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Carbon Emission Disclosure in Indonesia's Energy Sector: The Role of Environmental Performance and Media Exposure

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Abstrak

Tujuan *- Penelitian ini bertujuan untuk mengetahui pengaruh kinerja lingkungan dan paparan media terhadap pengungkapan emisi karbon.*
Desain/Metodologi/Pendekatan - *Metode penelitian yang digunakan adalah metode kuantitatif dengan teknik pengumpulan data melalui studi kepustakaan dan dokumentasi. Populasi yang digunakan dalam penelitian ini adalah perusahaan sektor energi yang terdaftar di Bursa Efek Indonesia pada tahun 2018-2022. Teknik pengambilan sampel menggunakan purposive sampling dan diperoleh sampel sebanyak 9 perusahaan sehingga total sampel sebanyak 45 data. Teknik analisis yang digunakan dalam penelitian ini adalah uji asumsi klasik, regresi linier berganda, uji korelasi, determinasi, uji t, dan uji f dengan menggunakan SPSS versi 25.*
Temuan *- Hasil penelitian menunjukkan bahwa kinerja lingkungan dan paparan media tidak berpengaruh terhadap pengungkapan emisi karbon.*
Keterbatasan/Implikasi Penelitian *- Batasan waktu penelitian mempersulit pemantauan perubahan pengungkapan karbon dari waktu ke waktu.*

Kata Kunci: Kinerja Lingkungan, Paparan Media, dan Pengungkapan Emisi Karbon

Abstract

Purpose - This study examines the effect of environmental performance and media exposure on carbon emission disclosure.

Design/methodology/approach - The research method used is quantitative with data collection techniques through literature study and documentation. The population used in this study is energy sector companies listed on the Indonesia Stock Exchange in 2018-2022. The sampling technique used purposive sampling, and a sample of 9 companies was obtained so that the total sample was 45 data. The analysis techniques used in this research are the classical assumption test, multiple linear regression, correlation test, determination, t-test, and f-test using SPSS version 25.
Findings - Research shows that environmental performance and media exposure has no effect on carbon emission disclosure.
Research limitations/implications - The time constraint of this research may also complicate monitoring changes in carbon disclosure over time.

Keywords: Environmental Performance, Media Exposure, and Carbon Emission Disclosure

Introduction

Climate change is an issue that needs to be managed by the world, including Indonesia. It occurs due to global warming, namely due to increased carbon emissions and greenhouse gasses (GHG). In 1997, the Kyoto Protocol was issued in Japan as a form of world attention that received support from the United Nations (UN). The Kyoto Protocol is an international agreement from various countries committed to reducing carbon emissions (Purnayudha et al., 2022).

Climate change and environmental issues are currently a concern, requiring companies to pay attention to three aspects often referred to as the triple bottom line. Indonesia must take action to reduce the greenhouse effect, starting with operational improvements, updating assets to lower pollution levels, implementing environmentally friendly technology, and reporting operational activities that involve the environment (Lestari, 2023).

It is essential to consider not only profitability but also the social and environmental consequences of the company's operations. The operational activities of the company can be disclosed through a sustainability report. The document comprises details regarding the company's environmental and social activities. Openness in reporting the company’s social and environmental responsibilities is also important. This is based on the Law on Limited Liability Companies (PT) Number 40 of 2007.

The energy sector is among the industries that make a substantial contribution to carbon emissions. According to the United Nations Environment Program (UNEP), 75% of greenhouse gas emissions worldwide are attributed to the energy industry. The increased disasters caused by climate change require the energy sector to decarbonize or reduce carbon dioxide emissions. Environmental regulations and policies must be considered to maintain and reduce carbon emissions (Republika, 2023).

One of the main sources of carbon emissions in Indonesia is the greenhouse gas emissions from the daily operations of industrial firms. Therefore, the corporation is required to make public any operations that result in carbon emissions, a process known as carbon disclosure, in order to gain public legitimacy. At this time, there is a lot of focus on carbon emissions disclosure because the information a firm discloses affects the company's reputation and long-term viability. For the benefit of the company's sustainability and reputation, the relevant stakeholders' environmental activities must therefore be disclosed in a clear and open manner (Asyari & Hernawati, 2023).

