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The Effect of Green Innovation, Carbon Emission Disclosure, And Environmental Costs on Company Value with Industry Type as A Moderation Variable

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Abstract

The purpose of this study was to analyze the effect of (1) *green innovation* on firm value, (2) *carbon emission disclosure* on firm value, (3) environmental costs on firm value, (4) type of industry in moderating *green innovation* on firm value, (5) type of industry in moderating *carbon emission disclosure* on company value, (6) type of industry in moderating environmental costs on company value.

This research uses quantitative research methods. The sampling procedure in this study was based on a purposive sampling method, the population in this study totaled 52 companies with 260 data. This study uses secondary data, which is obtained from the internet through the official IDX website (www.idx.co.id) and the official website of each company. The data used are annual reports *and* sustainability reports *published* by each company that is the sample of this study. The statistical method used to test the hypothesis is by using the SPSS statistical application.

The research results show that *green innovation*, *carbon emission disclosure*, and environmental costs positive effect on firm value. Whereas in the moderation effect in this study, the type of industry strengthens the effect of *carbon emission disclosure* on firm value, and the type of industry does not moderate the effect of *green innovation* and environmental costs on firm value.

Keywords : *Green Innovation*, *carbon emission disclosure*, environmental costs, type of industry and firm value.

INTRODUCTION

Economic growth is growing rapidly, marked by the development of the industrial world in recent years. In line with the development of the industrial world, issues regarding environmental pollution such as global warming and carbon emissions are also developing (Rahmanita, 2020) . Like the case of environmental pollution in the waters of GAG Papua island, pollution caused by PT GAG's nickel mining waste, a subsidiary of PT. Antam Tbk makes the waters brown (Ermaya and Mashuri, 2020) .

Non-governmental organization (*Greenpeace*) Indonesia has released the results of an investigation into coal mining activities in East Kalimantan by PT Indominco Mandiri, a subsidiary of PT Indo Tambangraya Megah Tbk. that damages the landscape and disrupts water quality. Land that was previously forest has turned into an abandoned mining lake (Ermaya and Mashuri, 2020) . This phenomenon is proof of the importance of obliging companies to care about the environment. In this case, it is necessary to have an enforced law to ensure that business people do not carry out business processes that can damage the environment. The Government of the Republic of Indonesia to deal with environmental problems is tightening regulations related to the environment including the latest regulations such as the Environmental Law no. 46 of 2017 concerning Environmental Economic Instruments.

The establishment of a company has a clear purpose. The company's long-term goal is to optimize company value by increasing wealth for shareholders (Isnurhadi *et al* ., 2020) . Firm value reflects investors' perception of how well or badly the management manages the company. The high value of the company will make the market not only believe in the company's current performance, but also the company's future prospects (Wardhani and Kawedar, 2019) .

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Increasing company value plays an important role for a company, so that shareholder prosperity ultimately becomes the main goal of the company itself (Monica, 2021) . Critical accounting writers argue that managers will only pursue social and environmental sustainability initiatives, if they have a positive impact on the financial performance of their companies (Narayanan *et al* ., 2021) . Even though high company value is not only illustrated by company profits, but must be combined with economic performance, concern for social justice, and corporate responsibility for sustainability (Aisahanafi and Hernindita, 2022) .

The first factor that affects the value of the company is *green innovation.* One way for companies to develop their business and compete in a healthy manner is by innovating and being linked to environmental conditions. The best innovation is innovation to realize environmental friendliness in all company activities. An innovation is an investment that requires a lot of money and time, but can have a positive impact on the company in the long run (Dewi and Rahmianingsih, 2020) . The research results of Fabiola and Khusnah (2022) found that *green innovation* in manufacturing companies can affect company value, and *green innovation* can be used as a prediction in measuring a company's value. In line with the research of Ramadhany *et al* . (2021) and Rachmawati (2021) found that *green strategy* has a positive and significant effect on company value. This shows that many companies feel the need to implement a green strategy.

