

THE EFFECT OF CARBON EMISSION DISCLOSURE ON FIRM PERFORMANCE MODERATED BY FIRM SIZE

ABSTRACT

This study explores the influence of carbon emission disclosure on firm performance, with firm size as a moderating factor. In today's climate of heightened awareness around environmental sustainability, companies are increasingly pressured to maintain transparency in reporting their carbon emissions. This research evaluates the effect of carbon disclosure on firm performance, measured by Tobin's Q, and assesses whether firm size impacts this relationship. Data from 200 publicly listed firms, sourced from sustainability and annual financial reports, were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) through WarpPLS, ideal for complex models with multiple constructs and indicators. Findings reveal a significant positive impact of carbon emission disclosure on firm performance, while firm size moderates this effect, indicating that environmental transparency supports performance improvements in firms of varying sizes. The study also identifies leverage and board size as positive contributors to firm performance, while age and board independence have minimal effects. These findings extend corporate sustainability insights and offer practical implications for policymakers and managers seeking to balance environmental responsibility with financial outcomes.

Keywords: Carbon Emission Disclosure, Firm Performance, Firm Size, Sustainability

1. INTRODUCTION

The IPCC report has made the world aware of the importance of stricter regulations to overcome the climate crisis. Public pressure is pushing governments and international institutions to formulate policies with the aim of limiting greenhouse gas emissions and accelerating the transition to a low-carbon economy (Calvin et al. 2023). One concrete step is through COP 26, which targets limiting the increase in earth's temperature to no more than 1.5°C and a commitment to achieve Net Zero Emissions (NZE) by 2060 or sooner (Anon n.d.).

Indonesia participated in ratifying the Paris Agreement in 2015, which was translated into Law no. 16 of 2016 concerning Climate Change. Even though it is a step forward, this regulation is more of an appeal than a compulsion, so its implementation still faces challenges, especially in accelerating the low-carbon economic transition. Efforts that are not yet optimal in reducing emissions can disrupt economic and social stability, especially for developing countries like Indonesia (United Nations Environment Programme 2023).

The Emission Gap Report 2023 states that global temperature increase is still in the range of 2.5%-2.9%, far above the Paris Agreement target (United Nations Environment Programme 2023). Industrial and energy companies are the main contributors to carbon emissions. In Indonesia, this sector contributes 18.67% to 2023 GDP and plays an important role in achieving climate targets. The transition to low-carbon practices is crucial, because transparency in emissions disclosure encourages sustainable changes in business behavior and improves company financial performance amidst increasing demands from investors and consumers.(Ashwin Kumar et al. 2016; Cadez, Czerny, and Letmathe 2019; Li, Zhang, and Zhao 2022; Naseer, Guo, and Zhu 2024).

Disclosure of carbon emissions (Carbon Emission Disclosure) is a main focus in sustainability literature. According to (Orazalin, Ntim, and Malagila 2024), this disclosure includes emissions data, reduction strategies, and related targets. Comprehensive disclosure shows a company's commitment to environmental risk management and acts as a positive signal to stakeholders (Li et al. 2018; Naseer et al. 2024; Siddique et al. 2021).

Company performance is the result of the interaction of internal and external factors, such as operational efficiency and adaptation to changes in the business environment (Sun et al. 2024). (Wahyuningrum et al. 2024) emphasizes that companies that successfully integrate sustainability aspects tend to show better financial performance in the long term (Bai et al. 2022; Butt, Baig, and Seyyed 2023; Dasgupta 2022; Khurram et al. 2023).

Company size (Firm Size) acts as a moderator in the relationship between carbon emission disclosure and company performance. (Xu et al. 2023) And (Herman and Shenk 2021) stated that large companies have more resources to invest in green technology and reporting systems, which improve the quality of disclosure. However, they also face greater public pressure and reputational risks (Calvin et al. 2023; Ika et al. 2022). Thus, the moderating impact of firm size may not always be linear and contextual.

