

Carbon Emission Disclosure: Relation to Environmental Performance, Carbon Performance, Company Size and Board Diversity

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ABSTRACT

The research aims to measure the impact of environmental performance, carbon performance, company size, and board diversity on the disclosure of carbon emissions. The samples were determined based on a quantitative purposive sampling method with a list of energy companies that have published the 2020-2022 Annual Report and Sustainability Report on the IDX with the acquisition of 18 samples. Multiple regression analysis is a method for measuring research hypotheses using SPSS v.25 statistical software. The results of this research show that the diversity of foreign boards and the diversity of board educational backgrounds influence the disclosure of carbon emissions. Meanwhile, carbon emissions disclosure cannot be influenced by environmental performance, carbon performance, board gender diversity and company size.

Keywords: Board Diversity; Carbon Performance; Company Size; Carbon Emission Disclosure; Environmental Performance.

Pengungkapan Emisi Karbon: Kaitannya dengan Kinerja Lingkungan, Kinerja Karbon, Ukuran Perusahaan dan Keberagaman Dewan

ABSTRAK

Penelitian ditujukan untuk mengukur dampak dari kinerja lingkungan, kinerja karbon, ukuran perusahaan, dan keberagaman dewan terhadap pengungkapan atas emisi karbon. Penetapan sampel yang diambil berdasarkan metode kuantitatif purposive sampling dengan daftar perusahaan energi yang telah mempublikasikan Annual Report dan Sustainability Report tahun 2020-2022 pada BEI dengan perolehan 18 sampel. Analisis regresi berganda merupakan metode untuk mengukur hipotesis penelitian dengan menggunakan software statistik SPSS v.25. Hasil penelitian ini menunjukkan keberagaman dewan asing dan keberagaman latar belakang pendidikan dewan berpengaruh secara signifikan terhadap pengungkapan emisi karbon. Sedangkan pengungkapan emisi karbon tidak dapat dipengaruhi oleh ukuran perusahaan, kinerja lingkungan, kinerja karbon dan keberagaman gender dewan.

Kata Kunci: Kinerja Lingkungan; Kinerja Karbon; Keberagaman Dewan; Ukuran Perusahaan; Pengungkapan Emisi Karbon

Artikel dapat diakses : <https://ojs.unud.ac.id/index.php/Akuntansi/index>



e-ISSN 2302-8556

Vol. 34 No. 5
Denpasar, 26 Mei 2024
Hal. 1152-1165

DOI:
10.24843/EJA.2024.v34.i05.p06

PENGUTIPAN:
Rahman, F. A., & Mujiyati.
(2024). Carbon Emission
Disclosure: Relation to
Environmental Performance,
Carbon Performance,
Company Size and Board
Diversity. *E-Jurnal Akuntansi*,
34(5), 1152-1165

RIWAYAT ARTIKEL:
Artikel Masuk:
26 April 2024
Artikel Diterima:
28 Mei 2024

INTRODUCTION

Changes that occur due to globalization can be triggered by external and internal behaviors that can force a business actor to strive to improve its performance and profits and force business actors to care about social problems. The bigger the amount of power that will accompany a business, the more it needs to be accompanied by a solution that can benefit all parties, both business actors, individuals, and society. Corporate responsibility behavior for a social attitude is contained through actions taken with corporate social responsibility (CSR) which is not only limited to economic activity but also social responsibility for the environment (Cahya, 2014). Citing research conducted by Yoon et al (2006) that CSR activities can create great public attention so that it can improve the company's brand image because it considers the company cares not only for shareholders but also for the public interest.

Increased economic growth will have adverse impacts such as environmental degradation. In industrial operations, burning fossil fuels to produce cement, metals and basic materials results in high carbon emissions. Over the past two decades, carbon emissions from fossil combustion and industrial processes have increased significantly (Kompas.com, 2020). In addition to the production process, carbon emissions are also caused by the greenhouse effect (Sadira Ashia Priliana & Ermaya, 2023). According to data published by the International Energy Agency (IEA) in 2022, carbon dioxide (CO₂) emissions that occur due to industrial operations and activities have reached a high value of 36.8 gigatons.

Climate change is a very serious problem, occurring due to the influence of global warming. Global warming occurs due to the release of carbon dioxide loads, or in the industry referred to as carbon emissions. Quoting the report given by the Intergovernmental Panel on Climate Change (IPCC) in its statement, it is stated that climate change in the world has changed drastically, exceeding what has been predicted. The IPCC also revealed that if there are no serious prevention efforts, there could be several problems that threaten human life, such as droughts, floods, and various other disasters.

