# Factors Influencing Disclosure of Carbon Emissions
## (Case Study of Manufacturing Companies Listed on The Stock Exchange In 2017-2021)

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*Abstract*
This study aims to analyze the effect of the independent variables, namely Board Governance, Financial Performance, and Environmental Management Systems, on the dependent variable, namely Disclosure of Carbon Emissions. The population in this study are manufacturing companies listed on the IDX for 2017-2021. The sampling technique used is purposive sampling, which collects data sources by selecting samples with certain considerations. The research sample was obtained from 20 manufacturing companies. The data analysis method uses multiple regression (multiple regression) with the help of the EViews data processing program. The results of the hypothesis show that board governance has a negative effect on carbon emissions testing, while financial performance and environmental management systems have a positive effect on carbon emissions.

**Keywords:** Board Governance, Carbon Emission Disclosure, Environmental Management System, Financial Performance.

## 1. Introduction

Now climate change is one of the focuses of problems in the world (Nizam et al., 2019). As it is known that climate change that occurs from year to year is accelerating, based on recorded data starting in 1850, the world experienced the warmest decade. The following is

Factors Influencing Disclosure of Carbon Emissions (Case Study of Manufacturing
Companies Listed on The Stock Exchange in 2017-2021)
Fathihani et al.

climate change data and predictions from 2014-2023 (http://Data Perubahan Iklim
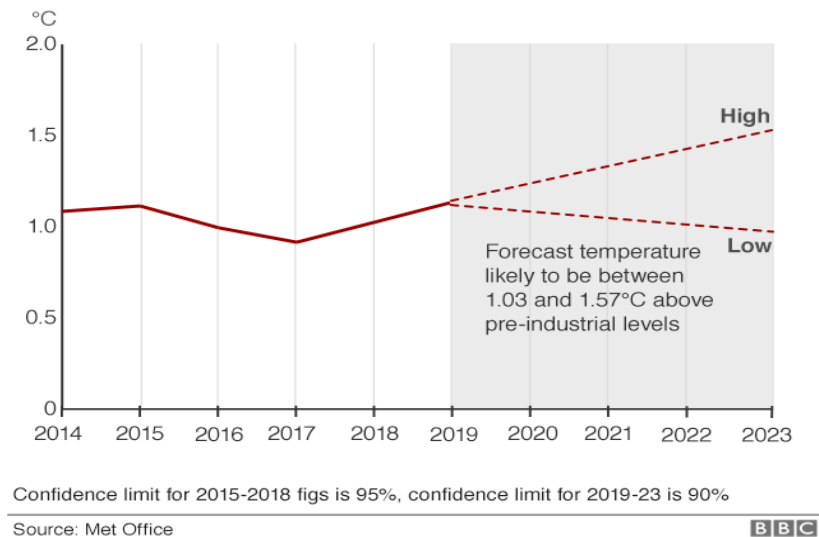Bappenas 2019).



Figure 1. Climate Change Data

Data shows that 2015 was the first year the global average surface temperature
reached one degree Celsius above pre-industrial levels (Bappenas, 2019). Looking at
forecasts up to 2023, the graph shows the global warming of the long-term effects of a 1.5-
degree Celsius increase in temperature. The average temperature in the world continues to
increase due to increasing concentrations of greenhouse gases such as carbon dioxide, which
comes from the continuous use of fossil fuels (Al Ahbabi & Nobanee, 2019). This indicates
the need for efforts to cut carbon to prevent global temperatures from exceeding the limit by
2023. Therefore it is necessary to reduce greenhouse gas emissions, and climate adaptation
measures must be a top priority for the world (Schumacher et al., 2020).

