

## CARBON EMISSION DISCLOSURE: A Study on Agriculture, Energy, and Industry Companies

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### ABSTRACT

This study examines the factors that influence the disclosure of carbon emissions. The factors tested in this study include company size, profitability, competition, growth, debt-to-equity ratio, the reputation of a public accounting firm, and environmental performance. The method used to measure the extent of carbon emission disclosure adopts a checklist developed based on a request sheet obtained from the Carbon Disclosure Project (CDP). The sample of this study was selected using purposive sampling and selected 40 agriculture, Industry, and energy companies listed on the Indonesia Stock Exchange consecutively from 2020-2022. The results of this study indicate that profitability, growth, and reputation of public accounting firms have a significant effect on the disclosure of carbon emissions. In contrast, other factors have no significant effect.

## **INTRODUCTION**

Climate change has emerged as a compelling subject of global significance (Nursulistyo et al., 2022). Stakeholders prioritize climate and environmental issues (Kartikasary et al., 2023). Global extreme weather changes are a significant climatic and environmental concern. These drastic weather fluctuations have emerged as a notable issue in recent years. The Ember Climate report, Global Electricity Review 2023, indicates that emissions from power plants rose to 12,431 million metric tons of CO<sub>2</sub> in 2022 across various countries, such as China (4,293.8 tons), the United States (1,579.8 tons), India (1,162.3 tons), the European Union (503.9 tons), Japan (468.2 tons), Russia (409.4 tons), South Korea (264.3 tons), Saudi Arabia (203.8 tons), and Indonesia (192.7 tons).

Elevated levels of greenhouse gases (GHGs) in the atmosphere are a major factor contributing to significant climatic changes. Greenhouse gases include Carbon Dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), Nitrogen Oxides (N<sub>2</sub>O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur Hexafluoride (SF<sub>6</sub>). High levels of greenhouse gas emissions can have adverse effects on the occurrence of severe climate change events, including global temperature rise, increased frequency of extreme weather events, and rising sea levels (Pramudiyanto & Suedy, 2020). According to Climate Observe, GHG emissions in 2022 are projected to exceed 50.6 gigatons of carbon dioxide equivalent (Gt CO<sub>2</sub> e). An increase of 2.6% is typically observed compared to the previous year, 2021. The energy sector is the largest contributor to greenhouse gas emissions globally, accounting for 75.3% of total emissions. The farming division produces 12.7%, the industrial division contributes 6.7%, the trash division contributes 3.5%, and the LULUCF section contributes 2.3%. The growing awareness of climate change has led to the necessity of quantifying and revealing greenhouse gas emissions from agriculture, energy, and industrial sectors, which are the primary contributors to greenhouse gas emissions.

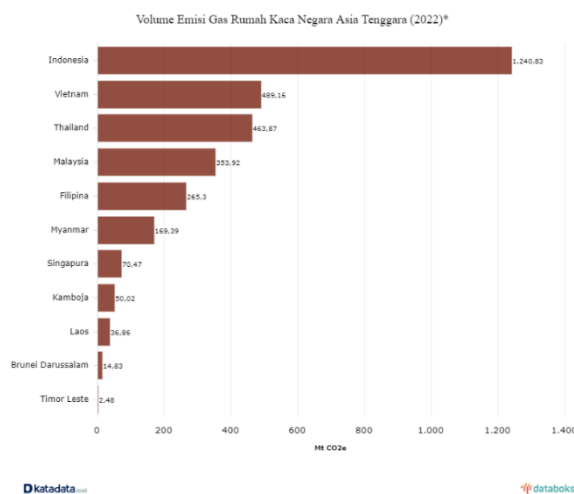
The World Bank states that CO<sub>2</sub> is the primary greenhouse gas responsible for global warming and climate change. CO<sub>2</sub> emissions are produced by the combustion of fossil fuels, including oil, coal, and gas, for energy production, as well as burning wood and waste and industrial processes such as cement manufacturing. CO<sub>2</sub> emissions result from land combustion of fossil fuels and cement production, excluding emissions from land use changes like deforestation. The use of carbon-based fuels during the industrial revolution has increased the concentration of CO<sub>2</sub> in the atmosphere. This has led to an increase in the global warming rate and fueled human-induced climate change. CO<sub>2</sub> significantly contributes to ocean acidification as it decomposes in water to form carbonic acid. The Earth's surface temperature increases and the resulting effects on climate, such as rising ocean levels, are caused by this phenomenon.

The Global Carbon Project data indicates a substantial rise in greenhouse gas emissions into the Earth's atmosphere since the early 1900s. The rise is attributed to three primary factors: economic expansion, population growth, and shifts in purchasing habits. The World Bank states that CO<sub>2</sub> is the primary greenhouse gas responsible for global warming and climate change. CO<sub>2</sub> emissions are produced by the combustion of fossil fuels, including oil, coal, and

gas, for energy production, as well as burning wood and waste and industrial processes such as cement manufacturing. CO<sub>2</sub> emissions result from land combustion of fossil fuels and cement production, excluding emissions from land use activities like deforestation. The use of carbon-based fuels during the industrial revolution has increased the concentration of CO<sub>2</sub> in the atmosphere. This has led to an increase in the global warming rate and caused human-induced climate change. CO<sub>2</sub> is a significant contributor to ocean acidification as it decomposes in water to form carbonic acid. The Earth's surface temperature increases, and the effects on climate, such as rising ocean levels, are caused by this phenomenon.

