The effect of green innovation , green house gas emission , and environmental performance on firm value

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ABSTRACT

This study looks at whether green innovation, greenhouse gas emissions, and environmental performance can affect company value. Companies included in the observation are SRI-KEHATI index companies from 2018 to 2022. The SPSS 26 application is used in this research's quantitative methodology to process panel data. Purposive sampling technique was used to select a sample with a total of 16 selected companies. The study observed company reports for 5 years, namely 2018-2022, so there were a total of 80 observations made for this study. The Indonesian Biodiversity Foundation website (www.kehati.or.id), the official websites of each company, and the IDX website (www.idx.co.id), were used to obtain secondary data for this study. Normality test, multicollinearity test, and heteroscedasticity test have been used to validate the data. According to this study, greenhouse gas emissions and green innovation both have a significant impact on company value. The value of the company will increase along with the increase in green innovation, conversely the value of the company will decrease if greenhouse gas emissions increase. While environmental performance has no significant effect on firm value.

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INTRODUCTION

Maintaining the company's viability can be achieved by maximizing its value, which is crucial as it reflects how the market perceives the company (Hirdinis, 2019). High company value indicates good performance and benefits shareholders. Chouaibi & Chouaibi (2021) found that social and ethical practices positively impact market valuation, contributing to the company's value over time. Environmental performance is also considered by stakeholders, alongside economic and social aspects (Agustia et al., 2019).

To enhance environmental performance, companies can implement green innovation strategies such as Green Process Innovation and Green Product Innovation (Agustia et al., 2019). These strategies positively and significantly affect firm value and can contribute to combating global warming and reducing carbon emissions (Nan et al., 2022).

The importance of the environment for companies cannot be overstated, as their survival and sustainability are dependent on it. As companies rely on natural resources for production, treating the environment as a stakeholder is essential (Utomo, 2019). Given conflicting results from previous research, this study aims to clarify whether the mentioned factors indeed influence firm value and resolve inconsistencies in prior studies.

Regarding the environmental performance variables, Yadav et al. (2016) and Uyar et al. (2022) both demonstrated a positive correlation between environmental performance and firm value. On the contrary, Ratri & Dewi (2017) found no significant impact of environmental performance on firm value. Yao et al. (2019) conducted their research in the context of emerging markets, specifically focusing on China, and discovered that environmentally friendly product and process innovations were negatively associated with firm value.

Given that Indonesia is also a developing country with similarities to China in terms of market conditions, this research aims to investigate whether similar results will be obtained in both countries. The study aims to shed light on the relationship between environmental performance and firm value in the Indonesian market

Based on the description above, this research is entitled **" The Influence of Green Innovation, Green House Gas Emission, and Environmental Performance t on Firm Value”.**

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THEORY REVIEW AND HYPOTHESIS DEVELOPMENT

Theoretical review serves as the foundation or foundation of a research. The theoretical review in this study is:

STAKEHOLDER THEORY

In 1984, Freeman introduced the definition of a stakeholder as "any group or individual capable of influencing or being influenced by the company's goal attainment." The stakeholder theory emphasizes that companies should not only prioritize benefits for shareholders but also consider the welfare of all stakeholders. This theory underlines the significance of organizational accountability beyond mere financial performance. According to Freeman (1984), stakeholders play a role in both strategic decision-making for long-term outcomes and normative decision-making, which encompasses social responsibility aspects. In this context, all stakeholders must have access to relevant information about the company's activities that could impact the decision-making process.

LEGITIMACY THEORY

Dowling & Pfeffer (1975) describe legitimacy as the alignment of business activities with accepted social values and approved behavior within the broader social system. According to this theory, legitimacy is an inherent aspect of business, arising from an implicit social contract between businesses and society. As a result, organizations operate within the boundaries defined by society, akin to locks on access to the market's products and resources (Campbell et al., 2002). To address the potential threat to their legitimacy, companies must enhance their disclosure and reporting practices.

THE EFFECT OF GREEN INNOVATION ON FIRM VALUE

The growth of business in society raises apprehensions about its potential negative impacts. While companies bring about positive changes, they are also associated with environmental concerns. Companies' attention to environmental issues is now a key factor considered by investors when selecting investment opportunities.

