

# DIGITALES ARCHIV

ZBW – Leibniz-Informationszentrum Wirtschaft  
ZBW – Leibniz Information Centre for Economics

Saraswati, Erwin; Puspita, Nadia Rani; Sagitaputri, Ananda

## Article

# Do firm and board characteristics affect carbon emission disclosures?

International Journal of Energy Economics and Policy

## Provided in Cooperation with:

International Journal of Energy Economics and Policy (IJEEP)

*Reference:* Saraswati, Erwin/Puspita, Nadia Rani et. al. (2021). Do firm and board characteristics affect carbon emission disclosures?. In: International Journal of Energy Economics and Policy 11 (3), S. 14 - 19.

<https://www.econjournals.com/index.php/ijEEP/article/download/10792/5778>.

doi:10.32479/ijEEP.10792.

This Version is available at:

<http://hdl.handle.net/11159/7678>

## Kontakt/Contact

ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics  
Düsternbrooker Weg 120  
24105 Kiel (Germany)  
E-Mail: [rights\[at\]zbw.eu](mailto:rights[at]zbw.eu)  
<https://www.zbw.eu/econis-archiv/>

## Standard-Nutzungsbedingungen:

Dieses Dokument darf zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden. Sie dürfen dieses Dokument nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, aufführen, vertreiben oder anderweitig nutzen. Sofern für das Dokument eine Open-Content-Lizenz verwendet wurde, so gelten abweichend von diesen Nutzungsbedingungen die in der Lizenz gewährten Nutzungsrechte.



<https://zbw.eu/econis-archiv/termsfuse>

## Terms of use:

*This document may be saved and copied for your personal and scholarly purposes. You are not to copy it for public or commercial purposes, to exhibit the document in public, to perform, distribute or otherwise use the document in public. If the document is made available under a Creative Commons Licence you may exercise further usage rights as specified in the licence.*



## Do Firm and Board Characteristics Affect Carbon Emission Disclosures?

Erwin Saraswati\*, Nadia Rani Puspita, Ananda Sagitaputri

Department of Accounting, Faculty of Economics and Business, Brawijaya Universitas, Indonesia.

\*Email: [erwin\\_saraswati@yahoo.com](mailto:erwin_saraswati@yahoo.com); [erwin@ub.ac.id](mailto:erwin@ub.ac.id)

Received: 19 October 2020

Accepted: 15 January 2021

DOI: <https://doi.org/10.32479/ijeep.10792>

### ABSTRACT

This research examines how profitability, company size, board independence, and board gender diversity affect carbon emission disclosures in Indonesian companies. The sample of this study consists of 36 manufacturing companies which were consecutively listed on Indonesian Stock Exchange from 2015 to 2018. The carbon emission disclosures were measured using a disclosure checklist consisting of 18 items. Using multiple regression analysis, this study found that carbon emission disclosures are greater in more profitable and larger companies. This suggests that financial resources availability and the political visibility can increase carbon emission disclosures. This study also finds that carbon emission disclosures are greater in companies with a large portion of independent commissioners and female directors. This supports the legitimacy and stakeholder theories that a more independent and diversified board will be more able to manage different stakeholder expectations. The findings can provide evidence to companies about how to increase their carbon emission disclosures, which can consequently help the government to control the national carbon emissions.

**Keywords:** Carbon Emission Disclosure, Profitability, Company Size, Board Independence, Board Gender Diversity

**JEL Classifications:** Q56, G34, M14

### 1. INTRODUCTION

The rapid economic growth does not only bring positive impact to the standard of living of the people, but also harm the natural resources and increase carbon emissions (Mardani et al., 2019; Trufvsa and Ardiyanto, 2019). Indonesia is the world's fourth largest producer of carbon emission in 2015 (Kementerian Perencanaan Pembangunan Nasional Republik Indonesia/Badan Perencanaan Pembangunan Nasional, 2019). To respond that phenomenon, in 2004 Indonesia has ratified the Kyoto Protocol founded by the United Nations Framework Convention on Climate Change (UNFCCC). The government of Indonesia has also started an initiative called the National Action Plan on Greenhouse Gases Emission or RAN-GRK. This initiative targeted a reduction of the Greenhouse Gases (GHG) emission as much as 26% with national effort or 41% with international support by 2020. Indonesia further set the reduction target of 29% by 2030 under

the Intended Nationally Determined Contribution (INDC) (Putranti and Imansyah, 2017). To achieve those targets, an integrated effort from the society and corporations are necessary. The corporations' role can be done through carbon accounting and carbon emission disclosure (Irwhantoko and Basuki, 2016).

