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INSIGHTS INTO RESEARCH ON CARBON DISCLOSURE

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Abstract. Along with the rapid growth of technology, environmental problems have become an unavoidable event. These environmental problems are the main factors that can affect sustainable development. Under the increasingly modern market pressure, many companies are disclosing information about carbon emission. This study tries to provide an overview of research related to carbon emission disclosure. This research was conducted by analyzing the research with the title "carbon emission disclosure" or "carbon disclosure project" on Scopus. 21 studies were found in this search. We found articles with extensive discussion covering the environment, accounting, and law. We also provide control variable may be used by future researchers.

Keywords: carbon disclosure project; carbon disclosure; CDP; carbon emissions

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JEL Classifications: Q50; Q01

1. Introduction

Carbon emissions are reaching disturbing levels, recommending the need to balance the company's environmental, social, and economic performance (Oestreich & Tsiakas, 2015; Zamil et al., 2019; Atari et al., Caurkubule et al., 2020; Tvaronavičienė et al., 2020; El Idrissi et al., 2020). Report of the Intergovernmental Panel on Climate Change (IPCC) stated that greenhouse gas emissions between 2000-2010 had reached 2.2% per year, yet it is the highest number in the last three decades. Compared to 1970-2000, greenhouse gas emission is about 1.3% per year (KLH, 2015). Numerous acts have been adopted to mitigate climate change. In 2000, the Carbon Disclosure Project (CDP) was launched in the UK, aiming to collect environment-related data. The data were collected among the company and make it available to the public to support climate or environment-related decisions for the manager and other company's stakeholders. As a form of their concern for climate change, the United Nations also enacted an international agreement on global warming called the Kyoto protocol. Countries that ratify this protocol are committed to reducing carbon dioxide emissions and other greenhouse gases.

The implications of the Kyoto Protocol have arisen the issue of carbon accounting, which is a way for companies to recognize, measure, record, present, and disclose carbon emissions. The alarming concerns in carbon pollution has prompted companies to conduct carbon emission disclosure as a form of their corporate responsibility. Carbon emission disclosure has become a topic that has often been discussed on several research in the past recent years (Choi et al., 2013; Ben-Amar et al., 2017; Chariri et al., 2018; Fonseca & Gonzales, 2008; Ganda & Ngwakwe 2013; Matsumura et al., 2014; Mayorova, 2019; Hermawan, Gunardi, 2019).

Carbon emission disclosure allows stakeholders to assess the role of their companies in reducing greenhouse gases. Also, carbon emission disclosure is one form of corporate concern for the environment. Andrew and Cortese (2011) state that carbon disclosure is presented as a voluntary form used for internal and external decision making. Voluntary environmental disclosure was found that they worked as a complement to enhance the performance of economic, social, and environment to achieve sustainable development in Bangladeshi corporation (Kumar, 2012). The company's efforts to reduce carbon emissions with carbon accounting are in line with the concept of Corporate Social Responsibility.

We conducted a search in May 2019 using Scopus database. We have narrowed the scope of our search and provided some initial insight on carbon disclosure practice. We use Scopus-indexed documents such as proceeding and journal articles that relevant to the carbon disclosure issue to be included in our paper discussion. This research aims to discuss the prior finding on Carbon Disclosures, identify trends, the theory, and overall relationships. The initial search found 22 results; one of the results is in the form of a book chapter. Of that initial search, 21 documents were relevant to be included in our paper discussion.

There are 8 studies using more than one country as their samples (Alrazi et al., 2018; Chariri et al., 2018; Green & Zhou, 2013; Hover & Fafatas, 2018; Kim & Lyon, 2011; Ott & Gunther, 2015; Turkova & Donze, 2016). While the rest uses only samples from one country consisting of German, Australia, Canada, Indonesia, China, French, Brazil, and Turkey. Almost all studies use samples from all industries except research conducted by (Hermawan et al., 2019).