The second factor that has an influence on company value is *carbon emission disclosure.* One issue that is developing intensely and is an issue that has the potential to threaten the future of the world is climate change. Carbon emissions, which are the result of operational activities in the industrial sector, have increased by 1.65% over the past four years (Karamahmutoğlu and Kuzey, 2019) . According to an analysis by Carbon Brief, a UK-based website that covers the latest developments in climate science, climate policy, and energy policy, the United States is the largest contributor of CO2 emissions since 1850, namely 509 billion tons or 20 percent of total global emissions. Underneath are China (11 percent), Russia (7 percent), Brazil (5 percent), and Indonesia (4 percent) (Kompas.com, 2022). Disclosure of carbon emissions is an added value for investors. Based on research conducted by Hardiyansah *et al.* (2021) and Damas *et al* . (2021) found that disclosure of carbon emissions has a positive effect on firm value.

The third factor is environmental costs. In managing environmental costs, companies think that environmental costs are only supporting costs, even though these costs are directly related to production costs. Actual economic growth must consider the environmental costs caused by company activities (Wang *et al* ., 2019) . Asjuwita and Agustin's research (2020) found that companies that have high profitability do not necessarily incur more environmental costs, and then reveal in the company's annual report and the results of their research also state that large environmental costs are not necessarily directly proportional to increased profitability.

Industry type as a moderating variable in this study. Some researchers use a *high profile versus low profile industry type classification* (Widiastuti *et al* ., 2018) . Companies with large profits will tend to disclose their social responsibility even more, because it serves as evidence of accountability to stakeholders and ensures that company activities are in accordance with social norms and values in society.

Previous researchers Damas *et al* . (2021) have conducted research related to environmental factors and company value. The difference between this research and the previous one is combining the *green innovation* and *carbon emission disclosure variables* and adding a new independent variable, namely environmental costs. This study also uses a moderating variable that is different from previous researchers, namely the type of industry. Furthermore, this study used samples and research periods that were different from previous researchers.

The reason for selecting the sample in this study is because the mining sector is one of the largest carbons producing sectors and has great potential to damage the environment. Manufacturing companies interact the most with the public, thereby making a significant contribution to environmental pollution, waste, product safety and labor issues. The banking sector currently has a very large contribution to the capital structure of industrial sectors, even though if seen directly, banks do not have a large contribution to the environment, but banks are involved in all company business activities, because of the relationship between creditors and debtors. Banking is considered to be also responsible for environmental damage, because it grants credit applications from companies that do not pay attention to the pollution they produce, as well as the products they produce.

THEORETICAL REVIEW AND HYPOTHESIS DEVELOPMENT

Stakeholder Theory

According to Freeman (1998); Damas et al. (2021) stakeholders are defined as " *Any group or individual who can influence or be influenced by the achievement of company goals.* " The translation is as a group or individual who can influence and/or be influenced by the achievement of certain goals. Environmental disclosure is expected to fulfill information needs. needed by stakeholders and in order to get support from stakeholders for the company's sustainability.Investors continue to evaluate related information, so companies are motivated to disclose information voluntarily to gain access to high-quality resources (Kurnia *et al* ., 2020) .According to Agustia *et al.* (2019) Stakeholder theory can be implemented by implementing green innovation or strategy within the company. The era of globalization has encouraged traded products to be environmentally friendly. Investors tend to choose companies that have and develop environmental policies and programs.

Signaling Theory

Signaling Theory or signaling theory developed by Ross (1978), states that company executives who have better information about their company will be encouraged to convey this information to potential investors so that the company's stock price increases. Signal theory is the theoretical basis that underlies the relationship of the effect of financial performance on firm value. Information received by investors is first interpreted as a good signal (good *news)* or a bad signal (bad *news)*. Information about environmental performance and environmental disclosure can be used by management to show shareholders or investors that the company has good environmental performance and is responsible for the company's environment and all the impacts of company activities (Sari *et al* ., 2020) .

