Quantitative Economics and Management Studies (QEMS) *ISSN: 2722-6247 (online)*
Vol. 5 No. 4 (2024)
https://doi.org/10.35877/454RI.qems2728

The Influence of Carbon Emission Disclosure, Green Intellectual Capital, and Environmental Performance on Firm Value with Moderation of Firm Size

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Abstract

This study aims to determine the relationship between firm value, carbon emission disclosure, green intellectual capital, and environmental performance and to determine the moderating role generated by firm size on the relationship between firm value, carbon emission disclosure, green intellectual capital, also environmental performance. The samples in this study were 21 companies in the energy and basic materials sectors written on the IDX in 2019-2022 which were taken using purposive sampling technique. The findings of this study resulted in six conclusions. First, carbon emission disclosure has a significant negative impact on firm value. Second, green intellectual capital has a significant positive impact on firm value. Third, environmental performance has a negative impact on firm value. Fourth, there is a positive influence between carbon emission disclosure and firm value moderated by firm size. Fifth, there is a negative influence between green intellectual capital and firm value moderated by firm size. Sixth, there is a positive influence between environmental performance and firm value moderated by firm size.

Keywords: firm value; carbon emission disclosure; green intellectual capital; environmental performance; firm size

Received: 13 March 2024 Revised: 27 June 2024 Accepted: 09 July 2024

1. Introduction

In response to the global climate crisis, especially in dealing with the problem of carbon emissions, the Indonesian Government has taken strategic steps. One of the concrete steps taken is implementing the Economic Value of Carbon (NEK) Policy and committing to achieving net zero by 2060. To achieve this goal, the government regularly adapts to the Nationally Determined Contribution (NDC), which involves the establishment of regulations, mechanisms, and legalization of carbon trading in Indonesia. According to Prahoro Yulijanto Nurtjahyo, Head of the ESDM Human Resources Development Agency, carbon trading will be introduced in 2023, especially for the power generation industry. This step is expected to reduce greenhouse gas emissions by 155 million tons of CO2e by 2030. This policy reflects Indonesia's commitment to being a leader in climate change mitigation, playing an important role in the transition to clean energy, as well as in efforts to reduce carbon emissions and encourage green economic development (Menteri Lingkungan Hidup dan Kehutanan RI, 2021).

Steps to reduce carbon emissions in Indonesia are related to global attention to the issue of global warming. The increase in earth's temperature caused by greenhouse gas emissions produced by human activities is a concern for many parties. These greenhouse gases include carbon dioxide (CO2), perfluorocarbons (PFCs), nitrogen oxides (N2O), hydrofluorocarbons (HFCs), methane (CH4), and sulfur hexafluoride (SF6) (Ratmono, 2021). Among these gases, CO2 is the most common in daily emissions, which is produced from burning coal, oil and other energy sources (Suhardi & Purwanto, 2015). It is important to address greenhouse gas emissions because global warming can cause various additional problems such as heavy rain, floods, droughts, as well as threats to the survival of living things on earth, and can even cause widespread environmental damage (Nur Cahyani & Gunawan, 2022).

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The topic of global warming has become the world's spotlight, resulting in the establishment of the Kyoto Protocol in 1997 under the United Nations Framework Convention on Climate Change (UNFCCC), which came into effect in February 2005. In general, the Kyoto Protocol is a mutual agreement for all parties involved, participated in regulating and reducing greenhouse gas emissions in the period 2008 to 2012 with a reduction target of 5.2%, which was then extended to 2020 through the Doha Amendment (Song, 2006). In 2016, the Paris Agreement was formed, which stipulates that each country must disclose its contribution to the Nationally Determined Contribution (NDC). The main objective of the Paris Agreement is to keep global temperature rise from exceeding 2 degrees Celsius from conditions before the industrial revolution, with efforts to limit the temperature increase to 1.5 degrees Celsius. Indonesia officially became a member of the Paris Agreement in 2016, with its first NDC reported to the UNFCCC. Within the framework of the Paris Agreement, Indonesia aims to reduce greenhouse gas emissions by up to 29% without international support, and up to 41% with international support, with a target to reduce emissions in the period up to 2030 (Nurdiawansyah et al., 2018).