Carbon emission disclosure in Indonesian companies are voluntary (Irwhantoko and Basuki, 2016), so the implementation is different in each company. However, studies examining the determinants of carbon emission disclosures were still inconclusive. The majority of studies found that profitable companies report more on carbon emission (Jannah and Muid, 2014; Akhiroh and Kiswanto, 2016; Faisal et al., 2018). However, some studies reported insignificant relationship (Choi et al., 2013; Chu et al., 2013; Chithambo and Tauringana, 2014). The majority of studies also found that bigger companies disclose more carbon emission disclosure (Choi et al., 2013; Nasih et al., 2019; Borghei-Ghomi and Leung, 2013; Faisal

et al., 2018). It was empirically proven that board gender diversity increases carbon emission disclosure (Liao et al., 2014; Ben-Amar and McIlkenny, 2014). However, Indonesian evidence do not find a significant relationship between the two (Nainggolan, 2015). Board independence was also found to significantly increase carbon emission disclosure (Liao et al., 2014; Nainggolan, 2015; Biswas et al., 2018). However, an Indonesian study conducted by Akhiroh and Kiswanto (2016) found an insignificant relationship.

This study aims to provide evidence on how profitability, company size, board independence, and board gender diversity affect the carbon emission disclosure made by manufacturing companies listed on Indonesian Stock Exchange for the period of 2015 to 2018. The manufacturing sector is one of the most significant sources of carbon emissions (Putranti and Imansyah, 2017). The findings of this study may contribute in expanding the carbon emission disclosure by Indonesian corporations, thus helping the government of Indonesia to more easily control the carbon emissions of the country.

## 2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

### 2.1. Theoretical Framework

The legitimacy theory explains that an organization seeks legitimacy or acceptance from the society by aligning its operations with the boundaries and norms of the society (Deegan and Unerman, 2008; Patten, 2005). Under this theory, an organization forms a social contract with the society (Deegan and Unerman, 2008). This social contract is constantly evolving with the society, hence organizations need to be responsive with the society's expectations (Mousa and Hassan, 2015).

Complementing the legitimacy theory, the stakeholder theory suggests that instead of a single social contract with the society, an organization is bound to different social contracts to each stakeholder. This is because every stakeholder has different perspectives with regards to the organization's activities (Deegan and Unerman, 2008). Stakeholders are generally divided into two groups, which are primary and secondary stakeholders (Post et al., 2002). Primary stakeholders are the ones having direct relationship with a company's activities; such as customers, suppliers, employees, and investors. While secondary stakeholders are the ones affected either directly or indirectly by the company's activities; such as the society, government, and social activists.

Based on the legitimacy and stakeholder theories, a corporation needs to align its operations with the boundaries and norms of the society. In conducting its business, a corporation makes an impact to the environment in which it operates. To ensure that the corporation has conducted its business in a responsible manner and maintained human rights to live a safe, peaceful, and prosperous life, corporations need to disclose social and environmental information, such as information regarding its carbon emissions (Hanifah, 2016).

### 2.2. Literature Review

Choi et al. (2013) examined the relationship between various company characteristics with carbon emission disclosures of 100

largest companies in Australian Securities Exchange for the period of 2006 to 2008. The study found that carbon emission disclosures are more extensive in companies operating in emission-intensive industries, companies with higher carbon emission level, bigger companies, and companies with better corporate governance. However, company profitability and financial distress do not affect carbon emission disclosures.

Liao et al. (2014) studied the GHG emissions disclosures of 329 largest companies in United Kingdom for the year 2011. The finding showed that GHG emissions disclosures increase when companies have more female members on the board. A more independent board and existence of an environmental committee will also increase the propensity for GHG emissions disclosure.