The relationship between green innovation and firm value is supported by legitimacy theory, which links a company's legitimacy to its alignment with social values and accepted norms within society (Dowling & Pfeffer, 1975). By adopting green innovation strategies, companies can establish their legitimacy and improve their long-term prospects by addressing

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environmental concerns. Agustia et al. (2019) affirm this, as their research indicates that green innovation positively and significantly affects firm value. Similarly, Zhang et al. (2020) found in their study that green innovation enhances the value of medium and high-end firms. However, Yao et al. (2019) discovered that green innovation has a negative impact on firm value in their research

Based on the description of the theory above and the differences in the results of previous studies, the hypothesis proposed is as follows:

H1:   Green Innovation has a positive effect on Firm Value

EFFECT OF GREENHOUSE GAS EMISSION ON FIRM VALUE

The stakeholder theory supports the relationship between greenhouse gas emissions and firm value. Freeman & Reid (1963) asserted that stakeholders, specific groups essential for a company's continuity, greatly influence its existence. Thus, considering stakeholders' interests can assist companies in achieving their goals (Ghozali & Chariri, 2007).

With the introduction of greenhouse gas-related regulations, various parties, including company stakeholders, are exerting pressure on companies to address these issues. Greenhouse gas emissions present a tangible risk for companies, particularly with the increasing shift towards a low-carbon economy (Rokhmawati et al., 2015). A company's decision to respond or ignore greenhouse gas issues can significantly impact the objective of maximizing firm value.

Saka & Oshika's (2018) research revealed that a company's carbon emissions have a negative correlation with its stock market value, while carbon management disclosure has a positive association with stock market value. Moreover, the positive link between carbon management disclosure and stock market value is more pronounced when carbon emissions volume is higher. Choi & Luo's study (2020) also supported this finding, demonstrating that carbon emissions have a detrimental effect on firm value.

Furthermore, Cooper's (2018) research indicated that a company's reputation for social responsibility does not shield it from negative stock value effects due to the impact of high corporate greenhouse gas emissions. Based on the description of the theory and previous research, the hypothesis is presented:

H2: Greenhouse Gas Emissions have a negative effect on Firm Value

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Companies need to align their economic, social, and environmental sustainability goals (Utomo, 2019). Environmental performance has become a focal point for business stakeholders and investors. It involves adopting green practices and engaging in environmental protection efforts (Bukit et al., 2018). Enhancing environmental performance also aims to establish legitimacy between the company and the community. Legitimacy is inherent to business and arises from a social contract between companies and society, as supported by Dowling & Pfeffer's (1975) legitimacy theory. Companies operate in accordance with societal norms, recognizing the importance of societal factors for long-term development. Therefore, companies take necessary steps to maintain their reputation as legitimate entities (Shamil et al., 2014). They also expect investors to respond positively to their environmental efforts, which can increase investors' interest in investing in the company (Hersugondo et al., 2019). An increase in company value is often reflected in rising stock prices, which reflect investors' perceptions of a company's future earning potential and growth (Jihadi et al., 2021).

Yadav et al. (2015) conducted research indicating a positive influence of environmental performance on firm value. This positive impact has been strengthening, indicating increasing investor expectations regarding consistent improvements in environmental performance. Similarly, Bukit et al. (2018), Khanifah et al. (2020), and Uyar et al. (2022) also found that environmental performance leads to higher firm value, implying a positive shareholder response to environmental engagement. However, Ratri & Dewi (2017) presented contrasting results, suggesting that environmental performance does not affect company value. Considering the discrepancies in the results of previous studies, the following hypothesis is proposed:

H3: Environmental Performance has an effect on Firm Value

Based on the theoretical basis and the derivation of the hypothesis, this research produces a conceptual framework. The interrelationship of these variables will be expressed in a conceptual framework which is described as follows:

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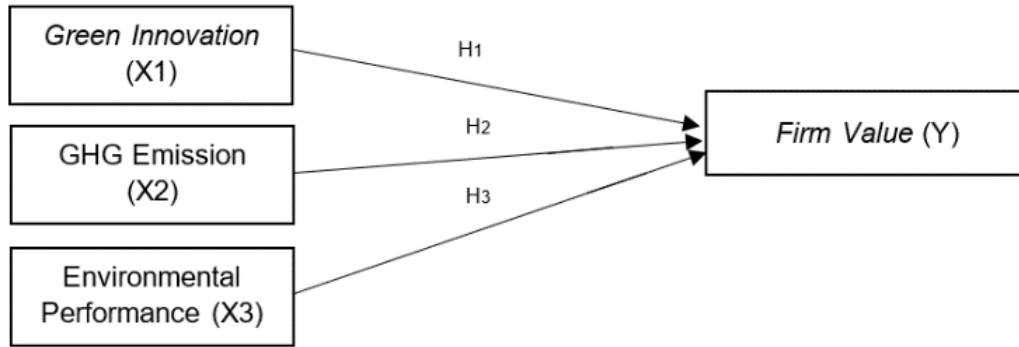
Figure 2.1 Research Model

RESEARCH METHODS

This research aims to explore how the disclosure of sustainability goals impacts green innovation, greenhouse gas emissions, and environmental protection, ultimately influencing the overall value of a company. The study relies on secondary data sources, including financial reports, evaluations from the SRI-KEHATI index, and corporate responsibility reports from 2018 to 2022. The population for this study comprises 41 companies that are included in the SRI-KEHATI index. From this population, the researcher selected a sample using a non-probability purposive sampling technique, where the sample is chosen based on specific criteria. The criteria for selecting the sample are as follows. The criteria are as follows:

Table 4.2 Sampling Criteria

No.	Criteria	Amount
1.	Non-bank companies included in the SRI-KEHATI index issuers in 2018-2022	34
2.	Companies that do not publish sustainability reports in the 2018-2022 period	(7)
3.	Companies with incomplete information	(11)
	The number of companies that meet the requirements as a sample	16
	Number of observations (16 x 5 years)	80

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Secondary data in this study are company financial reports from the official IDX website, namely www.idx.co.id, information on evaluating the SRI KEHATI index from the website www.kehati.go.id , and sustainability reports from the official websites of each company. The following is a variable measurement scale:

a. Green Innovation encompasses various forms of innovation aimed at minimizing environmental harm and optimizing the efficient utilization of natural resources. The measurement of this variable is conducted through content analysis, as established in prior research conducted by Xie et al. (2019). This variable is measured by the index:

  1) aims to decrease consumption while enhancing resource and energy efficiency.
  2) involves the utilization of recycled materials, recycling techniques, and environmental technologies.
  3) involves the execution of an environmental campaign.
  4) entails the utilization of pollution control equipment.
  5) includes the adoption of pollution control projects and technologies.
  6) involves modifying product designs to avoid the use of pollutants or toxic compounds during production.
  7) focuses on enhancing and designing eco-friendly packaging for both existing and new products
  8) product design modification aims to increase energy efficiency during use.

b. GHG Emissions, It is characterized as the release of seven different gases that directly contribute to climate change: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF6), and nitrogen trifluoride (NF3). This study uses the CO_2e intensity formula as a proxy for GHG emission based on previous research by Andewi Rokhmawati et al (2015). This variable is measured by the formula:

$$\text{CO2e Intensity }_{(t)} = \frac{\text{Tons of Co2e}}{\text{Revenue}_{(t)}}$$

c. Environmental performance, shows the company's efforts to reduce resource consumption and emissions (Yoon et al., 2018). In this study, environmental performance was measured using the formula used in a study by Lucato et al (2013) which measured the value of

environmental performance at the level of company eco-efficiency. The level of company efficiency is divided into two indicators, namely based on:

$$e_1 = \frac{\text{Monthly Net Revenue}}{\text{Monthly Energy Consumption}} \quad (1)$$

$$e_2 = \frac{\text{Monthly Net Revenue}}{\text{Monthly Water Consumption}} \quad (2)$$

The formula for calculating the number of eco-efficiency levels above is:

$$EM_t = \frac{e1 \times e2}{4}(3)$$

d. Firm Value , is the price a buyer is willing to pay each time the business is sold and reflects the value of the business at that time (Hardiyansyah et al ., 2020). An increase in company value is usually marked by an increase in stock prices, which reflects investors' perceptions of the company's ability to generate and grow profits in the future (Jihadi et al ., 2021). In this study, firm value is measured by the Tobin's Q number:

$$Tobin's\ Q = \frac{\text{Total Market Value} + \text{ TBV of Liabilities}}{\text{TBV ofAsset}}$$