Disclosure of carbon emissions by companies is expected to provide a positive signal to the market regarding sustainability commitments. However, its impact on company performance may differ depending on company size (Bedi and Singh 2024). This research aims to test the hypothesis that carbon emission disclosure has a positive effect on company performance and that company size moderates this relationship.

It is hoped that this research can fill the gap in literature by focusing on the context of Indonesia as a developing country. In addition, the results will provide insight for companies in making strategic decisions regarding environmental management. By understanding the relationship between emissions disclosure and performance, companies can design strategies to improve their reputation and competitiveness.

Theory

In accordance with the Resource-Based View (RBV), carbon emission disclosure can be considered an important strategic resource for companies because it is able to create competitive advantages (Ao 2023; He et al. 2022; Li et al. 2022; Naseer et al. 2024). Disclosure of carbon emissions, as part of a company's sustainability strategy, is able to help managers resolve problems in their business processes because it can improve the company's reputation and operational efficiency (Hoang 2023; Sun et al. 2024). This is also explained by (Wahyuningrum et al. 2024) where the practice of disclosing carbon emissions can help increase transparency and accountability in company business processes.

Stakeholder theory was also mentioned in several previous studies (Li et al. 2022) regarding the relationship between carbon emission disclosures with stakeholders and management. Stakeholder Theory explains that companies must consider the interests of various stakeholders, including shareholders, employees, customers, suppliers, and society at large, in their decision making. (Arslan et al. 2022; Feng, Wang, and Liang 2021). In the context of carbon emissions disclosure, this theory emphasizes the importance of transparency and corporate accountability for their environmental impacts to meet the expectations of various stakeholders (Orazalin et al. 2024). In connection with this stakeholder theory, carbon emission disclosure can be a way for management to satisfy stakeholders because it can show the company's commitment to sustainability and environmental responsibility (Naseer et al. 2024). Management is driven by the aim of maximizing long-term company value in one way, namely through comprehensive carbon emission disclosure practices, while stakeholders want to see the company's positive prospects which are in line with the global trend towards a low-carbon economy (Sun et al. 2024). (Arslan et al. 2022; Feng et al. 2021). In the context of carbon emissions disclosure, this theory emphasizes the importance of transparency and corporate

accountability for their environmental impacts to meet the expectations of various stakeholders (Orazalin et al. 2024). In connection with this stakeholder theory, carbon emission disclosure can be a way for management to satisfy stakeholders because it can show the company's commitment to sustainability and environmental responsibility. (Naseer et al. 2024). Management is driven by the aim of maximizing long-term company value in one way, namely through comprehensive carbon emission disclosure practices, while stakeholders want to see the company's positive prospects which are in line with the global trend towards a low-carbon economy (Sun et al. 2024).

Studies (Xu et al. 2023) also uses risk management theory, where it is said that companies must also maintain their reputation from all types of risks they face, including risks related to climate change and carbon emission regulations (Wahyuningrum et al. 2024) add that from a risk management perspective, inadequate disclosure of carbon emissions can give rise to risks to the company, such as regulatory risk, reputation risk and market risk. These risks should be closely watched by companies especially in light of increasing pressure from investors and regulators for greater transparency in corporate environmental (Calvin et al. 2023; Chen et al. 2023; Singhania and Saini 2023).

Legitimacy theory is also relevant in the context of carbon emissions disclosure and company performance. According to this theory, companies strive to operate within the boundaries and norms set by society to ensure their survival (Berglez and Olausson 2023; Li et al. 2022). Disclosure of carbon emissions can be seen as an attempt by companies to gain, maintain, or improve their social legitimacy in the eyes of society and other stakeholders (Orazalin et al. 2024). By voluntarily disclosing information about their carbon emissions, companies can demonstrate their commitment to environmental responsibility and increase their legitimacy in the market (Naseer et al. 2024).