As a region of eleven countries, ASEAN (Association of Southeast Asian Nations) has a high level of carbon dioxide (CO<sub>2</sub>) emissions. In 2022, eleven nations, including ASEAN, accounted for 7.35% of the global CO<sub>2</sub> emissions, which is approximately 1,240.8 million metric tons. Following Indonesia, Vietnam, Thailand, Malaysia, and the Philippines are also significant producers of greenhouse gas emissions, CO<sub>2</sub> emissions in ASEAN are expected to increase due to the ongoing industrialization process, which demands significant energy to sustain industrial activity. The data is obtained from [katadata.co.id](http://katadata.co.id) in 2023.

Picture 1.  
Volume Emisi GRK Negara Asia Tenggara



(Source: [katadata.co.id](http://katadata.co.id))

The Indonesian government has taken measures to promote sustainable development to reduce carbon emissions (Hapsari & Prasetyo, 2020). Indonesia ratified the Kyoto Protocol through State Law No. 17 of 2004 to support sustainable development and participate in global initiatives to reduce greenhouse gas emissions in light of growing environmental worries. Enterprises in Indonesia must voluntarily publish their carbon emissions (Hardiyansah et al., 2021). Companies must have a positive reputation to ensure the longevity of their firm. Law No. 40 of 2007 governs social and environmental responsibility as a

means of taking action. Businesses that operate in or are associated with certain activities must comply with the legislation.

The disclosure of carbon emissions serves as a mechanism by which businesses can be held responsible for their environmental activities (Nursulistyo et al., 2022). Indonesia is among the top 10 nations worldwide for carbon emissions, according to The Global Carbon Project, so action is necessary. A company's environmental accountability is intricately linked to its sustainability. Companies widely use the Triple Bottom Line (TBL) idea to achieve their business goals sustainably. The Triple Bottom Line concept emphasizes the importance of balancing environmental sustainability (planet, social well-being (people), and financial profitability (profit) in business practices to ensure long-term success. The TBL approach involves evaluating an organization's performance using three dimensions: environmental, social, and economic (Chadha and Mehta, 2022). This concept focuses on achieving long-term sustainability by assessing the influence of organizational actions on the environment and local communities, while also considering the economic advantages produced. The organization must establish unambiguous accountability concerning this issue to apply the Triple Bottom Line principle effectively.

The forest fires in Indonesia in 2015 and 2019 resulted in substantial carbon emissions. Deforestation, the pulp and paper industry, and oil palm plantations were key factors that triggered the forest fires. Sinar Mas Group, a major palm oil producer, disclosed 12.4 million tons of CO<sub>2</sub>e emissions from forest fires in 2019 according to a study by Greenpeace Indonesia. Asia Pulp and Paper (APP), a major pulp and paper manufacturer globally, has 10.5 million tons of carbon dioxide equivalent emissions from forest fires. Meanwhile, PT RAPP, one of the largest pulp and paper producers in Indonesia, has 6.3 million tons of CO<sub>2</sub> equivalent emissions from forest fires they cause. Sinar Mas Group discloses carbon emissions from plantations, while APP and PT RAPP do not publish any of their carbon emissions. The lack of openness hinders the assessment of these corporations' impact on climate change. The situation also hinders the government's ability to mitigate carbon emissions resulting from forest fires. Indonesia's government aims to reduce carbon emissions from forest fires by 29% by 2030. The government should work together with companies that contribute to carbon emissions from forest fires to achieve this objective.

The factors associated with the disclosure of carbon emissions have been the subject of numerous previous studies. Large firms publish their carbon emissions to justify their activities due to their increased vulnerability to political pressure (Hapsari & Prasetyo, 2020). Large firms disclose their carbon emissions in their annual reports as part of their responsibility to the environment and society (Sekarini & Setiadi, 2021). Hermawan et al (2020) found a relationship between the size of a company and its disclosure of carbon emissions. Kholmi et al (2020) found no association between the size of a firm and its disclosure of carbon emissions, contrary to previous research.

Research conducted by Abdullah et al. (2020), Hapsari and Prasetyo (2020), and Choi et al. (2013) indicates that profitability influences the disclosure of carbon emissions. Investors influence firms to prioritize environmental issues by urging them to disclose carbon emissions more transparently (Hapsari & Prasetyo, 2020). Sekarini's 2021 research did not uncover a significant correlation between carbon emissions disclosure and profitability. Carbon emissions disclosure, a type of transparency, offers information to stakeholders like investors, consumers, and the government.

Intense competition can exert pressure on other enterprises within the same industry. Having a greater market share does not always equate to having a more comprehensive disclosure of carbon emissions. Businesses typically evaluate climate change risks and options for reducing greenhouse gas emissions. Companies appear to aim to cultivate the impression that they prioritize environmental sustainability. The study by Irwhantoko and Basuki (2016) validates that the degree of competition might impact companies' decisions to decrease greenhouse gas emissions due to its association with efficiency and enhancing the company's reputation. Competition does not impact the level of carbon emission disclosure.

A comprehensive assessment of their ongoing progress provides businesses with an incentive to pursue substantial annual growth, according to Fauzi and Suhadak (2015). Thriving businesses will utilize their resources more efficiently. A study by Luo et al (2013) found a negative correlation between company growth and carbon emission disclosure. Irwhantoko and Basuki's (2016) analysis found no association between a company's size and its reporting of carbon emissions. Studies by Irwhantoko and Basuki (2016), Abdullah et al (2020), and Sekarini (2021) found that the debt-to-equity ratio affects the disclosure of carbon emissions. Disclosure diminishes when the debt-to-equity ratio increases.