Global warming that is happening nowadays is due to the increasing temperature of
the earth caused by activities carried out by humans (Witri Astiti & Wirama, 2020). Global
warming is one of the factors of climate change in Indonesia. The factors of climate change
are due to the effects of greenhouse gases, global warming and the destruction of the ozone
layer, and the destruction of forest functions and company exhaust gases (Indonesiabaik,
2020). Company exhaust gases or carbon emissions can be seen from various sectors of
Indonesian companies. Every year carbon emissions increase along with the economy's
progress in Indonesia (Wiratno & Muaziz, 2020). This condition is quite worrying and
endangers the existing ecosystem. Climate transparency data shows a graph of the increase
in emissions per five years from various sectors. Source: www.bps.go.id

Indonesia's desire to reduce carbon emissions is a government plan and program to
reduce carbon emissions by 29% - 40% in 2030 (Schumacher et al., 2020). This is inseparable
from Indonesia's participation in being part of the G77 international climate negotiating
block; besides that, Indonesia is also a member of the Cartagena Block. Indonesia's annual
carbon emissions are as much as 2.4 billion tons or equivalent to CO2 (GtCO2e) (Zhang &
Chen, 2017). With Indonesia's commitment to joining the Nationally Determined
Contribution (NDC) as a continuation of the Paris Agreement, Indonesia has stated that it is
participating in efforts to reduce carbon emissions by 29% in Business As Usual (BAU)

Factors Influencing Disclosure of Carbon Emissions (Case Study of Manufacturing
Companies Listed on The Stock Exchange in 2017-2021)
Fathihani et al.

practices with its efforts or assistance from outside the State of Indonesia by 41% starting from 2030 (Kemfert & Schmalz, 2019).

Furthermore, disclosure of carbon gas emissions is influenced by several factors, including corporate governance, financial performance proxied through profitability and solvency, implementation of environmental management systems, and media exposure. Research conducted by (Amaliyah & Solikhah, 2019a) suggests that corporate governance affects the disclosure of carbon emissions. Implementing good corporate governance in companies will also increase the disclosure of carbon emissions within the company. Good GCG is inseparable from the role and is also supported by the presence of stakeholders, which will make the company want to show the best in its reports relating to external parties outside the company, including disclosure of carbon emissions which will display a positive image. Research conducted by (Rusmana & Purnaman, 2020) and (Eka Chandra Pramuditya & Budiasih, 2020) showed that corporate governance positively affects financial performance. Good governance can provide good financial performance results.

The next factor influencing the disclosure of carbon emissions is financial performance, which is proxied through profitability and leverage. Financial performance provides information about company performance. The better the financial performance, the wider the company's annual information reporting. The research conducted (by Sekarini & Setiadi, 2021) shows that projected profitability with ROE shows that ROE positively affects the disclosure of carbon emissions, and leverage projected with DER shows negative results on the disclosure of carbon emissions. The results of different studies for the leverage variable were found in research (Florencia & Handoko, 2021), showing that profitability by proxy for ROE has no effect on the disclosure of carbon emissions, and leverage has a negative effect on the disclosure of carbon emissions.

Disclosure of carbon emissions is also inseparable from implementing the company's environmental management system. Every company that is ISO certified will be more confident in disclosing emission reports in its annual report. An ISO certificate is one of its points compared to companies that do not yet have an ISO certificate. The problem is that not all companies in Indonesia have ISO 1 certificates 4001, so measurements were made using a dummy. Value 1 for companies with ISO 14001 certificate ownership and value 0 for those who do not have one. Research (Adrati & Augustine, 2018) that the environmental management system is proxied by iso 14001 shows a positive influence of the environmental management system on the disclosure of carbon emissions. However, research conducted by (Amaliyah & Solikhah, 2019b) found no effect of the environmental management system on the disclosure of carbon emissions.

Lastly, this research is controlled by media exposure. Information media is the latest notification tool, especially on social media. With the existence of the media, it is hoped that external parties can get accurate and updated news. Media exposure is one of the factors that can influence the disclosure of a company's carbon emissions. According to research (Septriyawati & Anisah, 2019), media exposure affects the disclosure of carbon emissions. With the active role of the mass media, it will spur companies to make disclosures which will increase the value and name of the company to external parties.