In the context of company size as a moderator variable, the theory of economies of scale becomes relevant. This theory explains that larger companies have advantages in terms of cost efficiency and access to resources (Sun et al. 2024). In relation to carbon emission disclosure, large companies may have greater resources to invest in environmentally friendly technologies and more sophisticated reporting systems, which in turn may strengthen the relationship between carbon emission disclosure and corporate performance (Wahyuningrum et al. 2024).

This theoretical framework provides a strong basis for understanding the relationship between carbon emissions disclosure, firm performance, and the moderating role of firm size. These theories suggest that carbon emissions disclosure is not just a matter of compliance or social responsibility, but also a business strategy that can influence corporate performance through various mechanisms, including risk management, social legitimacy, and operational efficiency.

Literature Review & Hypothesis Development

The relationship between carbon emissions disclosure and corporate performance has gained importance as stakeholders increasingly demand transparency in environmental practices. Carbon emissions disclosure involves companies publicly reporting their greenhouse gas emissions as part of their environmental responsibility, reflecting corporate transparency and accountability under stakeholder and legitimacy theories. Meanwhile, financial performance indicates a company's financial health and operational efficiency, measured by metrics like profit, assets, and revenue, which are crucial for stakeholder investment decisions and the company's public image.

In Indonesia, the relationship between carbon emission disclosure, financial performance and stakeholder involvement has begun to attract the attention of researchers. Several studies show that the relationship between carbon emission disclosure and company financial performance is multifaceted. Studies indicate a positive correlation between carbon emission disclosure and company financial performance, particularly in Indonesia's manufacturing sector (Maria Kristari and Yusram Teruna 2023). Companies that transparently report their carbon emissions tend to show stronger financial outcomes, as this transparency reduces cash flow uncertainty, lowers capital costs, and

increases company value (Lee, Kim, and Kim 2023). Carbon disclosure is also viewed favorably by stakeholders, potentially boosting support and company valuation (Noor and Ginting 2022; Rahmianingsih and Malau 2022). These findings suggest that better carbon performance drives efficiency and cost savings, which in turn enhance financial results (Bauckloh et al. 2023; Khurram et al. 2023; Widagdo et al. 2023).

Several studies indicate that while carbon emissions disclosure is essential for accountability, it doesn't always directly enhance corporate value, as the relationship is complex and depends on factors like market conditions and stakeholder views (Anggita 2022; Sari and Budiasih 2022). Research by (Zhu et al. 2024) also shows that the impact of emissions disclosure on firm value varies by industry and regulatory pressures, with companies in highly regulated sectors experiencing distinct challenges (Adetutu et al. 2024; Yulianti and Waworuntu 2024). Additionally, higher carbon emissions often correlate with lower financial performance, as increased emissions can drive up costs and reduce profitability (Houqe et al. 2024). Shareholder activism on climate issues may also harm financial outcomes if investors see environmental proposals as costly, highlighting that carbon disclosure, while important, can sometimes negatively impact financial performance (Adetutu et al. 2024; Diaz-Rainey et al. 2024).

The impact of carbon emissions disclosure on company performance can be moderated by company size. Generally large companies have more resources and capabilities to conduct more comprehensive carbon emissions reporting, which can increase their credibility and trust among stakeholders (Bilal et al. 2022). Large companies, with higher visibility and closer scrutiny from stakeholders, are more likely to disclose their carbon emissions (Kartikasary et al. 2023). This suggests that company size can strengthen the positive impact of carbon emission disclosures on performance, especially because large companies have greater opportunities to utilize these disclosures as a competitive advantage. Conversely, smaller companies may struggle with the costs associated with reporting carbon emissions and may not experience the same financial benefits as larger companies. Findings from (Ghose, Makan, and Kabra 2023) show that the impact of carbon productivity on firm performance varies significantly across industry types and firm sizes, suggesting that the benefits of emissions disclosure may not be experienced uniformly (Ghose et al. 2023).