Studies by Irwhantoko & Basuki (2016), Abdullah et al (2020), and Sekarini (2021) found that debt to equity ratio affects the disclosure of carbon emissions. Carbon emissions disclosure reduces when debt-to-equity ratios increase (Irwhantoko & Basuki, 2016). Choi et al (2013) found no correlation between the debt-to-equity ratio and carbon emissions disclosure, contradicting previous research. Businesses with high debt-to-equity ratios often do not have the resources needed to publicly disclose their carbon emissions. These organizations must emphasize debt management (Bae Choi et al., 2013).

A reputable public accounting firm's high credibility attracts a larger clientele of businesses. Therefore, if the auditor raises more general concerns, the Public Accounting Firm can avoid any potential conflicts of interest that could strain the client relationship (Ahmad et al., 2003). Irwhantoko & Basuki (2016) did not discover a connection between public accounting firms' reputation and carbon emission disclosure.

The impact of environmental performance on carbon emission disclosure has been demonstrated in studies conducted by Safitri et al. (2018), Abdullah et al. (2020), and Saparudin et al. (2022). Ratmono et al (2020) found that

environmental performance did not affect this disclosure, which is different from the current study's results.

Previous research and observation of carbon events formed the basis for the study which investigated the factors that impact firms' reporting of carbon emissions. Companies from the agriculture, energy, and industrial sectors are selected for this study. These three businesses greatly influence carbon emissions. The study is based on the research conducted by Irwhantoko & Basuki in 2016.

Additional domains exhibit divergence in these findings. The study conducted by Irwhantoko & Basuki (2016) focused on enterprises in the agriculture, energy, and business sectors listed on the IDX between 2020 and 2022, despite the research sample consisting of manufacturing businesses. Researchers concentrate their studies on this business because to its status as a corporate sector that is particularly responsive to environmental concerns, specifically regarding carbon emissions. Researchers incorporated a new variable, environmental performance, from the Kholmi et al study (2020). Businesses can cultivate favorable relationships with stakeholders and potential new investors by sharing environmental data (Suratno et al., 2007).

This study provides a theoretical contribution towards enhancing corporate transparency and accountability while also offering practical assistance to investors in improving their investment decision-making processes in response to the issues raised by the described phenomenon.

## **LITERATURE REVIEW**

### **Legitimacy Theory**

The proponents of legitimacy theory, Dowling and Pfeffer (1975), assert that the objective of legitimacy theory is for an organization to achieve equilibrium between the societal ideals manifested in its activities and the prevailing norms in its social context. The concept of a "social contract" between an organization and the community it operates in is the basis of legitimacy theory (Ghozali, I., & Chariri, 2007). If there is a misalignment between the two systems, it might potentially jeopardize the company's authenticity.

The relationship between corporations and society, which allows them to use financial resources, is connected to legitimacy theory. According to the social contract argument, a company's ability to sustain growth is contingent upon the outcomes that society is capable of providing and distributing. This applies to all social groups, such as enterprises, that operate inside society through implicit or explicit social agreements. Legitimacy theory posits that to address social environmental pressures and maintain its standing, a corporation should make its carbon emissions known. The organization aims to ensure that its actions comply with the current norms and standards (Ghozali, I., & Chariri, 2007).

### ***Carbon Emission Disclosure***

Carbon emissions disclosures refer to the process of evaluating an organization's carbon emissions and establishing targets for reducing these emissions (Taufiq & Iqbal, 2021). Revealing carbon emissions is essential as stakeholders require the data. The individuals are keen on acquiring knowledge

about the ecological risks linked to the business's activities, as well as the measures taken by the company to safeguard and advance sustainable development (Sudiby, 2008). Only a small number of enterprises have made their carbon emissions public because this practice is still relatively uncommon in developing countries. In addition, firms in developing nations have a lack of financial resources that hinder their ability to provide the same level of information as those in wealthy nations. Irwhantoko and Basuki (2016) state that in Indonesia, the reporting of carbon emissions is not mandatory but rather a voluntary practice in this developing country

### ***Hipotesis***

#### *The influence of corporate size on the disclosure of carbon emissions*

According to liquidity theory, larger companies are expected by Cornier et al. (2005), Cornier & Gordon (2001), and Hackston & Mine (1996), larger companies tend to have a greater number of stakeholders who hold higher expectations about the company's greenhouse gas (GHG) emission regulations. Businesses can mitigate this pressure by disclosing their greenhouse gas (GHG) emissions (Rankin et al., 2011). Big enterprises will respond more promptly to GHG emissions disclosure to avoid conflicts (Cormier et al., 2015). Hermawan et al. (2018) found that larger firms are more inclined to offer comprehensive and reliable voluntary disclosures as a means to establish their reputation. Nevertheless, despite Indonesian companies opting to provide further disclosure to enhance their credibility among the public, a study conducted by Kholmi et al (2020) revealed that the size of the company did not affect the disclosure of carbon emissions. Based on the reasoning provided above, we can formulate the following hypothesis.

H1: The size of a corporation has a beneficial influence on the disclosure of carbon emissions.

#### *The influence of profitability on the disclosure of carbon emissions*

Legitimacy theory posits that firms strive to justify their existence by asserting that their actions are essential in light of external pressures (Dowling & Pfeffer, 1975). Investors exert pressure on businesses to disclose carbon emissions more responsibly to showcase their commitment to environmental concerns (Hapsari & Prasetyo, 2020). Profitable companies will face investor scrutiny as they are more visible and have the resources to disclose information, as stated by Pradini & Kiswara (2013). It may be deduced that the profitability of a firm will have a direct correlation with the level of emissions it exposes to investors. This is done to fulfill its responsibility towards investors and ensure that its operations are in line with societal norms and idiosyncrasies (Nugroho & Yulianto, 2015). Abdullah et al. (2020) and Hapsary & Prasetyo (2020) have found through their research that profitability influences the disclosure of carbon emissions. The following theory is proposed based on the above description.