Nasih et al. (2019) studied the carbon emission disclosures in Indonesian listed companies. The samples include 305 firm-year observations from manufacturing and agricultural companies from 2011 to 2016. The study found that bigger companies and companies with larger board size will disclose more information on carbon emissions. However, carbon emission disclosures decrease with the increase in board independence. This finding suggested that independent commissioners are more conservative in their approach, hence avoiding extensive disclosures.

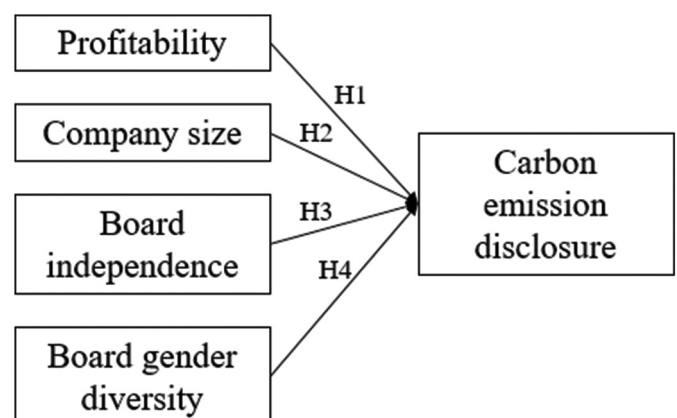
Akhiroh and Kiswanto (2016) studied the carbon emission disclosures of 32 non-financial listed companies in Indonesia from 2012 to 2014. The findings showed that company visibility, profitability, managerial ownership, and audit committee increase carbon emission disclosures. However, financial distress, institutional ownership, and board independence do not affect carbon emission disclosures.

### 2.3. Conceptual Framework and Hypotheses Development

This study will examine the impact of profitability, company size, board independence, and board gender diversity to carbon emission disclosures. The conceptual framework is shown in Figure 1.

Studies found that profitability increases carbon emission disclosures (Akhiroh and Kiswanto, 2016; Jannah and Muid, 2014; Choi et al., 2013). Since voluntary disclosures are costly,

Figure 1: Conceptual framework



highly profitable companies are more likely to disclose more information due to its resource availability. Based on stakeholder theory, profitable companies use their available resources to fulfill the expectations of stakeholders (Akhiroh and Kiswanto, 2016). Hence, we hypothesize that:

- $H_1$ : More profitable companies will have higher carbon emission disclosures

Studies also found that bigger companies disclose more information on carbon emission (Jannah and Muid, 2014; Choi et al., 2013). Bigger companies face more pressure from stakeholders as well as more exposure to the media (Jannah and Muid, 2014; Freedman and Jaggi, 2005). Hence, bigger companies disclose more voluntary information to obtain legitimacy. We hypothesize that:

- $H_2$ : Larger companies will have higher carbon emission disclosures

Studies found that board independence increases carbon emission disclosures (Nainggolan, 2014; Liao et al., 2014). Independent commissioners can provide better monitoring to the management and encourage transparency (Naseem et al., 2017). According to the stakeholder theory, an independent director can moderate conflicting interests between stakeholders (Liao et al., 2014). Independent commissioners are expected to represent the society and ensure their wellbeing (Nainggolan, 2015). Hence, we hypothesize that:

- $H_3$ : Companies with higher board independence will have higher carbon emission disclosures

Studies found that board gender diversity can increase carbon emission disclosures (Liao et al., 2014) and corporate social responsibility disclosures (Hadya and Susanto, 2018). Female directors are more likely to consider ethical dimensions when making decisions (Glass et al., 2015). According to the stakeholder theory, stakeholders may have different views on a company; hence, a more diverse board will be more likely to respond to different perspectives of stakeholders (Liao et al., 2014). Hence, we hypothesize that:

- $H_4$ : Companies with higher board gender diversity will have higher carbon emission disclosures.