Green Innovation

Environmental innovation (green *innovation)* is a process of developing, manufacturing and improving a product or process that provides a significant reduction in environmental impact. Environmental innovations are new or modified techniques, practices, systems and production processes to reduce the impact of environmental damage. Green strategies facilitate transformational decisions and initiatives that improve the environment. Define a vision and strategy that enables people to make better decisions that are aligned with the company's priorities for providing goods and services in global markets.

Carbon Emissions Disclosure

Emissions are substances, energy and components resulting from activities that have potential and are not potential air pollutant elements. According to the Big Indonesian Dictionary, carbon emissions are charcoal in the form of a colorless gas that is heavier than air. So, carbon emissions are carbon gas compounds produced from activities that have the potential to pollute the air. Based on *Our World in Data* , the largest contributors to carbon emissions are the United States, China and Europe, while the sectors that have the largest contribution to carbon emissions come from energy, industry, waste, transportation, land use sources, and agriculture (Kurnia et *al* . , 2020) .

Environmental Costs

Environmental Costs are costs incurred by the company to preserve the surrounding environment. Environmental costs in general include all internal and external costs of the steps taken or must be taken by the company to manage the environmental impacts caused by the company's operating activities, in the context of environmental responsibility and efforts to comply with applicable environmental rules and regulations and optimize the use of available resources. oriented with efforts to prevent or reduce waste and pollution. (Ahmad, 2021) .

The value of the company

Firm value is a certain condition that has been achieved by a company as an illustration of public trust in the company after going through a process of activity for several years, namely since the company was founded until now. Firm value is the investor's perception of the company's level of success, which is often associated with stock prices. Theoretically, the value of the company is the amount that someone must pay when buying or market confidence in the company's current performance and the company's prospects in the future. Therefore, company value is a value that can be determined from a comparison of company performance results, company value is seen from maximizing shareholder wealth (Hardiyansah *et al.* , 2021) .

Industry Type

Enterprises can be divided into *high profile* and *low-profile types. High profile* companies have a higher risk of being criticized, because the business activities carried out have a greater risk to the environment. The level of sensitivity of *high profile* companies to political, environmental and competition risks is also higher than that of *low profile companies* (Reverte, 2009) . Companies belonging to the *high-profile type* are mining, agriculture, forestry, telecommunications, chemicals, cement, paper, cigarettes, transportation, energy, telecommunications and pharmaceuticals. Most of these companies are *regulated companies* which have special laws and regulations made by the government (Setiani, 2020) . *Low profile* companies consist of banking, finance, investment, consumer goods, construction, retail, property and trade companies.

Hypothesis Development

The green innovation strategy focuses on the future, not only economic and social performance, environmental performance is an aspect that is considered by stakeholders. Green innovation can become a competitive advantage for companies if it is implemented regularly and applied to all business processes. The stakeholder theory *put* forward by Freeman states that the company's goals are not only to fulfill and create value for its shareholders, but to create value for all its stakeholders.

High levels of productivity and regular innovation can certainly help companies to achieve and maintain corporate value. Research conducted by Fabiola and Khusnah (2022) , Dai and Xue (2022) and Ramadhany *et al* . (2021) in the results of his research stated that green innovation products have a positive influence on company value. Meanwhile, research conducted by Sari and

Handayani (2020) found that *green process innovation* has not been able to increase company profits. Based on this description, the research hypothesis is:

H $_{1}$: *Green Innovation* has a positive effect on company value.

Carbon emission disclosure is a disclosure that assesses the carbon emissions of an entity or organization and sets targets for reducing these emissions. *Signaling theory* discusses the encouragement of companies to disclose information to external parties. Information issued by the company is important, because it can affect investment decisions on external parties of the company. Signal Theory Explains that the disclosure of carbon emissions by companies is a signal intended to attract *shareholders*

Research by Bahriansyah and Ginting (2022), Hardiyansah *et al* . (2021) , Damas *et al* . (2021) , and Rahmanita (2020) differ from the results of Kurnia *et al. 's research* . (2020) that *carbon emission disclosure* has no effect on company value. Research by Muhammad and Aryani (2021) and Firmansyah *et al* . (2021) found a negative effect of carbon disclosure on firm value. Based on the description above, the research hypothesis is:

H $_{2}$: *Carbon emission disclosure* has a positive effect on company value .