One form of corporate environmental responsibility can involve the disclosure of non-financial information, such as disclosure of carbon emissions, to gain legitimacy for the company's activities and maintain social consistency. It is expected that with the disclosure of carbon emissions contained in the financial statements, the company will gain legitimacy for its responsibility to social, environmental and natural preservation so that later the community will support a policy set by the company (Pratiwi, 2018). Legitimacy theory forces companies to pursue all actions that can encourage the creation of nature conservation so that this legitimacy will be seen in the corporate environment. Companies need to act in accordance with the needs and desires of the community which is an emerging responsibility towards their social environment (Cahya, 2016).

Based on PERPRES (2012) No.47 of 2012 concerning Social and Environmental Responsibility of Limited Liability Companies, commercial businesses contribute to efforts to reduce gas effects, including carbon emissions. Companies can assist in efforts to reduce emissions by disclosing emissions as business agents (Aji et al., 2023). Therefore, companies should prepare carbon

emission disclosure reports as a contribution to the environment. Disclosure of carbon emissions in Indonesia has not been done by all business entities, by always prioritizing profits, attention to environmental issues is reduced so that special attention is needed in conducting a responsible and sustainable business approach (Stechemesser & Guenther, 2012). Environmental problems caused by operations are not limited to the surrounding environment, but also develop in the effects of global warming released by gas emissions from former company operations (Cahya, 2016). Citing the work of Priyanto (2017) published through *tribunnews.com*, it was explained that in 2017 hundreds of residents were demonstrating over the attitude of air pollution carried out by PT Charoen Pokphand because of the impact of its factory operations, at that time the community felt that the company had violated of the use of public rights due to exceeding agreed capacity, unauthorized waste disposal.

Research the disclosure of carbon emissions has been developed by several previous researchers, among others; Sadira Ashia Priliana & Ermaya, (2023). The research findings show that environmental performance can have an equal impact on carbon emission disclosure, which means that companies with good environmental performance are more likely to recognize the value of environmental reports, while carbon emission disclosure cannot be influenced by foreign diversity and carbon performance. Furthermore, the findings by Cahya (2016) provides findings that the level of disclosure of carbon emissions can be influenced by the type of industry and profitability. While environmental performance, and company size and media exposure can not provide a significant influence on the level of disclosure of carbon emissions. Companies that make efforts by disclosing environmental performance are usually in line with their performance, because they are adaptive to solving the environmental problems caused. This is in accordance with the research results Dawkins & Fraas (2011); Calcarina (2018) and Maulidiavitasari & Yanthi (2021) shows that companies that have environmental performance will provide information earlier in their efforts to change and overcome environmental problems caused by carbon emissions.

H₁: Environmental performance affects carbon emission disclosure.

Companies are encouraged to maintain improvements in their carbon profile and inform society by providing disclosures about carbon emissions. This makes companies more objective, reliable and harder to copy by other companies that have not adopted this strategy. (Ratmono, 2019). Legitimacy theory explains the relationship between carbon performance and comprehensive disclosure as a form of corporate responsibility to society. Companies with good carbon performance have an incentive to provide information to investors and other stakeholders about their environmental strategies through voluntary disclosure to gain legitimacy. Ratmono (2019), Dian Rahmawati Putri & Murtanto (2023). Through this thinking structure, it was decided that

H₂: Carbon performance affects carbon emission disclosure

Research conducted Widia Astuti & Setiany (2021) which tests and measures carbon emissions disclosure through company size, leverage and probability. The findings revealed that board characteristics affect carbon emissions disclosure. Whereas firm board size, board gender and board diversity have no effect on carbon emissions disclosure. A lot of public attention is caused by a

company's size. This is because the pressure that occurs on a company's size will force the company to strive and overcome its environmental problems. Carbon emissions are also often associated with the amount of assets owned by the company, this is due to the performance activities and equipment that occur in the company. (Nastiti & Hardiningsih, 2022). The more attention it gets will encourage the acquisition of legitimacy which will then have a major impact on its popularity including in the influence of differences in company size on its carbon emissions disclosure. Eka Dewayani & Ratnadi (2021); Ratmono et al (2020); Wahyunigrum *et al* (2022).