### 3. METHODOLOGY

#### 3.1. Data Sources

In this study, we used secondary data from the available resources. The data were obtained from the financial, annual and sustainability reports gathered from company websites and Indonesian Stock Exchange portal (idx.co.id).

#### 3.2. Operational Definition and Measurement of Variables

The independent variables in this study are profitability, company size, board independence, and board gender diversity.

Company profitability is proxied with return on assets (ROA). A company's ROA shows its ability to generate profit using all of its assets.

$$\text{Profitability} = \frac{\text{Aftertax net income}}{\text{Total assets}} \quad (1)$$

Company size is measured by the natural logarithm of a company's total assets.

$$\text{Size} = \text{Ln}[\text{Total Assets}]$$

Independent commissioners are commissioners who do not have any affiliation with the majority shareholders, other board members, and the company itself. Board independence is measured by the proportion of independent commissioners on the Board of Commissioners (BoC).

$$\text{Board Independence} = \frac{\text{Number of independent commissioners}}{\text{Number of commissioners}} \quad (2)$$

Board gender diversity is measured by the proportion of female directors on the Board of Directors (BoD).

$$\text{Gender diversity} = \frac{\text{Number of female directors}}{\text{Number of directors}} \quad (3)$$

The control variables used in this study are leverage and industry type. Leverage is proxied by debt to equity ratio. Industry type is a dummy variable with the value of 1 given to high-profile industries, which are electricity, chemistry, oil and gas, nuclear, iron, automotive, pulp and paper, tobacco, health, food and beverages, transportation, and agrobusiness companies. While the value of 0 is given to low-profile industries, such as home furniture, personal products, etc (Sembiring, 2005).

The dependent variable of this study is the extent of carbon emission disclosures in companies' annual and sustainability reports. The disclosure checklist was adopted from previous research by Choi et al. (2013). This checklist was originally made based on the Information Request sheets by an organization called the carbon disclosure project (CDP). The disclosure checklist items are shown in Table 1.

Each indicator is given the score of 1 if disclosed in the annual or sustainability report. Then we summed up the total score of each observation. The checklist consists of 18 items in total, so the maximum score is 18 for each observation.

### 4. RESULTS AND DISCUSSION

The sample selection process can be seen in Table 2. We have chosen 36 listed manufacturing companies as sample. The research period was from 2015 to 2018, so the total sample was 144 firm-year observations.

**Table 1: Carbon emission disclosure items**

| Category                                | Item   |
|---|--|
| Climate change: risks and opportunities | CC1: assessment/description of the risks (regulatory, physical or general) relating to climate change and actions taken or to be taken to manage the risks<br>CC2: assessment/description of current (and future) financial implications, business implications and opportunities of climate change  |
| GHG emissions accounting                | GHG1: description of the methodology used to calculate GHG emissions (e.g. GHG protocol or ISO)<br>GHG2: existence external verification of quantity of GHG emission – if so, by whom and on what basis<br>GHG3: total GHG emissions – metric tons CO <sub>2</sub> -e emitted<br>GHG4: disclosure of Scopes 1 and 2, or scope 3 direct GHG emissions<br>GHG5: disclosure of GHG emissions by sources (e.g. coal, electricity, etc.)<br>GHG6: disclosure of GHG emissions by facility or segment level<br>GHG7: comparison of GHG emissions with previous years |
| Energy consumption accounting           | EC1: total energy consumed (e.g. tera-joules or peta-joules)<br>EC2: quantification of energy used from renewable sources<br>EC3: disclosure by type, facility or segment  |
| GHG reduction and cost                  | RC1: detail of plans or strategies to reduce GHG emissions<br>RC2: specification of GHG emissions reduction target level and target year<br>RC3: emissions reductions and associated costs or savings achieved to date as a result of the reduction plan<br>RC4: cost of future emissions factored into capital expenditure planning   |
| Carbon emission accountability          | ACC1: indication of which board committee (or other executive body) has overall responsibility for actions related to climate change<br>ACC2: description of the mechanism by which the board (or other executive body) reviews the company's progress regarding climate change  |

**Table 2: Sample selection**

| No. | Criteria   | No. of companies |
|-----|--|------------------|
| 1.  | Listed manufacturing companies in 2015-2018                                    | 141              |
| 2.  | Companies that did not publish financial statements consecutively in 2015-2018 | (10)             |
| 3.  | Companies that did not publish annual reports consecutively in 2015-2018       | (7)              |
| 4.  | Companies that did not publish at least one carbon emission policy             | (88)             |
|     | Number of samples per year   | 36               |
|     | Number of firm-year observations (36 × 4 years)                                | 144              |

Carbon emission disclosures trend over the years, shown in percentages of the disclosing companies to the total number of companies, are shown in Table 3.