The Intergovernmental Panel on Climate Change (IPCC) routinely publishes annual reports which are comprehensive scientific reviews of climate conditions (Boehm & Schumer, 2023). These reports are in accordance with the themes discussed at the UN Climate Change Conference, known as Conference of the Parties 27 (COP 27) in 2022. COP 27 was inaugurated on November 6 2022. As the leader of the Indonesian Pavilion at COP 27, the Director General Sustainable Management (PHL) KLHK Agus Justianto revealed the subtle adoption of diplomatic initiatives. The Indonesian Pavilion introduces the international community to the innovations, strategies and steps taken by Indonesia, including efforts to prevent global temperature increases exceeding 2 degrees Celsius, encouraging the promotion of climate control programs among various parties, and providing a platform for collaboration and networking between stakeholders to support climate change mitigation efforts in Indonesia (Humas EBTKE, 2022). One example of concrete efforts to control climate change is through transparent and sustainable reporting regarding greenhouse gas emissions. This step is in line with Financial Services Authority Regulation (POJK) no. 51 of 2017, which requires companies to compile and report information about corporate sustainability, including emissions produced in their business operations.

This research leads to research researched by Tonay & Murwaningsari (2022) which uses 2 independent variables, namely green innovation, GIC and one dependent variable, namely firm value and firm size, as moderating variables. In this research, the author adopted 1 independent variable, namely green intellectual capital, the dependent variable, namely firm value, and the moderating variable, namely firm size. However, there is a difference from previous research where in this research, researchers added 2 variables carbon emission disclosure and environmental performance as independent variables because there are still differences in research results in previous studies. Another difference is that the research was conducted in energy and basic materials sector companies listed on the IDX in 2019-2022.

Based on the background described regarding CED, GIC and environmental performance on firm value, firm size is a moderator and there are still differences in research results between previous researchers. So, researchers are interested in carrying out research with the title "The Influence of Carbon Emission Disclosure, Green Intellectual Capital, and Environmental Performance on Firm Value with Moderation of Firm Size".

The research arises from a lack of in-depth understanding of carbon emissions disclosure and its impact on firm value, particularly among companies that achieve high environmental performance. Previous research has not fully considered how specific carbon emissions disclosure strategies can influence market perceptions of firm value. This creates a need for more in-depth research in identifying the mechanisms and direct impacts of carbon emission disclosure on firm value, especially in the context of companies that prioritize sustainable practices. This was found in research by Akhtar, F. et al (2020) which showed that disclosure of carbon emissions has varying impacts on firm value, depending on how effectively the firm manages environmental risks and strengthens its sustainable corporate image. Recent research shows that there are significant differences in investors' perceptions of companies that disclose transparent environmental information and proactively adopt sustainable practices, especially in sectors at high risk of climate change. Therefore, this gap highlights the need for more in-depth research to understand how specific carbon emission disclosures influence firm value, especially among companies that perform high in environmental aspects.

Second, this research highlights the lack of thorough exploration of the relationship between green intellectual capital and firm value, especially when moderated by firm size. Although there is research showing a relationship between sustainable practices and corporate value, more specific research on green intellectual capital as a mediator in this relationship is lacking. Further studies are needed to understand how green intellectual capital influences firm value, especially considering moderating variables such as firm size that can significantly influence this relationship. This

was found in research by Bontis, N., et al (2021) showing that green intellectual capital can be a source of significant added value for companies, especially in terms of increasing competitiveness, innovation and firm reputation in terms of sustainability. However, specific research on how green intellectual capital can influence firm value is still limited. Therefore, more focused research is needed to explore the mechanisms and impacts of green intellectual capital on firm value, especially when considered in the context of different firm sizes.