H₃: Company size affects carbon emission disclosure

Carbon emission disclosure presented in the financial statements will certainly be influenced by the level of board diversity, one of which is gender diversity, Anggraini & Suwasono (2021) revealed that a female board of directors can improve the quality of decision making in a company and can help in maximizing the form of carbon emission disclosure. This is because women do things more carefully than men and tend to be more sensitive to their environment and want to help Khamimah & Siregar (2021). Other findings were also obtained through research Herinda et al (2021) which reveals that masculine environments usually tend to be considered competition, individualism, hierarchy, and technological achievement. Whereas women are generally based on mutual empowerment, empathy, and authenticity. Therefore, the presence of female directors is considered suitable for better evaluation of environmental issues.

H₄: Gender diversity affects carbon emissions disclosure

Foreign boards of directors bring different perspectives, beliefs, cultures and work experiences (Putri & Fadilah, 2021). Therefore, it can be said that decision-making is often influenced by the diversity of citizens. In addition, the presence of foreign nationals in board positions is often rigid and disciplined, which impacts the management of the company's assets (Rokhilla Haris Lubis et al., 2021). Therefore, the presence of a foreign board of directors will bring progress to the company, especially providing more extensive information Khamimah & Siregar (2021), Kılıç & Kuzey (2019); Lahyani (2022) revealed that the form of diversity that occurs in companies, especially in foreign diversity, can be an influence on the expansion of information related to carbon emissions.

H₅: Foreign diversity affects the disclosure of carbon emissions.

Educational background is related to a person's intellectual ability. People who work in a company cannot be separated from their education. In fact, companies will be more selective of employees based on educational background according to their needs. Education that suits the needs of the company is also important for the composition of the board of directors as a whole. This is because the educational background of the board of directors affects the level of knowledge of the board of directors Mahalik et al (2021); Rokhilla Haris Lubis et al., (2021).

H₆: Educational diversity affects carbon emissions disclosure

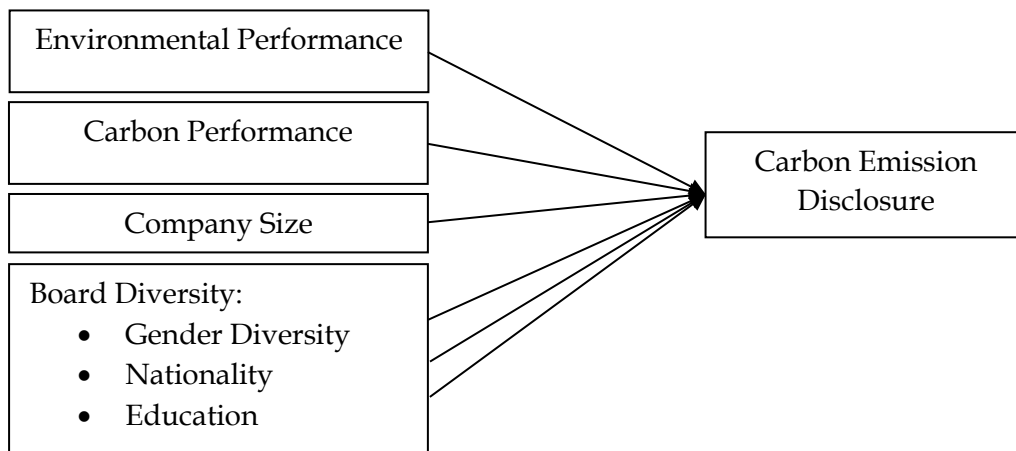


Figure 1. Research Model

Source: Research Data, 2024

RESEARCH METHODS

Researchers measured carbon emissions in energy sector companies from 2020 to 2022 by looking at the results of the value charge published in the company's annual report and sustainability report. The sample is a collection of data as a research subject through the determination chosen by the researcher, through quantitative method measurements carried out by purposive sampling method as a sample determination and sample measurements carried out on companies listed as energy sector companies on the Indonesian Stock Exchange (IDX). Companies in the energy sector were chosen with the consideration that they pay less attention to the adjustment of carbon emission reports, this was expressed by Fernanda (2022) which states that the acquisition of each energy sector company has a value for carbon emission disclosure that is not too high, meanwhile companies engaged in the energy sector have also taken actions that indicate damage to chicken resources, including the process of burning energy, extracting oil, using natural gas, massive mining and other actions that are prone to environmental damage.

