

Carbon Emission Disclosure and Moderating Role of Education Background of Board

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Abstract: *This study aims to prove the influence of company characteristics on carbon emission disclosure (CED) practices. This study uses a quantitative approach with a panel data regression analysis method. The research sample consists of 312 transportation and logistics sector companies listed on the Indonesia Stock Exchange (IDX) during 2017-2023. The results showed that company age has a significant positive effect on CED. On the other hand, the economic and business education background of the directors proved to strengthen the relationship between company age and CED. The results of this study contribute to the improvement of environmental disclosure performance in Indonesia where younger companies are expected to adopt best practices from more established companies, especially in terms of environmental transparency practices. On the other hand, management may consider selecting directors with a background in economics and business education with the aim of increasing corporate awareness and responsibility in carbon emissions disclosure.*

Keywords: *Carbon Emission Disclosure, Disclosure, Corporate Governance, Company Age, Education Background*

1. Introduction

Climate change risk has become one of the main challenges for various countries in the world, including Indonesia. The increased risk of climate change is caused by increased human activities that lead to increased carbon emissions [World Meteorological Organization, 2021]. With the current risks of climate change increasing, carbon emissions generated by human activities continue to be a matter of public concern and scrutiny [Lee and Cho, 2021]. This condition causes companies in various sectors to face pressure from various stakeholders to disclose information related to the carbon emissions they produce in their activities [Lee and Cho, 2021].

Based on the 2022 Climate Transparency Report Indonesia, the three main sectors that produce carbon emissions in Indonesia are the Power sector which contributes 43% of the total carbon emissions, Transportation 25%, and Industry 23%

[Institute for Essential Services Reform, 2022]. From this data, it can be concluded that the activities of companies contribute a considerable influence to the problem of global climate change. Action is needed to suppress and reduce the output of carbon emissions from company activities, which cannot be done independently but requires cooperation from various related parties.

Consequently, countries around the world are increasing their attention to the issue of carbon emission control [Saka and Oshika, 2014]. Indonesia is one of the countries committed to reducing greenhouse gas emissions significantly with its participation in the Paris Agreement to work together to reduce the impact of climate change by keeping global temperatures at 1.5°C [United Nations, 2022]. It aims to mitigate the negative impacts of climate change that can be a threat to the country such as flooding, sea level rise, extreme weather, and wind change [ASEAN, 2021].

In fact, companies are not only contributors to greenhouse gas emissions, but also strategic actors in climate change mitigation efforts. Companies have the role and authority to regulate their policies related to environmental issues. As a form of accountability and response to pressure from stakeholders, companies need to conduct carbon emission disclosure [Kılıç and Kuzey, 2019]. The disclosure of carbon emissions is expected to be a monitoring and control tool for stakeholders to monitor the company's carbon emission activities.

Previous research proves that there are several factors that can affect the disclosure of carbon emissions. The results of research Afrizal et al., (2023); Warokka et al., (2024) show that firm size has a positive effect on CED while research Barusman et al., (2020) shows insignificant results. Another variable, namely firm age, is also believed to affect the company's ability and desire to disclose environmental information. Research from Barusman et al., (2020) shows that company age has no effect on CED. Meanwhile, research Afrizal et al., (2023) shows significant positive results.

However, it is not only company characteristics that matter, but also corporate governance, especially leadership diversity. In the context of corporate governance, the presence of women in the board of directors is considered to bring a high ethical perspective and social concern [Abd Majid and Jaaffar, 2023] potentially strengthening the relationship between company characteristics and carbon emission disclosure. This

is consistent with previous studies by Abdalla et al., [2024]; Park et al., [2023] which prove that a higher proportion of women on the board of directors has a significant positive impact on carbon emissions disclosure practices.

The presence of female leadership roles in the company's board of directors has the potential to strengthen the relationship between firm characteristics such as firm size and age and strategic decisions, including the disclosure of environmental information such as carbon emissions. Therefore, the presence of women in the board of directors can serve as a moderating variable that strengthens the influence of firm size and firm age on the level of disclosure of carbon emissions, because gender diversity can encourage companies to be more proactive and responsible in conveying sustainability information to stakeholders [Meiryani et al., 2023].

This study aims to empirically examine how company size and age affect carbon emissions disclosure, as well as the moderating role of the presence of women on the board of directors in strengthening the relationship. By combining firm characteristics and governance factors, this study is expected to make theoretical and practical contributions to the development of sustainability reporting strategies, especially amidst the global push towards more environmentally friendly business practices.

