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Does the Diversity of the Board of Directors Affect the Disclosure of Carbon Emissions? (Empirical Study of Carbon-Intensive Industry Companies Listed on the Indonesia Stock Exchange for the 2020-2021 Period)

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ABSTRACT: *This study aims to determine the effect of the diversity of the board of directors on the disclosure of carbon emissions. This research is a quantitative study using multiple linear regression analysis with the help of SPSS version 24 software. The population in this study are carbon-intensive industrial companies consisting of the mining sector, basic and chemical industries, and consumer goods industries which are listed on the Indonesia Stock Exchange for the period 2020-2021. The selection of the research sample used purposive sampling and it is known that the samples used were 188 carbon-intensive industrial companies consisting of the mining, basic and chemical industries, and the consumer goods industry which was listed on the Indonesia Stock Exchange for the 2020-2021 period. The results of the study show that: (1) the variable gender diversity has no effect on the disclosure of carbon emissions; (2) the nationality diversity variable influences the disclosure of carbon emissions; (3) the age diversity variable has no effect on the disclosure of carbon emissions; (4) tenure diversity variable has no effect on disclosure of carbon emissions.*

Keywords: *Disclosure of Carbon Emissions, Diversity of the Board of Directors, Gender Diversity, Nationality Diversity, Age Diversity, Tenure Diversity*

I. INTRODUCTION

Global warming is not a foreign thing to the ears of the people, not infrequently the term is often used as the main cause of temperature changes, erratic weather, landslides, flash floods, threatened crop failures, the sinking of small islands, and other natural disasters. Global warming is caused by the increasing amount of greenhouse gases produced and released into the earth's atmosphere. There are two groups of greenhouse gases, namely the group of greenhouse gases that have a direct effect and the greenhouse gases which have an indirect effect on global warming (Rendi et al ., 2022). Many sectors contribute to carbon emissions, such as transportation, the automotive industry, household waste, and other industries. Corporate responsibility for environmental damage that is often discussed is corporate social responsibility (CSR). But over time, environmental problems are not only related to CSR but a broader issue, namely carbon emissions which cause global warming.

As a form of world attention to the problem of climate change, the Kyoto Protocol (1997) was issued in Japan which received support from The United Nations (UN) as an effort to reduce greenhouse gas emissions. Countries that verify this protocol commit to reducing emissions or release carbon dioxide and five other greenhouse gases or cooperate in trading emissions to address global warming (Umi, 2016). Indonesia as one of the largest contributors to carbon emissions has also started to make several efforts and commitments. The

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Indonesian government issued Law number 17 of 2004 concerning the Ratification of the Kyoto Protocol to The United Nations Framework Convention on Climate Change to prove the seriousness of the Indonesian Government in implementing sustainable development and participating in efforts to reduce greenhouse gas emissions. In addition, Indonesia also issued Presidential Regulation No. 61 of 2011 concerning the National Action Plan for Reducing Greenhouse Gas Emissions and Presidential Regulation No. 71 of 2011 regarding the implementation of a national greenhouse gas inventory. In article 4 of Presidential Decree No. 61 of 2011, it is stated that business actors also participate in efforts to reduce greenhouse gas emissions.

Corporate carbon disclosure is often presented as a form of voluntary disclosure that is useful for internal and external decision-making (Andrew and Cortese, 2011). Companies that make carbon disclosures will make it easier for stakeholders to make decisions about the state of the company's carbon emission performance, pressure companies to reduce carbon emissions, and contribute to public debate about climate change policies and regulations (Ennis et al ., 2012). Stakeholders need reports on greenhouse gas levels to assess company performance in times of climate change (Andrea et al ., 2015). According to Lash and Wellington (2007), stakeholders expect companies to calculate and report the resulting emissions because carbon management and reporting are used to manage and assess business risks related to climate change and business opportunities.

Carbon Disclosure Project (CDP) is a non-profit global disclosure system for companies, cities, states and regions to manage their environmental impact and for investors or buyers to access environmental information for use in making financial decisions (Dafqi and Dian, 2019). Climate change, water scarcity and deforestation are unparalleled global challenges that require systemic changes in market behavior. The carbon disclosure score considers several environmental aspects, such as risks, opportunities, impacts, investments and challenges (Lahyani, 2022).