Table 1. Sample Selection

Description	Total
Energy industry listed on the Indonesia Stock Exchange (IDX)	83
The energy industry is listed on the IDX but does not publish the complete Annual Report and Sustainability Report for 2020-2022 required in the study	(65)
Total Sample in One Year	18
Total Observation for Three Years	54
Total Samples Used	54

Source: Primarry Data processed, 2024

Carbon emission disclosure is defined as the dependent variable, which is then measured by the content analysis method such as assessing the content contained in the company's annual report and sustainability report. Looking at the ratio measured on the specified items by comparing the 18 disclosure items based

on the theory put forward by Choi et al (2013) such as climate change, the resulting greenhouse effect emissions, energy consumed, disclosure of greenhouse effect costs and gases, and accountability for carbon emissions. The equation is presented with CED values.

$$CED = \left(\frac{\text{Total Item Used}}{18 \text{ items}} \right) \times 100\% \dots \dots \dots (1)$$

While research on independent variables includes environmental performance, carbon performance, board diversity, and company size. Environmental performance includes sustainable measurement of environmental impacts with a long period of environmental performance, this measurement uses color criteria proxied through proper values. (Krisnawanto & Solikhah, 2019).

Carbon performance involves measuring the management of carbon emissions, which is measured by comparing the value of carbon emissions to sales (Sadira Ashia Priliana & Ermaya, 2023).

$$CP = \frac{\text{Total Carbon Emissions}}{\text{Total Company Sales}} \dots \dots \dots (2)$$

Company size includes the measurement of the scale of the size and value of the company which is assessed through total assets, market capitalization and or sales. (Septriyawati et al., 2019). Furthermore, Board Diversity includes the measurement of the heterogeneity of a member of the existing structure in the company, this measurement is assessed on interpersonal skills, operational, political, gender, nationality, age, to education and religion (Van Knippenberg et al., 2004).

$$\text{Gender Ratio} = \frac{\text{Total Female Directors}}{\text{Total Member Directors}} \dots \dots \dots (3)$$

$$\text{Foreign Ratio} = \frac{\text{Total Foreign Ratio}}{\text{Total Member Directions}} \dots \dots \dots (4)$$

$$\text{Ratio of Economic Graduates} = \frac{\text{Total Economic Graduates}}{\text{Total Member Directions}} \dots \dots \dots (5)$$

Then the measurement of the data value is measured through the SPSS v.25 statistical data analysis software program with the stages of measuring classical assumptions to measuring multiple regression analysis.

RESULTS AND DISCUSSION

Determination in data grouping refers to the results of descriptive statistics found such as knowing the loaded value. The data equation is loaded as:

Table 2. Descriptive Statistics Value Measure

Min	Max	Min	Max	Mean	Std.Deviation
CED	54	0.722	0.889	0.849	0.059
EP	54	0.000	5.000	1.980	2.097
CP	54	0.000	0.006	0.001	0.001
CS	54	26.416	32.759	30.274	1.322
GD	54	0.000	0.667	0.189	0.189
ND	54	0.000	0.636	0.132	0.185
ED	54	0.000	1.000	0.646	0.241

Source: Primary Data processed, 2024

It is stated that companies listed on the IDX have made disclosures of carbon emissions that are very large through the presentation of Table 2, it is found that the variable carbon emission disclosure (CED) spread over 18 samples means 84.8%. The next data are several other measurement variables, such as environmental performance (EP) with a mean of 1.98, it is said that the average PROPER value gets a value with blue, red and black color categories, which means that a company's compliance has not been fully carried out so that in the future the company will be optimal in disclosing carbon emissions and environmental management appropriately and completely. The next data is carbon performance (CP), which means 0.0009 acquisition of this value. It is said that the average company has a fairly poor carbon performance. The next data is the company size (CS) mean of 30.27. This acquisition can be categorized as the average company, which has a proportion of company size of 30.27. The next data is gender diversity (GD), which means 0.188. The acquisition of this data shows that the average company has diversity over gender by 18%. The next data is nationality diversity (ND), which means 0.13. With this acquisition, it can be said that the average company has a nationality diversity of 13%. The next data is the diversity of education (ED) mean of 0.646; this acquisition can be said that the average company has a diversity of education of 64%.

Table 3. Classical Assumption Value Measure

Description	Tolerance	VIF	Sig.	Asymp. Sig.	D-W Hitung
EP	0.442	2.263	0.976		
CP	0.745	1.341	0.230		
CS	0.479	1.341	0.872		
GD	0.560	1.785	0.555		
ND	0.792	1.262	0.836		
ED	0.788	1.269	0.405		
Normalitas				0.51	
Autokorelasi					1.095

Source: Primary Data processed, 2024

Then, the measurement of classical assumptions is determined by presenting the test values of normality, multicollinearity het, heteroscedasticity, and autocorrelation. The finding on the normality test value is 0.51, then multicollinearity testing is the VIF value, which is not less than 10, and heteroscedasticity testing is the Sig. value which is more than 0.05 so it is said that the findings do not indicate multicollinearity and heteroscedasticity and autocorrelation testing found a value of 1.095 so that there is no indication of autocorrelation because the findings of the D-W value are between -2 to +2.