Literature Review

Stakeholders Theory

Stakeholders are defined as groups or individuals who influence or are influenced by an organization's actions [Freeman and Mcvea, 2001]. Stakeholder theory discusses the relationship between management and its stakeholders. Where management needs to pay attention to the needs and desires of stakeholders in carrying out their company activities [Halkos and Skouloudis, 2016]. In response to stakeholder pressure, companies disclose carbon emissions as a means to demonstrate their commitment to climate change issues. Because disclosure is a company's effort to minimize social and political pressure by various stakeholders, including the community, employees, government, suppliers, capital markets, and others [Afrizal et al., 2023].

Upper Echelon Theory

The Upper Echelon theory describes the relationship between the individual characteristics possessed by the company's top management and the results of the decisions they make [Hambrick and Mason, 1984]. This theory suggests that individual characteristics such as educational background, experience, and sociodemographics including a person's gender will influence the values they hold [Abatecola and Cristofaro, 2020; Hambrick, 2007]. This study uses the Upper Echelon theory as a basis to test educational background in the board of directors to provide its influence in strengthening the practice of disclosing carbon emissions. This is because strategic decisions taken by companies, including environmental disclosure initiatives, are a reflection of the values held by key person including directors.

Hypothesis Development

Effect of Company Age on CED

According to Agustia & Suryani, [2018] organizational age is the life span since the organization was founded and operates which is calculated in units of years. Companies that are longer established tend to have better stability in their company performance including environmental performance. This is because the company has plenty of time to always improve and complete the information contained in the disclosure of carbon emissions [Barusman et al., 2020]. The age of the company shows the maturity of the company. The longer the company operates, the more time they have to manage the company's activities, including their maturity in facing the pressure of disclosing carbon emission information. This condition occurs because companies have years to complete and revise the information available in their carbon emission disclosures [Hapsoro and Ambarwati, 2018]. Where the establishment of a company certainly cannot be produced instantly and requires a long time to create. This is in line with previous studies finding that company age affects carbon emissions disclosure [Ghomi and Leung, 2013; Hapsoro and Ambarwati, 2018; Afrizal et al., 2023]. The hypotheses proposed in this study are:

H₁: Company age has a positive effect on CED.

The Effect of Director Educational Background in Moderating the Relationship of Company Age to CED

Various previous studies have proven that the educational background of top management has an influence on the strategy and direction of company rules including how companies disclose their information to the public [Ulinnuha et al., 2024]. This is because each individual has different cognitive, intellectual performance, wealth of experience and information [Guerra-Carrillo et al., 2017]. In this study, researchers tried to distinguish the effect between the differences in education of directors who had taken economic education and those who had never taken economic education. This is supported by the results of research by Lewis et al. (2014) which has proven that CEOs who have an MBA educational background are proven to have better awareness in terms of Carbon Disclosure Project (CDP) disclosure. Based on this, researchers hypothesize that directors with economics and business education have a deeper understanding of the risks and opportunities related to climate change, as well as a better understanding of stakeholder pressure for disclosure, which ultimately encourages them to provide more comprehensive information. For this reason, the proposed hypothesis is:

H₂: The presence of directors with economics education background strengthens the positive influence of firm size on CED.

2. Research Methods

This study uses a quantitative approach with a panel data regression analysis method to examine the effect of company size and company age on carbon emissions disclosure, as well as the moderating role of the presence of women on the board of directors. The data used is secondary data obtained from the annual report and sustainability report of the company. Data analysis was carried out using Eviews 13 statistical software.

Sample

This study uses 312 research samples of companies engaged in the transportation and logistics sector listed on the Indonesia Stock Exchange (IDX) during the period 2017 to 2023. The sample selection was carried out using purposive sampling

method, namely only companies that consistently publish annual reports and / or sustainability reports and have complete data on the variables studied.

Dependent Variable

The dependent variable in this study is Carbon Emissions Disclosure (CED). Measurement of carbon emission disclosure variables is carried out using the disclosure index from research Choi et al., [2013].

$$CED = \frac{\text{Number of CED items disclosed}}{18}$$

Independent Variables

The independent variables in this study are company size and age. The age variable is measured by the difference between the year of research and the year of company establishment [Barusman et al., 2020].

Moderating Variables

The educational background of the directors is a moderating variable in this study. This variable is measured based on the total number of directors who have an economic education background in a company [Ulinnuha et al., 2024].