H2: Profitability positively impacts the disclosure of carbon emissions

*The Influence of competition on the disclosure of carbon emissions*

Intense competition can impose significant pressure on other enterprises operating in the same industry ((Irwhantoko & Basuki, 2016). Disclosing carbon emissions is a strategy for holding corporations accountable for their environmental impact (Peng et al., 2015). Corporations operating in fiercely competitive industrial environments may be obligated to disclose their carbon emissions to maintain their competitiveness. Corporations operating in a fiercely competitive industrial environment may be obligated to disclose their carbon emissions to maintain their competitiveness (March, 1981). If less proficient corporations are obligated to compete with more proficient organizations by disclosing their emissions, they will incur greater expenses related to disclosure. The 2016 research conducted by Irwhantoko & Basuki suggests that competition does not significantly enhance the disclosure of carbon emissions. Competition can incentivize enterprises to reduce greenhouse gas emissions through the promotion of efficiency and the cultivation of emissions. Given these considerations, the subsequent hypothesis is put forward.

H3: The presence of competition enhances the probability of revealing carbon emissions.

*The influence of growth on the disclosure of carbon emission*

Effects of expansion on the disclosure of carbon emissions companies in the expansion phase will exercise greater caution in managing resources. The company will employ these resources to improve performance and promote economic growth. According to Pradolorenzo et al (2009), companies with significant growth potential prioritize economic goals over environmental sustainability. Long et al (2015) found evidence of a bidirectional correlation between Gross Domestic Product (GDP) and carbon emissions, as well as the consumption of coal, gas, and electricity. Coal and gas-based energy is correlated with economic growth, but in comparison to emerging renewable energy sources, it exhibits a more pronounced connection with elevated carbon emissions. Studies conducted by Irwhantoko & Basuki (2016) and Pratama (2018) suggest that expansion has a substantial impact on the disclosure of carbon emissions. A study conducted by Pranasyahputra et al (2020) suggests that there is no discernible relationship between the rate of growth and the extent of considerations.

H4: The disclosure of carbon emissions is positively influenced by growth.

*The influence of leverage on the disclosure of carbon emissions.*

Legitimacy theory pertains to firms ensuring the legitimacy of their economic operations in response to external pressures (O'Donovan, 2002). Creditors may exert pressure on the corporation to prioritize interest payments and fulfill its obligations instead of emphasizing voluntary transparency. The study was conducted by Choi et al. in 2013. Revealing carbon emissions could make creditors think that the company might have difficulty fulfilling financial responsibilities and paying interest because of the resources used for disclosures

(Hapsari & Prasetyo, 2020). As a company's debt increases, its level of disclosure on carbon emissions decreases. Research conducted by Abdullah et al (2020) and Hapsary & Prasetyo (2020) found that leverage has an impact on the disclosure of carbon emissions.

H5: The use of leverage hurts the disclosure of carbon emissions.

*The influence of the public accounting company's reputation on the disclosure of carbon emissions*

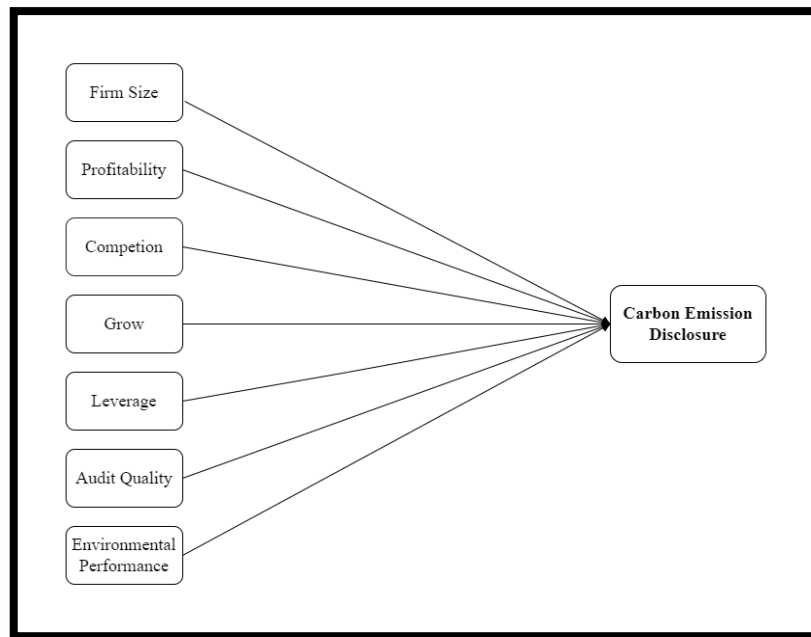
An audit reputation is a measure of the achievements and public trust that are linked to a renowned auditor. According to Titman and Trueman in 1986, auditors are responsible for providing relevant information to aid in decision-making. In their study, Craswell and Taylor (1992) discovered that organizations audited by reputable public accounting firms tended to make comprehensive disclosures to furnish auditors with further information. The research conducted by Whardani & Kawedar (2019) reveals the influence of a public accountant's reputation on the disclosure of carbon emissions. In their study, Irwhantoko and Basuki (2016) discovered that the reputation of public accountants has no impact on the disclosure of carbon emissions. Given these assumptions, this inquiry is postulated.

H6: The reputation of a Public Accounting Firm has an impact on the extent to which carbon emissions are disclosed.