## 2. Research Method

This type of causal research is useful for analyzing the relationships between one variable and another or how a variable affects other variables. This study uses a quantitative approach by testing each hypothesis. The author wants to know how big the relationship between a variable and other variables is done from several sample companies (cross-section) in certain populations for several years (time series). The dependent variable in this study is the Disclosure of Carbon Emissions. The independent variables in this study are

Factors Influencing Disclosure of Carbon Emissions (Case Study of Manufacturing
Companies Listed on The Stock Exchange in 2017-2021)
Fathihani et al.

board governance, profitability, leverage, and environmental management systems. The data analysis used in this study is multiple regression using EViews 9. The unit of analysis for this research is aimed at several companies in Indonesia. The data source for this research is the financial statements of companies listed on the IICG and the Indonesia Stock Exchange. The dependent or dependent variable, that is, the variable, is influenced or dependent on other variables. This study's dependent variable (Y) is the disclosure of carbon emissions. The measurement method used is content analysis described in the research (Witri Astiti & Wirama, 2020) 5 important categories related to climate change and carbon emissions, namely: (1) climate change risks and opportunities (CC/Climate Change), (2) greenhouse gas emissions (GHG/Greenhouse Gas), (3) energy consumption (EC/Energy Consumption), (4) reduction of greenhouse gases and costs (RC/Reduction and Cost) as well; and (5) carbon emission accountability (ACE/ Accountability of Carbon Emission).

**Formula used:**

Carbon Emission Disclosure = Disclosed Aspect (18 Disclosure Aspect Items)

The environmental management system is integral to the overall company management system. The environmental management system contains an organizational structure, responsibilities, procedures, processes, and resources to realize environmental policies. The environmental management system provides a direction and flows to achieve and demonstrate good environmental performance through efforts to control the environmental impact of production activities. The Environmental Management System is projected using ISO 14001, referring to research (Adrati & Augustine, 2018) using a dummy variable where one is for an ISO 14001 certified Environmental Management System and 0 is for companies that do not have an environmental management system.

Table 1. Operational Research Variables

| Variables | Indicator | Measurement |
|---|---|---|
| Disclosure of Carbon Emissions (Y) (Bae Choi et al., 2013): | CED | |
| Corporate governance (X1) (Chin et al., 2019). | CGPI | Skor CGPI Corporate Governance Principal Implementation Index (transparency, accountability, responsibility, independence, fairness, and equality) |
| Profitability (X1) (Salbiah & Mukhibad, 2018). | ROE | |
| Leverage (X2) (Safiullah *et al.*, 2021) | DER | *Debt to Equity Ratio* = $\frac{\text{Total Liabilities}}{\text{Total Capital}}$ |
| Environmental Management System (X3) (Shakil, 2021). (Evangelista *et al.*, 2018) | ISO 14001 | |

In determining the sample, the authors used the purposive sampling method to obtain the following data:

Table 2. Sampling Criteria

| No. | Criteria | Number of Companies |
|---|---|---|
| 1 | Companies listed on the IDX and IICG for June 2021 and reporting carbon emissions | 32 |
| 2 | Companies that do not have complete data and do not | -12 |

Factors Influencing Disclosure of Carbon Emissions (Case Study of Manufacturing
Companies Listed on The Stock Exchange in 2017-2021)
Fathihani et al.

| No. | Criteria | Number of Companies |
|---|---|---|
| | report carbon emissions | |
| 3 | Number of Companies that can be used in research | 20 |
| 4 | Year of Research | 5 |
| | **Total Observations** | **100** |

This classical assumption test was carried out before the multiple regression test. According to Ghozali (2016), multiple regression analysis must avoid deviations from classical assumptions so as not to cause problems in testing.

a. **Normality test**. This test tests the independent and dependent variable regression models and whether they can be normally distributed. A good regression model has normal or close-to-normal data distribution. To detect the normality of the data can be tested with Jarque Bera, with guidelines for making decisions:
   1) sig. or probability < 0.05, not normally distributed
   2) The Sig value or probability > 0.05 is normally distributed (Ghozali, 2016).

b. **Multicollinearity Test**. The purpose of carrying out this test is to find out whether there is a correlation between the independent and non-independent variables in the regression model. The use of a good model has an indicator that there is no high correlation in the independent variables. In order to see whether or not multicollinearity exists, look at the tolerance value and the variance inflation factor (VIF). The tolerance value is used in measuring the variability of the independent variables and cannot be translated into other variables. So this low value + high VIF value (because VIF = 1/tolerance) thus depicts the emergence of high coloniality. Generally, the use of a cut-off value is 0.10 or VIF above 10 (Ghozali, 2016).

