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# THE DEVELOPMENT OF CARBON EMISSION DISCLOSURE IN ACCOUNTING RESEARCH: EVIDENCE FROM INDONESIA

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## ABSTRACT

*The purpose of this paper is to analyze accounting research developments in the area of Carbon Emission Disclosure (CED) in Indonesia for the period 2015-2020. The focus of CED literature review is on disclosures and not to examine CED activities or programs. The CED research development was traced through mapping articles published in the national accredited accounting journals. A total of 44 articles were reviewed and analyzed. The analyses result showed that (1) The most widely used variable associated with CED was financial performance; (2) 86.36 percent of the CED measurement referred to used carbon disclosure project index lists and the rest use other measurements; (3) 38.64 percent of the CED research used annual reports as the source of data than sustainability report. The study results are important as a basis for future studies to provide a platform for the analysis to cover the gap between CED studies in the academic and business areas for not only Indonesia but also other countries.*

**Key words:** Carbon Emission Disclosure, Developing Country, Indonesia

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## 1. INTRODUCTION

Global warming is a phenomenon that is endless to talk about. In general, global warming is an event caused by an increase in the average temperature of the atmosphere that causes climate change. According to the Copernicus Climate Change Service (2020), January 2020 is the hottest month in history. The temperature is known to be 0.77 ° C higher in January 2020 from January 1981 to 2010. January 2020 is even hotter than January 2016 and 0.3 ° C higher.

January 2016 was the hottest month in history due to a combination of climate change and the El Nino cycle. Now the record has been beaten until January 2020, which means our earth is getting hotter (Nationalgeographic, 2020). The increase in temperature comes from increasing greenhouse gas emissions resulting from everyday human activities.

Indonesia is the fourth-largest greenhouse gas emitter in the world in 2015. Indonesia's annual greenhouse gas emissions in 2015 correspond to 2.4 billion tonnes of CO<sub>2</sub> equivalent (GtCO<sub>2</sub>e) (Potsdam Institute for Climate Impact Research (PIK)). Emissions per capita per year This reached 9.2 tonnes of CO<sub>2</sub>e, which was above the global average (7.0 tons CO<sub>2</sub>e) and the average in China (9.0 tons CO<sub>2</sub>e), the United Kingdom (7.7 tons CO<sub>2</sub>e) and the EU. Europe (8.1 ton CO<sub>2</sub>e), Indonesia has committed to reducing emissions by 29-41% by 2030. This commitment was communicated to the UNFCCC before the conference in Paris, which the Climate Action Tracker (CAT) rated as "very inadequate". An independent research project examining aviation policy based on CAT information, Indonesia's emissions have increased faster than expected in recent years.

Greater research on CED topics in Indonesia is important. Very meaningful and relevant for mastering the actual growth of CED research in Indonesia, especially in the area of accounting in the past 5 years (2015-2020). Very few research has been found to share the facts of CED development in accounting. Based on the description of whether CED research should develop and become a meaningful topic, this paper advocates the main goal of analyzing the growth of CED topics in accounting in Indonesia for the period 2015-2020. The accounting zone is selected because there is a lot of research and issues related to activities, CED, and industry performance (Gunawan & Setin, 2013, Andrian & Sudibyo, 2019, Andrian, 2020). This study is considered as the first CED literature review analyzed in accounting research publications. As CED topics have been emerging developed in many fields of studies, reviewing this topic in the accounting area resulted in interesting findings. These findings are useful not only for Indonesia but also for other countries. Further, this study provides a platform to fill many gaps for future research on the topic of CED in the accounting field.

## 2. LITERATURE REVIEW

Carbon accounting is a part of environmental accounting that informs the relevant parts of carbon in a company's financial statements from its operations, so carbon accounting measures total greenhouse gas emissions caused directly and indirectly by individuals and activities by an organization (Susilo, 2008). According to Dwijayanti (2011), any industry can measure the carbon emissions they cause, develop strategies to reduce them, record them, and report them to stakeholders when the carbon balance is available.