*The influence of environmental performance on the Disclosure of carbon emissions*

Analyzing the impact of environmental performance on the disclosure of carbon emissions. Legitimacy theory posits that an organization must conform to applicable standards by disclosing the consequences of its acts (Angelina & Handoko, 2023) Organizations that demonstrate exceptional environmental performance want to publicize their accomplishments through environmental disclosure (Majid & Ghozali, 2015). In 2013, Kiswara conducted a study that revealed that organizations with higher PROPER ratings have a greater tendency to offer comprehensive environmental information. This is because of their unwavering commitment to environmental sustainability and their recognition of the need to reveal environmental facts. Nugraha's (2015) study showed a significant positive influence of environmental performance on the disclosure of carbon emissions.

H7: Environmental performance has a favorable impact on the disclosure of carbon emissions.



Picture 2  
Research Framework

## METHODOLOGY

Carbon emission disclosure is measured using the approach of multiple linear analysis. This approach involves analyzing the annual reports and sustainability reports of the companies chosen as research samples. The study assessed the extent to which carbon emissions were disclosed by utilizing characteristics derived from the research conducted by Choi et al. (2013), which is commonly known as the Carbon Disclosure Project (CDP). The index created by Choi et al. (2013) comprises five factors that pertain to carbon emissions and climate change. These categories are climate change (including dangers and possibilities), greenhouse gas emissions, energy consumption, reduction of greenhouse gas and costs, and accountability for carbon emissions. The carbon emissions disclosure area has 18 checklist items that must be identified and are provided in Table 1.

Tabel 1. Carbon Emission Disclosure Checklist

Category	Item	Description
Climate change: Risks and opportunities	CC1	Assessment/description of risks (specific and general regulations) related to climate change and actions taken to manage these risks.
	CC2	Assessment/description of current (and future) financial business and opportunity implications of climate change.
Greenhouse Gas (GHG) Emissions	GH	Description of the methodology used to calculate greenhouse gas emissions (e.g. GHG protocol or ISO).
	G1	

		GH G2	The existence of external verification of the calculation of the quantity of GHG emissions by whom and on what basis.
		GH G3	Total greenhouse gas emissions (metric tons CO <sub>2</sub> -e) generated.
		GH G4	Disclosure of scope 1 and 2, or 3 direct GHG emissions.
		GH G5	Disclosure of GHG emissions by origin or source (e.g.coal, electricity, etc.).
		GH G6	Disclosure of GHG emissions by facility or segment level.
		GH G7	Comparison of GHG emissions with previous years.
Energy Consumption (EC)		EC1	The amount of energy consumed (e.g tera-joules or Peta-joules)
		EC2	Calculation of energy used from renewable resources.
		EC3	Disclosure by type, facility, or segment.
Greenhouse Gas Reduction and Cost (RC/Reduction and Cost)		RC1	Details of the plan or strategy to reduce GHG emissions.
		RC2	Breakdown of current GHG emission reduction target levels and emission reduction targets.
		RC3	Emission reductions and <i>costs</i> or savings achieved to date as a result of the emissions reduction plan.
		RC4	Future emission costs are taken into account in <i>capital expenditure planning</i> .
Accountability of Emission Carbon (AEC/Accountability of Emission Carbon)		AC C1	The indication that the board (or other executive body) has responsibility for actions related to climate change.
		AC C2	Description of the mechanism by which the board (or other executive body) reviews the company's progress with regard to climate change.

Source: Irwhantoko & Basuki (2020)

### ***Population and Samples***

Population and samples refer to two distinct concepts in statistics. The population for this study consists of 270 enterprises listed on the IDX in the years 2020-2022, specifically in the agriculture, energy, and industry sectors. Purposive sampling involves selecting samples for research based on specific criteria relevant to the study. The selection criteria employed encompass companies operating in the agriculture, energy, and industry sectors, which have released both Annual Reports and Sustainability Reports between 2020 and 2022. Additionally, the companies must have participated in the Performance Rating Program (PROPER) organized by the Ministry of Environment of the Republic of Indonesia during the research period. Furthermore, the companies must explicitly disclose their carbon emissions or by disclosing at least one item pertaining to carbon emission disclosure. Lastly, the companies must possess

comprehensive data on the variables under investigation. In order to enhance the clarity and precision of the variables in this study, the operational definitions of the variables are supplied in Table 2.

Table 2: Operational Definition of variables.

No	Variables	Definition and Measurement	Researcher
1.	Carbon emissions disclosure (CE_Disc)	<p>Carbon Emissions Disclosure is the extent of carbon emissions disclosure.</p> <p>Score each disclosure item (<i>Carbon Emission Disclosure Checklist</i>) on 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 item in its report, then the company's score is 18, then add up the score of each company. The carbon emission disclosure items are shown in Table 2.</p>	Choi <i>et al.</i> (2013)
2.	Company size ( <i>Size</i> )	<p>Company size is the natural logarithm (<math>\ln</math>) of total assets. The formula is as follows:</p> <p>Total Assets = Natural logarithm of total assets of company j in year t.</p>	Stanny dan Ely (2008)
3.	Profitability ( <i>Pro</i> )	<p>Profitability is the <i>return on assets</i> ratio ROA. Company profit is divided by total assets. The formula is as follows:</p> $\frac{\text{laba sebelum pajak}}{\text{total aset}}$ <p>Profit = Profit of company j in year t                      Total Asset = Total assets of company j in year t</p>	Jannah dan Muid (2014)
4.	Competition ( <i>Com</i> )	<p>Competition is the <i>Herfindahl-Hirschman Index</i> Value. The formula is as follows:</p> $\sum_{i=1}^n [S_{jt} / S_t]^2$ <p>S<sub>jt</sub> = Sales value of company j in year t                      S<sub>t</sub> = Total sales of all manufacturing companies in year t                      S<sub>jt</sub>/S<sub>t</sub> = Market share of company j in year t                      n = Number of companies in the manufacturing industry</p>	Peng <i>et al.</i> (2014)
5.	Growth ( <i>Grow</i> )	<p>Profit is the profit of the current year divided by the profit of the last four years minus one. The formula is as follows:</p> $\frac{\text{sales } t - \text{sales } t - 1}{\text{sales}}$	Luo <i>et al.</i> (2013)