Overall, the disclosures showed an upward trend. The highest item disclosed was the company's plans or strategies to reduce GHG emissions (RC-1) where 92% of the sample companies have disclosed the item. The lowest item disclosed was the cost of future emissions factored into capital expenditure planning (RC-4), with only 1% of the sample companies that disclosed the information. When averaged by category, the highest disclosed category was climate change risks and opportunities (CC) with an average of 54%, while the lowest disclosed categories were GHG emissions accounting (GHG) and energy assumption accounting (EC), with both having an average of 24%. This may be due to the weak implementation of carbon accounting in Indonesia.

The descriptive statistics of the data is shown in Table 4.

The descriptive statistics show us that the carbon emission disclosures (CED) had a wide range from 1 to 17. The average was 5.63 or 31% of the maximum possible score from the checklist.

This means that carbon emission disclosures practices in Indonesia were highly varied and relatively weak on average.

The profitability proxied by ROA was ranging from -0.16 to 0.53, with an average of 0.07. The size variable, measured by the total assets was ranging from IDR 89 billion to IDR 345 trillion, with an average of IDR 24 trillion. Board independence, measured by the proportion of independent commissioners on the BoC, was ranging from 20% to 100%. This means each company had at least one independent commissioner, as mandated by the applicable regulation on Limited Liability Companies. Board gender diversity, measured by the proportion of female directors on the BoD, was ranging from 0% to 50%. From 144 observations, 86 of them (or 60%) do not have any female directors.

We have tested the classical assumptions testing of normality, multicollinearity and heteroscedasticity. The normality testing was conducted using Kolmogorov Smirnov to test whether the residual values of a model were normally distributed. A set of data can be considered normally distributed when the  $P > 0.05$ . The result showed a p-value of 0.85 ( $P > 0.05$ ), so the normality assumption was met.

The multicollinearity testing was conducted to see whether there were any correlations between the independent variables. A set of data is considered to have a multicollinearity issue when any of the variables show a variance inflation factors (VIF) greater than 10. Our testing showed that each of the variables have VIF values less than 10. Hence, there were no multicollinearity issues in the model.

The heteroscedasticity testing was conducted to find out whether the residual values in the model are unequal. We conducted heteroscedasticity using scatter plots. The result showed a random pattern, concluding that the data had homogenous residuals.



The multiple regression result that tested our hypotheses is shown in Table 5.

The result showed an F significance of 0.00 ( $\alpha < 0.05$ ) and an adjusted R square value of 51%. Hence, the model is able to explain the carbon emission disclosures in Indonesia.

We found that profitability has a positive relation to carbon emission disclosures which is significant at 99% confidence level. This finding is consistent with the previous studies (Jannah and Muid, 2014; Akhiron and Kiswanto, 2016; Faisal et al., 2018). This proves that companies with more financial resources will engage in more carbon emission disclosures, since those disclosures are relatively costly. More profitable companies are also expected to contribute to reducing environmental impact (Choi et al., 2013).