Furthermore, the relationship between carbon emission disclosure and company performance is also influenced by the industrial sector in which the company operates. Research shows that the effectiveness of carbon disclosure varies among industry sectors, with sectors that are more closely watched for their environmental impact, such as manufacturing and energy, showing more significant effects (Alipour et al. 2019; Kholmi, Karsono, and Syam 2020). These variations suggest that research on carbon emissions disclosure and company performance must consider the industrial context to gain a more comprehensive understanding.

Hypothesis 1 (H1): Disclosure of carbon emissions positively influences company financial performance. Transparent disclosure of carbon emissions will improve a company's reputation and stakeholder trust, which in turn improves financial results.

Hypothesis 2 (H2): Company size moderates the relationship between carbon emissions disclosure and company performance, where the positive impact of carbon emissions disclosure on performance will be stronger in larger companies.

2. METHODOLOGY

Sample selection and data collection

This research focuses on manufacturing and energy companies listed on the Indonesia Stock Exchange (BEI) as the study population. The selection of this sector is based on the potential for significant environmental impacts from its operational activities, especially related to carbon

emissions. The purposive sampling method was used to select research samples with criteria including, (1) companies listed on the IDX during the 2019-2023 period, and (2) publishing complete annual financial and sustainability reports consistently during the period study. Based on these criteria, a final sample of 200 companies was obtained that met the requirements for further analysis.

The data used in this research is secondary, obtained from annual financial reports and company sustainability reports which are accessed through the official websites of the IDX and each company. Data collection was carried out using the content analysis method on these reports to extract information related to research variables, namely Carbon Emission Disclosure (CED), Firm Performance (FP), Firm size (FS), Leverage (L), Board Size (BS), Board Independence (BI), Age (A) as in Table 1.

For data analysis, this research adopted a Partial Least Squares Structural Equation Modeling (PLS-SEM) approach using WarpPLS software. This method was chosen because of its ability to handle complex models with multiple constructs and indicators, and does not require the assumption of a multivariate normal distribution (Arthachinda and Charoensukmongkol 2024; Nurleni et al. 2018). PLS-SEM also allows simultaneous evaluation of measurement models and structural models, providing a more comprehensive analysis of the relationships between variables in the context of carbon emissions disclosure and corporate financial performance.

Variable definition

Carbon Emission Disclosure

Independent Variable Carbon Emission Disclosure (CED) measurement is carried out through in-depth analysis of company sustainability reports, using a disclosure index consisting of 18 criteria. This methodology adopts the approach developed by (Liu et al. 2023), which combines various international frameworks such as the Climate Disclosure Standard Board, GHG Protocol, and Task Force on Climate-related Financial Disclosure. Each item in the index is given a score of 1 if the information is available and 0 if it is not, resulting in a total score that reflects the company's level of carbon emissions disclosure. (Liu et al. 2023) stated, "This approach allows for a more objective and standardized assessment of companies' carbon emissions disclosure practices, facilitating comparisons across sectors and geographic regions.

Firm Performance

For the dependent variable (Firm Performance) we use Tobin's Q to measure this variable. This indicator has been widely used to assess company performance because it combines aspects of the company's market value and book value. Tobin's Q itself has been used to measure company value variables such as in journals (Bedi and Singh 2024; Butt et al. 2023).