c. **Heteroscedasticity Test.** The third assumption (heteroscedasticity) is used to determine the emergence of heteroscedasticity, which is carried out in the scatterplot graph analysis. If a pattern such as dots appears and has a regular pattern (waves, widens, or narrows), it indicates heteroscedasticity appears. You can also do the Glejser test by regressing the residual absolute value on the dependent variable. Then look at the consistent table; if Sig ≤ 0.05, the data is symptomatic.

d. **Autocorrelation Test.** This test aims to see a correlation between the residual period t and t-I in the linear regression model. The good indicator of the regression model is seen in the absence of autocorrelation; in order to detect it, the Durbin Watson (DW) test is carried out (Ghozali, 2016):
   1) If the DW value is located at the upper limit or upper bound (du) and (4- du), it means that the autocorrelation coefficient is zero, and there is no positive autocorrelation
   2) If the DW value is lower than the lower limit or lower bound (dl), the autocorrelation coefficient is greater than zero and is positive.

Factors Influencing Disclosure of Carbon Emissions (Case Study of Manufacturing
Companies Listed on The Stock Exchange in 2017-2021)
Fathihani et al.

3) If the DW value is greater than the lower limit or lower bound (4-dl), it means that the autocorrelation coefficient is smaller than zero and is negative.

4) If the DW value is at the upper (du) and lower (dl) limits or the DW is at (4-du) and (4-dl), it means that it cannot be concluded.

The data collected was then tested and analyzed using statistical analysis tools, namely multiple regression analysis because the regression model includes more than one independent variable. This method can test the existence of independent variables that influence the dependent variable. Moreover, whether the moderating variable strengthens or weakens the relationship between the independent and dependent variables. Based on the existing variables, the regression equation can be formulated:

$$CED = \beta_1\ BG + \beta_2\ PRO + \beta_3\ LEV + B_4\ SML\ + e$$

Information:

| | |
|---|---|
| CED | = Carbon Emissions Disclosure |
| BG | = Board Governance |
| PRO | = Profitability |
| LEV | = Leverage |
| SML | = Environmental Management System |
| E | = error |

Hypothesis testing is done by:

1. **Coefficient of Determination ($R^2$)**. This test aims to understand the model's ability to explain changes in the dependent variable. With the magnitude of the coefficient of determination 0 and 1. The smaller $R^2$, the smaller the ability of the independent variable to explain the dependent variable. The study uses Adjusted R square (Adj $R^2$) because it contains several independent variables; if there is only one independent variable, R square (R2) is used to explain the effect (Ghozali, 2016).

2. **Simultaneous Significance Test (Statistical F Test)**. Assuming the determination of the other independent variables is the same. Testing the significance of these individual parameters is used to determine whether the independent variable only affects the dependent (Ghozali, 2016), with the following criteria:
   a. Ha is rejected if the value > 0.05 or sig. > α 0.05 means that this regression model is not fit to use.
   b. Ha is accepted if value = 0.05 or sig less than or sma with an α value of 0.05, meaning that the regression in this study is fit (fit) to use.

3. **Individual Parameter Significance Test (Statistical Test t).** The significance test on individual parameters enabled us to see the effect of the independent variables individually bound on the assumptions of the determination of other independent variables (Ghozali, 2016), with the criteria:
   a. Ha rejected, if. Value> 0.05 or sig. > α 0.05 means that the independent variables affect the dependent variable individually
   b. Ha accepted, if. Value = 0.05 or sig value. Less than or equal to the value of α 0.05 means that the independent variable affects the dependent individually.

Factors Influencing Disclosure of Carbon Emissions (Case Study of Manufacturing
Companies Listed on The Stock Exchange in 2017-2021)
Fathihani et al.

## 3. Results and Discussion

### 3.1. Results

The results of descriptive statistics are used to provide an overview or description of the variables contained in this study. Descriptive statistics only describe or provide information about data, situations, or phenomena in tabular form to make it easy to understand and interpret. The following are the results of descriptive statistical testing of the variables used in this study.