Third, this study highlights the lack of research on how environmental performance, measured through various metrics, directly influences firm value. While much research has demonstrated the relationship between sustainable practices and financial performance, the specific role of environmental performance in shaping corporate value is still not fully understood. Further research is needed to explore how various aspects of environmental performance, such as resource efficiency, regulatory compliance, and sustainable innovation, can influence market perceptions and overall firm value. This was found in research by Christmann & Taylor (2021) which highlighted the importance of environmental performance as a significant predictor of firm value, especially in the face of pressure from stakeholders and increasingly stringent environmental regulations. However, research that specifically explores how various aspects of environmental performance influence firm value is still limited. Thus, further research is needed to deepen understanding of the relationship between environmental performance and firm value, as well as how contextual factors such as firm size may moderate this relationship.

Fourth, this research highlights the need for a deeper understanding of how firm size can moderate the relationship between sustainability factors such as carbon emissions disclosure, green intellectual capital, and environmental performance with firm value. Although some studies have proposed that firm size may influence the relationship between sustainable practices and firm value, the specific role of firm size as a moderator in this context remains unclear. Future research could examine in more depth how firm size may influence the mechanisms and impact of sustainability factors on firm value, thereby providing better insight into how these factors interact in different contexts. This was found in research by Epstein & Roy (2003) showing that firm size can influence sustainable strategies and practices, as well as market perceptions of firm performance and value. However, research that specifically considers the moderating role of firm size in the relationship between sustainability factors and firm value is still limited. Therefore, more focused research is needed to understand how firm size moderates the influence of carbon emissions disclosure, green intellectual capital, and environmental performance on firm value.

The fifth highlights the need for clarification of how specific carbon emissions disclosure can lead to the formation and strengthening of green intellectual capital in the context of companies of different sizes. Although there has been research showing that carbon emissions disclosure can be a catalyst for the development of green intellectual capital, the contextual differences between large and small companies in this regard have not been studied in depth. Further research could help understand the most effective mechanisms and strategies for integrating carbon emissions disclosure with green intellectual capital formation in various organizational contexts. This was found in research by Kolk & Perego (2010) showing that carbon emissions disclosure can be an impetus for the development of green intellectual capital in various organizational contexts. However, research that specifically looks at how specific disclosure of carbon emissions can influence the formation and strengthening of green intellectual capital is still limited. Therefore, more in-depth research is needed to understand the possible mechanisms and strategies for integrating carbon emissions disclosure with green intellectual capital formation, especially in the context of companies of different sizes.

2. Research Method and Materials

This research is entitled "The Influence of Carbon Emission Disclosure, Green Intellectual Capital, and Environmental Performance on Firm Value with Moderation of Firm Size" in energy and basic materials sector companies on the IDX in 2019-2022. This research uses hypothesis testing and uses surveys in energy and basic materials sector companies on the IDX as a research strategy. The unit of analysis used as the population subject is the energy and basic materials sector companies listed on the BEI for 2019-2022 by downloading the annual report and sustainability report obtained from the BEI website, namely www.idx.co.id as well as the websites of each associated company. The independent variables in this research are carbon emission disclosure, green intellectual capital, and environmental performance. The dependent variable in this research is firm value and the moderating variable is firm size. This research uses a research time horizon, namely Pooling Data/Panel Data, which is a combination of time-series and cross-section.

3. Results and Discussion

3.1. Results

A multiple regression model was used to analyze the data in this study, with a sig level. worth 5% (α=0.05). To see the extent to which the dependent variable is influenced by the independent variable, a t test is carried out. The decision is taken with the condition that the sig value. t count > 0.05 then rejects Ho; if not then accept Ha.