The allocation of environmental costs in the company in the short term seems to be a burden and reduces *profits* for the company, but in the long term it can provide social and economic benefits. By increasing the amount of social-environmental disclosure information, *stakeholders* including the public as users of social-environmental disclosure reports will reduce claims on the company's activities. Decreasing claims and increasing public support for the company will indirectly increase a positive image in the eyes *of shareholders.*

The greater the costs incurred by the company, it shows that the company has carried out environmental responsibility very well, so that the information becomes *good news information* on the stock market and will attract investors and can then increase the value of the company. In line with the research of Ahmad (2021) and Hapsoro and Adyaksana (2020) who found that environmental costs have a negative effect on company value. Unlike the research by Siregar *et al* . (2019) and Ulum *et al.* (2020 stated that spending on environmental costs did not affect the company's profit increase. Based on this description, the hypothesis in this study is:

H $_{3}$: Environmental Costs have a positive effect on firm value .

Companies with *high profile industrial types* in carrying out their business activities modify the environment a lot and cause negative social impacts on society. Companies belonging to *a high profile* usually get a lot of attention or scrutiny from the wider community, because they have a tight level of competition, a high level of political risk and have a high level of sensitivity compared to *low profile industrial companies* . Singh *et al* . (2022) stated that while best practices and case examples of green innovation generally reflect the reality of large-sized companies, small companies need to better understand the characteristics of their green innovations. Therefore, *high profile companies* will be more active in implementing green innovation in their production processes, to attract investors' attention. Based on this description, the research hypothesis is:

H $_{4:}$ Industry type moderates the effect of *green innovation* on firm value.

Companies that are high in producing carbon emissions will tend to disclose information about their carbon emissions. Saptiwi (2019) states that disclosing information about carbon emissions by carbon-intensive companies will help companies gain legitimacy from society and as a form of corporate responsibility to their stakeholders. According to research (Hardiyansah *et al* ., 2021) this strategy can be an alternative taken by companies belonging to the *high profile industry group* to improve their image and reputation. These things will then increase the value of the company. Based on the explanation above, the hypothesis is formulated as follows:

H $_{5:}$ Industry type moderates the effect of *carbon emission disclosure* on firm value.

Purwanto (2011) states that companies that are included in *high profile* companies have characteristics such as having a larger number of workers and in the production, process emitting more residues, such as waste and pollution. Companies that generate high profits are classified as *high-profile industries* and will incur more environmental costs for their operational activities, compared to *low profile industries.* The higher the profit earned by the company, the greater the profit is used by the company to carry out social and environmental responsibility. This is done to fulfill the company's responsibility to *stakeholders* and it can also increase a positive image and affect the increase in sales and profits received by the company.

H $_{6:}$ Industry type moderates the effect of *green innovation* on firm value.

RESEARCH METHODS

This research is a quantitative research using purposive sampling technique in taking the sample. This study uses secondary data obtained from the internet through the official IDX website (www.idx.co.id) and the official website of each company. The data used are annual reports *and* sustainability reports *published* by each company that is the sample of this study. The sample in this study amounted to 52 companies 260 data. Data analysis method used descriptive statistics, data quality test, classical assumption test and hypothesis test with the help of the IBM SPSS for windows computer.

