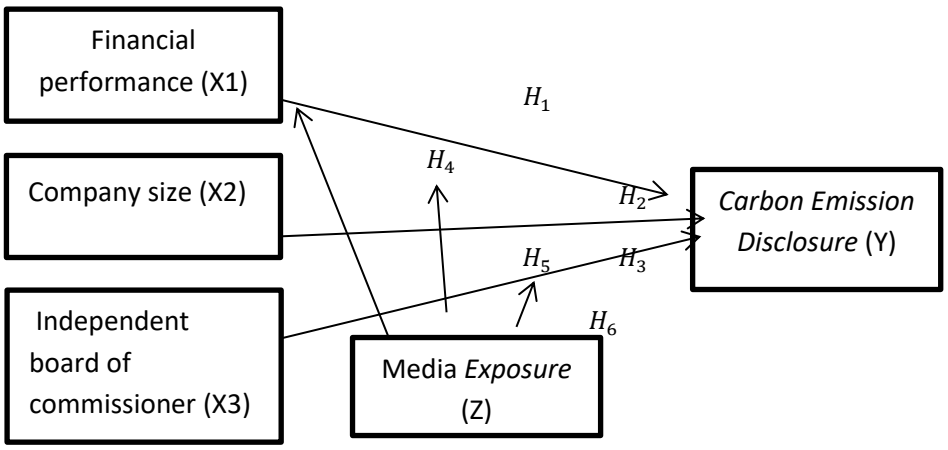


Figure 1. Conceptual Framework

METHODOLOGY

This study focused on mining corporations that maintained active listings on Indonesia's primary stock market between 2020 and 2022. From a total population of 90 mining enterprises, researchers selected 61 companies for detailed analysis using specific selection criteria through purposive sampling methods. To examine the relationships between variables, the research team employed moderated linear regression as their primary analytical tool.

Population and Research

The subjects of this research consist of mining sector companies that maintained active listings on Indonesia's primary stock market (IDX) during the three-year period spanning from 2020 through 2022. From a total pool of 30 mining enterprises registered on the exchange, specific companies were chosen as research participants based on predetermined selection parameters. These parameters were established to ensure the sample would effectively serve the study's objectives:

1. Mining companies listed on the IDX in 2020-2022
2. Mining companies that publish annual sustainability reports during the 2020-2022 period
3. Mining companies that publish annual financial reports for the period 2020-2022

Mining companies that report carbon emission information for at least 1 scope (1 of 18) in their annual reports and sustainability reports for 2020-2022.

Operational Definition

1. *ROA*

variable Return on Assetsused as a measure of the company as a whole to generate profits from all assets available to the company.

$$ROA = \frac{Net\ Profit\ After\ Tax}{Total\ Assets}$$

2. *Company size*

Company size is measured using the total amount of assets owned by a company (Ramadhany & Syofyan 2021).

UK= (Ln) total aset

3. *Idependent board of commissioners*

The increasing number of independent commissioners will encourage companies' efforts to disclose carbon emissions as an effort for companies to satisfy stakeholders and gain legitimacy (Oyewo, 2023).

$$\text{Idependent board of commissioners} = \frac{Total\ Independent\ Commissioner}{All\ God\ Commissioners} x100\%$$

4. *Carbon emissions*

Each item has a value of 1 and if it is empty it gets a value of zero so that if the company fully discloses the item in its report then the company's score is 18 and the minimum score is 0.

$$CED=\frac{\sum di}{M} X100\%$$

5. *Media exposure*

Media exposure by using variables dummy. Score 1 for companies that provide information related to carbon emission disclosure through website companies and a value of 0 for companies that are otherwise (Septriyawati & Anisah, 2019).

RESEARCH RESULT

Descriptive Statistical Analysis

Statistical description methods help summarize and explain the key characteristics of research variables in a more comprehensible way. When conducting descriptive statistical analysis, researchers examine several core metrics: the arithmetic mean to find the central tendency, the peak and bottom values to understand the data range, and the standard deviation to measure how spread out the data points are from their average.