Table 1. Moderated Regression Test Results

Variables	Prediction Direction	Coefficient	Std. Error	t-Statistics	Prob.
Carbon Emission Disclosure	(+)	-8.1037	3.6022	-2.2496	0.0273
Green Intellectual Capital	(+)	16,696	4.7462	3.5178	0.0007
Environmental Performance	(+)	-0.4470	0.1697	-2.6343	0.0102
Moderation 1	(+)	0.2501	0.1171	2.1353	0.0359
Moderation 2	(+)	-0.5252	0.1544	-3.4000	0.0011
Moderation 3	(+)	0.0132	0.0056	2.3293	0.0225
C		-0.0417	0.2144	-0.1948	0.8461

Data sources were processed with EViews 12.0

3.1.1. Panel Data Regression Equation

Based on Table1, the findings of the regression test, the following equation is formulated:

$$\boldsymbol{Ri} = -0{,}0417 - 8{,}103\ \boldsymbol{CED} + 16{,}696\ \boldsymbol{GIC} - 0{,}447\ \boldsymbol{KL} + 0{,}250\ \boldsymbol{CED} * \boldsymbol{UP} - 0{,}525\ \boldsymbol{GIC} * \boldsymbol{UP} + 0{,}013\ \boldsymbol{KL} * \boldsymbol{UP}$$

Information:

Ri = Firm Value
α = Constant Value
β = Regression Coefficient
CED = Carbon Emission Disclosure
GIC = Green Intellectual Capital
KL = Environmental Performance
UP = Firm Size

1. The constant value is –0.0417, meaning that if the independent variable increases by 1 unit while the other variables are considered constant, then the firm value variable will decrease by 0.0417.
2. Carbon Emission Disclosure = –8.103. This means that if the carbon emission disclosure variable increases by 1 unit while other variables are assumed to be constant, then the firm value variable will decrease by 8.103.
3. Green Intellectual Capital = 16,696. This means that if the green intellectual capital variable increases by 1 unit while the other variables are assumed to be constant, then the firm value variable will increase by 16,696.
4. Environmental Performance = –0.447. This means that if the environmental performance variable increases by 1 unit while other variables are considered constant, then the firm value variable will decrease by 0.447.
5. Carbon Emission Disclosure which is moderated by firm size = 0.250. This means that if the carbon emission disclosure variable which is moderated by firm size increases by 1 unit while the other variables are assumed to be constant, then the firm value variable will increase by 0.250.
6. Green Intellectual Capital moderated by firm size = –0.525. This means that if the green intellectual capital variable which is moderated by firm value increases by 1 unit while other variables are considered constant, then the firm value variable will experience a decrease of 0.525.
7. Environmental Performance which is moderated by firm size = 0.013. This means that if the environmental performance variable which is moderated by firm size increases by 1 unit while other variables are assumed to be constant, then the firm value variable will increase by 0.013.

3.1.2. Carbon Emission Disclosure Has a Positive Influence on Firm Value

Based on the findings of the t test from the table in the carbon emission disclosure regression model, a significance value of 0.0273 was obtained, which means < 0.05 (0.0273 < 0.05) and the coefficient value is -8.1037 in the negative

direction, T count > T Table (-2.2496 > 1.990). It is concluded that H1 is rejected, this means that the carbon emission disclosure variable partially has a negative influence on firm value.

3.1.3. Green Intellectual Capital Has a Positive Influence on Firm Value

Based on the findings of the t test from the table in the green intellectual capital regression model, a significance value of 0.0007 was obtained, which means < 0.05 (0.0007 < 0.05) and the coefficient value is 16.696 in a positive direction, T count > T Table (3.517 > 1.990). It is concluded that H2 is accepted, this means that partially the green intellectual capital variable has a positive influence on firm value.

3.1.4. Environmental Performance Has a Positive Influence on Firm Value

Based on the findings of the t test processing from the table in the environmental performance regression model, the sig value is obtained. worth 0.0102, which means < 0.05 (0.0102 < 0.05) and the coefficient value is –0.447 in a negative direction, T count > T table (-2.6343 > 1.990). It is concluded that H3 is rejected, this means that partially the environmental performance variable has a negative influence on firm value.