II. Literature Review and Hypothesis Development

2.1. Theritical Perspective

Stakeholder Theory

Stakeholder theory states that a company is not an entity that only operates for its own sake, but must also provide benefits to its stakeholders (shareholders, creditors, consumers, suppliers, government, community, analysts and other parties). According to Freeman and Reed (1984), stakeholder theory is any individual or group that can be identified as influencing or influencing an organizational goal. Stakeholder theory suggests that companies need to report relevant information to stakeholders, including investors, partners and customers. Previous carbon disclosure literature has underlined the benefits of voluntary disclosure of environmental information for increasing stakeholder satisfaction (Guthrie et al ., 2004) and accountability for sustainability (Zhang and Liu, 2020). In particular, companies with high carbon emissions face significant pressure from various stakeholders to implement effective sustainability practices and strategies (Mardini and Lahyani, 2022).

Legatimacy Theory

Legitimacy theory is based on the notion of a social contract implied between social institutions and society (Ahmad and Sulaiman, 2004). Legitimacy theory provides another theoretical framework to explain the importance of carbon disclosure as an effective tool to enhance a company reputation and legitimacy (Deegan, 2002; Michelon and Parbonetti, 2012; Li et al ., 2016). Corporate environmental activities must comply with community values, norms, and regulations. Qian and Schaltegger (2017) argue that carbon disclosure is a legitimate tool that reflects a company's propensity to meet stakeholders' environmental expectations.

2.2. Hypotesis Development

Gender Diversity

Gender diversity is likely to influence corporate governance positively, given the problem-solving

capacity and social behavior of female directors who exhibit better interactions with stakeholders. Researchers have researched and reported the results that there is a positive relationship between appointing a female director in the meeting room and the disclosure of carbon emissions (Galbreath, 2009; Haque and Deegan, 2011; Rankin et al ., 2011; Ortiz-de-Mandojana et al ., 2016) from the perspective of stakeholder theory and the perspective of agency theory. With a higher number of female board members it can be associated with a higher quantity of carbon disclosure as well (Hossain et al ., 2017; Al-Qahtani and Elgharbawy, 2020) and also quality (Rankin et al ., 2011). A plausible explanation for the increasing selection of women as directors is that women have their advantages and characteristics, especially their relational skills (Khatib et al ., 2020), which makes it easier to share sustainability information with stakeholders (Rao and Tilt, 2016). However, Bui et al . (2020) said that the actual situation shows that the relationship between female directors and carbon disclosure in the United States is not statistically significant. Women directors may be able to consider broader and more specific sustainability multifaceted characteristics such as carbon indicators. Based on this description, the researcher formulated the hypothesis as follows:

H1: Gender diversity has a positive effect on carbon emission disclosure.

Nationality Diversity

International directors from various countries can bring new perspectives because their expertise and ways of working are diverse and different from us, who can make more informed decisions (Est élyi and Nizar, 2016). From a legitimacy theory perspective, Depoers et al . (2016) confirm that national diversity can support an increase in the amount of information on climate change that is disclosed voluntarily to company stakeholders and considers carbon disclosure as a beneficial communication tool to be able to maintain the level of legitimacy of companies in France. Still in the context of the same institution, Mardini and Lahyani (2022) reveal that international directors are oriented toward stakeholders, by encouraging carbon disclosure policies to increase transparency and improve company reputation in the carbon-incentive sector. Despite the increasing awareness of stakeholders and the public on climate change, studies examining the relationship between national diversity and disclosure of carbon information are still quite rare. With these assumptions, it can be assumed that:

H2: Nationality diversity has a positive effect on carbon emission disclosure

Age Diversity

The diversity of ages in the boardroom can provide fresh perspectives given the diverse backgrounds and expertise of each person, which can lead to effective decisions that take into account the needs of stakeholders. Chams and García-Bland (2019) reveal that when viewed from a stakeholder theory perspective, there is a positive and significant relationship between age diversity and sustainability performance in the United States with a sample of multinational companies. Beji et al . (2020) revealed that in France, older directors with different values and perspectives show more and greater concern for ongoing environmental problems. Still in the same context, Post et al . (2011) also suggested that there is a significant relationship between the age of company boards and sustainable performance. It is also known that directors in the 1950s at large companies in the USA tended to be more oriented toward environmental stakeholders (Post et al ., 2011). Senior directors who have high values and more experience in their performance on company boards support the company's ecological responsibility in dealing with sustainability issues (Chams and García-Bland, 2019). Therefore the researcher assumes that:

H3: Age diversity has a positive effect on carbon emission disclosure

Tenure Diversity

There is little empirical evidence on the impact of tenure diversity on carbon disclosure. Related and

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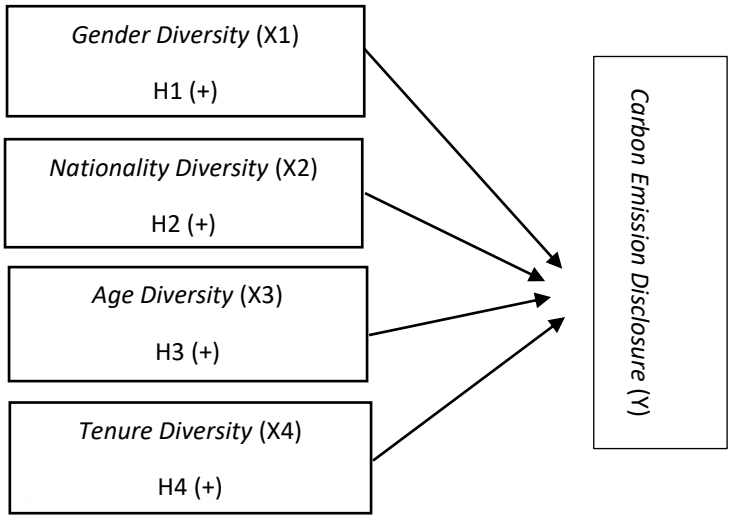
seen from the perspective of stakeholder theory, Rao and Tilt (2016) revealed a positive relationship between board tenure and CSR. In Australia, where it is shown that meeting rooms with directors with longer tenure tend to be able to issue broader CSR disclosures (Lahyani, 2022). A longer board tenure will add to the director's experience and knowledge of the industry and enable a better understanding of dealing with sustainability issues and the needs of stakeholders. From this description, the researcher assumes that:

H4: Tenure diversity has a positive effect on carbon emission disclosure

III. Conceptual Framework

In accordance with the literature review that has been stated above and by looking at the results of research on the effect of diversity of the board of directors on carbon emissions disclosure, the researchers developed a conceptual framework related to the research as a basis for determining hypotheses, which will be described in the chart below.



IV. Research Method

The population in this study are carbon-intensive industrial companies consisting of the mining sector, basic and chemical industries, and the consumer goods industry which are listed on the Indonesia Stock Exchange for the 2020-2021 period which were obtained through the media website of the Indonesian Stock Exchange (IDX) (idx.co.id) and the company's official website. The sample in this research is 188 carbon-intensive industrial companies consisting of the mining sector, basic and chemical industries, and the consumer goods industry which are listed on the Indonesia Stock Exchange for the 2020-2021 period. Determination of the sample in this study using the purposive sampling method.

The sample criteria used by researchers in this study are:

a. A carbon-intensive industrial company listed on the Indonesia Stock Exchange during 2020-2021.
b. A carbon-intensive industry company that publishes a complete annual report on the Indonesian Stock Exchange website for 2020-2021.
c. Carbon-intensive industry companies whose annual reports have complete data for research.
d. The financial statements of carbon-intensive industry companies for 2020-2021 have profits and no losses.

4.1 Evaluation Methods

To test the hypothesis above, this study uses multiple regression analysis. The dependent variable of

this study is a disclosure of carbon emissions, and the independent variables are gender diversity, nationality diversity, age diversity and tenure diversity. The control variables in this study are firm size, leverage and profitability. The following is the research model used:

CE_Disc = α + β1GD + β2ND + β3AD + β4TD + β5Size + β6Lev + β7Pro + e

Where CE_Disc: disclosure of carbon emissions; β1GD : gender diversity; β2ND : national diversity; β3AD : age diversity; β4TD : tenure diversity; β5Size : firm size; β6Lev : leverage; β7Pro : profitability.