RESULTS AND DISCUSSION

Results of Descriptive Statistics

Descriptive Statistics

	N	Minimum	Maximum	Means	std. Deviation
Gre G Green Innovation	260	,50	1.00	,8413	,18002
Carbon emission discsoure	260	,22	,83	,5712	,16521
Environmental costs	260	,00079	,109	,0131	,01818
The value of the company	260	,22	5.50	1.4357	,88488
Industry Type	260	,00	1.00	,7500	,43385

Source: Secondary data processed in 2023

Table above It can be seen that the min value of *green innovation* is 0.50, which means that companies that publish annual reports and implement *green innovation* have the lowest value and the max value is 1.00, which means that companies that publish annual reports and implement *green innovation* have the highest value.

The min value of *carbon emission disclosure* is 0.22, which means that companies that publish annual reports disclose the lowest *carbon emission* value and the max value is 0.83, which means that companies that publish annual reports disclose *emission disclosures.*

The min value of environmental costs is 0.00079 which means that companies that publish annual reports incur the lowest environmental costs of this value and the max value is 0.109 which means that companies that publish annual reports incur the highest environmental costs of that value.

The min value of the company value is 0.22, which means that companies that publish annual reports experience an increase in the lowest company value of that value and the max value is 5.50, which means that companies that publish annual reports incur the highest environmental costs of that value.

Classic assumption test

Normality test

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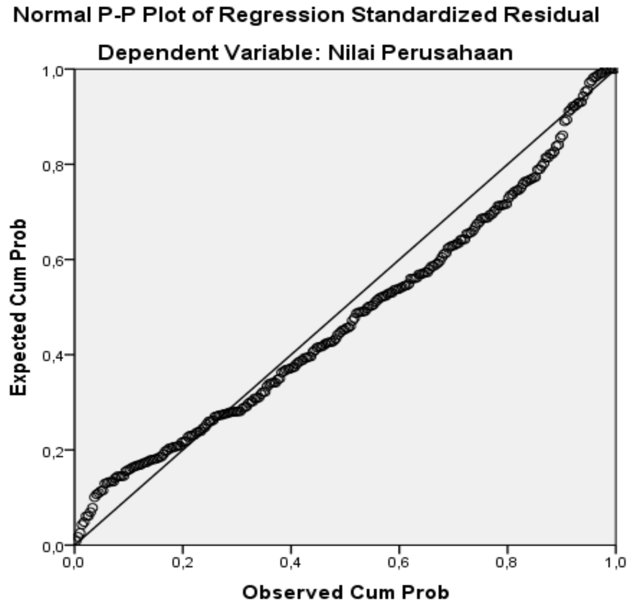
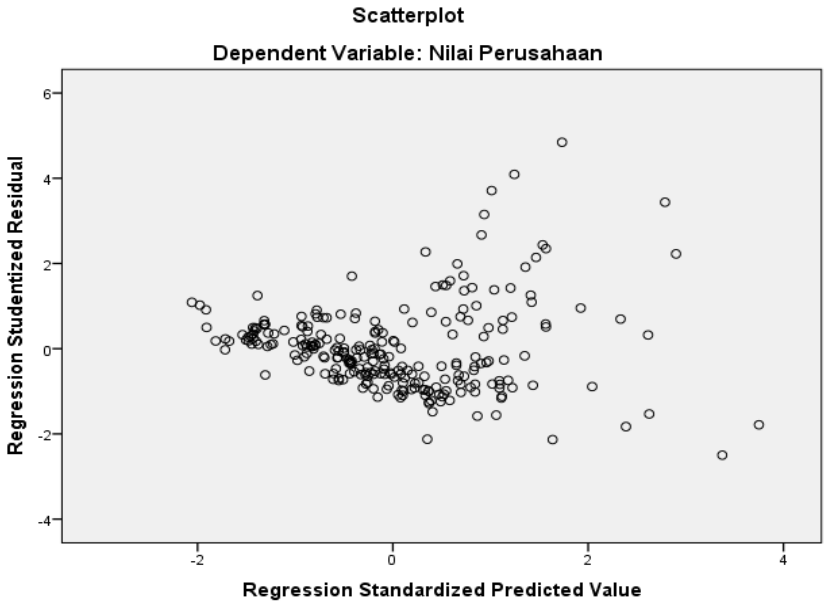


Source: Secondary data processed in 2023

. The results of the normality test shown in the picture above show that the distribution of points is around the diagonal line and follows the direction of the diagonal line. it can be concluded that the regression model meets the assumption of normality.