3.1.5. Carbon Emission Disclosure Moderated by Firm Size Has a Positive Influence on Firm Value

Based on the findings of the t test from the table in the carbon emission disclosure regression model moderated by firm size, a significance value of 0.0359 was obtained, where the meaning is < 0.05 (0.0359 < 0.05) and the coefficient value is 0.250 in a positive direction, T count > T table (2.1353 > 1.990). It is concluded that H4 is accepted, this means that firm size strengthens the influence of the CED variable on firm value.

3.1.6. Green Intellectual Capital Moderated by Firm Size Has a Positive Influence on Firm Value

Based on the findings of the t test from the table in the green intellectual capital regression model, a significance value of 0.0011 was obtained, which means < 0.05 (0.0011 < 0.05) and the coefficient value is – 0.525 in a negative direction, T count < T Table (-3,400 < 1,990). It is concluded that H5 is rejected, this means that the firm size variable weakens the influence of green intellectual capital on firm value.

3.1.7. Environmental Performance Moderated by Firm Size Has a Positive Influence on Firm Value

Based on the findings of the t test processing from the table in the environmental performance regression model, the sig value is obtained. worth 0.0225, which means < 0.05 (0.0225 < 0.05) and the coefficient value is 0.0132 in the positive direction, T count < T table (2.3293 > 1.990). It is concluded that H6 is accepted, this means that firm size strengthens the influence of environmental performance variables on firm value.

3.2. Discussion

3.2.1. The Influence of Carbon Emission Disclosure on Firm Value

The findings of the hypothesis test showing that there is a negative influence between CED and firm value are in line with the findings in research conducted by Lee & Cho (2021); Mahmudah et al. (2023). However, this is not in line with the findings in research carried out by Abd Latif et al. (2023); Wiryawan (2023) which stated that the greater the CED of a firm, the greater the value of the firm. This conclusion can be explained by the many mechanisms that occur in the interaction of these two variables.

Sustainability theory (Meadows et al, 1972) emphasizes the importance of maintaining a balance between environmental, social and economic sustainability in business activities. The research results show a negative influence between carbon emission disclosure and firm value, indicating that companies are not sustainable enough in their environmental practices. This may indicate that the firm has not succeeded in effectively integrating sustainability into its business strategy, and is still focused more on short-term profits than long-term impacts on the environment.

Sudaryanto (2011) believes that the operational activities carried out by companies to optimize their value cannot be separated from their external environment. CED is the disclosure of a firm's carbon emissions assessment and emission reduction targets with the aim of determining the risk of carbon emissions to the environment from the firm's operational activities (Wenni Anggita et al., 2022). Companies that have gained legitimacy generally experience an increase in public perception and reputation, thereby influencing firm assessment (Nur Cahyani & Gunawan, 2022). So that disclosure of carbon emissions can increase firm value.

There are three previous studies that investigated the effect of carbon emissions disclosure on firm value. The first research, conducted by Kim, S., Lee, H., & Park (2023), shows that disclosing carbon emissions can improve a firm's reputation in terms of environmental sustainability, which in turn can influence investor and public perceptions of firm value. This research highlights the importance of transparency in managing a firm's environmental impact on market valuation. Meanwhile, second research by Wang, In other words, companies that are more proactive in disclosing carbon emissions are likely to achieve sustainable competitive advantage, which is reflected in higher market valuations. These results provide a strong case for companies to prioritize transparency in reporting their environmental practices. In addition, third research by Gupta et al. (2021) found that good carbon emission disclosure can have a positive impact on a firm's access to capital and lower capital costs. This shows that investors tend to give preference to companies that are more transparent in managing environmental risks, which in turn can increase firm value in the long term. The conclusions of these studies emphasize the importance of carbon emissions disclosure as a strategy to increase firm value, both from the perspective of reputation, financial performance and access to financial resources.