**Table 3: Carbon emission disclosures trend**

| Item    | % of Carbon emission disclosures |      |      |      |         |
|---------|----------------------------------|------|------|------|---------|
|         | 2015                             | 2016 | 2017 | 2018 | Average |
| CC1     | 75                               | 75   | 72   | 83   | 76      |
| CC2     | 39                               | 28   | 33   | 28   | 32      |
| GHG-1   | 19                               | 22   | 25   | 28   | 24      |
| GHG-2   | 8                                | 11   | 17   | 19   | 14      |
| GHG-3   | 25                               | 25   | 39   | 39   | 32      |
| GHG-4   | 22                               | 22   | 25   | 22   | 23      |
| GHG-5   | 22                               | 11   | 19   | 28   | 20      |
| GHG-6   | 19                               | 22   | 28   | 31   | 25      |
| GHG-7   | 25                               | 25   | 28   | 33   | 28      |
| EC-1    | 28                               | 28   | 33   | 36   | 31      |
| EC-2    | 19                               | 19   | 19   | 19   | 19      |
| EC-3    | 22                               | 19   | 25   | 17   | 21      |
| RC-1    | 94                               | 89   | 92   | 92   | 92      |
| RC-2    | 22                               | 22   | 31   | 25   | 25      |
| RC-3    | 33                               | 28   | 36   | 39   | 34      |
| RC-4    | 0                                | 0    | 0    | 3    | 1       |
| ACC-1   | 47                               | 56   | 58   | 64   | 56      |
| ACC-2   | 8                                | 11   | 14   | 11   | 11      |
| Average | 29                               | 29   | 33   | 34   | 31      |

**Table 4: Descriptive statistics**

| Variable               | Min   | Max   | Mean  | Stdev |
|------------------------|-------|-------|-------|-------|
| CED                    | 1     | 17    | 5.63  | 4.49  |
| Profitability          | -0.16 | 0.53  | 0.07  | 0.11  |
| Size                   | 25.22 | 33.47 | 29.57 | 1.66  |
| Board independence     | 0.20  | 1.00  | 0.42  | 0.14  |
| Board gender diversity | 0.00  | 0.50  | 0.09  | 0.13  |
| Leverage               | -5.02 | 7.50  | 1.00  | 1.30  |
| Industry type          | 0     | 1     | 0.83  | 0.37  |

**Table 5: Multiple regression result**

| Model                  | B     | T      | Sig.    |
|------------------------|-------|--------|---------|
| (Constant)             | -3.43 | -3.73  | 0.00*** |
| Profitability          | 1.95  | 3.68   | 0.00*** |
| Size                   | 0.14  | 4.13   | 0.00*** |
| Board independence     | 1.18  | 2.86   | 0.00*** |
| Board gender diversity | 0.87  | 1.64   | 0.052*  |
| Leverage               | -0.03 | -0.86  | 0.196   |
| Industry type          | 0.13  | 0.97   | 0.167   |
| F value                |       | 25.97  |         |
| Significance           |       | 0.0000 |         |
| Adjusted R square      |       | 0.51   |         |

\*\*\*Significant at  $\alpha=0.01$ . \*\*Significant at  $\alpha=0.05$ . \*Significant at  $\alpha=0.1$

The result also shows that company size has a positive relation to carbon emission disclosures which is significant at 99% confidence level. This is consistent with the previous findings (Choi et al., 2013; Borghei-Ghomi and Leung, 2013; Nasih et al., 2019; Faisal et al., 2019). Larger companies have higher visibility from the society, the media, and the government. This leads to more pressure from the stakeholders, and the company has to disclose more to fulfill the different interests of the stakeholders.

We also found that carbon emission disclosures increase with board independence at 99% confidence level. This finding is consistent with the previous studies (Liao et al., 2013; Biswas et al., 2018; Nainggolan, 2015; Prado-Lorenzo and Garcia-Sanchez, 2010). Independent commissioners can intensify the monitoring to the management and encourage the transparency of the management.

The regression result also shows that board gender diversity positively affects carbon emission disclosures, although only at 90% confidence level. This is consistent with the previous findings (Liao et al., 2014; Ben-Amar et al. 2017; Hollindale et al., 2019; Rupley et al., 2012). The weak relationship can be caused by the small number of female directors in the observations. Studies found that female directors are more risk-averse, forward-thinking, and ethical in their decision making (Ararat and Sayedy, 2019; Glass et al., 2015).

According to the legitimacy and stakeholder theories, companies form social contracts with stakeholders. Those stakeholders may have different perspectives and expectations to the company. A more independent and diverse board is expected to have the more ability to moderate conflicting interests between stakeholders (Liao et al., 2014).