2. Frame Condition

The theory used in relation to carbon emission disclosure is Legitimacy theory and Stakeholder theory. There are socialization theory due to topics related to gender but it is not because of the carbon emission disclosure. The concept of the legitimacy theory in the relationship between the company and the environment is important in the analysis process. Legitimacy can be achieved by taking actions that support the company's social obligations such as corporate social responsibility through environmental concerns. According to the stakeholder theory by Freeman (1984), A stakeholder is a group or individual who can affect or is affected by the achievement of the organization's objectives. Any voluntary disclosures made in the Company Report aim to address stakeholders' concerns. The companies will respond to the stakeholder by disclosing information that is perceived by the stakeholders but still consistent with the firm's activities (Freedman & Jaggi, 2011). Nowadays, various stakeholders are concerned about environmental things such as climate change, GHG emission, and also carbon emission. For example, Institutional investors, for instance, will focus their attention on the financial impact of carbon management, customers are attentive to the way firms meet their climate change commitments, suppliers are interested in potential production process transformations, public opinion (the collective body or community) is concerned about the effects of GHG emissions on human health, etc (Depoers et al., 2016). Their concern may put pressure on firms to report their environmental-related responsibility.

Table 1. Frame Condition

No	Tittle & Author	Journal	Theory	Country
1	Andromidas (2013)	Neue Solidaritat	Legitimacy Theory	German
2	Chariri et al. (2018)	International Conference on Energy, Environmental, and Information System		Global ((Denmark, Finland, Iceland, Norway, and Sweden)
3	Bae Choi et al. (2013)	Pacific Accounting Review	Legitimacy Theory	Australia
4	Ben-Amar et al. (2017)	Journal Business Ethics	Socialization Theory	Canada
5	Sudibyo (2018)	The 4th International Seminar on Sustainable Urban Development		Indonesia
6	Yumeng, Yu (2014)	13th International Conference on Service Systems and Service Management		China
7	De Faria, Andrade, & da Silva Gomes (2018)	Mitigation and Adaptation Strategies for Global Changes	Legitimacy Theory	

8	Depoers, Jeanjean, & Jérôme (2016)	Journal Business Ethics	Stakeholder Theory	French
9	Farias & Andrade (2014)	International Journal Innovation and Sustainable Development		Brazil
10	Ganda (2018)	Environment, Development, and Sustainability	Legitimacy Theory	South Africa
11	Green & Zhou (2013)	Australian Accounting Review		Global
12	Hoover & Fafatas (2018)	Academic Paper	Stakeholder Theory	Global
13	Alrazi, Bahari, Mat Husin, & Khalid (2018)	International Journal of Engineering and Technology		Global
14	Kim & Lyon (2011)	The B.E Journal Economics Analysis and Policy		Global
15	Matisoff, Noonan, & O'Brien (2013)	Business Strategy and The Environment		Global
16	Ott, Schiemann, & Günther (2017)	Journal of Accounting and Public Policy		Global
17	Simnettand & Nugent (2013)	Forum: Accounting and Auditing Standards Board		Australia
18	Kılıç & Kuzey (2019)	International Journal of Climate Change Strategies and Management		Turkey
19	Nisak & Yuniarti (2018)	2nd International Conference on Energy and Environmental Science	Legitimacy Theory	Indonesia
20	Turková & Donze (2016)	International Journal of Sustainable Development and Planning		Global (EU, US, UK)
21	Hermawan, Aisyah, Gunardi, & Putri (2018)	International Journal of Energy Economics and Policy 8(1), pp. 55-61		Indonesia

3. CDP as Dependent Variable

Table 2. CDP as Dependent Variable

Author	Dependent Variable	Interested Variable
Chariri et al. (2018)	Carbon Emission Disclosure	1. Independent Audit Committee 2. Audit Committee expertise 3. Audit Committee meeting
Ben-Amar et al. (2017)	Disclosure Decisions	Board Gender Diversity
Alrazi et al. (2018)	Carbon Emission Disclosure	1. EMS Certification, Environmental Committee 2. GRI guidelines 3. CDP Survey
Ott et al. (2017)	1. Firms Respond to CDP	1. Profit 2. ISO14000 3. Publication
	2. Publication	1. Profit 2. ISO14000 3. GHG 4. GHG_SQ 5. Substitutability 6. Market Size
Kılıç & Kuzey (2019)	1. CDI 2. Firms Respond to CDP	1. Board Size 2. Board Independence 3. Board Gender Diversity 4. Blau index of gender diversity 5. Blau index of nationality diversity 6. Sustainability committee 7. Blau foreign
Nisak & Yuniarti (2018)	Carbon Emission Disclosure	1. Regulators 2. Institutional ownership 3. Firm size 4. Profitability