6.	Debt-to-equity ratio (DER)	<p>The debt-to-equity ratio is total debt divided by total equity. The formula is as follows:</p> $\text{Debt to Equity Ratio} = \frac{\text{Total utang}}{\text{Total ekuitas}}$ <p>Total debt: the company's total debt Total equity: total equity of the company</p>	D'Amico <i>et al.</i> (2014)
7.	Reputation of Public Accounting Firm	<p>The reputation of the Public Accounting Firm is the Public Accounting Firm that provides opinions on the company's financial statements.</p> <p>Public Accounting Firm Reputation is measured using a <i>dummy</i> variable. If the company is audited by a <i>Big Four</i> accounting firm (Pricewaterhouse Cooper, KPMG, Ernst &amp; Young dan Deloitte), it will be rated 1 and will be rated 0 for other than <i>Big Four</i>.</p>	Zorio <i>et al.</i> (2013)
8.	Environmental	<p>Environmental performance is the company's performance in creating a good environment.</p> <p>Environmental performance is measured using PROPER. PROPER is a Company Performance Rating Program in management. Scale 0 if no PROPER is published and 1-5 according to the color type of PROPER as seen from AR.</p>	KLH (2013) Pradini (2013) Nugraha & Juliarto (2015)

Source: *Irwhantoko & Basuki (2020)*

### ***Analysis Regression***

Data processing was carried out using IBM SPSS 25. The tests carried out consisted of normality, autocorrelation, multicollinearity, and heteroscedasticity. This study has a regression equation:

$$\text{CED} = \alpha + \beta_1 \text{Size} + \beta_2 \text{Pro} + \beta_3 \text{Com} + \beta_4 \text{Grow} + \beta_5 \text{DER} + \beta_6 \text{KAP} + \beta_7 \text{EP}$$

- Information
- $\alpha$  : Constant
- Size : Company Size
- Pro : Profitability
- Com : Competition
- Grow : Growth
- DER : Debt to equity ratio
- KAP : Public accountant reputation
- EP : Environmental performance
- CED : Carbon Emission Disclosure
- $\beta$  : Regression Coefficient

## RESEARCH RESULT

### *Descriptive Stastical Analysis*

Table 3. Descriptives Statistics

	Size	Pro	Com	Grow	DER	KAP	EP	CED
<b>Minimum</b>	27.66	0.00	0.00	-0.33	0.22	0.00	4.00	0.11
<b>Maximum</b>	33.54	0.21	2.11	0.77	2.09	1.00	4.00	55.60
<b>Mean</b>	29.9150	0.0853	0.6156	0.1394	0.8167	0.6389	4.0000	2.6009
<b>S.deviation</b>	1.62209	0.05495	0.65984	0.26173	0.52966	0.48714	0.0000	9.78316

*Source: statistical output form spss*

The table displayed above illustrates the data distribution for the variable representing the size of the company. This variable is measured using the natural logarithm (LN). The data distribution has a minimum value of 27.66, a maximum value of 33.54, a mean of 29.91950, and a standard deviation of 1.62209. These results suggest that the companies in the research sample are quite tiny, as evidenced by the close proximity between the mean and maximum values. The data variation appears to be reasonably minor based on the close proximity between the average value and standard deviation. The table displays the data distribution for the profitability variable. The measurement of this variable is conducted using the Return on Asset metric. The data distribution exhibits a minimum value of 0.00, a maximum value of 0.21, a mean of 0.0853, and a standard deviation of 0.05485. This figure demonstrates that the number of companies that incur losses is higher than the number of companies that generate profits, as indicated by the proximity of the mean and minimum values. The data variation appears to be reasonably minor based on the close proximity of the average value and standard deviation. The table displays the data distribution for the competition variable. The HHI value is used to measure this variable. The data distribution exhibits a minimum value of 00.00, a maximum value of 2.11, a mean of 0.6156, and a standard deviation of 0.65984. These results suggest that the companies in the research sample are quite tiny, as evidenced by the close proximity of the mean and minimum values. The data variation appears to be minor based on the close proximity of the average value and standard deviation.

The table displays the data distribution for the growth variable. The measurement of this variable is conducted through the utilization of Return on Asset. The data distribution has a minimum value of -0.33 and a maximum value of 0.77. a mean of 0.1394, and a standard deviation of 0.226173. This graph illustrates a significant rise in the profitability of the companies as compared to the preceding three years. The data variation appears to be significant based on the proximity between the mean value and standard deviation. The table displays the data distribution for the variable of the debt-to-equity ratio. This variable is quantified using the DER (Data Envelopment Analysis) method. The data distribution has a minimum value of 0.22, a maximum value of 2.09, a mean of 0.8167, and a standard deviation of 0.52966. These results suggest that the companies in the research sample are quite tiny, as evidenced by the close

proximity of the mean and minimum values. The data variation appears to be reasonably minor based on the close proximity of the average value and standard deviation. The table displays the data distribution for the variable representing the reputation of public accountants. This variable is quantified using a binary variable. The data distribution exhibits a minimum value of 0.00 and a maximum value of 1.00. The mean of the distribution is 0.06389, while the standard deviation is 0.48714. The data illustrates that a greater number of enterprises in the study sample underwent audits conducted by auditors who are not part of the four largest auditing firms. The data variation appears to be reasonably minor based on the close proximity of the mean value and standard deviation. The EP (Environmental Performance) variable ranges from a minimum value of PROPER 1 to a maximum value of PROPER 4, with a standard deviation of 0.00. These findings suggest that no organizations have achieved an excellent PROPER rating of 5. The carbon emissions disclosed in the annual reports and sustainability reports analyzed had an average value of 2.6009 and a maximum value of 55.60. According to the Carbon Emission Disclosure Project (CDP) index, the average company disclosed 3 out of 18 categories.