Table 1 Descriptive Statistics Results

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
KP	90	-.12	.65	.1026	.16721
UK	90	13.96	28.07	21.4873	4.04055
DKI	90	.00	.80	.3633	.13021
CED	90	.11	.89	.4801	.18730
ME	90	0	1	.76	.432
Valid N (listwise)	90				

Source: Output SPSS, 2024

Classical Assumption Test

Normality test

Table 2 Normalitas Test Result

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		90
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	.15782699
Most Extreme Differences	Absolute	.073
	Positive	.073
	Negative	-.061
Test Statistic		.073
Asymp. Sig. (2-tailed)		.200[c,d]
	Sig.	.709[e]

Monte Carlo Sig. (2-tailed)	99% Confidence Interval	Lower Bound	.697
		Upper Bound	.721
a. Test distribution is Normal.			
b. Calculated from data.			
c. Lilliefors Significance Correction.			
d. This is a lower bound of the true significance.			
e. Based on 10000 sampled tables with starting seed 2000000.			

Based on the Monte Carlo simulation approach, the analysis yielded a value of 0.709, exceeding the significance threshold of 0.05. This statistical outcome indicates that the data follows a normal distribution pattern, allowing us to proceed with the regression model analysis.

Multicollinearity Test

Table 3 Multikoliniealitas Test Result

Coefficients[a]			
Model		Collinearity Statistics	
		Tolerance	VIF
1	KP	.956	1.046
	UK	.820	1.220
	DKI	.928	1.077
	ME	.837	1.195
a. Dependent Variable: CED			

Source: Output SPSS, 2024

Based on the analysis of tolerance values, all independent variables exceeded the 0.10 (10%) threshold. This indicates an absence of correlation among the independent variables in the study. Additionally, examination of the Variance Inflation Factor (VIF) revealed that none of the independent variables surpassed the critical value of 10. These findings collectively demonstrate that the regression model is free from multicollinearity issues, ensuring the reliability of the statistical analysis.

Autokorelasi Test

Table 4 Autokorelasi Test Result

Runs Test	
	Unstandardized Residual
Test Value[a]	-.01935
Cases < Test Value	45
Cases >= Test Value	45

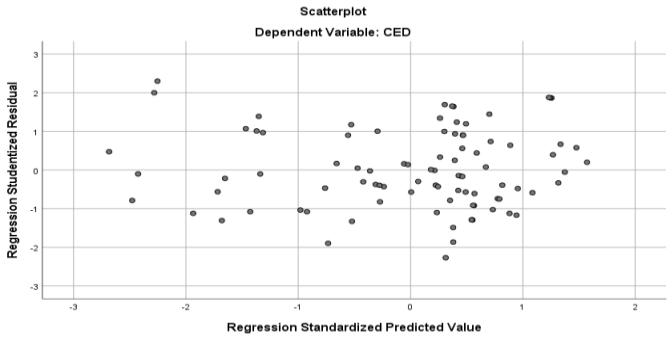
Total Cases	90
Number of Runs	39
Z	-1.484
Asymp. Sig. (2-tailed)	.138
a. Median	

Source: Output SPSS, 2024

Based on the run test analysis, the autocorrelation examination yielded an Asymp.Sig(2-tailed) value of 0.138. Since this figure exceeds the 0.05 threshold, the data demonstrates no autocorrelation pattern.

Heteroskedasitas Test

Table 5 Heteroskedastisitas Test Result



Source: Output SPSS, 2024

The image above shows points that indicate the components of the variables are spread randomly on the plane.scatterthen it can be concluded that heteroscedasticity does not occur.

Moderation Regression Analysis

Table 6 Results of Moderation Regression Analysis Test

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.940	.113		8.345	.000
	KP	-.052	.155	-.046	-.337	.737
	UK	-.017	.005	-.376	-3.629	.000
	DKI	-.416	.269	-.289	-1.543	.127
	KP*Z	-.208	.207	-.141	-1.003	.319
	UK*Z	-.005	.006	-.273	-.958	.341
	DKI*Z	.629	.315	.658	1.995	.049

a. Dependent Variable: CED

Source: Output SPSS, 2024

The regression model equation is as follows:

CED= $0{,}940 - 0{,}052\ KP - 0{,}017 UK - 0{,}416\ DKI - 0{,}208$ KP*Z – 0,005 UK*Z + 0,629 DKI*Z + ε

Hypothesis Testing

Partial Test (t Statistic Test)