Table 3. Descriptive Analysis Results

|  | N | Minimum | Maximum | Mean | Std. Dev |
|---|---|---|---|---|---|
| CED | 100 | 0.1100 | 0.8900 | 0.5687 | 0.1822 |
| BG | 100 | 69.7200 | 94.9400 | 85.6617 | 5.7307 |
| PRO | 100 | -0.4700 | 0.3700 | 0.1272 | 0.1140 |
| LEV | 100 | 0.2800 | 1.9200 | 0.7319 | 0.2958 |
| SML | 100 | 0.0000 | 1.0000 | 0.4800 | 0.5030 |

Source: Research Data, 2022

From the output of descriptive statistics in Table 3 above, it is known that:

1. N = 100 means that the data processed in this study is 100 samples of 20 companies sampled for five years consisting of variable data on Carbon Emissions Disclosure, Board Governance, Financial Performance, and Environmental Management Systems.
2. The dependent variable is the Disclosure of Carbon Emissions (CED) with a minimum value of 0.1100, which PT owns. BPD West Java and Banten Tbk. in 2018 because the company only disclosed two of the eighteen indicators contained in the disclosure of carbon emissions. The highest value is 0.8900, which PT owns. Timah (Persero) Tbk is in the mining sector, so its activities are related to environmental sustainability and led to the disclosure of carbon emissions disclosure as many as 16 indicators out of 18. The mean value of the CED variable is 0.5687, which means that, on average, there are 56.87% CED disclosures or the equivalent of 10 items.
3. The first independent variable is Board Governance (BG), with a minimum value of 69.72 obtained by PT. Bakrie & Brothers Tbk. 2017. The score results from the assessment obtained by IICG from PT. Bakrie & Brothers Tbk in 2019 showed that the implementation of Corporate Governance had not been maximized within the company. It was proven that in 2017 other companies received the title of very trusted and trusted during PT. Bakrie & Brothers Tbk is the only company that has received the title of being quite trusted. The maximum value of 94,9400 was obtained by PT Bank Mandiri (Persero) Tbk. 2020. This cannot be denied because PT Bank Mandiri (Persero) Tbk pays attention to company management as a BUMN.
4. The second independent variable is Profitability (PRO), with a minimum value of -0.4700 obtained by PT. Bakrie & Brothers Tbk in 2020 due to losses experienced in 2020, and the highest value of 0.3700 was obtained by PT. Bakrie & Brothers Tbk. The average value of the profitability variable is 0.1272, which indicates an average of 12.72% of the company's profitability. The standard deviation value is 0.1140, meaning the data variation from profitability is 11.40%.
5. The third independent variable is the Leverage (LEV) ratio of at least 0.280 obtained by PT. Semen Indonesia (Persero) Tbk. Two thousand seventeen shows the financial performance of PT. Semen Indonesia is good for minimizing debt that must be paid off. Meanwhile, the highest score of 1.9200 was obtained by PT. Bakrie & Brothers Tbk in 2018

indicates that companies must be extra in managing their financial performance, especially in settlement of company obligations.

6. The fourth independent variable is the environmental management system (EMS), with a minimum value of 0.0000, obtained by companies without ISO 14001 environmental certification, especially in the financial sector, such as banks. While the highest score of 1.00 is obtained by a company with ISO 14001 environmental certification and carries out environmental activities, having this certification is necessary. The average value is 0.4800. The standard deviation is 0.5030, with an average of 0.4800. The average value of the environmental management system variable is 0.4800, which means that 48% of companies disclose environmental management systems, while the standard deviation value is 0.5030, which means that the variation in environmental management system data is 50.3%.

