Does Carbon Emission Affect Corporate Sustainability In Digitalization Era. (A Systematic Literature Review)

Yobi Nagoya Pratiwi[1], Febrianty [2],Fahmi Ajismanto[3]*,Guntoro Barovih[4]

[*] Universitas Bina Darma
[**]Universitas Malahayati
[***&****] Jakarta International University
Corresponding Author: Email: fahmi@jiu.ac

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***Abstract*- Purpose**: The primary goal of this research is to offer information regarding the evolution of carbon emissions research and its relationship to company sustainability in the digitalization era, so that it may be used as a reference for future research development in this subject. Also, to answer the question is it true that the level of carbon emissions can be a factor causing the company's sustainability?.**Design/ Methodology/approach**: The article data used in this study comes from articles published in Scopus-indexed international journals registered in the Scopus database with the subject areas Computer Science, Business, Management, and Accounting. Use the Prisma method for sample selection, the analysis descriptive for cause and effect relationship. The selection of this subject area is to narrow the scope of research to obtain specific literature review results in the accounting scientific field. **Results/findings:** The result is that from the cause-effect relationship, financial determinants have a positive and negative effect, while non-financial determinants have a positive impact. From the analysis, no carbon emission study directly measured carbon emissions, but rather the disclosure of carbon emissions from environmental performance reports of companies or related independent institutions **Practical Implication:** This study can be used as a starting point for further research on carbon emissions and corporate sustainability in the digitalization era. **Originality** - The recommendations in this study are novel in the field of accounting research on carbon emissions and their relationship to company sustainability for using information technology. For instance, the creation of carbon emission calculations is guided by accounting theory, calculated in monetary terms and based on application.

Keywords: *Carbon Emission 1, Corporate Sustainability 2, Sustainable Development Goals 3, Green IT 4.*

I. INTRODUCTION

Increasing human awareness in maintaining environmental sustainability by starting to minimize activities that hurt the environment, especially reducing carbon emissions that directly impact climate change. Companies always play a major role in creating climate change problems because business activities are one of the largest emitters (Kouloukoui et al., 2019). With increasing human awareness of protecting the environment, companies are now trying to reduce carbon emissions resulting from their activities and contribute to stabilizing climate change (He et al., 2022). This is also one of the ways to achieve the Sustainable Development Goals in the practice of climate action. Research on carbon emissions, carbon disclosure, carbon performances, and their relation to corporate sustainability is growing and becoming an important topic that needs attention. This is related to the increase in carbon disclosure carried out by companies as a way of communicating companies to stakeholders through environmental disclosure (Velte, Stawinoga and Lueg, 2020) Carbon performance and disclosure, as well as a management tool in climate change, have become prominent among stakeholders in the modern era.

As a general definition, carbon performance describes quantitative emissions of climate-changing greenhouse gases as well as measures and processes to reduce emissions from the air (Mateo-Márquez, González-González and Zamora-Ramírez, 2020)). In addition to carbon performance, carbon disclosure relates to internal and external stakeholders as a regular information instrument and includes information on carbon performance, strategy, and outlook (Velte, Stawinoga and Lueg, 2020). This added commitment to carbon reporting and reduction, however, may be detrimental to the company, as environmental costs arise. Carbon emissions at high levels may also imply high amounts of future environmental responsibilities, meaning future costs are greater than earnings (Choi and Luo, 2021). This will certainly affect the sustainability of the company, if the indicator is based on the triple bottom line concept by John Elkington, the company must pay attention to the aspects of profit, people, and the planet. Where the carbon emission element is included in the planetary aspect. This means that companies with high carbon emissions are not friendly to the environment, as a cause of increased climate change, and do not fulfill the aspects of sustainability put forward by John Elkington.

Currently, many studies examine carbon emissions from various scientific perspectives and their relation to company survival. The number of scientific perspectives such as accounting science, environmental science, and others that examine this topic makes the topic of carbon emissions research very broad. Both with qualitative and quantitative approaches. This has led to various research methods with various approaches and cross-disciplinary

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perspectives. So researchers need to classify the research methods used by using a specific accounting and computer science scientific point of view and grouping research based on the approach used. This is a systematic literature review on carbon emissions and their relation to corporate sustainability by classifying research based on accounting and computer science scientific perspectives by comparing qualitative and quantitative research. Also, the question is it true that the level of carbon emissions can be a factor causing the sustainability of the company?

The core objective of this analysis is to provide information about the development of research on carbon emissions and its relation to company sustainability so that it can be a reference for conducting future research development in this field. Then discuss the possibility of existing methodologies that can be implemented in the development of accounting research. inception of ideas till their publications.

II. Literature review and hypothesis/es development

SLRs have several advantages over traditional review such as a large number of unique procedures. Through the use of sophisticated search tools, specified search strings, and standard inclusion and exclusion criteria, SLRs encourage researchers to explore studies beyond their field of study and network (Robinson and Lowe, 2015; Mohamed Shaffril, Samsuddin and Abu Samah, 2021). This type of review stresses transparency; for example, all terminology in the inclusion criteria must be defined and justified, and article exclusions must be justified (Greyson et al., 2019). This research is a systematic literature review of carbon emissions and it is related to corporate sustainability. The recent worldwide climate convention aims to raise awareness among countries and the corporate sector about the importance of implementing effective environmental mitigation solutions. By setting lofty aims, the Paris Agreement in 2015 succeeded in uniting all countries for the first time. The ultimate goal is to respond to the threat of climate change by keeping temperatures in this century below 2 degrees Celsius above pre-industrial levels and to maintain efforts to prevent temperature increases to 1.5 degrees Celsius (Córdova Román, Zorio-Grima and Merello, 2021). Scholars have long paid close attention to the phenomena of sustainability. Any country's main priority is to make every attempt to get its economy back on track. and maintain its momentum (Nguyen, Diaz-Rainey and Kuruppuarachchi, 2021). The existing literature emphasizes that a company's transition to sustainability is usually neither immediate nor easy to achieve. Corporate sustainability is measured by financial, social, and environmental aspects, companies need to pay attention to these three aspects in evaluating their performance (Pratiwi, Meutia and Syamsurijal, 2020).