Several studies have been conducted to look for factors that affect CED and to achieve different results at a national level, namely Suhardi and Purwanto (2015), the results of the study show that industry type, company size, and profitability have a positive impact on the disclosure of CO<sub>2</sub> emissions, while leverage and environmental performance have a negative impact on the disclosure of carbon emissions. The results of the Prafitri study (2016) show that the environmental management system, environmental performance, company size, industry type, and leverage have a positive impact on carbon-emissions disclosure, while return on investment does not affect carbon emissions disclosure. Also, Nurdiawansyah et al. (2018) found that company size, profitability, and media exposure had a positive impact on carbon emissions disclosure, while leverage had no impact on carbon emissions disclosure. Continued, Probosari and Karwendar (2019) The results of the study showed that industry type, company size, and environmental performance had a positive impact on carbon emissions disclosure, while media exposure had no impact on carbon emissions disclosure.

The results of the study by Widiyanto and Sari (2020) also show that environmental performance and company size have a positive effect on the disclosure of carbon emissions, while the leverage effect does not influence on the disclosure of carbon emissions.

To get a precise idea of whether CED research development in the accounting area in Indonesia has been supporting the development of CED practices, this analysis focused on answering two research questions, namely:

RQ1. What are the major variables involved in CED that have been examined?

RQ2. What are the measurements used to measure carbon emission disclosures (CED)?

These two questions were answered by conducting a thorough evaluation by mapping prominent accounting publications.

### 3. RESEARCH METHODOLOGY

This study applied a descriptive approach to explaining the results of the CED mapping research in Indonesia. The mapping steps are undertaken in this study, namely, first, define the topics that will be examined based on the publisher. The topic that will be investigated is CED research in the accounting area in Indonesia. Second, determine the period of research that will be used as a data source. The period 2015-2020 was chosen as CED development in Indonesia has shown a positive trend as proved by the increase in the number of sustainability reports (Gunawan and Setin, 2018). For a national accredited journal, articles were searched online only via google scholar. After choosing the topic, research period, and search for articles based on the topic chosen, this study conducted the following steps:

- The first step was to map the variables used in the research publications, whether they were independent, moderating, mediating, or dependent variables. The purpose of mapping variables was to analyze which variables were frequently used and related to CED variables.
- Second, the adjusted R-square result from the published articles was compared among all selected publications. The adjusted R-square represents a more objective measurement of variance, as it involves an adjustment based on the number of independent variables relative to the sample size (Hair et al., 2010).
- The third step was to compare the results of the relationship among variables through hypotheses testing. This step was important to obtain insights from all the research results on which variables significantly affected CED.
- In the fourth step, this study identified the measurement for CED.

Table 1 explains the number of articles on CED topics from nationally accredited journals in the period 2015-2020:

**Table 1** CED articles from an Accredited National Journal

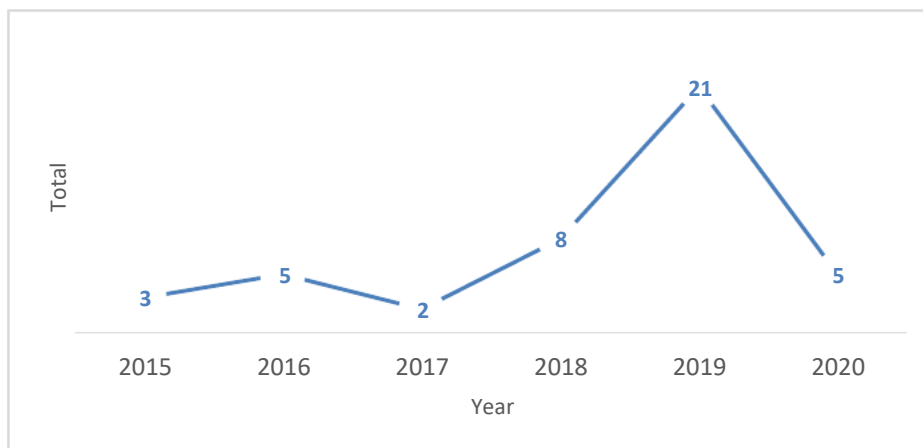
No	List of Publishers	$\Sigma$ Article
1.	Accounting Analysis Journal	2
2.	AKUNESA: Jurnal Akuntansi Unesa	1
3.	Akuntansi Dewantara	1
4.	ATESTASI: Jurnal Ilmiah Akuntansi	1
5.	Buletin Bisnis dan Manajemen	1
6.	Diponegoro Journal of Accounting	12
7.	EQUILIBIRUM: Jurnal Ekonomi Syariah	1
8.	Accountthink: Journal Of Accounting and Finance	1
9.	Journal of Accounting, Entrepreneurship and Financial Technology	1
10.	Journal of Economic, Management, Accounting and Technology (JEMATech)	1