The presentation or revelation of the company's actions is a factor that can impact whether the value of carbon emission disclosure increases or decreases. Disclosure of information about the company, including environmental issues, is important for investors as an indicator to assess a company’s sustainability. The company's transparency and accountability are demonstrated by the information disclosed in its annual and sustainability reports. This is important because it gives shareholders access to information about the endeavors undertaken by the company to address the consequences or influence of climate change.

Environmental performance is a practice that can help companies to gain value from shareholders and reduce environmental impacts. Greenhouse gas emissions are one of the environmental impacts that will arise due to companies not implementing good protection to reduce emission levels. Environmental performance is carried out as an assessment of company activities to manage, maintain, and improve the sustainability of the surrounding environment (Damas et al., 2021).

Moreover, strengthening the company's reputation can also be enhanced by its resource management and environmental performance. When environmental responsibility is performed well by a company, it can contribute to the company's perception. Furthermore, the organization should pay attention to optimal environmental management.

Then, the technology increasingly developing today makes it easy for companies to increase public trust. Communication through corporate media can affect how potential investors see the company. Investors expect that media exposure can provide information for external parties so that companies can increase public trust. The existence of media exposure can motivate companies to disclose carbon emission reductions in sustainability reports.

The purpose of this research is to examine the connections among corporate media communication, technology advancements, investor perceptions of businesses, and carbon disclosure in sustainability reports. The study intends to determine whether media exposure can encourage companies to openly disclose their efforts to reduce carbon emissions, as well as their impact on the degree of public confidence in companies, by comprehending how emerging technology affects corporate communication and investor perception.

Literature Review and Hypothesis

Literature Review

Legitimacy Theory

Legitimacy theory, popularized by Dowling & Pfeffer in 1975, is a theory that states that companies carry out social disclosure to gain legitimacy from society. To gain legitimacy from society, environmental management activities are a form of corporate attention to society and the environment. Companies must make various efforts to obtain legitimacy from society, one of which is by making social disclosures. The revelation of carbon emissions is done through the issuance of sustainability reports (Mardiana & Wuryani, 2019).

This theory explicitly describes that a business will always be bound by a social contract. As a result of the corporation's actions in the public sphere, the public began to demand that the company take environmental circumstances more seriously. Companies may be encouraged by the legitimacy hypothesis to take environmental responsibility actions in order to gain public acceptance. In order to get legitimacy from the community, entrepreneurs must eventually pay attention to environmental circumstances and take responsibility for their commercial operations that influence the environment. This is due in part to the public's growing concern for the environment (Amaliyah & Solikhah, 2019).

The goal of a firm to voluntarily disclose is defined and explained by the notion of legitimacy. This disclosure enhances the public's favorable perception of the firm and makes it possible for the public to learn about all of the activities that the company engages in within its surroundings. The legitimacy theory, which holds that businesses are socially conscious and can demonstrate that all of their operational actions are lawful and have struck a balance between relevant norms and social ideals, lends credence to this (Angelina & Handoko, 2023).

Annual Report

The company publishes an annual report to view important information about the company's development and financial condition. The annual report includes financial reports, management analysis, notes from auditors, and other information relevant to stakeholders (Alfayerds & Setiawan, 2021).

Companies use annual reports as a communication tool to share and convey critical data that may be utilized to construct a narrative that is rhetorical about the performance of the firm (Oktaviani et al., 2017).

Drawing from the description, it can be inferred that the annual report's disclosure acts as a conduit for information pertaining to the company's performance, thereby mitigating information asymmetry between the management and stakeholders.

Sustainability Report

The Sustainability Report, which explains the company's care for the community regarding the aspects it reports and simultaneously bridges the demands of stakeholders in decision-making, is a corporate contribution to society from three perspectives: economic, social, and environmental (Suharyani, 2019).

Information related to company activities related to environmental aspects is reported in a sustainable report referred to as a sustainability report. Corporate reports known as sustainability reports include non-financial data as well, such as details about social and environmental initiatives that support businesses on going growth and success (Sulistyawati & Qadriatin, 2018).

Media Online

Online media, often known as Internet cyber media, uses websites to broadcast ceremonial announcements online. Multimedia and telecommunication-based media is commonly referred to as online media. (internet and computer). There exist several online media platforms such as websites, online radio, online television, online press, mail-online, and portals, each with unique features based on the features that enable users to access them. Any form of media or communication that takes place online via an internet connection is referred to as online media. Examples include email, websites, blogs, social media, and social networking (Siswanto et al., 2023).