Control Variables

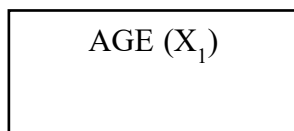
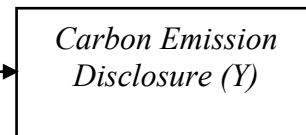
This study uses several control variables, including ROA, ROE, DER and BIG4. First, ROA, which proxies the level of financial profitability of the company as measured by Return on Asset [Ararat and Sayedy, 2019]. Financially healthy companies are expected to allocate more of their resources to environmental disclosure costs. Second, ROE, measured by Return on Equity [Park et al., 2023]. Third, leverage, measured by debt to equity ratio or DER [Fabrício et al., 2022; Kim, 2022; Binh and Lee, 2024]. Companies that have a higher debt ratio have higher pressure from stakeholders, so to respond to this pressure companies can practice disclosure of carbon emissions. Fourth, BIG4 year, this variable is measured by a dummy measurement by giving a value of 1 for companies in year t audited by BIG4 KAP and a value of 0 for years audited by non BIG4 KAP [Khan et al., 2022].

Regression Model:

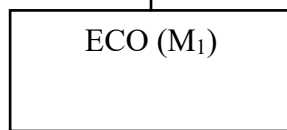
$$CED_{it} = \alpha + \beta_1 AGE_{it} + \beta_2 ECO_{it} + \beta_3 (AGE_{it} \times ECO_{it}) + \beta_4 ROA_{it} + \beta_5 ROE_{it} + \beta_6 DER_{it} + \beta_7 BIG4_{it} + e$$

Description:

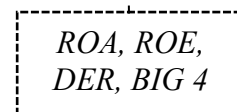
CED	= Carbon Emissions Discosure
AGE	= Company Age
ECO	= Director with economics and business education background
ROA	= Return on Assets
ROE	= Return on Equity
DER	= Debt to Equity Ratio
BIG4	= Audit Quality

Independent Variable**Dependent Variable**

(+) H2



Moderating Variable



Control Variable

Figure 1. Research Framework

3. Result and Discussion**Descriptive Statistic**

Table 1. Descriptive Statistics

	<i>Obs</i>	<i>Mean</i>	<i>Max</i>	<i>Min</i>	<i>SD</i>
CED	312	0.2653	0.8333	0.0000	0.2665
AGE	312	27.5	70	3	14.9520
ECO	312	2.3	6	0	1.2346
ROA	312	0.0334	0.3210	-0.3796	0.0823
ROE	312	0.0547	0.8731	-0.7786	0.1594
DER	312	0.4295	1.0651	0.0001	0.2222
BIG4	312	0.2660	1	0	0.4426

Source: Data processing results using Eviews and table created by authors.

The results of descriptive statistics in Table 1 show the minimum, maximum, average, and standard deviation values of each research variable. The value of CED (carbon emission disclosure) ranges from a minimum of 0% to a maximum of 83.33% and an average of 26.53%. These results indicate that the practice of disclosing carbon emissions in transportation and logistics companies in Indonesia is still relatively low, and there are even companies that do not disclose their carbon emission items. For the age of the company (AGE) that became the research sample, it shows a range from 3 years old to 70 years old for the maximum number and an average of 27.5 years. For the variable Economic education of directors (ECO), the descriptive statistic results show a maximum value of 6 and a minimum of 0. This shows that from all samples there are companies that have 6 directors who have an economic education background, but there are also those that do not have directors with economic education at all. On the other hand, the average value of the ECO variable is 2.3. This shows a relatively low number because the existing sample on average only has 2 directors who have an economic education background.

Table 2. Pearson Correlation Analysis

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
[1] CED	1						
[2] AGE	0.1266** (0.0253)	1					
[3] ECO	0.1077* (0.0575)	0.1043* (0.0658)	1				
[4] ROA	0.1353** (0.0168)	-0.1648*** (0.0035)	0.0578 (0.3091)	1			
[5] ROE	0.1426** (0.0117)	-0.0982* (0.0834)	0.0492 (0.3861)	0.8852*** (0.0000)	1		
[6] DER	0.0796 (0.1607)	0.1774*** (0.0017)	0.1833*** (0.0011)	-0.1797*** (0.0014)	-0.0689 (0.2250)	1	
[7] BIG4	0.1857*** (0.0010)	0.1729*** (0.0022)	0.2926*** (0.0000)	0.0953* (0.0928)	0.0850 (0.1341)	0.2371*** (0.0000)	1

Notes: ***, **, *, sig at 1%, 5%, 10%

Source: Table created by authors.