4.2 Research Variabel

Dependent Variable: Disclosure of Carbon Emissions

Carbon emission disclosure is a part of Carbon Accounting, namely the obligation for a company to measure, recognize, record, present and disclose carbon emissions. This variable is calculated using the carbon disclosure score developed by CDP to measure the level of voluntary carbon disclosure. By giving a score to each disclosure item (Carbon Emission Disclosure Checklist) with a dichotomous scale. The maximum score is 18, while the minimum score is 0. Each item is worth 1 so if the company fully discloses the items in its report, then the company's score is 18, then adding up the scores for each company.

Independent Variables and Control Variables

The independent variables in this study are gender diversity, nationality diversity, age diversity and tenure diversity. While the control variables in this study are firm size, leverage and profitability. Here are the measurements:

Variable	Measurement
Gender Diversity	Blau Index
National Diversity	Number of international board of directors/Number of board of directors
Age Diversity	Blau Index
Tenure Diversity	Blau Index
Firm Size	Natural Logarithm of Total Assets
leverage	Return on Assets (ROA)
Profitability	Debt to Assets Ratio (DAR)

V. Results and Discussion

1. Descriptive Statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Y	188	0,000	0,722	0,19387	0,200890
X1GD	188	0,000	0,500	0,17411	0,195223
X2ND	188	0,000	0,600	0,08486	0,155301
X3AD	188	0,000	0,781	0,51510	0,143169
X4TD	188	0,000	0,778	0,32032	0,261410
FS	188	11,263	19,005	15,09566	1,692415
LEV	188	0,065	0,888	0,41901	0,190952
PRO	188	0,000	0,212	0,05888	0,049276

 Received-14-12-2022, Accepted- 23-12-2022

Valid N (listwise)	188

From the table above it can be seen that there are 188 samples (N). Where the dependent variable, namely disclosure of carbon emissions, has a minimum value of 0,000 and a maximum of 0,722 with an average value of 0,193 and a standard deviation value of 0,200. For the independent variable gender diversity, it has a minimum value of 0,000 and a maximum of 0,500 with an average value of 0,174 and a standard deviation value of 0,195. For the independent variable nationality diversity, it has a minimum value of 0,000 and a maximum of 0,600 with an average value of 0,084 and a standard deviation value of 0.155. For the independent variable age diversity, it has a minimum value of 0,000 and a maximum of 0,781 with an average value of 0,515 and a standard deviation value of 0,143. For the independent variable tenure diversity, it has a minimum value of 0,000 and a maximum of 0,778 with an average value of 0,320 and a standard deviation value of 0,261.

For the firm size control variable, it has a minimum value of 11.263 and a maximum of 19,005 with an average value of 15,095 and a standard deviation value of 1,692. The leverage control variable has a minimum value of 0,065 and a maximum of 0,888 with an average value of 0,419 and a standard deviation of 0,190. For the profitability control variable, it has a minimum value of 0,000 and a maximum of 0,212 with an average value of 0.058 and a standard deviation value of 0,049.

2. Hypothesis Testing

a. Multiple Linear Analysis

In this study, hypothesis testing was carried out using a multiple linear regression model that was tested using the SPSS version 24 statistical tool. The following is a multiple linear regression table:

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-0,144	0,143		-1,010	0,314		
	X1GD	-0,067	0,076	-0,065	-0,880	0,380	0,917	1,090
	X2ND	0,283	0,095	0,219	2,993	0,003	0,927	1,079
	X3AD	-0,065	0,102	-0,046	-0,640	0,523	0,942	1,062
	X4TD	-0,023	0,057	-0,030	-0,404	0,687	0,905	1,106
	FS	0,024	0,009	0,201	2,595	0,010	0,825	1,212
	LEV	-0,016	0,087	-0,015	-0,185	0,853	0,731	1,368
	PRO	0,217	0,328	0,053	0,663	0,508	0,767	1,303

Based on the predetermined regression formula, the following equation model is obtained: CE_Disc = -0,144 – 0,067 GD + 0,283 ND – 0,065 AD – 0,023 TD + 0,024 Size – 0,016 Lev + 0,217 Pro + e.