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11. Journal of Indonesian Economy and Business	1
12. Jurnal Akuntansi & Auditing	1
13. Jurnal Akuntansi Aktual	1
14. Jurnal Akuntansi Bisnis	1
15. Jurnal Akuntansi dan Keuangan	1
16. Jurnal Dinamika Akuntansi	1
17. Jurnal Ekonomi & Keuangan Islam	1
18. Jurnal Ekonomi, Bisnis dan Akuntansi (JEBA)	1
19. Jurnal Ilmiah Akuntansi dan Bisnis	1
20. Jurnal Ilmiah Akuntansi Fakultas Ekonomi (JIAFE)	1
21. Jurnal Ilmiah Akuntansi Universitas Pamulang	1
22. Jurnal Kajian Ilmiah Akuntansi Fakultas Ekonomi UNTAN (KIAFE)	1
23. Jurnal Wahana Riset Akuntansi (WRA)	1
24. Jurnal: Riset Akuntansi dan Keuangan Indonesia	1
25. Multidisciplinary Digital Publishing Institute (MDPI)	1
26. Nizham Journal of Islamic Studies	1
27. Research Journal of Finance and Accounting	1
28. Review of Integrative Business and Economics Research	1
29. Reviu Akuntansi dan Bisnis Indonesia	1
30. Seminar Nasional Ekonomi dan Bisnis	1
31. The International Journal of Business Review (The Jobs Review)	1
32. Widyakala	1
Total Articles	44

Source: Author's Research

Table 1 shows that 44 articles were published for accredited national journals on carbon emissions disclosures in 2015-2020. Most of the articles in the Diponegoro Journal of Accounting at Diponegoro University with a total of 12 articles. There were now 2 articles in the Accounting Analysis Journal at the State University of Semarang. While other publishers only have one article from nationally accredited journals published by universities or colleges in Indonesia. This shows that the number of publications related to the disclosure of carbon emissions is still low and may also be caused by the scope of publishers who do not include environmental accounting topics.



**Figure 1** The Development of CED from Accredited National Publications During 2015-2020

The picture above shows a graph of the growth of research publications linked to the topic of carbon emission disclosure collected during 2015 to May 2020 originating from national accredited journals. In 2015, accredited national journals were obtained as many as 3 journals. In 2016, there were 5 journals obtained. In 2017, are very few with only 2 journals obtained.

In 2018 there were 8 journals obtained. On the other hand, the journals obtained in 2019 were the most with 21 journals due to the issue of global warming which was increasingly discussed and in 2020 the journals obtained by 5 journals were due to the period that was used only until May 2020 so that not all of the growth of publications had been seen yet to this topic.

#### 4. RESULT AND DISCUSSION

From the 44 articles that have been successfully collected, any research with CED is like a dependent variable, and the author shows 10 ranking variables that are used very often as follows:

**Table 2** Variables examined towards CED as a dependent variable

No	Independent Variables	$\Sigma$	Moderating	$\Sigma$
1	Profitability	29	Institutional Ownership	1
2	Size	26	Corporate Governance	1
3	Leverage	22		
4	Environmental Performance	16		
5	Type Industry	13		
6	Media	9		
7	Board Independen	8		
8	Company's Growth & Institutional Ownership	4		
9	Audit Committee, Environmental Management System, & Firm Age	3		
10	Others	1		