On environmental performance, some companies measure using the resulting carbon emissions. Carbon emissions are the main cause of global climate change (Fatica and Panzica, 2021). Companies have started to draw attention to how they reduce carbon emissions and were starting to disclose facts about carbon emissions as an assessment of their environmental performance (Wedari, Jubb and Moradi-Motlagh, 2021). Chinese scholars believe that carbon information should cover changes in financial risk benefits, corporate strategy, business, potential illegal risks, and the public responsibility companies face due to carbon emissions (Tang et al., 2020). Companies tend to provide substantial carbon reduction actions and reporting, companies in less carbon-intensive industries in particular exhibit a symbolic disclosure approach. In their examination of the consistency of carbon disclosures presented in company reports and by CDP (Borghei, 2021). Company executives are challenged by stakeholders to disclose further details regarding their carbon footprint and strategies to improve it. Firms are also challenged in setting up appropriate carbon disclosure plans, which necessitates an awareness of the costs and benefits of improving carbon efforts and reporting (Alsaifi, Elnahass and Salama, 2020).

Previous research indicated that disclosure reforms had a major impact on Indian corporations' sustainability reporting. To implement India's 2 percent mandated spending model for corporate social responsibility, businesses must select primary areas of social responsibility. Carbon footprint disclosure should be made mandatory, and a more independent director should be selected to ensure that these measures are implemented successfully. Market regulators should be strengthened and given the authority to punish corporations engaging in fraud, with heavy fines applied for non-compliance (Goel, 2019). In another study, carbon integration and environmental strategy in corporate disclosure are investigated. By looking into companies subject to the Quebec emissions trading scheme (ETS), which is their environmental and carbon policies as disclosed in their sustainability reports. This research offers a methodology for capturing disclosed carbon and integrating environmental and carbon policies based on sustainability disclosures (Radu, Caron and Arroyo, 2020).

Most of the research on carbon emissions and company sustainability examines the connection between carbon disclosure, carbon performance, environmental performance, and financial performance. According to one study, carbon disclosure had a favorable impact on carbon performance, which is consistent with signaling theory, the result shows that carbon disclosure has a short-term (long-term) negative (positive) impact on financial performance (Siddique et al., 2021). There hasn't been much research carried out regarding the social component. The impact of carbon emissions on corporate social performance. Because, to achieve business sustainability, not only financial and environmental issues but also social aspects, must be measured. The company's carbon emissions can pollute the air, lowering the quality of the air that humans breathe. This is an important issue for businesses to consider because it affects people's quality of life. Corporate social responsibility is a variable that can be used to analyze social performance (Nguyen and Ngo, 2022). Several CSR elements, including socioeconomic and environmental effects, have an impact on long-term economic development. As a result, a governance framework must be built to control the true influence of these issues. Although some governance metrics have a positive enumeration of development sustainability, governance determination can improve the economic development (Chien et al., 2021).

Additional research on the transport of carbon emissions by employing the social network analysis (Sun et al., 2020). Those who analyze the costs of CSR incurred by companies that have no direct relationship with profit are under pressure to survive in market competition or seize new markets for corporate survival (Anser, Zhang and Kanwal, 2018). Others seek to ascertain the

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impact of environmental management initiatives (EMI) on the authenticity and credibility of corporate social responsibility (CSR). The current study additionally investigates the effect of CSR authenticity on CSR legitimacy, as well as the role of CSR authenticity in mediating the relationship between EMI and the CSR legitimacy (Lin et al., 2021). However, no results on the influence of carbon emissions on social elements are presented in these recent studies.

III. Methodology

This study is a semi-systematic literature review. Semi-systematic or narrative-approach literature reviews are designed for topics that have been conceptualized differently and studied by different groups of researchers in different disciplines and that hinder the full systematic review process (Wong et al., 2013). In addition to aiming to review a topic, semi-systematic reviews often look at how research in a chosen field has evolved or how a topic has developed across research traditions (Snyder, 2019). The article data used in this study comes from articles that have been published in Scopus-indexed international journals registered in the Scopus database with the subject areas of CBusiness, Management, and Accounting. The selection of this subject area is to narrow the scope of the research so that the results of the literature review are specific to the accounting science field.

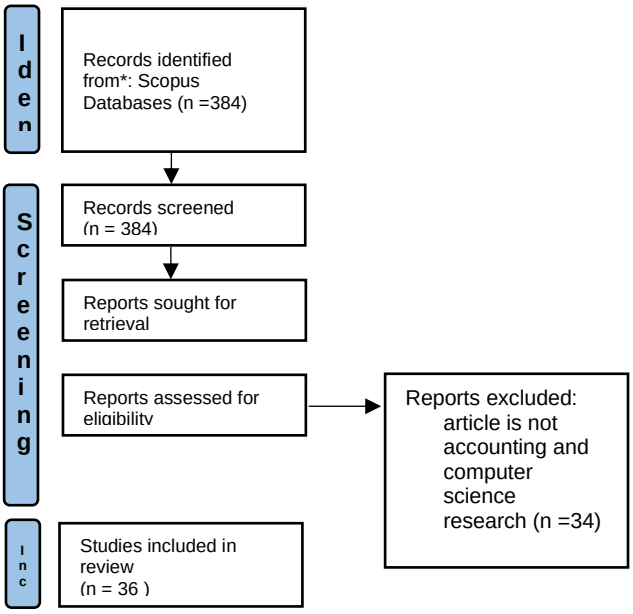

Figure 1: Prisma Flow Diagram

The use of certain keywords is used such as 'carbon emission' and 'corporate sustainability'. This is because the purpose of the literature review is to review whether carbon emissions owned by the company can affect the sustainability of the company. The search resulted in 36 articles published by 15 different journals from 2004 to April 2023. The literature review used the narrative method by grouping the results of extracting similar data according to the measurable results to answer the objectives, then collected and made a summary journal, including the name of the researcher, year of journal publication, research title, method and summary of results or findings. The research journal summary is included in the table according to the format. The journals were read and examined to further clarify the investigation of the abstract and full text. The summary journal then evaluates the research objectives and results/findings (Farida, Aryani and Setiawan, 2022).