Heteroscedasticity Test



Source: Secondary data processed in 2023

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The picture above is the result of the heteroscedasticity test which shows that the points spread above and below the number 0 on the Y axis, so it can be concluded that there is no heteroscedasticity.

Multicollinearity Test

Multicollinearity test results

	tolerance	VIF	Multicollinearity Test
Green Innovation	0.521	1,918	No multicollinearity
Carbon Emissions Disclosure	0.440	2,270	No multicollinearity
Environmental Costs	0.896	1.116	No multicollinearity
Industry Type	0.483	2071	No multicollinearity

Source: Secondary data processed in 2023

Multicollinearity testing in the table above, the test results show the tolerance value of each variable has a tolerance value of > 0.1 and the VIF value of each variable is < 10. This shows that there is no multicollinearity between the independent variables in the study This.

Autocorrelation Test

Run Test	
	Unstandardized Residuals
Test Value [a]	-,07092
Cases < Test Value	130
Cases >= Test Value	130
Total Cases	260
Number of Runs	119
Z	-1,491
asymp. Sig. (2-tailed)	,136
a. Median	

Source: Secondary data processed in 2023

Based on the table above, it can be seen that the Asymp value of 0.136 is greater than 0.05, so it can be concluded that there are no autocorrelation symptoms or problems.

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Multiple Regression Analysis

Regression test results without moderation

Independent Variable	Coefficient	t	Sig.	Information
Constant	2,193			
Green Innovation (X1)	1,290	4,387	0.000	Accepted
Carbon Emissions Disclosure (X2)	1,725	4,945	0.000	Accepted
Environmental Costs (X3)	4,553	2,130	0.034	Accepted
a= 5%=0.05 **R Square=0.525**				

Source: Secondary data processed in 2023

Based on the results of multiple linear regression tests using the SPSS application. The *green innovation* variable has a significant positive effect on firm value. It can be seen from the coefficient value of 1.290 and a significance of 0.000. This means that many companies feel the need to implement a green strategy, even though they have to spend more to carry out greening activities in accordance with the company's vision. *Green innovation* provides long-term benefits for sustainable economic performance and company performance in the following year. The era of globalization has pushed traded products to be environmentally friendly. Based on the stakeholder theory, companies need good management and strategies in carrying out their operational activities so that they can maintain good relations with all stakeholders which can generate a positive response from all stakeholders. This research is in line with the research of Cahyaningtyas *et al.* (2022), Damas *et al.* (2021), Dewi and Rahmaningsih (2021), Rachmawati (2021), and Mariyamah and Handayani (2019), whose research results also prove that *green innovation* has an effect on increasing company value.

Based on the results of multiple linear regression tests using the SPSS application. *Carbon emission disclosure* variable has a significant positive effect on firm value. It can be seen from the coefficient value of 1.725 and a significance of 0.000. The market responds voluntarily to disclosure of carbon emissions, because the market believes that carbon emission information is one of their considerations in predicting company sustainability. Based on signaling theory, disclosure of carbon emissions gives a signal that companies can improve their performance in the future by carrying out environmental responsibility. Investors and potential investors respond positively to management's efforts to disclose carbon emissions in their annual reports. The results of this study are in line with the research of Bahriansyah and ginting (2022), Damas *et al*, (2021), Hardiansyah *et al.*, (2021), Rusnawa and Purnawan (2020), Permana and tjahjadi (2020), Zuhrufiyah and Anggraeni (2019).