Table 7 Statistik t Test Result

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.940	.113		8.345	.000
	KP	-.052	.155	-.046	-.337	.737
	UK	-.017	.005	-.376	-3.629	.000
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	KP*Z	-.208	.207	-.141	-1.003	.319
	UK*Z	-.005	.006	-.273	-.958	.341
	DKI*Z	.629	.315	.658	1.995	.049

a. Dependent Variable: CED

Source: Output SPSS, 2024

Based on the test results above, it is known that:

a. Results of hypothesis test 1 (H1)
   The statistical results of t between Variable X1 or financial performance against the carbon emission variable obtained a significance value of 0.737. The significance value is greater than alpha, so variable X1 or financial performance does nothas an influence on variable Y or carbon emission disclosure. Thus, the first hypothesis of this study is rejected.
b. Results of hypothesis test 2 (H2)
   The statistical results of t between Variable X2 or company size and carbon emission variable obtained the analysis revealed a p-value of 0.000, which falls below the established alpha threshold. This statistical finding demonstrates that there is a significant relationship between company size (X2) and the extent of carbon emission disclosure (Y). Based on these results, we can conclude that our second hypothesis, which proposed a connection between these variables, is supported by the data.
c. Results of hypothesis test 3 (H3)
   The statistical results of t between Variable X3 or independent board of commissioners on carbon emission variables obtained a significance value of 0.127. Based on the statistical analysis, the study found that the independent board of commissioners (X3) shows no significant relationship with carbon emission disclosure (Y), as evidenced by the significance value exceeding the threshold of 0.05. These findings lead to

the rejection of the study's third hypothesis, which had proposed a connection between these variables.

d. Results of hypothesis test 4 (H4)
   The results of the test of the moderating effect between financial performance variables and carbon emission variables moderated by the media.exposureobtained a significance value of 0.319. This significance value is greater than alpha 0.05, thus indicating that the mediaexposuredoes not moderate the effect of financial performance on carbon emission disclosure. The fourth hypothesis in this study is rejected.
e. Results of hypothesis test 5 (H5)
   When examining how media exposure influences the relationship between company size and carbon emission disclosure, statistical analysis revealed a significance value of 0.341. Since this value exceeds the 0.05 alpha threshold, the findings suggest that media exposure has no significant moderating impact on how company size affects the disclosure of carbon emissions. The fifth hypothesis in this study is rejected.
f. Results of hypothesis test 6 (H6)
   The results of the test of the moderating influence between the independent board of commissioners variable and the carbon emissions variable moderated by the media.exposureobtained a significance value of 0.049. This significance value is smaller than alpha 0.05, thus indicating that the mediaexposure moderates the influence of independent board of commissioners on carbon emission disclosure. The sixth hypothesis in this study is accepted.

Coefficient of Determination ***(R^2)***

Table 8 Results of the Determination Coefficient Test (R^2)

Model Summary[b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.558[a]	.312	.262	.16090
a. Predictors: (Constant), X3Z, UK, KP, DKI, X1Z, X2Z				
b. Dependent Variable: CED				

Source: Output SPSS, 2024

Table 4.8 shows that the analysis revealed that the adjusted R-squared value reached 0.262, indicating that approximately 26.2% of the variations in the dependent variable can be accounted for by the selected predictor variables. Specifically, this suggests that factors including financial metrics, organizational scale, independence of the board of commissioners, and media coverage as a moderating factor collectively influence carbon emission levels by 26.2%. The remaining 73.8% of variance is attributable to external factors that were beyond the scope of this research investigation.

DISCUSSION

This The Impact of Financial Performance on Carbon Emissions

Based on table 7 shows the results of the partial test (t-test) that the significance value obtained is 0.737. With the significance results greater than 0.05 (sig> 0.05). Therefore, the first hypothesis is rejected. Based on the analysis, the findings reveal that there is no significant relationship between a company's financial performance and its carbon emissions disclosure. The negative regression coefficient of -0.052 indicates an inverse relationship, suggesting that for each unit increase in financial performance metrics, there is a corresponding decrease of 0.052 units in carbon emissions disclosure levels. This demonstrates an unexpected pattern where better financial results are associated with slightly lower levels of environmental reporting.