IV. Results and Discussion

The articles used in this study have met the criteria for selecting research samples, table one is the result of data tabulation, namely the classification of articles based on journals..

Table 1 Classification of Article by Journal

No	Journal	Author	Year	Percentage
1	Business Strategy and the Environment (No Of Articles.19)	Andersen O.; Lundli H.-E.; Holden E.; Høyer K.G.	2004	52%
		Matisoff D.C.; Noonan D.S.; O'Brien J.J.	2013	
		Dou Y.; Zhu Q.; Sarkis J.	2015	
		Ben-Amar W.; McIlkenny P.	2015	
		Dahlmann F.; Branicki L.; Brammer S.	2017	
		Lewandowski S.	2017	
		Christ K.L.; Burritt R.L.; Varsei M.	2017	
		Hsueh L.	2019	
		Thompson B.S.	2019	
		Hoang T.-H.-V.; Przychodzen W.; Przychodzen J.; Segbotangni E.A.	2020	
		Moussa T.; Allam A.; Elbanna S.; Bani-Mustafa A.	2020	
		Galletta S.; Mazzù S.; Naciti V.	2021	
		Mateo-Márquez A.J.; González-González J.M.; Zamora-Ramírez C.	2021	
		Fatica S.; Panzica R.	2021	
		Stefanelli N.O.; Chiappetta Jabbour C.J.; Liboni Amui L.B.; Caldeira de Oliveira J.H.; Latan H.; Paillé P.; Hingley M.	2021	
		Soler-Domínguez A.; Matallín-Sáez J.C.; de Mingo-López D.V.; Tortosa-Ausina E.	2021	
		Sharma M.; Kumar A.; Luthra S.; Joshi S.; Upadhyay A.	2022	
		Haque F.; Ntim C.G.	2022	

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No	Journal	Author	Year	Percentage
		Tanthanongsakkun S.; Treepongkaruna S.; Jiraporn P.	2023	
2	Corporate Ownership and Control (No Of Articles.1)	Ngwakwe C.C.; Netswera F.G.	2013	2.7%
3	Organization and Environment (No Of Articles.2)	Delmas M.A.; Nairn-Birch N.; Lim J.	2015	5.5%
		Wannags L.L.; Gold S.	2022	
4	PSU Research Review (No Of Articles.1)	Munguia N.; Varela A.; Esquer J.; Velázquez Contreras L.E.	2017	2.7%
5	Journal of Cleaner Production (No Of Articles.3)	Harangozo G.; Szigeti C.	2017	
		da Silva B.A.; Constantino M.; de Oliveira O.S.; dos Santos S.A.L.; Tabak B.M.; da Costa R.B.	2019	8.3%
		Mateo-Márquez A.J.; González-González J.M.; Zamora-Ramírez C.	2022	
6	Transportation Research Part A: Policy and Practice (No Of Articles.1)	Rotaris L.; Giansoldati M.; Scorrano M.	2020	2.7%
7	British Accounting Review (No Of Articles.1)	Choi B.; Luo L.	2021	2.7%
8	Technological Forecasting and Social Change (No Of Articles.1)	Córdova Román C.; Zorio-Grima A.; Merello P.	2021	2.7%
9	Contemporary Economics (No Of Articles.1)	Nguyen T.-D.; Ngo Q.-T.	2022	2.7%
10	Journal of Information Technology (No Of Articles.1)	Rajão R.; Marcolino C.	2016	2.7%
11	2023 International Conference on Advances in Computation, Communication and Information Technology, ICAICCIT 2023(No Of Articles.1)	Sheela G.; Rajini G.	2023	2.7%
12	PACIS 2009 - 13th Pacific Asia Conference on Information Systems: IT Services in a Global Environment (No Of Articles.1)	Sarkar P.K.; Young L.W.	2009	2.7%
13	9th International Conference on Strategic Management and its Support by Information Systems, 2011 (No Of Articles.1)	Petrovic N.; Jeremic V.; Isljamovic S.	2011	2.7%
14	Proceedings - 2021 3rd International Conference on Internet Technology and Educational Informization, ITEI 2021 (No Of Articles.1)	Zhou X.; Pan C.-L.; Feng Y.; Bu M.	2021	2.7%
15	Lecture Notes on Data Engineering and Communications Technologies (No Of Articles.1)	Tayal S.; Rajagopal K.; Mahajan V.	2023	2.7%
Total				100%

Source: Data Tabulation, 2023.