## 5. CONCLUSION

This research aims at providing an empirical evidence on the profitability, company size, board independence, and board gender diversity affect the carbon emission disclosure. The research sample are manufacturing companies listed on Indonesian Stock Exchange from 2015 to 2018. The carbon emission disclosure is measured using a checklist consisting of 18 items.

Using multiple regression, we found that more profitable and larger companies disclose more information on carbon emissions. Since disclosures are costly, companies with more financial resources are more likely to disclose. Larger companies also face more pressure from the media, society, and the government, so they have to disclose more information to mediate the different information needs of stakeholders.

We also found that carbon emission disclosures increase with more independent commissioners and female directors. This supports the stakeholder theory which poses that stakeholders have different views and interests on a company. Hence, a more independent and diverse boards are more able to manage those various stakeholder expectations.

The findings of the research can help companies improve their carbon emission disclosures, by having more independent

commissioners and female directors on board. With more carbon emission disclosures, the government can more easily control the national carbon emission and reach the national carbon reduction target.

This research has several limitations. First, there may be an element of subjectivity when the researchers interpret the information included in company reports. Second, this research is only limited to the manufacturing companies of the Indonesian Stock Exchange.

## REFERENCES

- Akhiroh, T., Kiswanto, K. (2016), The determinant of carbon emission disclosures. *Accounting Analysis Journal*, 5(4), 326-336.
- Ararat, M., Sayedy, B. (2019), Gender and climate change disclosure: An interdimensional policy approach. *Sustainability*, 11(1), 107-125.
- Ben-Amar, W., McIlkenny, P. (2014), Board effectiveness and the voluntary disclosure of climate change information. *Business Strategy and the Environment*, 24(8), 704-719.
- Biswas, P., Mansi, M., Pandey, R. (2018), Board composition, sustainability committee and corporate social and environmental performance in Australia. *Pacific Accounting Review*, 30(4), 517-540.
- Borghei-Ghomi, Z., Leung, P. (2013), An empirical analysis of the determinants of greenhouse gas voluntary disclosure in Australia. *Accounting and Finance Research*, 2(1), 110-124.
- Chithambo, L., Tauringana, V. (2014), Company specific determinants of green house gases disclosures. *Journal of Applied Accounting Research*, 15(2), 323-338.
- Choi, B.B., Lee, D., Psaros, J. (2013), An analysis of Australian company carbon emission disclosures. *Pacific Accounting Review*, 25(1), 58-79.
- Chu, C.I., Chatterjee, B., Brown, A. (2013), The current status of greenhouse gas reporting by Chinese companies: A test of legitimacy theory. *Managerial Auditing Journal*, 28(2), 114-139. Available from: <https://www.emerald.com>. [Last accessed on 2020 Mar 27].
- Deegan, C., Unerman, J. (2008), *Financial Accounting Theory European Edition*. United Kingdom: McGraw-Hill.
- Faisal, F., Andiningtyas, E.D., Achmad, T., Haryanto, H., Meiranto, W. (2018), The content and determinants of greenhouse gas emission disclosure: Evidence from Indonesian companies. *Corporate Social Responsibility and Environmental Management*, 25(6), 1397-1406.
- Freedman, M., Jaggi, B. (2005), Global warming, commitment to the Kyoto protocol, and accounting disclosures by the largest global public firms from polluting industries. *The International Journal of Accounting*, 40(3), 215-232.
- Glass, C., Cook, A., Ingersoll, A.R. (2015), Do Women leaders promote sustainability? Analyzing the effect of corporate governance composition on environmental performance. *Business Strategy and the Environment*, 25(7), 495-511.