Firm Size

For the moderating variable (Firm Size), the measurement is defined and measured using total assets. The use of total assets in this measurement refers to the formula for the natural logarithm of total assets (Ln Total Assets). Large companies tend to have more resources and capacity to make more transparent disclosures, as well as adapt to environmental regulations and stakeholder expectations, so as to improve their financial performance. (Bedi and Singh 2024; Perera et al. 2023)

Variable Control

In this research, leverage, board size, board independence, age are used as control variables. Leverage assessed through the debt-to-asset ratio, which shows the proportion of assets financed by debt (Astuti, Yanti, and Itqoni 2023; Bedi and Singh 2024; Wahyuningrum et al. 2024; Yulianti and Waworuntu 2024). Board Size refers to the number of members who sit on a company's board of directors (Bedi and Singh 2024; People & Global Business Association et al. 2024). Board

independence is a concept where members of the board of commissioners or board of directors have a high level of autonomy in carrying out their duties and functions (Bedi and Singh 2024; Hsiao, Liao, and Su 2024). They are free from undue influence, both from internal and external parties, so they can make decisions that are objective and in the best interests of the company as a whole. Age is taken from the year the company IPO (*Initial Public Offering*) (Harasheh 2023).

Measures

Table 1. Measurements

Variable	Measurement	Explanation
Carbon emission disclosure (Independent)	Carbon emission disclosure	total disclosure by a company
Firm Performance (Dependent)	Tobin's Q	calculate the ratio of market capitalization and book value of debt to book value of assets.
Firm Size (Moderate)	Firm size	natural logarithm of total assets
Leverage (control)	Leverage	ratio of total debt to total assets
Board Size (control)	Board size	natural logarithm of the total number of directors
Board Independence (control)	Board independence	proportion of independent directors
Age (control)	Company age	natural logarithm of the number of years since IPO

3. RESULTS AND DISCUSSION

Descriptive statistics

Table 2 presents descriptive statistics for the sample variables analyzed. Carbon Emission Disclosure (CED) has a value range from 0.000 to 0.778, with a mean of 0.360 and a median of 0.278. This shows that disclosure of carbon emissions by companies in Indonesia is still at an early stage. This finding is in line with research by (Widagdo et al. 2023) revealed that companies that disclose carbon emissions can increase their legitimacy in the eyes of the public, but many companies in Indonesia are still reluctant to do so.

Firm Performance (FP) shows a wide range, from 0.182 to 26.159, with a mean of 1.625 and a median of 1.056. The significant difference between the mean and median, as well as the high standard deviation (1.888), indicates large variability in the company's financial performance. However, positive mean and median values indicate that the majority of companies in the sample have profitable financial performance.

Table 2. Descriptive Statistics

Variable	Mean	Median	S.D.	Min	Max
Carbon Emission Disclosure (CED)	0.360	0.278	0.237	0.000	0.778

Firm Performance (FP)	1.625	1.056	1.888	0.182	26.159
Firm size (FS)	28.924	28.792	1.767	20.755	20.755
Leverage (L)	0.486	0.464	0.331	-0.214	3.940
Board Size (BS)	1.267	1.099	0.276	0.693	2.079
Board Independence (BI)	0.551	0.667	0.138	0.143	0.667
Age (A)	2.611	2.944	0.878	0.000	3.829

Multicollinearity Test

Table 3. Full collinearity VIFs

Variable	Full collinearity VIFs
Carbon Emission Disclosure (CED)	1.044
Firm Performance (FP)	1.038
Firm size (FS)	1.131
Leverage (L)	1.036
Board Size (BS)	2.521
Board Independence (BI)	2.416
Age (A)	1.100
FS*CED	1.027

Table 3 presents full collinearity VIF is used to measure the level of collinearity in the regression model. A regression model can be said to be free from multicollinearity problems if the VIF value is ≤ 3.3 . If we look at the test results, in this study all variables have VIF values below 3.3, with the highest value being Board Size (BS) of 2.521 and the lowest value being the interaction of Firm Size and Carbon Emission Disclosure (FS*CED) of 1.027. Therefore, it can be concluded that all variables in the model are free from multicollinearity problems.

Inner model analysis

R-squared (R^2)

Based on the results of this study, the R-squared value is 0.063, which means that 6.3% of the variation in the dependent variable can be explained by the independent variables in this model (Carbon Emission Disclosure (CED), Firm size (FS), Leverage (L), Board Size (BS), Board Independence (BI), Age (A)). In addition, 93.7% of the variation was influenced by other variables not included in this study. Therefore, it can be concluded that this value has a fairly low explanatory power of the model. However, a low R^2 does not necessarily indicate a weak model; in complex systems such as behavioral finance and corporate studies, other variables outside the model may account for unexplained variance.