Table 1 shows 9 Scopus-indexed journals that published articles on carbon emissions and their relation to corporate sustainability from 2004 to April 2023. From Table 1, it is also obtained that the average publication of research articles on carbon emissions and their relation to corporate sustainability in one year is only one research article. The highest number of articles published was in 2021, where 7 research articles were published. Business Strategy and the Environment Journal published 5 research articles, British Accounting Review published 1 article, and Technological Forecasting and Social Change published 1 article. The higher number of publications in 2021 is due to the issue of climate change which is increasingly becoming a global concern where carbon emissions are one of the largest contributing factors to climate change in the world. Every country is also starting to implement sustainable development goals, so there are regulations made for companies to be more friendly to the environment by paying attention to environmental aspects in company activities (Schumacher, Chenet and Volz, 2020). This phenomenon has

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made many scientists interested in researching carbon emissions and corporate sustainability

Table 2 Research Method Approach Used in CE and CS Research

No	Journal	Methods		
		Total Articles	Qualitative	Quantitative
1	Business Strategy and The Environment	19	3	16
2	Corporate Ownership and Control	1	1	-
3	Organization and Environment	2	1	1
4	PSU Research Review	1	1	-
5	Journal of Cleaner Production	3	2	1
6	Transportation Research Part A: Policy and Practice	1	-	1
7	British Accounting Review	1	-	1
8	Technological Forecasting and Social Change	1	-	1
9	Contemporary Economics	1	-	1
Total		**30**	**8**	**22**

Source: Data Tabulation, 2023

Table 2 shows the number of studies using a qualitative approach is 8 articles, while for research with a quantitative approach, there are 22 articles. Research articles that use a qualitative approach are case study research, where researchers conduct research on one research object only and further formulate the company's environmental strategy in addressing carbon emissions. This research was conducted by (Andersen et al., 2004) (Ngwakwe and Netswera, 2013) (Kortelainen and Kuosmanen, 2004) (Dou, Zhu and Sarkis, 2015) (Munguia et al., 2017) (Harangozo and Szigeti, 2017) (Thompson, 2019) (Wannags and Gold, 2022)Another 23 research articles used a quantitative research approach. There is a distribution of articles on financial and non-financial determinants used to test hypotheses regarding carbon emissions and their link to corporate sustainability. Financial factors refer to factors that influence companies in controlling carbon emissions and their link to corporate sustainability.

Utilizing longitudinal data for 1,095 firms in the United States from 2004 to 2008, a period of increased activity for climate change legislation, to estimate the effect of greenhouse gas emissions on short-term and long-term financial performance measures. The findings were that during this period, improvements in corporate environmental performance led to a decline in the short-term financial performance indicator, return on assets. Nonetheless, investors saw the long-term value potential of improved environmental performance, which was manifested by an increase in Tobin's q. These results suggest that the limited adoption of proactive strategies may be partly due to short-term financial performance targets guiding the managerial decision-making (Delmas, Nairn-Birch and Lim, 2015). In line with this, (Delmas, Nairn-Birch and Lim, 2015) environmental transparency positively affects current accounting and stock market performance but negatively affects the return on capital employed. Moreover, lower pollution emissions tend to increase the current return on assets, but at the same time are harmful to long-term capital utilization efficiency. The empirical results also show that the Global Financial Crisis (2007-2010) increased the environmental transparency of firms with green patents, but negatively impacted their price-to-earnings ratio. At the same time, lower waste disposal reduced stock valuations, while the opposite was true for the water use (Hoang et al., 2020).

Table 3 Distribution of Article on Financial Determinant

No	Variable	Symbol	Variable Used in Article	Percentage
1	Return on asset	ROA	2	25%
2	Tobins Q	TQ	1	13%
3	Greener Supply Chain	GSC	1	13%
4	Financial Performances	FP	3	38%
5	Finance Practices	FPS	1	13%
6	Market Value	MV	1	13%
7	Digital Supply Chain	DSC	1	13%
Total			**9**	**100%**

Researchers classify the distribution of articles based on financial and non-financial determinants found in Table 3 and Table 4. In Table 3 of 30 articles examining the effects of corporate carbon emissions on corporate sustainability in Scopus-indexed journals, researchers classified 6 financial variables used in 9 research articles. Namely return on assets, Tobins Q, greener supply chain, financial performances, finance practices, and market value. The result is that these financial factors can positively influence corporate sustainability (Delmas, Nairn-Birch and Lim, 2015) (Dou, Zhu and Sarkis, 2015) (Liu, Giurco and Mukheibir, 2017) (Hoang et al., 2020) (Choi, Luo and Shrestha, 2021) (Fatica and Panzica, 2021). The largest percentage is 38% of financial performances, then 28% of return on assets (ROA). For the rest, each factor has a percentage of 13%.

Table 4 Distribution of Article on Non-Financial Determinant

No	Variable	Symbol	Variable Used in Article	Percentage
1	Corporate Strategy	CSY	7	18.9%
2	Corporate Sustainability	CS	7	18.0%
3	Carbon Disclosure	CD	4	10.8%
4	Board Director Effectiveness	BDE	1	2.7%
5	Carbon Performance	CP	3	8.10%
6	Environmental Performances	EP	6	16,2%
7	Corporate Social Responsibility	CSR	1	8.10%
8	Climate Change	CC	1	2.7%
9	Environmental Disclosure	ED	3	8.10%

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No	Variable	Symbol	Variable Used in Article	Percentage
10	Regulative Pressure	RP	1	2.7%
11	Blockchain	BC	2	5.4%
12	Green IT	GIT	1	2.7%
Total			**37**	**100%**

12 non-financial determinants affect corporate carbon emissions and their relation to corporate sustainability: corporate strategy, corporate sustainability, carbon disclosure, board director effectiveness, carbon performances, CSR, climate change, environmental disclosure, regulatory pressure, blockchain, and green IT. These factors are used by researchers to assess corporate sustainability, where these factors are part of environmental performances and some are human factors as subjects who make decisions. This is in line with the concept of the triple bottom line proposed by John Elkingkon, that to achieve corporate sustainability companies must pay attention to aspects of the planet, people, and profit (Elkington, 1998). The highest non-financial determinants are corporate strategy and corporate sustainability 18.9% and 18% for environmental performances.