According to Nur (2021), online media is any type of communication media that requires an internet connection to access it. Online media can include internet media such as websites and others. Online media can be interpreted as the third-generation media after print and electronic media.

Environmental Performance

Environmental performance describes how successfully a company manages and addresses the environmental aspects surrounding its operational location. The achievement of the company in the environmental performance rating can be used to gauge its environmental performance. The high level of stakeholder trust in the company in protecting the environment is due to the better results of environmental performance assessment (PROPER) in a company. A company's sustainability level can be achieved when the company gets the trust of stakeholders (Hardianti & Mulyani, 2023).

For businesses involved in reducing the effects of climate change and global warming, good environmental performance has long-term benefits. In response to Indonesia's environmental issues, the government released the Corporate Performance Rating Assessment Program (PROPER). The purpose of Environmental PROPER is to oversee the application of laws pertaining to the evaluation and quantification of environmental performance. When a business exhibits environmental performance that is favorable to and endorses the perspective of the color assigned to the PROPER to an enterprise or activity, it is said to be doing so (Alfayerds & Setiawan, 2021).

Media Exposure

A firm can release information about itself to the media more flexibly and not tied to a specific time, such as annual and sustainability reports. The disclosure extends beyond sustainability reports and annual reports, which are issued only once a year. Utilizing this exposure to the media can help spread knowledge. about public concern for the environment (Kurniansyah et al., 2021).

A company's means of disseminating information to the media in order to make itself noticeable is known as media exposure. Because stakeholders, particularly the public, now use publicity in the media to monitor environmental and social issues resulting from corporate actions, it has become increasingly crucial (Yuliandhari & Angraini, 2022).

Carbon Emission Disclosure

Carbon emissions are the release of carbon into the atmosphere resulting from a company's operations. Carbon emissions are linked to greenhouse gas emissions and significantly contribute to climate change. Carbon emission releases carbon dioxide into the atmosphere naturally or from human activities (Puteri & Inawati, 2023).

Disclosure of carbon emissions is one of the contributions to the government in controlling carbon emissions. In addition to focusing on disclosing financial aspects, a company must also be open to providing information to the public to increase trust in the company to invest (Bahriansyah & Lestari Ginting, 2022).

Hypothesis

The Effect of Environmental Performance on Carbon Emission Disclosure

Environmental performance is the company's ability to create a green and clean environment. In line with legitimacy theory, the company's relationship with society causes the company to comply with the norms. Norms that are applicable in community life, one of which is to protect the environment (Amaliyah & Solikhah, 2019).

With the existence of legitimacy theory, environmental preservation needs to be done by the company. When the company has good environmental performance, then will encourage the company to report carbon emissions disclosure to stakeholders to gain legitimacy (Dewayani & Ratnadi, 2021).

According to the legitimacy argument, businesses must abide by the rules in place, which requires them to disclose their environmental practices. Environmental disclosure is typically implemented in businesses with better working conditions than their surroundings. The company's enhanced ability to function in its surroundings inspires it to implement environmental approaches or disclosures in order to foster beneficial connections with stakeholders (Angelina & Handoko, 2023).

H_1 : environmental performance positively influences the disclosure of carbon emissions.

The Effect of Media Exposure on Carbon Emission Disclosure

For the company, media exposure is crucial to their ability to enlighten the public. The media is one of the effective means for companies to make voluntary environmental disclosures to gain legitimacy from the community and get a positive response from stakeholders. When the media plays an active role in monitoring a company's environment, the company will be more motivated to disclose its activities, namely as the publication of carbon emissions (Septriyawati & Anisah, 2019).

One of the most crucial pieces of information for investors is carbon disclosure, which reveals how a business handles its risks. When it comes to transparency, the media is essential in informing investors of information. The information that can be shared with the public includes the company's operations. Businesses should also exercise caution when dealing with the media, as their attention is linked to the company's image. Companies may be encouraged by media coverage to share information about their operations, particularly environmental ones, in an effort to attract investors (Bahriansyah & Lestari Ginting, 2022).

H_2 : media exposure positively influences carbon emission disclosure.