The Effect of Company Size on Carbon Emissions

Based on table 7 shows the results of the partial test (t-test) that the significance value obtained is 0.000. With the results of the significance is less than 0.05 (sig <0.05). Therefore, the second hypothesis is accepted. Based on the analysis, the findings demonstrate that there is a relationship between a company's size and its carbon emissions levels. The analysis revealed a negative regression coefficient of -0.017 for the size variable, indicating an inverse relationship. This suggests that for every single unit increase in company size, there is a corresponding decrease of 0.017 units in carbon emissions disclosure, showing an opposing directional effect between these variables.

The Influence of Independent Board of Commissioners on Carbon Emissions

The analysis of the t-test results presented in table 7 indicates a significance value of 0.127, which exceeds the threshold of 0.05. Since this value is higher than the established significance level (0.05), we must reject the third hypothesis. This statistical evidence demonstrates that there is no significant relationship between the independent board of commissioners and carbon emissions. Furthermore, the analysis revealed a negative regression coefficient of -0.052 for financial performance. This negative correlation suggests an inverse relationship, where each unit increase in financial performance corresponds to a 0.052 unit reduction in carbon emission disclosure.

Media Exposure Moderating the Effect of Financial Performance on Carbon Emissions

The statistical analysis revealed that media exposure does not play a moderating role in the relationship between financial performance and carbon emissions. This conclusion is supported by the t-test results presented in table 7, which yielded a significance value of 0.319, exceeding the threshold of 0.05. Additionally, the interaction between financial performance and media exposure demonstrated a negative coefficient of -0.208, indicating an inverse relationship. Specifically, when the interaction term increases by one unit, carbon emission disclosures decrease by 0.208 units. These findings led to the rejection of the fourth hypothesis, suggesting that media coverage does not significantly influence how financial performance affects carbon emission practices.

Media Exposure Moderating the Effect of Firm Size on Carbon Emissions

Based on table 7 shows the results of the partial test (t-test) that the significance value obtained is 0.341. With the results of the significance is greater than 0.05 (sig > 0.05). Therefore, the fifth hypothesis is rejected. The findings indicate that media exposure does not serve as a moderating variable in the relationship between company size and carbon emission levels. The interaction analysis revealed a negative coefficient of -0.005 between company size and media exposure. This suggests that when the interaction term between these two variables increases by one unit, there is a corresponding decrease of 0.005 units in carbon emission disclosures, demonstrating an inverse relationship between these factors.

Media Exposure Moderating the Influence of Independent Board of Commissioners on Carbon Emissions

Based on table 7 shows the results of the partial test (t-test) that the significance value obtained is 0.049. With the results of the significance is smaller than 0.05 (sig < 0.05). Therefore, the sixth hypothesis is accepted. Based on the findings, media coverage acts as a moderating factor in how independent commissioners affect carbon emission disclosures. The statistical analysis revealed that when independent commissioners interact with media exposure, it produces a positive correlation coefficient of 0.629. This indicates that for each unit increase in the interaction between independent commissioners and media exposure, there is a corresponding rise of 0.629 units in carbon emission disclosure, demonstrating a direct relationship between these variables.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the research analysis that have been explained or presented in the previous chapter, it can be concluded that financial performance and independent board of commissioners do not affect carbon emissions. Company size has a significant negative effect on carbon emissions. Media exposure cannot moderate the influence between financial performance and company size on carbon emissions. While media exposure can moderate the influence between independent board of commissioners on carbon emissions.

ADVANCED RESEARCH

Based on the conclusions and limitations that have been described above, the researcher provides several suggestions as follows: For subsequent studies, researchers should consider incorporating more recent time periods to capture contemporary findings. Additionally, expanding the research scope to include a broader range of companies listed on the Indonesian Stock Exchange would yield a larger sample size, potentially leading to more comprehensive and robust results. Further researchers are advised to add or replace variables that will be used in further research such as carbon performance, sustainability committees, andgreen strategyespecially those closely related to carbon emission issues. Further researchers are advised to use other measurement methods in measuring the relevant variables for better results.

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