Based on the results of multiple linear regression tests using the SPSS application. The environmental cost variable has a significant positive effect on firm value. It can be seen from the

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coefficient value of 4.553 and a significance of 0.034. This means that the greater the environmental costs incurred by the company, the higher the value of the company. By continuously improving environmental quality, companies can increase *output* that is free from damage, so that companies can maximize profits and increase company value. Teori *Stakeholders* menjelaskan dalam aktivitas bisnis perusahaan tidak bisa lepas dari peran stakeholders, sehingga perusahaan perlu memuaskan stakeholders, salah satunya dengan cara mengungkapan biaya lingkungan yang dilakukan perusahaan setiap tahunnya pada *sustainibility report* atau *annual report.* The results of this study are not in line with previous research conducted by Hapsoro and Adyaksa (2020) and Ahmad (2021) who found that environmental costs have a negative effect on firm value, while this study found environmental costs have a positive effect on firm value.

Moderation Regression Analysis

Moderation regression test results

	Coefficient	Q	Sig.	Information
X1. Z	-162	-527	0.599	Rejected
X2. z	1,813	4,226	0.000	Accepted
X3. Z	-3,490	-1,210	0.227	Rejected
a= 5%=0.05 **R Square=0.525**				

Source: Secondary data processed in 2023

there is no interaction between industrial type and *green innovation* significant effect on firm value. The results of this study indicate that companies that are included in the *high-profile category have not implemented green innovation* practices both in their processes and production results. Based on the research of Singh *et al* . (2022) stated that best practice companies implementing green innovation generally describe the reality of large companies, small companies must better understand the characteristics of green innovation and require substantial funds.

Based on the results of the moderation regression test, it shows that the interaction between industry type and *carbon emission disclosure* has a significant positive effect on firm value. Based on the results of the research above, it shows that companies that are included in the category of *high-profile industries* and implement disclosure of carbon emissions can further increase the value of the company. Companies with *high profile* industrial types that are intensive in producing carbon emissions have also fully complied with government regulations regarding carbon emission reporting. The results of this study are in line with the research of Hardiansya *et al.* (2021) and based on signal theory, company efforts to pay more attention to the environment by disclosing carbon emissions can be good news for investors who invest in related companies because they remember that these companies are safe to invest in. This effort is also considered as one of the guarantees related to the continuity of the company's business. Thus, the type of industry can strengthen the relationship between the effect of disclosure of carbon emissions on firm value.

Based on the results of the moderation regression test, it shows that the interaction between industry types and environmental costs No significant positive effect on firm value. This means that the type of industry is not able to moderate the relationship between environmental costs on firm value in manufacturing, mining and financial companies. The hypothesis put forward by the researchers was rejected. Companies that generate high profits are classified as *high-profile industries* and should incur more environmental costs for their operations which intensively produce carbon emissions and damage the environment, compared to *low profile industries.*

CONCLUSIONS AND RECOMMENDATIONS

Based on the results and findings of the discussion described in the previous chapters, the conclusions that can be drawn include:

Green *innovation* has an effect on company value. The magnitude of the application of *green innovation* in the company's production process will increase the value of the company. *Carbon emission disclosure* affects the value of the company. The more information on carbon emissions disclosed in *the annual report* or *sustainability report* will increase the value of the company. Environmental costs affect the value of the company. The greater the environmental costs incurred by the company shows the greater the environmental social responsibility of the company and will increase the value of the company.

type does not moderate the relationship between *green innovation* and firm value. The type of industry moderates the relationship between *carbon emission disclosure* and company value. Industry type does not moderate the relationship between environmental costs to company value.

Limitations

This study has limitations, including researchers experiencing problems in analyzing disclosure of carbon emissions, because not all companies make detailed disclosures. There were quite a number of manufacturing and mining companies that did not disclose environmental aspects in their annual reports or sustainability reports during the study period. And there are quite a number of companies that experienced losses during the research period, especially in (2020-2021)

Suggestion

Based on the research that has been carried out there are several suggestions that can be submitted, as follows:

Future researchers are expected to be able to add other variables that affect firm value in order to obtain more accurate results. Future studies can reexamine the moderating variable in this study by adding a sample of the study.

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