In this research sample for human or social aspects, only 2.7% of the research used social aspects such as corporate social responsibility which examined studies of corporate social responsibility (CSR) on renewable energy consumption and energy use (Nguyen and Ngo, 2022). The use of energy which is quite large affects the level of carbon emissions produced which is also identified as one of the causes of global warming (Tanthanongsakkun, Treepongkaruna and Jiraporn, 2022). An interesting factor used in research on carbon emissions and their relationship to corporate sustainability is the regulatory pressure factor. How do the regulatory, normative, and cultural dimensions of the institution put pressure on both the company's decision to voluntarily disclose environmental information and on the quality of the information which is a form of environmental and social responsibility related to company activities that can cause carbon emissions and climate change (Mateo-Márquez, González-González and Zamora-Ramírez, 2021). This is interesting because the issue of climate change resulting from high carbon emissions is a global concern and it is important to plan together in order to minimize environmental damage which will also affect the quality of human life.

In line with the Sustainable Development Goals (SDGs), blockchain and green IT (information technology) are becoming indispensable instruments for cutting carbon emissions and improving corporate sustainability. Studies underscore the importance of digital technologies, such as blockchain, in empowering industrial enterprises to achieve net-zero emissions and the SDGs (Yadav et al., 2023). In addition, the integration of digital technologies like blockchain is crucial for optimizing green finance, guaranteeing transparency, and reducing hazards [3]. Furthermore, the effect of digitization on lowering carbon intensity emphasizes the critical role that digital infrastructure plays in sustainable development, especially in China (Ji et al., 2023). Furthermore, it has been demonstrated that the carbon trading regime greatly encourages businesses to innovate in green technologies, highlighting the significance of market mechanisms in propelling sustainability initiatives (Fu, 2023). Thus, it is essential to incorporate green IT and blockchain into business plans to promote sustainable practices and meet environmental targets.

Table 4 is the distribution of articles with non-financial determinants that are more on environmental performance reporting. Research on carbon emissions in the scope of accounting research mostly discloses carbon emissions rather than making direct measurements. However, from the research sample, the researchers found the measuring instruments used even though the process was not explained directly.

Table 5 Measurement Tools of Carbon Emission

No	Variable	Symbol	Variable Used In Article	Percentage
1	Total Energy Use	Teu	1	3%
2	Carbon Emission	Ce	2	7%
3	Ghg Emission	Ghe	1	3%
4	Water Use	Wu	1	3%
5	Waste Emission	We	1	3%
	Total		6	13%

Table 5 provides information on which measurement tools are used in accounting research to measure carbon emissions. Measurements of carbon emissions found in this research sample are total energy use, measurement of carbon emission, GHG emission, water use, and waste emission. 7% is the measurement of carbon emissions, then 3% is the total energy used by the company, GHG emission, water use, and emissions from the company's operational waste. The use of energy, water, and materials that generate waste produces carbon emissions and is accounted for in the measurement of carbon emissions (Nguyen, Diaz-Rainey and Kuruppuarachchi, 2021).

Mapping Cause and Effect Relationship

Mapping cause and effect relationships in this study use variables used in 30 Scopus-indexed studies that examine the effect of carbon emissions on corporate sustainability. There are two classifications, namely financial and non-financial determinations. The cause and effect relationship is depicted in Figure 2

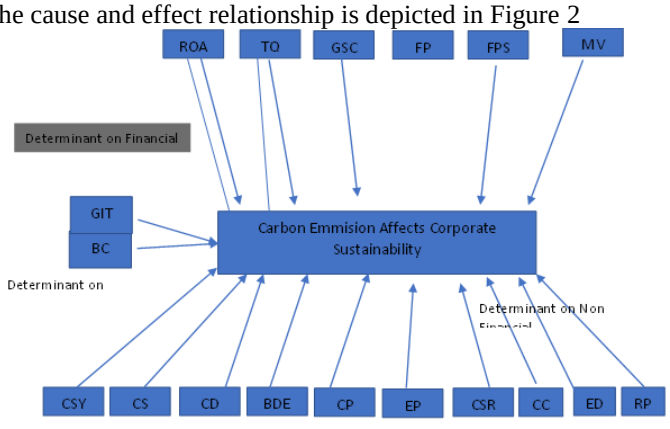

Figure 2.Cause and Effect Relationship

Figure 2 shows two classifications, financial and non-financial. In the financial classification return on assets, Tobins Q, greener supply chain, financial performances, financial practices, and market value. In non-financial corporate strategy, corporate

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sustainability, carbon disclosure, board director effectiveness, carbon performance, CSR, climate change, environmental disclosure, and regulatory pressure. In financial determination, there are two variables that have a positive and negative relationship, namely ROA and Tobins Q. Namely in research (Delmas et al., 2015). Improving corporate environmental performance causes a decline in an indicator of short-term financial performance, return on assets. Nonetheless, investors see the potential long-term value of improved environmental performance, manifested by an increase in Tobin's q (Delmas et al., 2015). Financial variables have a positive relationship. Return on assets, return on sales, and return on investment which are proxies for measuring financial performance also have a positive effect on the corporate sustainability (Delmas, Nairn-Birch and Lim, 2015; Christ, Burritt and Varsei, 2017). Other financial variables have a positive relationship. As for non-financial determination, 10 variables show a positive relationship.