Pearson correlation test shows the correlation between the research variables. The results show that all coefficients are lower than the 0.9 limit, which means that there is no multicollinearity problem in the research data (Farrar & Glauber 1967).

Table 3. Regression Results and Testing

	(Y) CED		
	a	b	c
C	-41.1154 (0.000)***	-43.0828 (0.000)***	-41.6246 (0.000)***
AGE	1.6827 (0.0000)***	1.7151 (0.0000)***	1.5488 (0.0000)***
ECO		0.4556 (0.0673)*	0.0875 (0.7499)
AGE*ECO			0.1432 (0.0035)***
ROA	-6.1120 (0.2906)	-6.5607 (0.2549)	-5.8044 (0.3067)
ROE	3.1426 (0.2575)	3.3904 (0.2202)	2.9590 (0.2778)
DER	-1.2502 (0.4168)	-1.1834 (0.4400)	-0.3489 (0.8202)
BIG4	0.5797 (0.5282)	0.5683 (0.5345)	0.5188 (0.5647)
N	312	312	312
Adj. R ²	0.7116	0.7144	0.7231
F-stat	0.0000	0.0000	0.0000

Notes: ***, **, *, sig at 1%, 5%, 10%

Source: Table created by authors.

Before conducting panel regression estimation, researchers conducted a model selection test to determine the most appropriate model used in this study, namely the Chow Test, Hausman Test, and Lagrange Multiplier (LM) Test. The final results of the test show that the Fixed Effect model is the most appropriate model used in this study.

Effect of Company Age on CED

The regression results in Table 3 show a significant positive effect of company age on carbon emission disclosure practices. When tested separately (column A) without using moderating variables, the results show a significant 0.0000 ($p < 0.01$), so H_1 is accepted. Consistent with the test using moderating variables, the results also show that the age variable is significant at 0.0000 ($p < 0.01$). This finding indicates that the older the age of the company, the higher the level of disclosure of carbon emissions. This result is in line with previous research, namely [Ghomi and Leung, 2013; Hapsoro and Ambarwati, 2018; Afrizal et al., 2023]. This result supports stakeholder theory, that in response to stakeholder pressure, companies disclose carbon emissions as a means to demonstrate their commitment to climate change issues. The longer a company has been

operating, the more extensive its stakeholder network is compared to a newly established company. In addition, longer-established companies will have plenty of time to continue to develop, improve and complete the information contained in their disclosures including carbon emission disclosures [Barusman et al., 2020]. Thus, it can be concluded that company age is one of the important factors that encourage company disclosure in communicating its environmental responsibilities, including carbon emission disclosure practices.

Effect of Director's Educational Background in Moderating the Relationship of Company Age to CED

The regression results in table 3 show a significant positive effect of director's economic and business educational background on carbon emission disclosure practices. This result is shown in column c with a significance value of 0.0035 ($p < 0.01$) so that H_2 is accepted, which means that the presence of directors with an economic education background strengthens the positive effect of company size on CED. The results of this study are in line with the upper echelons theory which states that different characteristics of top management will have a different influence on the strategy and outcome of an organization [Hambrick and Mason, 1984]. Companies with directors who have an economics and business education will have a deeper understanding of the risks and opportunities related to climate change. In addition, they will better understand stakeholder pressures related to disclosure responsibilities, which will then encourage them to provide more comprehensive information to the public [Lewis et al., 2014]. It can be concluded that leaders with an economic education background will be more responsive to business risks and stakeholder pressures, which then affect the company's carbon emission disclosure practices.

4. Conclusion

Based on the results of this study, it can be concluded that the practice of disclosing carbon emissions in transportation and logistics companies in Indonesia is still relatively low, with an average of 26.53%. The empirical test results show that H_1 and H_2 are accepted. The first finding shows that the older the age of the company, the higher the level of carbon emission disclosure. On the other hand, the economic and

business education background of directors is proven to strengthen the relationship between company age and carbon emission disclosure. This suggests that companies with directors who have economics and business education will have a deeper understanding of the risks related to climate change and better understand stakeholder pressures related to disclosure responsibilities. The results of this study provide contributions related to improving environmental disclosure performance in Indonesia. First, younger companies are expected to learn and adopt best practices from more established (older) companies, especially in terms of environmental transparency practices. The management of recently established companies needs to realize the importance of disclosing carbon emissions to build legitimacy and public trust. Second, company management needs to pay attention to the educational qualifications of their directors. Management may consider selecting directors with a background in economics and business education with the aim of increasing corporate awareness and responsibility in disclosing carbon emissions.

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