Source: Author's Research

44 articles use 46 independent variables that are expected to affect the level of carbon emissions disclosure. Table 2 above shows that with 29 researchers, profitability is the most independent variable used by researchers. Next, the second most independent variable is the company size with a total of 26 researchers. With a total of 22 researchers, leverage is the third most independent variable. Next, the fourth most independent variable is an environmental performance with a total of 16 researchers. The fifth most independent variable is Industry Type with a total of 13 researchers. There are also other independent variables such as media with a total of 9 researchers; Independent board with a total of 8 researchers; Growth and institutional responsibility of the company with a total of 4 researchers; Examination board, environmental management system and company age with a total of 3 researchers; On the other hand, the other independent variables are only 1 researcher. Then every researcher has one that uses the variable institutional ownership and corporate governance as a moderating variable in the research being examined.

**Table 3** The Adjusted R-square result in CED as a dependent variable

No	Independent Variables	Adjusted R Square (%)
1	Profitability; Leverage; Size	96.2
2	Leverage; Financial Slack; Company's Growth; Profitability	6

Source: Author's Research

Table 3 shows that the influence of the independent variables on the carbon emission data, which are indicated by the adjusted R-square, is between  $\pm 6$  percent and  $\pm 97$  percent. The larger the adjusted R-squared value, the greater the ability of the independent variable to

explain the dependent variable. According to Table 3, the adjusted R-square, which indicates the impact of the independent variable on carbon emissions disclosure, has the smallest value of 6 percent, which is the result of studies by Mahardika & Kawendar (2019) using the variables leverage, financial slack, company growth, and profitability was derived from company samples that provide an annual report and meet at least 1 point of the carbon index in manufacturing companies listed on the Indonesian Stock Exchange (IDX) between 2013-2017, while the largest value of 96.2 percent from the study by Mujiani et al. (2019) using the profitability variable; Leverage; and size with a sample of companies that submit annual reports and meet at least 1 point of the carbon index in SOEs listed on the IDX in 2013-2017. The results show that other possible independent variables that can be tested to test their effect on carbon emissions disclosure.

**Table 4** Relationship between CED (Dependent variable) and independent variables

No	Independent Variable	Result(s)/ Sign
1	Profitability	Has no effect
2	Size	Has an effect (+)
3	Leverage	Has an effect (-)
4	Environmental Performance	Has no effect
5	Type Industry	Has an effect (+)
6	Media	Has an effect (+)
7	Board Independen	Has an effect (-)
8	Company's Growth	Has no effect
9	Institutional Ownership	Has an effect (+)
10	Audit Committee	Has an effect (+)
11	Environmental Management System	Has no effect
12	Firm Age	Has no effect

Source: Author's Research

Table 4 shows the results of the relationship among variables through hypotheses testing. This relationship is useful in providing insights into the relation between CED (dependent variable) and independent variables. The results of the influence of various independent variables mapping toward CED are relatively conclusive that the independent variables of the company's size, type of industry, media, institutional ownership, and audit committee as a positive (+) influence toward CED. However, the results of the independent variables (profitability, environmental performance, company's growth, environmental management system, and firm age) toward CED are still inconclusive. These findings indicate that independent variables that have a positive effect are part of corporate attributes that can maximize the disclosure of carbon emissions made by the company.

**Table 5** CED Measurement

Year	CED Measurement						
	CDP Index (Choi, et al (2013))	CDP Index (Bae, et al (2014))	CDP Index (Kilic, et al (2018))	CDP's 2016	ISO 14064-1	GRI Guidelines version 4 (G4)	Dummy
2015	1				1	1	
2016	4						1
2017	1					1	
2018	6			1			1
2019	18	1	1			1	
2020	4	1					
Σ	34	2	1	1	1	3	2