Table 5 Cause and Effect Relationship

No	Variable	Symbol	Result
1	Return on asset	ROA	Positive-Negative
2	Tobins Q	TQ	Positive-Negative
3	Greener Supply Chain	GSC	Positive
4	Financial Performances	FP	Positive
5	Finance Practices	FPS	Positive
6	Market Value	MV	Positive
7	Corporate Strategy	CSY	Positive
8	Corporate Sustainability	CS	Positive
9	Carbon Disclosure	CD	Positive
10	Board Director Effectiveness	BDE	Positive
11	Carbon Performance	CP	Positive
12	Environmental Performances	EP	Positive
13	Corporate Social Responsibility	CSR	Positive
14	Climate Change	CC	Positive
15	Environmental Disclosure	ED	Positive
16	Regulative Pressure	RP	Positive

Table 5 is a summary of the cause-and-effect relationship. The positive effect is dominated by non-financial factors which are part of environmental performance. This states that indeed environmental factors, namely carbon emissions that cause climate change, can affect corporate sustainability. Financial factors that have positive and negative effects are return on assets. In the research (Hoang et al., 2020) return on assets has a positive influence while in the research (Delmas, Nairn-Birch and Lim, 2015) has a negative influence. This is because ROA is a short-term goal of the company. Meanwhile, corporate sustainability refers to the firm's prospective carbon emissions, which have been identified as the primary driver of global warming and are environmentally detrimental. Given the gravity of climate change, firms are encouraged to implement corporate environmental plans (Hsueh, 2019).

V. CONCLUSION

This study provides evidence of research articles examining carbon emissions and corporate sustainability published in Scopus-indexed journals. The database used also comes from the Scopus database for the last ten years. There were only 30 articles that met the sample selection criteria. In one year, there was only one research article on carbon emissions and their relation to corporate sustainability. The highest number of articles published was in 2021, where 7 research articles were published. Business Strategy and the Environment Journal published 5 research articles, British Accounting Review published 1 article, and Technological Forecasting and Social Change published 1 article. The number of studies using a qualitative approach is 8 articles, while for research with a quantitative approach, there are 22 articles. Research articles that use a qualitative approach are case study research, where researchers conduct research on one research object only and further formulate the company's environmental strategy in addressing carbon emissions. This research was conducted by (Andersen et al., 2004) (Ngwakwe and Netswera, 2013) (Dou, Zhu and Sarkis, 2015) (Munguia et al., 2017) (Harangozo and Szigeti, 2017) (Harangozo & Szigeti, 2017) (Thompson, 2019) (Wannags and Gold, 2022) Another 23 research articles used a quantitative research approach.

Financial determinants are returned on assets, Tobins Q, greener supply chain, financial performances, finance practices, and market value. The result is that these financial factors can positively influence corporate sustainability (Delmas, Nairn-Birch and Lim, 2015) (Dou, Zhu and Sarkis, 2015) (Zhang et al., 2021) (Liu, Giurco and Mukheibir, 2017) (Hoang et al., 2020) (Choi and Luo, 2021) (Fatica and Panzica, 2021). The largest percentage is 38% of financial performances, then 28% of return on assets (ROA). For the rest, each factor has a percentage of 13%. As for non-financial. The non-financial factors are corporate strategy, corporate sustainability, carbon disclosure, board director effectiveness, carbon performances, CSR, climate change, environmental disclosure, and regulatory pressure. These factors are used by researchers to assess corporate sustainability, where these factors are part of environmental performances and some are human factors as subjects who make decisions.

In this research sample, no carbon emission study directly measured carbon emissions, but rather the disclosure of carbon emissions from environmental performance reports of companies or related independent institutions. According to researchers, measuring carbon emissions using an accounting approach is important to find out how much carbon emissions are when calculated by accounting theory and can use monetary units, and how the measurement is carried out, which is then treated in financial reports and their relation to financial performance, social, and the environment. This is important because in the future the carbon emissions produced by the company may become a burden on the company and affect corporate sustainability. Thus this becomes a researcher's suggestion for accounting research that examines further carbon emissions.

Prospective areas for future study on blockchain and green IT for carbon emissions and their effects on SDGs and corporate sustainability can be explored. Transparency and proactive carbon management can be increased with enhanced blockchain applications for carbon management, such as creating smart

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contracts for environmental compliance and combining blockchain with the Internet of Things (IoT) for real-time data on emissions. Advanced data center technology and environmentally friendly software development are two examples of green IT innovations that can drastically cut carbon emissions and energy use. More businesses can be encouraged to embrace these technologies by performing case studies of successful implementations and research on how to calculate the return on investment (ROI) of sustainable IT investments. Developing policy and legal frameworks, as well as conducting quantitative impact assessments, can bolster the argument for blockchain technology.

REFERENCES

[1] Alsaifi, K., Elnahass, M. and Salama, A. (2020) 'Market responses to firms' voluntary carbon disclosure: Empirical evidence from the United Kingdom', Journal of Cleaner Production, 262. doi: 10.1016/j.jclepro.2020.121377.

[2] Andersen, O. et al. (2004) 'a Company Strategy Scenarios As Basis for Environmental Reporting', 61(2004), pp. 43–61.

[3] Anser, M. K., Zhang, Z. and Kanwal, L. (2018) 'Moderating effect of innovation on corporate social responsibility and firm performance in realm of sustainable development', Corporate Social Responsibility and Environmental Management, 25(5), pp. 799–806. doi: 10.1002/csr.1495.

[4] Borghei, Z. (2021) 'Carbon disclosure: a systematic literature review', Accounting and Finance, 61(4), pp. 5255–5280. doi: 10.1111/acfi.12757.

[5] Chien, F. et al. (2021) 'Does the combining effects of energy and consideration of financial development lead to environmental burden: social perspective of energy finance?', Environmental Science and Pollution Research, 28(30), pp. 40957–40970. doi: 10.1007/s11356-021-13423-6.

[6] Choi, B. and Luo, L. (2021) 'Does the market value greenhouse gas emissions? Evidence from multi-country firm data', British Accounting Review, 53(1), p. 100909. doi: 10.1016/j.bar.2020.100909.