Q-squared (Q^2)

The Q-squared value is an indicator of the model's predictive ability. Here, the Q^2 value is reported as 0.065. This means the model explains about 6.5% of the data variability for the prediction sample. Although this is a small percentage, this value indicates that the model has some predictive power. Higher values, typically above 0.25, indicate a model with strong predictive ability.

Goodness of Fit (GoF)

Tenenhaus GoF for the model is 0.251. GoF is a global measure of fit that combines measurement and structural model qualities. In this case, small $GoF \geq 0.1$; moderate $GoF \geq 0.25$; Large $GoF \geq 0.36$. With a GoF of 0.251, the research model falls into the “moderate” category, meaning the model provides a moderate overall fit. In addition, other goodness-of-fit indicators such as Average Path Coefficient ($APC = 0.091$), Average Block VIF ($AVIF = 1.294$), and Sympton's Paradox Ratio ($SPR = 1.000$) all meet the ideal threshold, indicating that the model is robust in dealing with multicollinearity problems and statistical emphasis Based on the GoF results above, the research model that can be used is as follows:

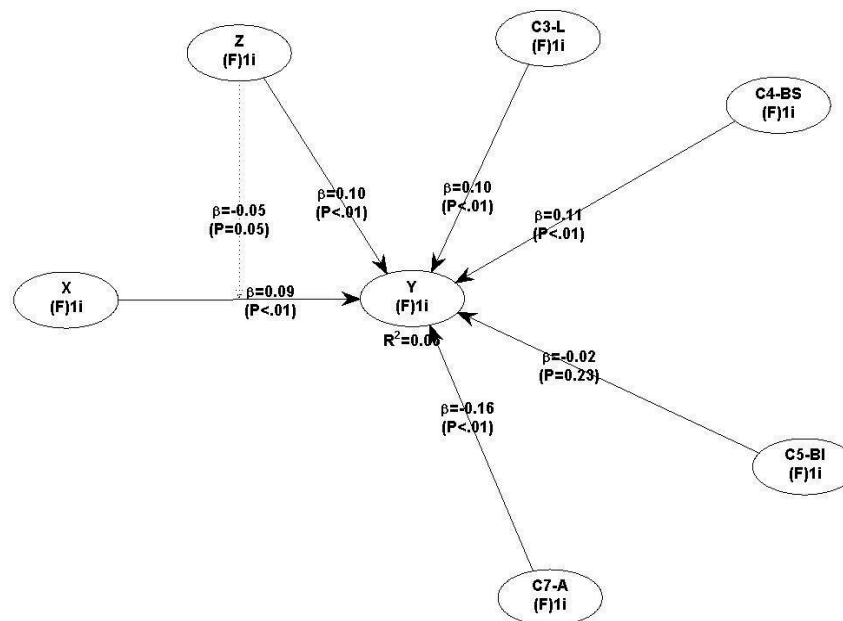


Figure 1.

Hypothesis Model

Notes: X = Carbon Emission Disclosure (CED), Y = Firm Performance (FP), Z = Firm size (FS), C3-L = Leverage (L), C4-BS = Board Size (BS), C5- BI = Board Independence (BI), C7-A = Age (A)

Hypothesis Testing

Hypothesis testing is carried out to test the direct effect of each line between variables. The results of this hypothesis testing can be seen in Figure 1. Figure 1 shows the results of hypothesis testing using PLS.