A total of 6 studies used carbon emission disclosure as a dependent variable. The studies that use CDP as their dependent variable are summarized in Table 2. The study discusses the relationship between corporate governance (Chariri et al., 2018; Kilic & Kuzey, 2019, Ott et al., 2017), firm characteristic (Nisak & Yuniarti, 2018; Ott et al., 2017), and internal control (Al-Razi et al., 2018; Ott et al., 2017) on carbon emission disclosure.

The measurement of carbon emission disclosure variables differs in each study. Chariri et al. (2018) measured carbon emission disclosure using the carbon emissions disclosure scores obtained from the Nordic Carbon Disclosure Project in 2015. Ben-Amar et al. (2017) measured carbon emission disclosure as a dummy variable, that equals one if the firm has responded to the CDP request for public disclosure of climate change strategies and GHG emissions and zero if otherwise. Alrazi et al. (2018) measured carbon emission disclosure according to the disclosure index from the CDP Annual Information request sheets, and they measure the disclosure with dummy variable (1=if disclosed, 0= if not disclosed). Ott et al. (2017) measured carbon emission disclosure using dummy variables in two different measurements. First, he used firm's respond to CDP, which defined as a dichotomous variable that equals one if a firm responds to the CDP questionnaire in the following year and zero otherwise. Second, he used publication, which defined as a dichotomous variable that equals one if a firm publishes its response to the CDP questionnaire in the following year and zero otherwise. Kilic and Kuzey (2019) also use two proxies to measure carbon emission disclosure. First is the carbon disclosure index, calculated by dividing the items disclosed to a maximum number of items that a firm could disclose. The second measurement is the same as the measurement taken by Ben-Amar et al. (2017). And the last Nisak and Yuniarti (2018) measure carbon emission disclosure with a dummy variable. If the company's disclosure in accordance with the specified item will be given a score of 1, whereas if the item determined is not disclosed within the disclosure it will be given a score of 0, then the score 1 overall summed and divided by the maximum number of items that can be expressed and then multiplied by 100%.

Previous research can be classified into two, first concerning the company's corporate governance, and the second is regarding the corporate characteristics. In the corporate governance issue, the existence of an independent audit committee, audit committee expertise, audit committee meeting, and board gender diversity within the company have a positive effect on carbon emission disclosure (Chariri et al., 2018). Independent audit committees make their members more objective and neutral in supervising management regarding financial reporting practice, including carbon emission disclosure (Chariri et al., 2018). The second classification is based on their concern on firm characteristics, which consists of firm profitability, leverage, and market size. Firm profitability has a positive impact, while leverage has a negative impact on carbon emissions disclosure (Nisak & Yuniarti, 2018). Market size also showed a negative impact on publication decisions (Ott et al., 2017). A study about internal control shows a positive relationship between ISO14000, profitability, and the publication of CSR report within firms in responding to the Carbon Disclosure Project (Ott et al., 2017). Profit, ISO14000, greenhouse gas, squared greenhouse gas, and substitutability are also documented to have a positive impact on a firm's publication decision (Ott et al., 2017).

Four of the six studies that used carbon emission disclosure as the dependent variable employed firm size as a control variable (Alrazi et al., 2018; Ben-Amar et al., 2017; Kilic & Kuzey, 2019; Ott et al., 2017). The results show a consistent result where firm size positively affects carbon emission disclosure (Ben-Amar et al., 2017; Kilic & Kuzey, 2019; Ott et al., 2017). Ott et al. (2017) find that size seems to be a determinant of both response decisions and publication decisions. Several reasons shaped a positive relationship between firm size and voluntary carbon emission disclosure (Kilic & Kuzey, 2019). Large firms are subject to more intense external monitoring than smaller firms, as this happened such as firm will disclose more environmental information, this argument in line with accountability and visibilities as outlined in legitimacy theory (Cornier et al., 2006). Second, carbon emission reporting is a part of overall carbon mitigation activities involving a substantial investment, a long-term commitment, and the establishment of a carbon management system. Large companies have pressure from stakeholders that causes companies to report carbon emission disclosure properly (Nisak & Yuniarti, 2018). The cost of making a revision in existing infrastructures or establishing a carbon management system will be more affordable for large entities (Kilic & Kuzey, 2019).