Table 4. T-Test Results (Hypothesis Test)

|  | Arah Prediksi | Coefficient | Sig | Kesimpulan |
|---|---|---|---|---|
| C |  | -0.5205 | 0.4722 |  |
| BG | + | -0.0650 | 0.0154 | H1 Ditolak |
| PRO | + | 6.8489 | 0.0202 | H2 Diterima |
| LEV | - | 4.3715 | 0.0103 | H3 Ditolak |
| SML | + | 2.3669 | 0.0281 | H4 Diterima |

Source: Research Data, 2022

The multiple regression equation formed is as follows:

$$CED = -0.5205 + 0.0650*BG + 6.8489*PRO - 4.3715*LEV + 2.3669*SML$$

## 3.2. Discussion

In testing the 1st hypothesis regarding the effect of board governance on the disclosure of carbon emissions, it gave a significant negative result, so the hypothesis that board governance has a significant positive effect on the disclosure of carbon emissions is rejected. This study's results align with research conducted by Putri Halimah & Yanto (2018) and (Ezhilarasi & Kabra, 2017), who obtained corporate governance results proxied by institutional ownership, which had a negative effect on the disclosure of carbon emissions. The high percentage of institutional ownership allows shareholders to control management, not to make environmental disclosures. This research proxy is different from research conducted by Putri Halimah & Yanto (2018), which only uses institutional ownership as a proxy for board governance, while the board governance in this study uses scoring values from CGPI.

Testing the second hypothesis regarding the effect of profitability on the disclosure of carbon emissions gives a significant positive result, so the hypothesis states that profitability has a significant positive effect on the disclosure of carbon emissions is accepted. This research supports the legitimacy theory, where companies in good financial condition can pay for the additional human or financial resources needed in better voluntary reporting to deter societal pressure. Companies with high profitability are more qualified to disclose carbon emissions than those with low profitability. The results of this study support research conducted by (Zahra et al., 2020) and (Cahya, 2016) that profitability has a significant positive effect on the disclosure of carbon emissions.

Testing the 3rd hypothesis related to the effect of leverage on the disclosure of carbon emissions gives a significant positive result, so the hypothesis that leverage has a significant negative effect on the disclosure of carbon emissions is rejected. The results of this study reveal that the higher the leverage value of a company, the greater the disclosure about the environment, especially about carbon emissions. In line with the stakeholder theory, stakeholders have the "power" and ability to pressure management to make disclosures related to the environment, such as the disclosure of carbon emissions. The results of this study support research conducted by (Mujiani et al., 2019) that leverage positively affect disclosing carbon emissions because stakeholders can force companies to disclose carbon emissions.

In testing the 4th hypothesis regarding the effect of the environmental management system on the disclosure of carbon emissions, it gave a significant positive result so that the hypothesis, which states that the environmental management system has a positive effect on the disclosure of carbon emissions, is accepted. Companies that implement an environmental management system will disclose more carbon emissions voluntarily than companies that do not implement an environmental management system. The results of this study support research conducted by Prafitri & Zulaikha (2016), which show that environmental management systems positively affect the disclosure of carbon emissions.

## 4. Conclusion

The study results prove that board governance has no positive effect on the disclosure of carbon emissions. The application of good and proper board governance will be able to make and control management to disclose carbon emissions. Profitability has a positive effect on the disclosure of carbon emissions. This study supports the opinions of (Zahra et al., 2020), which state that profitability positively affects the disclosure of carbon emissions. Companies with high levels of profitability are more capable of making disclosures than companies with profitability. Low. Leverage has no negative effect on the disclosure of carbon emissions. This supports the results of previous research conducted by Saptiwi (2019). These results indicate that the level of corporate leverage will not affect the disclosure of carbon emissions in a company. The environmental management system positively affects the disclosure of carbon emissions. This research supports the results of previous research conducted (Prafitri & Zulaikha, 2016) that companies that implement an environmental management system will make broader and more complete disclosures of carbon emissions.

Future researchers are expected to be able to explore other variables to be added in order to influence the disclosure of carbon emissions further, research on disclosure of carbon emissions should be carried out in one particular sector so that it can describe properly and the disclosure of carbon emissions, and the use of a scoring system in the analysis content can improved with a more comprehensive scoring system such as improving the partnering system (two) or group (3-4 people) to ensure objective scoring results better.

Factors Influencing Disclosure of Carbon Emissions (Case Study of Manufacturing
Companies Listed on The Stock Exchange in 2017-2021)
Fathihani et al.

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Factors Influencing Disclosure of Carbon Emissions (Case Study of Manufacturing
Companies Listed on The Stock Exchange in 2017-2021)
Fathihani et al.

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