Source: Author's Research

When performing research, researchers use various methods to measure the dependent variable of carbon emissions, e.g. B. the CDP index, the disclosure index, the disclosure value of GRI, dummy variables, and the content analysis. Based on Table 5, most dependent carbon emissions disclosure variables are measured using the method of Choi et al. (2013) developed the CDP index measured with a total of 18 indices consisting of 5 categories, namely climate change: risks and opportunities, greenhouse gas emissions, energy consumption, greenhouse gas reduction, and costs, responsibility for carbon emissions up to 34 researchers. There are researchers who use the method described by Bae et al. (2014) developed a CDP index with a total of 18 indices used by 2 researchers in 2019 and 2020, researchers using the method described by Kilic et al. (2018) use the developed CDP index, which gives a total of 20 indices out of 1 researchers in 2019, researchers who used the CDP index 2016, which included 27 indices in the CDP climate protection information 2016, up to 1 researcher in 2018, Researchers who used the Disclosure Index were 20 index, which refers to ISO 14064-1 with a total score of 36, an index of 1 researcher in 2015, researchers who use the disclosure value of GRI, which is in "hard" with 29 steps and "soft" with 16 steps, and a scorecard that consists of seven categories (1-4 stands for "hard object" and 5-7 ("soft items") were 3 researchers, a dummy variable, in 2015 1 Code 1 applies to companies that disclose information about greenhouse gas emissions in I am their report and the value 0 for companies that did not publish any information about greenhouse gas emissions in their report, there were 2 researchers in 2016.

It can, therefore be concluded from Table 5 above that the use of quantitative methods in CED research dominates in Indonesia. The results support Pal (2017), who explains why quantitative approaches to numbers play an important role in social accounting. This is due to the preference of many investors for simple and relatively robust and comparative key figures that are created using quantitative methods. Here it can be seen that the most likely perspective of an accounting researcher using a quantitative method approach is still focused on the interests of the shareholders (investors) and has not responded to the interests of the non-shareholder components (Gunawan & Setin, 2018). The number of studies that the Choi et al. (2013) using the developed CDP index amounted to 18 indices from 34 researchers distributed between 2015 and 2020. This is because the Choi et al. (2013) used Disclosure Index weight of 100% of the total information and recommendations of the Task Force on climate change- related to financial information (2019).

## 5. CONCLUSION

### 5.1. Conclusion

This study provides evidence of the amount of CED studies in the accounting area in developing countries and adds the existing body of CED literature. Although this is a descriptive approach, the findings of this study provide important and relevant insights for CED research in the accounting area. The usage of quantitative methods in CED studies alone is unlikely to provide a comprehensive understanding of the motivation for, and consequences related to disclosure choices. The results of this study provide insights into CED research which contribute to the improvement for both local and international audience, including the academicians and business practitioners.

### 5.2. Suggestion

Based on the results obtained, the following are suggestions:

Future research is expected to answer this research gap by applying moderating variables (i.e. corporate code of conduct, type of industry, and good corporate governance) and mediating variables (i.e. risk management and public image). Other variables that can also be

examined in future research include variables associated with business benefits predicted to follow from CED, such as green strategy and green habit. Then, most of the theories used by all of these studies only use the theory of legitimacy and stakeholder theory. Researchers can use research references conducted by Garriga & Mele (2012) to find other theories that more accurately describe research topics such as linking them with instrumental theory, political theory, ethical theory, and normative stakeholder theory.

This research has limitations that can be used as a tool to be considered in future research. First, a national accredited journal received up to 44 articles between 2015 and 2020. Second, there was a comparison of perspectives between researchers when calculating carbon emissions. Third, the keywords used in this study are "Pengungkapan Emisi Karbon", "Carbon Emissions Disclosure", "Greenhouse Gas Emissions Disclosure", and "Greenhouse Gas Disclosure". Fourth, Google and Google Scholar are used in the search for nationally accredited journals in this study. This limitation is hoped to help improve the limitations of this study in future studies. First, the number of daily research projects is increased to increase knowledge about carbon-emissions disclosure. Second, extend the years of research and multiply the research variables. Third, you can use the search on other journal search engines such as Emerald, Proquest, and so on to get more journals related to the topic of carbon emission disclosure. Fourth, you need to develop measurements related to carbon emissions disclosure to reflect the evolving situation in each country.

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