[7] Choi, B., Luo, L. and Shrestha, P. (2021) 'The value relevance of carbon emissions information from Australian-listed companies', Australian Journal of Management, 46(1), pp. 3–23. doi: 10.1177/0312896220918642.

[8] Christ, K. L., Burritt, R. L. and Varsei, M. (2017) 'Coopetition as a Potential Strategy for Corporate Sustainability', Business Strategy and the Environment, 26(7), pp. 1029–1040. doi: 10.1002/bse.1967.

[9] Córdova Román, C., Zorio-Grima, A. and Merello, P. (2021) 'Economic development and CSR assurance: Important drivers for carbon reporting… yet inefficient drivers for carbon management?', Technological Forecasting and Social Change, 163(October), p. 120424. doi: 10.1016/j.techfore.2020.120424.

[10] Delmas, M. A., Nairn-Birch, N. and Lim, J. (2015) 'Dynamics of Environmental and Financial Performance: The Case of Greenhouse Gas Emissions', Organization and Environment, 28(4), pp. 374–393. doi: 10.1177/1086026615620238.

[11] Dou, Y., Zhu, Q. and Sarkis, J. (2015) 'Integrating Strategic Carbon Management into Formal Evaluation of Environmental Supplier Development Programs', Business Strategy and the Environment, 24(8), pp. 873–891. doi: 10.1002/bse.1851.

[12] Elkington, J. (1998) 'ACCOUNTING FOR THE TRIPLE "BOTTOM LINE", Measuring Business Excellence', Emerald Insight, 2(3), pp. 18–22. doi: doi.org/10.1108/eb025539.

[13] Farida, I., Aryani, Y. A. and Setiawan, D. (2022) 'Empirical Evidence of Management Control System in the Emerging Market', Corporate and Business Strategy Review, 3(2), pp. 112–124. doi: 10.22495/cbsrv3i2art10.

[14] Fatica, S. and Panzica, R. (2021) 'Green bonds as a tool against climate change?', Business Strategy and the Environment, 30(5), pp. 2688–2701. doi: 10.1002/bse.2771.

[15] Fu, C. (2023) 'Carbon Emissions Trading and Corporate Green Technology Innovation', Frontiers in Business, Economics and Management, 10(1), pp. 38–49. doi: 10.54097/fbem.v10i1.9859.

[16] Goel, P. (2019) 'Rising standards of sustainability reporting in India: A study of impact of reforms in disclosure norms on corporate performance', Journal of Indian Business Research, 13(1), pp. 92–109. doi: 10.1108/JIBR-06-2018-0166.

[17] Greyson, D. et al. (2019) 'Systematic review searches must be systematic, comprehensive, and transparent: A critique of Perman et al', BMC Public Health, 19(1), pp. 1–6. doi: 10.1186/s12889-018-6275-y.

[18] Harangozo, G. and Szigeti, C. (2017) 'Corporate carbon footprint analysis in practice – With a special focus on validity and reliability issues', Journal of Cleaner Production, 167, pp. 1177–1183. doi: 10.1016/j.jclepro.2017.07.237.

[19] He, R. et al. (2022) 'Corporate carbon accounting: a literature review of carbon accounting research from the Kyoto Protocol to the Paris Agreement', Accounting and Finance, 62(1), pp. 261–298. doi: 10.1111/acfi.12789.

[20] Hoang, T. H. Van et al. (2020) 'Does it pay to be green? A disaggregated analysis of U.S. firms with green patents', Business Strategy and the Environment, 29(3), pp. 1331–1361. doi: 10.1002/bse.2437.

[21] Hsueh, L. (2019) 'Opening up the firm: What explains participation and effort in voluntary carbon disclosure by global businesses? An analysis of internal firm factors and dynamics', Business Strategy and the Environment, 28(7), pp. 1302–1322. doi: 10.1002/bse.2317.

[22] Ji, Z. et al. (2023) 'The critical role of digital technology in sustainable development goals: A two-stage analysis of the spatial spillover effect of carbon intensity', Journal of Renewable and Sustainable Energy, 15(3), p. 35903. doi: 10.1063/5.0143739.

[23] Kortelainen, M. and Kuosmanen, T. (2004) 'Measuring eco-efficiency of production: A frontier approach', Journal of Economic Literature, (December), pp. 1–23.

[24] Kouloukoui, D. et al. (2019) 'Corporate climate risk management and the implementation of climate projects by the world's largest emitters', Journal of Cleaner Production, 238. doi: 10.1016/j.jclepro.2019.117935.

[25] Lin, K. et al. (2021) 'Bright harmony of environmental management initiatives for achieving corporate social responsibility authenticity and legitimacy: Glimpse of hotel and tourism industry', Corporate Social Responsibility and Environmental Management, 28(2), pp. 640–647. doi: 10.1002/csr.2076.

[26] Liu, A., Giurco, D. and Mukheibir, P. (2017) 'Advancing household water-use feedback to inform customer behaviour for sustainable urban water', Water Science and Technology: Water Supply, 17(1), pp. 198–205. doi: 10.2166/ws.2016.119.

[27] Mateo-Márquez, A. J., González-González, J. M. and Zamora-Ramírez, C. (2020) 'Countries' regulatory context and voluntary carbon disclosures', Sustainability Accounting, Management and Policy Journal, 11(2), pp. 383–408. doi: 10.1108/SAMPJ-11-2018-0302.

[28] Mateo-Márquez, A. J., González-González, J. M. and Zamora-Ramírez, C. (2021) 'The influence of countries' climate change-related institutional profile on voluntary environmental disclosures', Business Strategy and the Environment, 30(2), pp. 1357–1373. doi: 10.1002/bse.2690.