3.2.2. The Influence of Green Intellectual Capital on Firm Value

The findings of the hypothesis test show that there is a positive influence between GIC and firm value, which is in line with the findings in research conducted by Dila & Titik Aryati (2023) and Tonay & Murwaningsari (2022) showing that there is positive influence of GIC on firm value. This conclusion explains that the higher the level of green intellectual capital of a firm, the greater the value of the firm. The positive influence between GIC and firm value can be explained through a number of mechanisms.

The positive influence between GIC and firm value can be explained through a number of mechanisms. Sustainability theory (Meadows et al, 1972) highlights the importance of integration between economic, social and environmental activities in firm strategy. Based on research results, the use of GIC reflects the firm's commitment to achieving sustainable growth, where environmentally friendly business practices are the key to creating long-term value. By utilizing GIC, companies can reduce negative impacts on the environment and society and optimize the efficient use of resources. This can increase firm competitiveness, reduce operational risks, and create long-term value for shareholders and other stakeholders.

According to Tonay & Murwaningsari (2022), green intellectual capital plays a role in maintaining a regulatory focus in order to meet the firm's sustainability goals. GIC encouraging companies to produce sustainable innovations, such as environmentally friendly technology and energy efficient production processes. This allows companies to reduce long-term operational costs and increase productivity, which can result in increasing firm value.

Green Intellectual Capital allows companies to differentiate themselves from their competitors so that it can become the basis for sustainable competitive advantage. Competitive advantage is the basis and source for increasing a firm's financial performance (Augustine & Dwianika, 2019). Companies that pay attention to environmentally friendly practices and invest in developing green intellectual capital tend to gain a better reputation in the eyes of customers, investors and other stakeholders, thereby increasing trust and loyalty, as well as investor interest, which has the potential to increase firm value.

3.2.3. The Influence of Environmental Performance on Firm Value

The findings of the hypothesis test show that there is a significant negative influence between environmental performance and firm value, which is in line with the findings in research conducted by Khanifah Khanifah et al. (2020). However, this research is not in line with the findings in research conducted by Arimbi & Mayangsari (2022); NABILA (2019); Wibawa & Khomsiyah (2022) suggest that environmental performance has a significant positive influence on firm value. This conclusion indicates that the higher the level of environmental performance of a firm, the lower the value of the firm. The negative influence between environmental performance and firm value can be explained through several mechanisms.

The negative influence between environmental performance and firm value can be explained through several mechanisms. Legitimacy theory Dila & Titik Aryati (2023) emphasizes the importance of companies to maintain support and legitimacy from the community and other stakeholders. In situations where poor environmental performance negatively impacts the public's perception of the firm, this can threaten the firm's legitimacy. Companies deemed environmentally irresponsible may face pressure from various stakeholders, such as environmentally conscious consumers, non-governmental organizations (NGOs), and regulators. If a firm's environmental performance is assessed as poor by stakeholders, the firm may experience a decline in reputation, decreased sales, or even regulatory sanctions. In the long term, this can have a negative impact on firm value.

Environmental Performance is the firm's relationship with the environment and the results of operational activities carried out by the firm responsibly towards its operating environment (Affan & Wicaksana, 2023). Companies in the energy and basic materials sectors often have to comply with strict environmental regulations, such as emission limits and environmental rehabilitation requirements. Meeting these requirements can result in increased operational and investment costs, which in turn can reduce profitability and firm value.

Operational activities in the energy and basic materials sectors, such as oil drilling and mining, are often considered to damage the environment. NABILA (2019) argues that environmental performance indicates the strategic approach adopted by an organization in dealing with the environment. A firm is categorized as having good environmental performance if the firm is able to maintain and manage the environment in its production process. If companies in this sector are deemed environmentally unfriendly, this could damage the firm's image and reputation in the eyes of the public and investors, which in turn could reduce the firm's value. Poor environmental performance can increase the risk of litigation from interested parties who care about the environment. Apart from that, this can also trigger protests and social pressure from the community, which can disrupt firm operations and have a negative impact on firm value.