The measurement of the tested variables is then presented through multiple regression analysis findings and presented by determining a significant value of 0.05 and the regression coefficient value (β) can be found in the linear regression model.

Table 4. Multiple Linear Regression Value Measure

Description	Total	(β)	Std. Error	t	sig
(Constant)	0.509	0.208		2.452	0.018
Perfomance	0.004	0.005	0.143	0.870	0.389
Enviromental					
Carbon	-6.901	7.361	-0.118	-0.937	0.353
Performance					
Company Size	0.013	0.007	0.283	1.798	0.079
Gender	0.054	0.045	0.174	1.196	0.238
Diversity					
Nationality	0.094	0.039	0.297	2.425	0.019
Eduation	-0.100	0.030	-0.410	-3.338	0.002
Diversity					
Adj. R2					0.37
F statistic					6.189
F sig.					0.000

Source: Primary Data processed, 2024

The findings are then represented as

$$CED = 0,509 + 0,004EP - 6,901CP + 0,013SC + 0,054GD + 0,094ND - 0,100ED + e.....(6)$$

Measurement of the results of the significant value of a test of environmental performance variables is 0.389, and a t value of 0.870 stated that environmental performance can not provide sufficient considerable value to the disclosure of carbon emissions. So through these results, it is stated that hypothesis one is rejected because in the data measurement findings found sig. Value which is more than 0.05. The same result was found by Cahya (2016) Sekarini & Setiadi (2021) which states that environmental performance on disclosure of carbon emissions is insignificant. Conversely, this finding is not in line with the research of Sadira Ashia Priliana & Ermaya (2023) which reveals that the disclosure of carbon emissions can be influenced by environmental performance. This is expected because the PROPER obtained for disclosing carbon emissions in the company's financial statements has not been fully managed and appropriately addressed. Assessing the existence of corporate legitimacy theory should pay attention to indications that lead to environmental impacts and companies can be more active with a variety of options that arise such as conducting programs that can prevent the impact of excessive pollution, and can utilize renewable energy. Revealed by Jannah & Muid (2020) that this initiative can be utilized for ease in companies disclosing their carbon emissions, it is stated that this behavior can support the assessment of shareholders as additional information in actions that can increase the credibility of the company. So with this it is stated that the factor that influences the disclosure of carbon emissions is not from environmental performance

Furthermore, the measurement of the significant value of a test of the carbon performance variable is 0.353, and the t value is -0.937; it is stated that carbon performance cannot provide sufficient significant value to the disclosure of carbon emissions. So, through this result, it is stated that hypothesis two is rejected because, in the data measurement, findings found a sig. value greater than 0.05. The results of this study are in line with the research Sadira Ashia Priliana &

Ermaya (2023) Iratiwi & Sulfitri (2023) which reveals that carbon performance has no effect on carbon emission disclosure. Companies with a tendency to have a low level of carbon performance when disclosing carbon emissions can incur additional costs from the disclosure they make, it can also cause a decrease in reputation and the company's image, and this can have an impact on the decline in the share price owned by the company. Therefore, it can have an impact on the decline in the price of shares owned by the company. This leads to the need for mutually beneficial actions for the company, such as actions regarding the dissemination of information on its carbon profile, as well as actions that can detail the programs and problem solving that have been carried out in recent decades. This relationship relates back to legitimacy theory that the company will benefit from its initiative to disclose carbon emissions because it will improve the company's image and reputation.

Measurement of the results of the significant value of a test of the company size variable is worth 0.079, and the t value of 1.798 stated that the size of the company can not provide sufficient significant value to the disclosure of carbon emissions. So, these results show that the third hypothesis is rejected because, in the findings of data measurement, a sig. Value of more than 0.05 is found. PERPRES No. 61 2011 shows that disclosure of carbon emissions is not only based on company size. A company's size should try to disclose its carbon emissions. Still, companies tend to make other efforts that can increase their legitimacy value by taking actions similar to protecting nature and striving to maintain actions that can project environmental pollution. This result agrees with the research Kholmi et al (2020) Septriyawati & Anisah (2019) which states that the disclosure of carbon emissions cannot be influenced by the size of a company. In contrast to research Jannah & Muid (2020) which states that company size affects the disclosure of carbon emissions.