Research Method

This study employed a quantitative approach with descriptive statistics. The approach used for data analysis employed is a parametric statistic. So, before conducting a classical assumption test, the Method of Successive (MSI) is first carried out to raise the ordinal scale to an interval scale. This study uses secondary data from annual reports, sustainability reports, and websites of energy sector companies listed on the Indonesia Stock Exchange 2018-2022. The technique employed was purposive sampling in this study, with the following criteria:

Table 1
Sample Criteria

No	Criteria	Number of Companies
1	Energy sector companies listed on the Indonesia Stock Exchange 2018-2022.	82
2	Companies in the energy sector listed on the Indonesia Stock Exchange that conduct Initial Public Offering (IPO) after 2018.	(20)
3	Companies in the energy sector listed on the Indonesia Stock Exchange that experience suspension during 2018-2022.	(11)
4	Companies in the energy sector listed on the Indonesia Stock Exchange that do not publish sustainability reports in 2018-2022.	(39)
5	Energy sector companies listed on the Indonesia Stock Exchange that refrained from participating in PROPER from 2018 to 2022.	(3)
Total Research Sample (5 years)		9

Source: Processed Data (2023)

Operational Variables

Environmental Performance

Measured based on the provisions by the Ministry of Environment and Forestry (KLHK), namely using the PROPER rating (Mardiana & Wuryani, 2019) with five color ratings such as gold, green, blue, red, and black.

Media Exposure

Measured using the Janis-Fadner Coefficient by calculating how many articles are both favorable and unfavorable about the corporate environmental disclosed through news portals in online media (Mashuri & Ermaya, 2020) with the following formula:

Janis-Fadner Coefficient

$$* \quad \frac{(e^2 - ec)}{t^2} \quad if\ e > c$$
$$** \quad \frac{(e^2 - ec)}{t^2} \quad if\ c > e$$
$$*** \quad 0 \qquad if\ c = e$$

Description:
e : total articles positive about the environment
c : total articles negative about the environment
t : total of articles positive and negative

Carbon Emission Disclosure

Measured through checklist issued by Choi et al. (2013) has 18 disclosure items with the following formula:

$$Carbon\ Emission\ Disclosure = \frac{Number\ of\ Disclosed\ Items}{Total\ Number\ of\ Disclosed\ Items} x100$$

Results and Discussion

The following are this study's descriptive statistical tests using SPSS IBM Statistical Software version 25:

Table 2
Descriptive Statistical Test Results

	N	Min	Max	Mean	Std. Dev
X1_EP	45	3.00	5.23	4.05	.90
X2_ME	45	.00	1.00	.64	.47
Y_CED	45	.06	.67	.39	.13
Valid D	45				

Source: Processed Data (2023)

Based on table 2, there are 45 total observations made in this research. The following are the outcomes of the descriptive analysis:

1. The mean of the environmental performance variables is 4.05. This data indicates the Indonesian Stock Exchange's energy sector has an excellent environmental performance rating.
2. The average of the media exposure variables is 0.64. The Indonesian Stock Exchange's energy sector has a comparatively low media exposure value. Out of a total that should have been 1.00, the company only reported 0.64.
3. The average of the carbon emission disclosure variables is 0.39. The Indonesian Stock Exchange's energy sector has a low carbon emission disclosure value. On average, companies only disclose 39% of the 18 total carbon emission disclosure indices.

Classical Assumption Test
Normality Test

Table 3
Normality Test Results

	Unstandardized Residual
Asymp. Sig. (2-tailed)	.158[c]

Source: Processed Data (2023)

The two-sided asymptotic significance has a value of 0.158, surpassing the significant value which should be 0.05. The results above the data show a distribution that is normal.

Multicollinearity Test

Table 4
Multicollinearity Test Results
Coefficients[a]

Model		Tolerance	VIF
1	Environmental Performance	.995	1.005
	Media Exposure	.995	1.005

Source: Processed Data (2023)

Table 4 indicates that the three independent variables have a tolerance > 0.10 and a VIF < 10. indicating the absence of multicollinearity.

Heteroscedasticity Test

This study uses the glejser test to determine whether or not heteroscedasticity occurs. The selection is based on the assumption that there is no heteroscedasticity if the significance value (Sig) surpasses 0.05. The following are the outcomes:

Table 5
Heteroscedasticity Test Results
Coefficients[a]

Model		Sig
1	Environmental Performance	.729
	Media Exposure	.599

Source: Processed Data (2023)

Table 5 above illustrates how the glejser test results can be inferred from the sig value is 0.729 and the media exposure variable is 0.599. Both numbers have a sig value > 0.05, it can be said that there is no heteroscedasticity.