Table 4. Classical Assumption Test

Assumption Test	CED (Y)	Results
Normality Test <i>Kolmogorov - Smirnov Z</i> <i>Asymp. Sig (2-tailed)</i>	0.114 0.200	Residual data is normally distributed and there is no normality
Autocorrelation Run Test	0.635	Residual data is random and there is no normality
Heteroscedasticity (t count/sign) Company size (X1) Profitability (X2) Competition (X3) Growth (X4) Debt to Equity Ratio (X5) Public Accounting Firm (X6) Environmental Performance (X7)	1.533 (0.136) -1.972 (0.58) 1.285 (0.209) 0.708 (0.484) -1.341 (0.190) 0.702 (0.488)	The residual variance from observation to observation is constant and there is no heteroscedasticity
Multicollinearity 1. Tolerance (TOL) Company size (X1) Profitability (X2) Competition (X3) Growth (X4) Debt to Equity Ratio (X5) Public Accounting Firm (X6)	0.473 0.234 0.327 0.613 0.441 0.902 0.463	Independent variables with each other are not correlated with each other and there is no multicollinearity

Environmental Performance (X7)		
2. Variance Inflation Factor (VIF)	2.114	
Company size (X1)	4.276	
Profitability (X2)	3.054	
Competition (X3)	1.632	
Growth (X4)	2.267	
Debt to Equity Ratio (X5)	1.108	
Public Accounting Firm (X6)	2.251	
Environmental Performance (X7)		

Source: statistical output from spss

According to the data in Table 5, the significance value for the Kolmogorov-Smirnov test is 0.200, which is higher than the threshold of 0.050. Based on the findings, it can be concluded that there are no issues with normality. The p-value for the park test is greater than 0.050. It can be concluded that there is no issue of heteroscedasticity. The Durbin-Watson statistic is 1.927. According to the Durbin-Watson table, the Durbin-Watson value falls within the range of DU and 4-DU. Based on the analysis, it can be concluded that there is no issue of autocorrelation. The VIF value is less than 10. The tolerance value exceeds 0.1. Based on the analysis, it can be concluded that there is no issue of multicollinearity.

### Regression Analysis

This study employs regression analysis to examine the hypothesis. The regression analysis findings are presented in Table 5.

Table 5. Regression Analysis

Variable	Coefficient	t-statistic	significance
Constant	17.070	-0.222	0.826
SIZE	0.628	0.555	0.583
PRO	26.381	-3.028	0.005*
COM	1.857	1.074	0.292
GROW	3.422	3.640	0.001*
DER	1.993	-1.493	0.146
KAP	1.515	2.311	0.028*
EP	0.093	1.38	0.133
F-statistic (sig)	3.701 (0.007*)		
R <sup>2</sup>	0.434		
*Significant in 0.05			

Source: statistical output from spss

The table shows that company size (SIZE) has a coefficient of 0.628, a t-statistic of -0.555, and a significance value of 0.583 (insignificant). This indicates that H1 is rejected where company size does not affect the disclosure of carbon emissions. Profitability (PRO) has a coefficient of 26.381, a t-statistic of -3.028, and a significance value of 0.005 (insignificant). This indicates that H2 is accepted where profitability has a positive effect on the disclosure of carbon emissions. Competition (COM) has a coefficient of 1.857, a t-statistic of 1.074, and a significance value of 0.292. This shows that H3 is rejected where competition does not affect the disclosure of carbon emissions. Growth (GROW) has a coefficient of 3.422, a t-statistic of 3.640, and a significance value of 0.001. This indicates that H4 is accepted where growth has a positive effect on the disclosure of carbon emissions. The debt-to-equity ratio (DER) has a coefficient of 1.993, a t-statistic of -1.493, and a significance value of 0.146. This shows that H5 is rejected where the ratio of debt to equity has no effect on the disclosure of carbon emissions. Public accountant reputation (KAP) has a coefficient of 1.515, a t-statistic of 2.311, and a significance value of 0.028. This indicates that H6 is accepted where the reputation of public accountants has a positive effect on the disclosure of carbon emissions. Environmental Performance (EP) has a coefficient of 0.093, a t-statistic of 1.38, and a significance value of 0.133. This indicates that H7 is rejected where environmental performance does not affect the disclosure of carbon emissions.

## DISCUSSION

The correlation between the size of a corporation and its level of carbon emission disclosure. After analyzing the data, it has been determined that hypothesis H1 is not supported. This means that the size of a corporation does not have an impact on the disclosure of carbon emissions. The number of companies in Indonesia may not have an impact on the disclosure of carbon emissions as companies may opt to provide alternative disclosures in order to enhance their credibility among the general public. Companies hold the belief that carbon emission disclosure will not yield any additional benefits in the future due to its voluntary nature. Therefore, it contradicts the findings of Abdullah et al. (2020), Hapsary & Prasetyo (2020), Ratmono et al. (2020), Hermawan et al. (2020), Ambarwati et al. (2020), and Sekarini (2021). The findings of this study are consistent with the research undertaken by Irwhantoko & Basuki (2016) and Kholmi et al (2020).