Testing the direct effect of Carbon Emission Disclosure (X) on Firm Financial Performance (Tobin's Q) (Y), the result of the path coefficient (coefficient of inner weights) is 0.09, with a p-value of <0.01 . These results indicate that the direct effect between Carbon Emission Disclosure and Firm

Financial Performance is significant. With a positive path coefficient (0.09), this shows that the higher the level of carbon emissions disclosure, the higher the company's financial performance.

Testing the moderating effect of Firm Size (Z) on the relationship between Carbon Emission Disclosure (X) and Firm Financial Performance (Y), shows a coefficient of -0.05 with a p-value of 0.05. These results indicate that Firm Size has a significant negative moderating effect, weakening the positive effect between carbon emissions disclosure and company financial performance. Testing the direct effect of Firm Size (Z) on Firm Financial Performance (Y), with a path coefficient of 0.10 and p-value < 0.1, shows that Firm Size has a positive and significant effect on the company's financial performance.

Testing the direct effect of Age (C7-A) on Firm Financial Performance (Y), where Age is measured from the year of the company's IPO, shows a path coefficient of -0.16 and p-value < 0.01. These results indicate that Age has a significant negative effect on Firm Financial Performance, so that the longer a company has been since its IPO, its financial performance tends to decline.

Testing the direct effect of Board Independent (C5-BI) on Firm Financial Performance (Y) produces a coefficient of -0.02 with a p-value of 0.23, which indicates that this effect is not significant.

Testing the direct effect of Board Size (C4-BS) on Firm Financial Performance (Y), shows a coefficient of 0.10 with a p-value < 0.1, indicating a positive and marginally significant effect.

Testing the direct effect of Leverage (C3-L) on Firm Financial Performance (Y), with a coefficient of 0.11 and p-value < 0.1, shows that Leverage has a significant positive effect on the company's financial performance.

Table 4. Result

Relationship	Path Coefficient	p-value	Information
Carbon Emission Disclosure → Firm Performance	0.09	<0.01	Supported signification
Firm Size moderates CED → FFP	-0.05	0.05	Not Supported not signification

Discussion

Table 4 presents that disclosure of carbon emissions in Indonesia has a positive influence on company financial performance, especially in the manufacturing and energy sectors listed on the Indonesia Stock Exchange (BEI), although with variations in influence influenced by company size. This finding contradicts the research results (Bedi and Singh 2024) in India, which found that investors there tend to view CEDs as a misuse of resources, given the high costs required to manage global warming and climate change, so that carbon emissions disclosures have a negative impact on companies' financial performance. This difference can also be explained by several factors, including regulatory context, public awareness of environmental issues, and differences in economic characteristics between developing countries such as Indonesia and India.

This finding is in line with theory *Resource-Based View* (RBV), which views Carbon Emission Disclosure as a strategic resource that can create a competitive advantage for companies. Companies that are able to manage these disclosure practices well scan utilize CED as a tool to improve their reputation in the eyes of investors and stakeholders, especially amidst global demands for more sustainable business practices. This is different from conditions in India, where looser regulations and lower awareness of environmental sustainability may influence negative perceptions of Carbon Emission Disclosure.

This research found that in Indonesia, company size as a moderating variable has a negative relationship between carbon emission disclosure (CED) and company financial performance. These

results show that although large companies are better able to disclose carbon emissions, this does not always lead to improved financial performance. The costs and resources that must be allocated to disclosure may exceed the direct benefits, causing a negative impact on financial performance.

However, when company size is used as a control variable, the relationship between carbon emission disclosure and financial performance actually becomes positive and significant. This means that large companies in Indonesia, when other moderating factors are taken into account, are able to utilize carbon emission disclosures to improve their financial performance. In the context of control, large companies have more resources to manage disclosure practices more efficiently, which can create a positive image in the eyes of stakeholders and investors. Thus, company size plays an important role in determining how effective carbon emission disclosure can impact financial performance.

In contrast, Bedi's research in India found that company size as a moderating variable directly strengthens the positive relationship between CED and financial performance. Large companies in India have consistently successfully used these disclosures to enhance their reputation and market value, thanks to their ability to invest in sustainability strategies.