[29] Mohamed Shaffril, H. A., Samsuddin, S. F. and Abu Samah, A. (2021) 'The ABC of systematic literature review: the basic methodological guidance for beginners', Quality and Quantity, 55(4), pp. 1319–1346. doi: 10.1007/s11135-020-01059-6.

[30] Munguia, N. et al. (2017) 'Fostering corporate sustainability in the Mexican coffee industry', PSU Research Review, 1(1), pp. 51–62. doi: 10.1108/PRR-10-2016-0002.

[31] Nguyen, Q., Diaz-Rainey, I. and Kuruppuarachchi, D. (2021) 'Predicting corporate carbon footprints for climate finance risk analyses: A machine learning approach', Energy Economics, 95, p. 105129. doi: 10.1016/j.eneco.2021.105129.

[32] Nguyen, T. D. and Ngo, Q. T. (2022) 'The Impact of Corporate Social Responsibility, Energy Consumption, Energy Import and Usages and Carbon Emission on Sustainable Economic Development: Evidence from ASEAN countries', Contemporary Economics, 16(2), pp. 241–256. doi: 10.5709/ce.1897-9254.480.

[33] Ngwakwe, C. C. and Netswera, F. G. (2013) 'On veracity in corporate sustainability claims: Why society should be cautious', Corporate Ownership and Control, 11(1 M), pp. 869–873. doi: 10.22495/cocv11i1c10p1.

[34] Pratiwi, Y. N., Meutia, I. and Syamsurijal, S. (2020) 'The Effect of Environmental Management Accounting on Corporate Sustainability', Binus Business Review, 11(1), pp. 43–49. doi: 10.21512/bbr.v11i1.6028.

[35] Radu, C., Caron, M. A. and Arroyo, P. (2020) 'Integration of carbon and environmental strategies within corporate disclosures', Journal of Cleaner Production, 244. doi: 10.1016/j.jclepro.2019.118681.

This publication is licensed under Creative Commons Attribution CC BY.

[36] Robinson, P. and Lowe, J. (2015) 'Literature reviews vs systematic reviews', Australian and New Zealand Journal of Public Health, 39(2), p. 103. doi: 10.1111/1753-6405.12393.

[37] Schumacher, K., Chenet, H. and Volz, U. (2020) 'Sustainable finance in Japan', Journal of Sustainable Finance and Investment, 10(2), pp. 213–246. doi: 10.1080/20430795.2020.1735219.

[38] Siddique, M. A. et al. (2021) 'Carbon disclosure, carbon performance and financial performance: International evidence', International Review of Financial Analysis, 75(February), p. 101734. doi: 10.1016/j.irfa.2021.101734.

[39] Snyder, H. (2019) 'Literature review as a research methodology: An overview and guidelines', Journal of Business Research, 104(July), pp. 333–339. doi: 10.1016/j.jbusres.2019.07.039.

[40] Sun, L. et al. (2020) 'Analyzing carbon emission transfer network structure among provinces in China: new evidence from social network analysis', Environmental Science and Pollution Research, 27(18), pp. 23281–23300. doi: 10.1007/s11356-020-08911-0.

[41] Tang, Y. et al. (2020) 'The External Pressure, Internal Drive and Voluntary Carbon Disclosure in China', Emerging Markets Finance and Trade, 56(14), pp. 3367–3382. doi: 10.1080/1540496X.2019.1689356.

[42] Tanthanongsakkun, Treepongkaruna and Jiraporn (2022) 'Carbon emissions, corporate governance, and staggered boards', Business Strategy and the Environment, 32(1), pp. 769–780. doi: 10.1002/bse.3174.

[43] Thompson, B. S. (2019) 'Payments for ecosystem services and corporate social responsibility: Perspectives on sustainable production, stakeholder relations, and philanthropy in Thailand', Business Strategy and the Environment, 28(4), pp. 497–511. doi: 10.1002/bse.2260.

[44] Velte, P., Stawinoga, M. and Lueg, R. (2020) 'Carbon performance and disclosure: A systematic review of governance-related determinants and financial consequences', Journal of Cleaner Production, 254, p. 120063. doi: 10.1016/j.jclepro.2020.120063.

[45] Wannags, L. L. and Gold, S. (2022) 'The Quest for Low-Carbon Mobility: Sustainability Tensions and Responses When Retail Translates a Manufacturer's Decarbonization Strategy', Organization and Environment, 35(2), pp. 202–232. doi: 10.1177/10860266211028645.

[46] Wedari, L. K., Jubb, C. and Moradi-Motlagh, A. (2021) 'Corporate climate-related voluntary disclosures: Does potential greenwash exist among Australian high emitters reports?', Business Strategy and the Environment, 30(8), pp. 3721–3739. doi: 10.1002/bse.2836.

[47] Yadav, S. et al. (2023) 'Achieving the sustainable development goals through net zero emissions: Innovation-driven strategies for transitioning from incremental to radical lean, green and digital technologies', Resources, Conservation and Recycling, 197(May), p. 107094. doi: 10.1016/j.resconrec.2023.107094.

[48] Zhang, Y. et al. (2021) 'Eco-efficiency, eco-technology innovation and eco-well-being performance to improve global sustainable development', Environmental Impact Assessment Review, 89(January), p. 106580. doi: 10.1016/j.eiar.2021.106580

AUTHORS

First Author – Yobi Nagoya Pratiwi, Universitas Bina Darma and yobi.np@binadarma.ac.id
Second Author – Febrianty, Universitas Malahayati and febrianty@malahayati.ac.id.
Third Author – Fahmi AJismanto, Jakarta International University and fahmi@jiu.ac
Four Author - Guntoro Barovih, Jakarta International University and guntoro@jiu.ac
Correspondence Author – Fahmi AJismanto, Jakarta International University and fahmi@jiu.ac, +62823 7222 9913.

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