3.2.4. The Influence of Carbon Emission Disclosure Moderated by Firm Size Towards Firm Value

Hypothesis test findings show that there is a positive influence between CED and firm value which is moderated by firm size. Firm size strengthens the influence between CED and firm value. The conclusions of this research indicate that the effect of CED, which is moderated by firm size, will increase firm value. Stakeholders such as society and investors put strong pressure in their expectations of carbon management by large companies (Luo et al., 2010). Therefore, carbon emission disclosure will be influenced by firm size factors. Because the larger the size of the firm, the greater the carbon management and contribution of the firm to the environment. So that carbon emission disclosure carried out by large companies has an effect on increasing firm value.

Stakeholder theory Wiryawan (2023) emphasizes the importance of taking into account the interests and needs of various stakeholders in firm decision making. In this case, carbon emissions disclosure can be understood as a firm's effort to meet the expectations and needs of stakeholders, such as investors who are increasingly concerned about the firm's environmental impact. Disclosure of carbon emissions can be seen as a form of transparency and accountability for a firm's environmental impact, which may increase trust and support from stakeholders. Investors, in this case, can view carbon emissions disclosures as an indicator that companies are taking environmental risks into account in their business strategies. However, the influence between carbon emission disclosure and firm value can be moderated by firm size. Larger companies may have greater resources and capabilities to better disclose carbon emissions, or even implement environmentally friendly practices more effectively. Therefore, firm size can strengthen the relationship between carbon emission disclosure and firm value.

3.2.5. The Influence of Green Intellectual Capital Moderated by Firm Size on Firm Value

Hypothesis test findings show that there is a negative influence between GIC and firm value which is moderated by firm size. Firm size weakens the influence of GIC on firm value. The conclusion of this research indicates that the influence of GIC which is moderated by firm size will reduce firm value. This finding is not in line with research conducted by Tonay & Murwaningsari (2022) that firm size does not strengthen the influence of GIC on firm value. According to Tonay & Murwaningsari (2022), firm size is a classification of how large or small an entity is based on the total assets of a firm which is a determining factor in carrying out strategic decisions. Large companies will have the capital strength to carry out sustainable business activities and strategies so that they will create firm value in terms of fundamentals and firm image. The larger the firm size, the firm's GIC such as knowledge, abilities, skills, policies, attitudes, experience, employee commitment, and innovation towards the environment become a competitive advantage for the firm's sustainability.

Sustainability theory (Meadows et al, 1972) highlights the importance of integrating economic, social and environmental aspects in firm strategy to achieve sustainable growth. In this case, GIC reflects a firm's efforts to adopt environmentally, socially and economically friendly business practices, with the hope that this will increase the firm's value in the long term. The research results show that there is a negative influence between GIC and firm value which is moderated by firm size, this is because smaller companies have limitations in terms of resources, capabilities and access to markets which makes it more difficult for them to implement GIC practices effectively. This may result in a negative impact on the relationship between GIC and firm value in the context of smaller firms. Larger companies have more mature organizational structures and management systems, which enable them to better integrate GIC practices into their operations. Meanwhile, smaller companies may still be in the early stages of developing and implementing GIC practices, so their impact on firm value may not yet be fully realized.

Previous research confirms that there is a significant correlation between Green Intellectual Capital (GIC) and firm value. In a study conducted by Wang, Y., & Sarkis, J. (2023), it was found that companies that allocate resources to GIC development tend to have higher firm value compared to those that do not. However, the role of firm size in moderating the relationship between GIC and firm value has also been documented in previous literature. A study by Li, X., Wu, complex and may experience obstacles in integrating GIC into their strategy.

In addition, several studies conclude that firm size plays an important role in moderating the relationship between GIC and firm value. For example, research conducted by Jin, M., & Lee (2023), shows that the positive effect of GIC on firm value is stronger in relatively smaller companies, because they tend to be more flexible in adopting sustainable practices and changing their structure corresponds to green values. However, large companies can also leverage GIC to increase their value, but may require different strategies to integrate sustainable practices into their operations.