The measurement of the results of the significant value of a gender diversity variable test is worth 0.238, and the t value of 1.196 indicates that gender diversity can not provide sufficient significant value to the disclosure of carbon emissions. So, through this result, it is stated that the fourth hypothesis is rejected because the data measurement findings found sig. Value which is more than 0.05. Through the findings displayed in the descriptive statistics table, it is shown that the presence of female gender in energy sector companies is only around 18.8%, which means that the dominance provided by female directors has low results so that it cannot support the disclosure of company carbon emissions, the presence of female directors will provide significant results if the company can strive for dominance to reach the value of "critical mass". The role of gender diversity can help companies design structures and manage companies to be more dynamic, because a company's gender diversity will influence the involvement that occurs when deliberating. Chapple (2019) revealed that the existing gender diversity ranks will make the company more stable because it considers that the female gender is the one who has responsible behavior and social attitudes, so it is expected that it contributes more to environmental disclosure. These findings are consistent with research Trufvisa & Ardiyanto (2019) Firza et al (2023) that gender diversity on the board of commissioners does not have a significant impact on carbon disclosure.

Measurement of the results of the significant value of a test of the citizenship diversity variable is worth 0.019, and the t value of 2.425 stated that the diversity of a citizenship behavior can provide sufficient significant value to the disclosure of carbon emissions. So, these results show that the fifth hypothesis is accepted because the data measurement findings showed a sig. Value that is less than 0.05. This is not in line with the research Widia Astuti & Setiany (2021) which states that nationality diversity has no effect on carbon emission disclosure. Any research is in line with research conducted by Chika & Patricia Widianingsih, (2024); Syabilla et al (2021) which reveals that the presence of foreign diversity in a board of directors can expand the disclosure of information about the company's carbon emissions. The cultural differences created by the diversity of directors' citizenship can provide a perspective of action, this can also support the existence of new information provided voluntarily to achieve a company's interests. Legitimacy theory explains that the diversity of foreign directors will use carbon emission disclosure reports as a means of defending against threats.

Measurement of the results of a significant value of a variable test of educational diversity is worth 0.002, and a t value of -3.338 stated that the diversity that occurs on an education level can have a significant effect on the disclosure of carbon emissions due to the acquisition of the results of the sig value is less than 0.05. So, through these results, it is stated that the sixth hypothesis is accepted. Research Amaliyah & Solikhah (2019) is not in line with the study's results, where educational diversity does not affect the disclosure of carbon emissions. But, this is in line with the opinion of Desky Aprilia & Astrid Kesaulya (2023); Firza et al., (2023) which state that having an educational background, especially economics, can make the distribution of a company's carbon emissions run better because it can directly understand the needs of shareholders. When the position of the board of directors is given to those who have an economic education background, it will make decision making can be taken optimally, the position of the board that comes from an economic background will provide another positive thing because there will be better and more transparent disclosure. The support of directors who come from economic education will provide the ability for the company's image and credibility to increase.

Then, the measurement of the f value of each test variable is 0.000, which is a value that is worthy of more profound research because it is less than 0.05. Furthermore, it is known that the r square value in a test model is 0.37 or 37%, which explains that this value is known for the influence given by company size, environmental performance, carbon performance, gender diversity, foreign diversity, and educational diversity on carbon emission disclosure.

CONCLUSIONS

The data findings state that environmental performance, carbon performance, company size, and gender diversity cannot provide positive results in disclosing carbon emissions. This is due to the results provided by PROPER, which states that the company's compliance is lacking in encouraging disclosure of carbon emissions and environmental management, and legitimacy theory explains that companies need to implement and disseminate information widely to increase recognition in the community. Meanwhile, the diversity of nationality and

educational background can provide results that reveal the disclosure of carbon emissions. The limitations of the study lie in the object of research which only covers energy sector companies for the period 2020-2022, further researchers can expand the object of research because based on the GICS index it is known that companies in the manufacturing and non-manufacturing sectors are also companies that have high intensity on carbon emissions. The year used in this study also only takes three years so that it is less to be used as a picture of long-term conditions, for future researchers can extend the research period taken so that it will be more accurate, besides that there is also a weak point in the measurement of carbon emission disclosure items because there is an element of researcher objectivity so that there may be different results between researchers so that future researchers can use a more standardized measurement of carbon emission disclosure.

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