The differences in results between research in Indonesia and in India highlight the importance of considering contextual characteristics such as market conditions, environmental policies, and stakeholder awareness in evaluating the impact of carbon emissions disclosure on company performance. The results of this research provide implications for stakeholders and policy makers in Indonesia to encourage transparency in the disclosure of carbon emissions, especially for large companies, in order to improve environmental reputation and company competitiveness in the global market.

4. CONCLUSIONS AND SUGGESTIONS

There is a significant direct effect of Carbon Emission Disclosure (CED) on firm performance. Given that the coefficient of inner weight has a positive mark, it indicates that the relationship between them is positive. It means that the higher the Carbon Emission Disclosure, the higher the firm performance, particularly in manufacturing and energy companies listed on the Indonesia Stock Exchange (IDX).

There is a significant moderating effect of firm size on the relationship between Carbon Emission Disclosure (CED) and firm performance. Given that the coefficient of inner weight has a negative mark, it indicates that the moderating relationship is negative. It means suggesting that larger companies may face higher costs and resource allocation challenges in implementing carbon emission disclosure practices relative to their financial benefits.

The findings of this research have several important implications for policy makers, society and company executives in Indonesia. The results of the analysis show that carbon emission disclosure (CED) can have a positive impact on company financial performance, especially for large companies. Therefore, the Indonesian government needs to consider strengthening regulations regarding carbon emission disclosure and providing incentives for companies, especially small and medium companies, so that they are more encouraged to invest in environmentally friendly energy technologies. Apart from that, the government can also provide support in the form of subsidies or tax incentives to help companies implement low-carbon technology.

From a societal perspective, disclosure of carbon emissions by companies provides greater transparency in the management of environmental impacts. It is important for society to understand how companies contribute to climate change mitigation efforts. For stakeholders, this disclosure information can be a basis for evaluating a company's financial risks and potential, especially amidst increasing awareness about sustainability. In addition, financial institutions can also use this information to evaluate the environmental impact of company operations as a factor in making investment decisions.

From a business perspective, the threat of climate change, such as scarcity of natural resources and increased environmental risks, has an impact on the continuity of company operations. The findings of this research emphasize that companies, especially larger ones, need to adopt sustainability strategies such as carbon emission disclosures to improve their reputation in the eyes of investors and the public. Companies should emphasize the economic benefits of disclosing carbon emissions through sustainable strategies, such as reducing energy costs and increasing operational efficiency. In addition, this research also shows that company size plays an important role in moderating the relationship between carbon emission disclosure and financial performance, which companies need to consider in designing their sustainability strategies.

Limitations and Future Research

No research is without limitations, and this research also has several limitations. First, this research only focuses on companies in the manufacturing and energy sectors listed on the Indonesia Stock Exchange (BEI), which tend to be medium to large companies. Future research could expand the scope by including companies from other sectors or small and medium-sized companies that may have different characteristics in terms of carbon emission disclosure and financial performance.

Second, the measurement of carbon emission disclosure in this study was only carried out through annual financial reports and company sustainability reports. Future research could consider other sources, such as company websites or special sustainability-related reports, that could provide a more comprehensive picture of a company's sustainability strategy.

Third, in examining the impact of carbon emissions disclosure on financial performance, this research has not considered other relevant factors, such as government policies and industry-specific challenges. Future research could examine the role of government regulation and specific industry challenges in influencing the relationship between carbon emissions disclosure and financial performance. In addition, future researchers can also consider confounding variables, such as company innovation or the level of adoption of environmentally friendly technologies, which may influence the relationship between carbon emission disclosure and financial performance.

Finally, future research could also explore the impact of carbon emissions disclosure on other aspects of corporate performance, such as operational performance, level of innovation, and corporate reputation, thereby providing a more comprehensive picture of the benefits of sustainability for companies across multiple dimensions.

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