3.2.6. The Influence of Environmental Performance Moderated by Firm Size on Firm Value

Hypothesis test findings show that there is a positive influence between environmental performance and firm value which is moderated by firm size. Firm size strengthens the influence of environmental performance on firm value. The conclusion of this research indicates that the influence of environmental performance which is moderated by firm size will increase firm value. In terms of disclosing information in annual reports, large companies will be more careful so that they will disclose more information than small companies about environmental contributions and social concerns (Abd Latif et al., 2023).

Sustainability theory (Meadows et al, 1972) emphasizes the importance of integrating economic, social and environmental aspects in firm strategy to achieve sustainable growth. In this case, environmental performance reflects a firm's efforts to adopt environmentally friendly business practices, which can create long-term value for the firm. The positive influence between environmental performance and firm value is because companies that are known to have good environmental performance tend to gain a better reputation in the eyes of stakeholders, including consumers, investors and the general public. This can result in increased consumer trust and loyalty, as well as increased investor interest, which in turn can increase firm value. Moderation by firm size indicates that the positive effect of environmental performance on firm value may vary based on firm size. Larger companies may have greater resources and capabilities to implement more effective environmental practices and gain greater benefits from those efforts.

Previous studies have previously highlighted the relationship between environmental performance and firm value, taking into account the moderation of firm size. First, research conducted by Jiang & Fu (2019) show that environmental performance can make a significant contribution to increasing firm value, especially in contexts where companies are larger. These findings indicate that companies that are committed to sustainable environmental practices tend to generate higher value for their shareholders, especially when the firm's operational scale is larger. Second, research conducted by Nazwa & Fitri (2022) found that the positive effect of environmental performance on firm value can be influenced by firm size. In this context, larger companies tend to have greater resources and capabilities to implement effective environmental practices, thereby increasing their impact on overall firm value. These results emphasize the importance of taking into account firm size factors in understanding the relationship between environmental performance and firm value. Third, research conducted by Rusmanto & Lisal (2019) shows that the relationship between environmental performance and firm value can vary depending on firm size. Although environmental performance can generally increase firm value, this study highlights that the effect may be more significant in large firms than in small ones. This emphasizes need for different approaches in managing environmental practices, especially in the context of companies of different sizes, to maximize overall corporate value.

4. Conclusion

Conclusions that can be drawn regarding this research are based on the results that can be obtained from the analysis carried out is CED has a significant negative influence on firm value. The level of CED disclosure in a firm can cause a decrease in firm value due to environmental impacts resulting from operational activities, strict regulations, and changes in investor preferences for environmental factors. GIC has a significant positive influence on firm value. GIC practices play a crucial role in increasing the value of companies in the energy and basic materials sectors through continuous innovation, improved reputation and better financial performance, environmental performance has a negative influence on firm value. Poor environmental performance in the energy and basic materials sectors has a negative impact on firm value through increased operational costs, damage to image and reputation, as well as increased litigation and social risks. There is a positive influence between CED and firm value which is moderated by

firm size. These results show that firm size strengthens the influence between CED and firm value. Firm size strengthens the influence between CED and firm value in energy and basic materials sector companies through greater resource allocation, improved reputation, and better compliance with environmental regulations. There is a negative influence between GIC and firm value which is moderated by firm size. These results show that firm size weakens the influence between GIC and firm value. Large firm size can weaken the influence between GIC and firm value in energy and basic materials sector companies due to less flexible policies and practices, as well as a focus on operational efficiency rather than sustainability fund. There is a positive influence between environmental performance and firm value which is moderated by firm size. These results show that firm size strengthens the influence between environmental performance and firm value. Large firm size in companies in the energy and basic materials sectors can strengthen the relationship between environmental performance and firm value due to greater resources and market influence as well as involvement in deeper environmental initiatives.

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