From the regression equation above it can be interpreted as follows:

a. The constant value is -0,144, meaning that Disclosure of Carbon Emissions will be worth -0,144 if each of the independent variables in the study, namely gender diversity, nationality diversity, age diversity and tenure diversity is zero.

b. The independent variable gender diversity has a regression coefficient of -0,067. If the percentage increase in the gender diversity variable with the values of the other independent variables remains constant, then gender diversity will increase by -0,067.

c. The independent variable nationality diversity has a regression coefficient value of 0,283. If the percentage increase in the nationality diversity variable with the values of other independent variables remains constant, then nationality diversity will increase by 0,283.
d. The independent variable age diversity has a regression coefficient of -0,065. If the percentage increase in the age diversity variable with the values of the other independent variables remains constant, then age diversity will increase by -0,065.
e. The independent variable tenure diversity has a regression coefficient of -0,023. If the percentage increase in the tenure diversity variable with the values of the other independent variables remains constant, tenure diversity will increase by -0,023.
f. Firm size control variable has a regression coefficient value of 0,024. If the percentage increase in the firm size variable with the values of the other independent variables remains constant, the firm size will increase by 0,024.
g. The leverage control variable has a regression coefficient value of -0,016. If the percentage increase in the leverage variable with the values of the other independent variables remains constant, the leverage will increase by -0,016.
h. The profitability control variable has a regression coefficient value of 0,217. If the percentage increase in the profitability variable with the value of the other independent variables remains constant, the profitability will increase by 0,217.

b. Statistical Test (t-test)

The t-statistical test shows how far the influence of the independent variables individually explains the dependent variable. This study uses a significance level of 0,05. The significance value of t must be compared with α (0,05). Based on the table above, it can be seen that only the independent variable national diversity and the control variable firm size are accepted and have a significant effect on the dependent variable. Where the national diversity variable has a sig. value of 0,003 < 0,05. And for the firm size variable it has a sig. value of 0,010 < 0,05. The F statistical test shows whether all the dependent or independent variables included in the model have a joint effect on the dependent or dependent variable. The F statistical test also determines whether the regression model is fit or not. This study uses a significant level of 0.05. Here is the F-test table:

c. Model Feasibility Test (F-Test)

The F statistical test shows whether all the dependent or independent variables included in the model have a joint effect on the dependent or dependent variable. The F statistical test also determines whether the regression model is fit or not. This study uses a significant level of 0.05. Here is the F-test table:

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	0,813	7	0,116	3,104	,004[b]
	Residual	6,734	180	0,037		
	Total	7,547	187			

As seen from the table above the F-test results show a significant value of 0,004. The significant value of the F-test < 0,05 can be concluded if the regression model is feasible to be used as a model in this study.

d. Determination Coefficient Test (R_2)

According to Ghozali (2011: 97) the coefficient of determination (R2) is used to measure how far the model's ability to explain the variation of the dependent variable is. The value of the coefficient of determination is between zero and one. Getting closer to zero means that the ability of the independent variables to explain the variation in the dependent variable is very limited. A value close to one means that the independent

 Received-14-12-2022, Accepted- 23-12-2022

variables provide almost all the information needed to predict the variation of the dependent variable. The following table test the coefficient of determination:

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,328[a]	0,108	0,073	0,193419	1,715

If we look at the determination efficiency test table above, it can be seen that the adjusted R square value is 0,073 or 7,3%. This means the variables gender diversity, nationality diversity, age diversity, tenure diversity, firm size, leverage and profitability can explain the dependent variable of 7,3%. While the value of 92,7% is explained by other variables outside of these variables.