Multiple Linear Regression Test

Table 6
Multiple Linear Regression Test Results
Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error
1	(Constant)	.389	.090
	X1_EP	-.013	.025
	X2_ME	-.019	.043

Source: Processed Data (2023)

The equation in this study is as follows:

$$Y = 0{,}389 - 0{,}013X1 - 0{,}019X2$$

The equation can be interpreted as follows:

1. The carbon emission disclosure coefficient is represented by a constant value of 0.389, which is impacted by environmental performance and media exposure.
2. The environmental performance (X1) regression coefficient is -0.013. This indicates that a one percent rise in the environmental performance variable (X1) will result in a one percent decrease in the carbon emission disclosure variable.
3. The media exposure (X_2) regression coefficient is -0.019, which suggests that this value shows a negative influence (opposite direction) between media exposure (X_2) and carbon emission disclosure (Y). This demonstrates that a one percent increase in the media exposure variable (X_2) will result in a corresponding one percent decrease in the carbon emission disclosure variable (Y), or -0.019.

Correlation Analysis Test

Table 7
Correlation Analysis Test Results
Correlation

		X1	X2	Y
X1	Pearson Correlation	1	.039	-0.81
X2	Pearson Correlation	.039	1	-.072
Y	Pearson Correlation	-.081	-.072	1

Source: Processed Data (2023)

Table 8
Correlation Analysis Test Interpretation Results

Variables	Correlation Coefficient	Coefficient Interval	Interpretation
X1_EP	-0.081	0.00-0.199	Very Low
X2_ME	-0.072	0.00-0.199	Very Low

Source: Processed Data (2023)

Table 8 above illustrates the interpretation results of the correlation analysis test. It is evident that there is a relationship very low level of relationship, the correlation coefficient value shows a negative number, this indicates that any increase in environmental performance and media exposure will be accompanied by a decrease in carbon emission disclosure.

Coefficient of Determination Analysis Test

Table 9
Determination Analysis Test Results
Model Summary[b]

Model	R	R	Adj R	Std.

		Square	Square	Error
1	.106[a]	0.11	-.037	.1314

Source: Processed Data (2023)

Kd = R^2 x 100%
= $(0.106)^2$ x 100%
= 1.02%

Table 10 above illustrates the coefficient of determination, which is 1.02% or 1%. This means that this study has an influence or relationship closeness of 1%, the remaining 99% is affected by additional factors that were excluded from this research.

Results of the t-test

Table 10
Results of the t-test
Coefficients[a]

Model		t	Sig.	Information
1	(Constant)	4.342	.000	
	X1_EP	-.506	.616	Rejected
	X2_ME	-.442	.661	Rejected

Source: Processed Data (2023)

Results of the f-test

Table 11
Results of the f-test
ANOVA[a]

Model		Sum of Squares	df	Mean Square	f	Sig.
1	Regression	.008	2	.004	.235	.729[b]
	Residual	.708	41	.017		
	Total	.716	43			

Source: Processed Data (2023)

Table 12
Results and Explanation of the t-test

Results	Explanation
The value of the environmental performance variable is -0.506 less than 2.014 with a significance rate of 0.616, more than 0.05.	This suggests that there is no significant influence between environmental performance and carbon emission disclosure. Then H0 is accepted and Ha rejected.
The value of the media exposure variable is -0.442 less than 2.014 with the significance rate 0.661 more than 0.05.	This suggests that there is no significant influence between media exposure and carbon emission disclosure. Then H0 is accepted and Ha rejected.

Source: Processed Data (2023)

Table 13
Results and Explanation of the f-test

Results	Explanation
The test value of f obtained was 0.235 less than 3.21 with a degree of significance of 0.792, more than 0.05.	This suggests that there is no significant influence between environmental performance and carbon emission disclosure. Then H0 is accepted and Ha rejected. This suggests that environmental performance and media exposure simultaneously have no significant impact on carbon emission disclosure.

Source: Processed Data (2023)

Environmental Performance on Carbon Emission Disclosure

The value is -0.506 < 2.014, so it does not has a substantial impact. Based on the regression test is negative, which means that an increase in environmental performance causes a decrease in carbon emission disclosure.