The correlation between profitability and the disclosure of carbon emissions. After analyzing the data, we have accepted hypothesis H2, which states that profitability has a beneficial impact on the disclosure of carbon emissions. The findings of this study align with the research conducted by Hapsary and Prasetyo (2020) and Abdullah et al (2020), which both provide evidence of the impact of profitability on the disclosure of carbon emissions. Research indicates that companies with sound financial standing are capable of making impactful environmental choices. Conversely, organizations that have inadequate financial resources focus primarily on attaining financial objectives

and enhancing their operational efficiency, so restricting their capacity to mitigate and disclose carbon emissions.

The correlation between competition and the disclosure of carbon emissions. After analyzing the data, hypothesis H3 is disproven, indicating that competition does not have an impact on carbon emission disclosure. The findings of this study align with the research conducted by Irwhantoko and Basuki in 2026, which did not find any indication of competition affecting the disclosure of carbon emissions. The findings of this study diverge with the research undertaken by Peng et al (2014), which concluded that competition exerts a notable and favorable influence on the disclosure of carbon emissions. This outcome is noteworthy since the size of a company's market share does not necessarily correlate with its carbon emissions. Companies are more inclined to assess and make decisions about measures aimed at mitigating greenhouse gas emissions and managing the risks associated with climate change. Companies often strive to demonstrate their commitment to environmental sustainability. Therefore, companies that are perceived as environmentally conscious should prioritize the production of eco-friendly products. However, the consumer focus does not provide information on the carbon footprint. This analysis demonstrates that a limited number and the methodologies employed to quantify them. Hence, the research findings indicate that competition does not have a significant impact on the breadth of carbon emissions disclosure. However, it does influence enterprises in decreasing greenhouse gas emissions, particularly in terms of efficiency and the aspiration to cultivate a positive image.

The correlation between economic growth and the extent to which carbon emissions are publicly disclosed. According to the examination of the data, hypothesis H4 is confirmed, indicating that growth has a beneficial impact on the disclosure of carbon emissions. The findings of this study align with the research conducted by El-Khatib et al. (2018), which provided evidence of the impact of growth on the disclosure of carbon emissions. Increased business expansion correlates with a favorable impact on the disclosure of greenhouse gas emissions. Those undergoing expansion are more inclined to publish extensive information regarding their greenhouse gas emissions, in contrast to those with stable growth.

The correlation between the debt-to-equity ratio and the disclosure of carbon emissions. After analyzing the data, hypothesis H5 is disproven, indicating that the ratio of debt to equity does not impact the disclosure of carbon emissions. The findings of this study align with the research conducted by Cheng et al (2014), which did not find any indication of the impact of the debt-to-equity ratio on the disclosure of carbon emissions. Companies having a high Debt-to-Equity Ratio (DER) may face restricted access to money, which in turn limits their ability to invest in the measurement and reporting of carbon emissions. Nevertheless, corporations with a high degree of debt-to-equity ratio (DER) and the ability to tap into robust financial markets may still possess ample resources to disclose their carbon emissions.

The correlation between the reputation of public accounting firms and the disclosure of carbon emissions. Hypothesis H6 is supported by the data analysis, indicating that the reputation of public accounting companies has a beneficial impact on the disclosure of carbon emissions. The finding of this study aligns with the research conducted by Cheng et al. (2014), which demonstrated the presence of a correlation between economic growth and the disclosure of carbon emissions. The reputation of KAP has a direct impact on the disclosure of carbon emissions, suggesting that KAP, with a strong reputation, can enhance the quality and transparency of carbon emissions disclosure. A KAP with a strong reputation possesses greater skill, trustworthiness, and experience in addressing intricate matters such as carbon emissions. Utilizing KAP (Knowledgeable Assurance Provider) with a strong reputation can offer increased confidence to investors and stakeholders regarding the accuracy and reliability of the company's published carbon emission information.

The correlation between environmental performance and the disclosure of carbon emissions. After analyzing the data, hypothesis H7 is disproven, indicating that environmental performance does have an impact on carbon emission disclosure. The findings of this study align with the research conducted by Majid and Ghozali (2015), which concluded that there is no indication of a relationship between environmental performance and the disclosure of carbon emissions. Certain corporations may prioritize different areas of Corporate Social Responsibility (CSR), such as community development, waste reduction, or natural resource sustainability, over carbon emission disclosure as a measure of environmental performance.

## **CONCLUSIONS AND RECOMMENDATIONS**

The findings indicated that the disclosure of carbon emissions is positively impacted by the profitability, growth, and reputation of public accounting companies. Furthermore, the findings of this study indicate that factors such as firm size, competition, leverage, and corporate environmental performance have little impact on the disclosure of carbon emissions. An inherent constraint of this study is that there exist additional variables, apart from corporate size, profitability, competition, growth, debt-to-equity ratio, reputation of public accounting firms, and environmental performance, that may serve as predictors for the dependent variable, specifically the disclosure of carbon emissions. To enhance future research, it is recommended that additional variables not included in this study be included as they may influence the variables under investigation. Additional independent variables that may be linked to carbon emission disclosure include national constitution ownership and eco-control.

## **ADVANCED RESEARCH**

In writing this article, the researcher realizes that this article still needs constructive input and suggestions. Therefore, researchers expect constructive criticism and suggestions from various parties so that this article can continue to be a strong foundation for the implementation of future plans.

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