Discussion

a. The effect of gender diversity on carbon disclosure

Based on the test results, it was obtained that the regression coefficient was -0,067 and the t count was -0,880 with a significance value of 0,380. The significance value is greater than the specified error tolerance (0,380 > 0,05). This shows that gender diversity has a negative and insignificant effect on the disclosure of carbon emissions, so the first hypothesis is rejected. Where the number of female directors does not affect the disclosure of a company's carbon emissions. Many companies have only male boards of directors but still have high levels of carbon disclosure. The results of the study are in accordance with the research of Bui et al., (2020) who said that in actual circumstances the relationship between female directors and carbon disclosure in the United States is not statistically significant. Women directors may be able to consider broader and more specific sustainability multifaceted characteristics such as carbon indicators.

b. The effect of nationality diversity on carbon disclosure

Based on the test results, the regression coefficient was 0,283 and the t-count was -2,993 with a significance value of 0,003. The significance value is smaller than the specified error tolerance (0,003 <0,05). This shows that nationality diversity has a positive and significant effect on the disclosure of carbon emissions, so the second hypothesis is accepted. Where the existence of diversity in culture, background, language, ways of acting and thinking can increase the efficiency of the board of directors in making decisions. And also the diversity of nationalities will represent diverse characteristics and perspectives. And this diversity of nationalities can also add to the company's connections regarding suppliers, customers and also the board of directors from other companies. The results of this study are in accordance with the research of Mardini and Lahyani (2022) which revealed that international directors are stakeholder-oriented, by encouraging carbon disclosure policies to increase transparency and improve company reputation in the carbon-incentive sector.

c. The effect of age diversity on carbon disclosure

Based on the test results, it was obtained that the regression coefficient was -0,065 and the t-count was -0,640 with a significance value of 0,523. The significance value is greater than the specified error tolerance (0,523 > 0,05). This shows that age diversity has a negative and insignificant effect on the disclosure of carbon emissions, so the third hypothesis is rejected. Where the age of the board of directors which is older does not affect the disclosure of carbon emissions because many companies that have boards of young directors also have a high level of disclosure of carbon emissions. These results are in accordance with research (Fathia, 2022) were in his research revealed that age does not affect corporate carbon disclosure because anyone can be productive.

d. The effect of tenure diversity on carbon disclosure

Based on the test results, it was obtained that the regression coefficient was -0,023 and the t-count was -0,404 with a significance value of 0,687. The significance value is greater than the specified error tolerance (0,687 > 0,05). This shows that tenure diversity has a negative and insignificant effect on the disclosure of carbon

emissions, so the fourth hypothesis is rejected. Where long work experience also can not affect the level of disclosure of carbon emissions.

VI. Conclusion

This study aims to determine the effect of the diversity of the board of directors on the disclosure of carbon emissions in carbon-intensive industrial companies consisting of the mining, basic and chemical industries, and consumer goods industries listed on the Indonesia Stock Exchange for the 2020-2021 period. This study uses a quantitative approach using secondary data. Based on the research sample criteria, a final sample was produced, namely 188 carbon-intensive industrial companies consisting of the mining, basic and chemical industries, and consumer goods industries listed on the Indonesia Stock Exchange for the 2020-2021 period. The method of analysis technique used is multiple linear regression analysis. Based on the results of the test, this study concludes that nationality diversity affects the disclosure of carbon emissions, so hypothesis-2 is accepted; gender diversity does not affect the disclosure of carbon emissions so hypothesis-1 is rejected; age diversity does not affect the disclosure of carbon emissions so that hypothesis-3 is rejected; tenure diversity does not affect disclosure of carbon emissions so that hypothesis-4 is rejected; firm size affects the disclosure of carbon emissions so that the 5th hypothesis is accepted; leverage does not affect the disclosure of carbon emissions so that the 6th hypothesis is rejected; profitability does not affect the disclosure of carbon emissions so that the 7th hypothesis is rejected. In this study, the independent variable that influences the dependent variable is only nationality diversity. Where the existence of diversity in culture, background, language, ways of acting and thinking can increase the efficiency of the board of directors in making decisions. And also the diversity of nationalities will represent diverse characteristics and perspectives. And this diversity of nationalities, can also add to the company's connections regarding suppliers, customers and also the board of directors from other companies.

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