Leverage also becomes one of the control variables that mostly used in research with carbon emission disclosure as the dependent variable (Alrazi et al., 2018; Bae et al., 2013; Kilic & Kuzey,2019; Ott et al., 2017). Only research conducted by Ott et al. (2017) found that leverage has a positive and significant impact on a firm's publication decisions. Creditors appear to exercise on the firm to publish environmental information, which they need to evaluate the firms' environmental performance (Ott et al., 2017). Other control variable used the other control variable, they were independence committee, CEO duality, number of board standing committee, high carbon industrial sector, mandatory retirement policy for directors, profitability, price to book, and board size (Ben-Amar et al., 2017), return on asset (Alrazi et al., 2018), GHG, GHG_SQ, CONC, Substitutability, market size, age, capex, CIND, TRAD, SIGNAT, GHGDUM, EXP_RESP, EXP_PUBL (Matsumura et al., 2014), ROA, ROE, Industry, listing (Kilic & Kuzey, 2019).

4. CDP as Independent Variable

Table 3. CDP as Independent Variable

Author	Dependent Variable	Interested Variable
Sudibyo (2018)	Firm Value	Volume of Carbon Emissions, Disclosure of Carbon Management Practice, and Carbon Management Disclosure
Ganda (2018)	Firm Performance	Carbon Emission Disclosure Rating

Previous research (Table 3) shows that Carbon Disclosure becomes not only dependent variables but also as independent variables Freeman (1984) and Ott at al. (2017). This idea is brought up from the notion that carbon emissions disclosure is a significant green-based practice that promotes sustainable development. On the other side, the company is also required to be resource efficient and cost-effective to enhance profitability. As such, companies should transform their carbon-related environmental capabilities into a competitive advantage, thereby improving their overall economic and financial performance. This perspective explains increased global interest in carbon emissions disclosure, carbon performance, and corporate financial performance Freedman and Jaggi (2011).

Ganda (2018) shows that the carbon disclosure rating generates a positive relationship with ROA. As accounting-based indicators, ROA usually shows historical and short-run financial performance. Company and stakeholders are also interested in past and short-term carbon reporting in order to manage green-linked risks associated with fast-growing green stakeholders, as carbon disclosure also showing a short-term report, it is viable that carbon disclosure is associated with higher ROA. Content analysis was employed to collect the firm's Carbon Disclosure rating scores on the other side using developing countries as the research sample, Sudibyo (2018) found that carbon emission was not related to firm value. This finding remains different from similar research done in developed countries, Saka and Oshika (2014) find that carbon disclosure has a positive effect on firm value. Carbon emission disclosure is measured by the scoring model using the checklist that constructed based on the factors identified in the information request sheet by the CDP (Bae-Choi et al., 2013; Sudibyo 2018).

5. Conclusions

Construction companies in Indonesia demonstrate the accountability of their companies by participating in reporting information relating to environmental issues in their sustainability report. This research that involves 152 sustainability reports of companies in the building and non-building construction sectors listed on the Indonesia Stock Exchange in 2010-2018, was analyzed using sentiment analysis.

The results of the sentiment analysis showed that many companies in the building and non-building construction sectors had used a choice of words that contained positive sentiment compared to negative sentiment. In firm distribution analysis, non-building construction sectors use words with positive sentiments, compared to building one.

From these results, sentiment analysis in construction companies is expected to contribute in helping stakeholders to analyse and assist stakeholders in making decisions related to economic, social and environmental issues while at the same time being an evaluation material for companies to make disclosures in order to increase corporate accountability, as well as paying attention to economic, social and environmental issues.

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