The study of this is consistent with studies carried out by Apriliana et al. (2019) and Lisadi & Luthan (2023) which states that environmental performance does not affect carbon emission disclosure. A high PROPER rating for companies does not guarantee the disclosure of carbon emissions, as companies may prioritize environmental disclosures published through sustainability reports. However, this study differs from earlier research by Maulidiavitasari & Yanthi (2021) and Melja et al. (2022) it asserts the revelation of carbon emissions is influenced by the environmental performance.

The conclusion that the higher the company discloses environmental performance, the lower the carbon emission disclosure.

According to the legitimacy theory, organizations frequently take specific acts or implement particular policies in order to preserve or improve their legitimacy in the eyes of the general public, stakeholders, and governments. Given this, it is reasonable to interpret the company's choice to reveal its carbon emissions as an effort to uphold its credibility as a sustainable and environmentally conscious business.

The study's alignment with the legitimacy theory, companies could give priority to particular disclosures, such those about their environmental performance, in order to preserve or improve their legitimacy in the eyes of the public and stakeholders. The hypothesis indicating a direct correlation between environmental performance and carbon emission disclosure was, nevertheless, disproved in spite of this theoretical framework. There are multiple explanations for this; complexity of carbon emission disclosure. In comparison to other environmental disclosures, the disclosure of carbon emissions may be viewed as being more complicated or less clear-cut. Businesses may find it difficult to measure and disclose carbon emissions precisely, so they may give priority to alternate disclosure methods that they view as simpler or less dangerous.

Media Exposure on Carbon Emission Disclosure

The value of media exposure is -0.442 < 2.014, which means that there is no affect. Based on regression testing, the value is negative, which means that an increase in media exposure causes a decrease in carbon emission disclosure.

This study is in accordance with the previous research carried out by Laksani et al. (2020) and Sandi et al. (2021) that asserts that media exposure does not have a substantial impact. Information on online media does not influence companies to disclose more information on carbon emissions. However, this research is not in line with research conducted by Firdausa et al. (2022) and Nurjanah & Herawaty (2022) it asserts that media exposure influenced carbon emission disclosure.

Its conclusion is, that the higher the company discloses media exposure, the lower the carbon emission disclosure.

Regression analysis revealed that media exposure had a negative coefficient meaning that more media exposure was associated with less disclosure of carbon emissions. The theory of legitimacy states that in order to preserve or improve their legitimacy in the eyes of stakeholders, organizations may prioritize making particular disclosures. However, given that other forms of disclosure are viewed as more strategically important to preserve legitimacy, it appears that in this instance, media exposure does not induce corporations to release more information about their carbon emissions.

The Regulatory Environment may be to blame for the hypothesis's rejection and the negative correlation found between media exposure and disclosure of carbon emissions. The company's independent disclosure policies for media exposures may be impacted by regulatory obligations and expectations around carbon emissions reporting. Businesses may place a higher priority on following rules than on voluntary disclosures brought about by media attention.

Conclusion and Recommendation

Conclusions

Environmental performance and media exposure do not positively influence carbon emission disclosure. Data concerning environmental disclosure stands as a vital piece of information that companies furnish to stakeholders. Information about company activities disseminated through online media and the environmental performance rating of a company does not guarantee that the company will enhance its carbon emission disclosure as the company focuses on environmental disclosures published through sustainability reports.

Numerous factors contribute to the limitations of research on how media exposure and environmental performance affect disclosure of carbon emissions. First, it becomes difficult to extrapolate the researcher's conclusions to the full population of organizations because they might only apply to a subset of businesses or industries. Furthermore, there is a chance that measurements based on variables, including media exposure and environmental performance, would not accurately reflect real-world events. The study's temporal limits might also make it more difficult to monitor changes in carbon disclosure over time. Because of this, evaluating the long-term effects of media exposure and environmental performance on carbon emission disclosure may be challenging.

Suggestions

Future research should take into consideration the limitations of this study, especially other factors that can affect. Because, in this study, it can only affect 1%. To overcome this obstacle, future research should pay attention to 99% of other factors that can affect carbon emission disclosure. Other suggestions for further research are as follows:

1. Additional research is recommended to add independent variables that have a strong influence on carbon emission disclosure.
2. Extend the observation period so that the research results are more accurate.
3. For companies, they should further improve the disclosure of information related to carbon emissions in sustainable reports with informative, precise and clear.

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