- Hadya, R., Susanto, R. (2018), Model hubungan antara keberagaman gender, pendidikan dan nationality dewan komisaris terhadap pengungkapan corporate social responsibility. *Jurnal Benefita*, 3(2), 149-160.
- Hanifah, U. (2016), Aktualitas Carbon Emission Disclosure: Sebagai Dasar dan Arah Pengembangan Triple Bottom Line. Seminar Nasional dan the 3<sup>rd</sup> Call For Syariah Paper (SANCALL). p125-135.
- Hollindale, J., Kent, P., Routledge, J., Chapple, L. (2019), Women on boards and greenhouse gas emission disclosures. *Accounting and Finance*, 59(1), 277-308.
- Irwhantoko, I., Basuki, B. (2016), Carbon emission disclosure: Studi pada perusahaan manufaktur Indonesia. *Jurnal Akuntansi Dan Keuangan*, 18(2), 92-104.
- Jannah, R., Muid, D. (2014), Analisis faktor-faktor yang mempengaruhi carbon emission disclosure pada perusahaan di Indonesia (Studi empiris pada perusahaan yang terdaftar di bursa efek Indonesia periode 2010-2012), *Diponegoro Journal of Accounting*, 3(2), 1-11.
- Kementerian Perencanaan Pembangunan Nasional Republik Indonesia/ Badan Perencanaan Pembangunan Nasional. (2019), *Low Carbon Development: A Paradigm Shift Towards a Green Economy in Indonesia*. Available from: <https://www.bappenas.go.id>. [Last accessed on 2020 Mar 10].
- Liao, L., Luo, L., Tang, Q. (2014), Gender diversity, board independence, environmental committee and greenhouse gas disclosure. *The British Accounting Review*, 47(4), 409-424.
- Mardani, A., Streimikiene, D., Cavallaro, F., Loganathan, N., Khoshnoudi, M. (2019), Carbon dioxide (CO<sub>2</sub>) emissions and economic growth: A systematic review of two decades of research from 1995 to 2017. *Science of The Total Environment*, 64(4), 31-49.
- Mousa, G., Hassan, N. (2015), Legitimacy theory and environmental practices: Short notes. *International Journal of Business and Statistical Analysis*, 2(1), 41-53.
- Nainggolan, N.E. (2015), Pengaruh struktur corporate governance terhadap pengungkapan lingkungan (studi empiris pada perusahaan non-keuangan yang terdaftar di bursa efek Indonesia periode 2011-2013). *Diponegoro Journal of Accounting*, 4(2), 1-9.
- Naseem, M.A., Riaz, S., Rehman, R., Ikram, A., Malik, F. (2017), Impact of board characteristics on corporate social responsibility disclosure. *The Journal of Applied Business Research*, 3(4), 801-810.
- Nasih, M., Harymawan, I., Paramitasari, Y.I., Handayani, A. (2019), Carbon emissions, firm size, and corporate governance structure: Evidence from the mining and agricultural industries in Indonesia. *Sustainability*, 11(9), 1-14.
- Patten, D.M. (2005), The accuracy of financial report projections of future environmental capital expenditures: A research note. *Accounting, Organizations and Society*, 30(5), 457-468.
- Post, J.E., Lawrence, A.T., Weber, J. (2002), *Business and Society: Corporate Strategy, Public Policy, Ethics*. 10<sup>th</sup> ed. New York: McGraw-Hill.
- Prado-Lorenzo, J.M., Garcia-Sanchez, I.M. (2010), The role of the board of directors in disseminating relevant information on greenhouse gases. *Journal of Business Ethics*, 97(3), 391-424.
- Putranti, T.M., Imansyah, H.M. (2017), The Change of CO<sub>2</sub> Emission on Manufacturing Sectors in Indonesia: An Input-Output Analysis. *AIP Conference Proceedings* 1918, 020005-1-020005-8.
- Rupley, K.H., Brown, D., Marshall, S. (2012), Governance, media, and the quality of environmental disclosure. *Journal of Accounting and Public Policy*, 31(6), 610640.
- Sembiring, E.R. (2005), *Karakteristik Perusahaan dan Pengungkapan Tanggung Jawab Sosial: Study Empiris Pada Perusahaan Yang Tercatat di Bursa Efek Jakarta*. SNA VIII Solo, (September), 15-16.
- Trufvisa, U.S., Ardiyanto, M.D. (2019), Pengaruh karakteristik dewan komisaris terhadap pengungkapan emisi Karbon. *Diponegoro Journal of Accounting*, 8(3), 1-11.