Classic assumption test

a. Normality test

The fulfillment of the assumption of normally distributed data is essential in the regression model. Hence, the purpose of conducting a normality test is to examine whether the confounding or residual variables in the regression model exhibit a normal distribution (Hamid et al., 2020). In this study, the normality test was performed using the Kolmogorov-Smirnov test, where:

1) If the probability value of KS > 0.05 then the residuals are normally distributed
2) If the probability value of KS < 0.05 then the residuals are not normally distributed

b. Multicollinearity Test

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Multicollinearity refers to a situation in a multiple regression model where there is a significant correlation or association between two or more independent variables. The purpose of the multicollinearity test is to detect any departures from the classic multicollinearity assumption, which assumes a linear relationship among the independent variables in the regression model (Matondang & Nasution, 2021). The decision criteria for the multicollinearity test are:

1) If the VIF value < 10, it means that multicollinearity does not occur

2) If the VIF value > 10, multicollinearity is stated

c. Heteroscedasticity Test

The existence of a residual variance in the regression model that is not the same indicates a symptom of heteroscedasticity. Conversely, if the variance of the regression model variable has the same (constant) value, this shows symptoms of homoscedasticity (Hamid et al., 2020). A good regression model must be free from symptoms of heteroscedasticity, which means that the data can represent various sizes. To determine whether this study shows evidence of heteroscedasticity, the Glejser test was performed, where the decision criteria for this test were:

1) If the significance value is > 0.05, then there is no heteroscedasticity

2) If the significance value is < 0.05, then there is heteroscedasticity

Hypothesis test

a. Determination Coefficient Test (R^2)

The coefficient of determination test (R^2) is employed to assess the collective impact of the independent variables on the dependent variable. R^2 ranges between 0 and 1. A small coefficient value suggests that the capacity of the independent variables to collectively explain the dependent variable is considered limited, whereas a higher value indicates a stronger explanatory power of the independent variables on the dependent variable (Priyatno, 2016).

b. t-test

he partial test, also known as the t-test, is conducted to examine whether the independent variable has a significant influence on the dependent variable. According to Sugiyono (2018),

the t-test serves as a tool to address a specific research question that pertains to the relationship between two or more variables. The decision criteria for the t-test are:

1) If the p-value is > 0.05, the independent variable has no significant effect on the dependent variable

2) If the p-value <0.05, the independent variable has a significant effect on the dependent variable.

RESULTS AND DISCUSSION

Classic assumption test

a. Normality test

The objective of the normality test is to examine the normal distribution of confounding or residual variables in a regression model (Hamid et al., 2020). The normality test in this study was conducted using the Kolmogorov-Smirnov test.

Table 4.1 Kolmogorov-Smirnov Test Results

		Unstandardized Residuals
N		80
Normal Parameters [a,b]	Means	.0000000
	std. Deviation	3.04847216
Most Extreme Differences	absolute	.231
	Positive	.231
	Negative	-.173
Test Statistics		.069
asymp. Sig. (2-tailed)		.200 [c,d]

Source: Data processed with SPSS, 2023.

Asymp value. Sig. (2-tailed) of 0.200 or greater than 0.05 so that the assumptions are met indicating that the data is normal.

b. Multicollinearity Test

Multicollinearity is a state that reveals a robust correlation or connection between two or more independent variables within a multiple regression model. The purpose of conducting the multicollinearity test is to ascertain whether there are any departures from the classical

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multicollinearity assumption, which assumes a linear relationship between the independent variables in the regression model (Matondang & Nasution, 2021).

Table 5.3 Multicollinearity Test Results

Variables	tolerance	VIF	Information
GI	.866	1.155	Multicollinearity does not occur
GHG	.593	1687	Multicollinearity does not occur
EP	.578	1,729	Multicollinearity does not occur
SDGs	.925	1,081	Multicollinearity does not occur

Source: Data processed with SPSS, 2023.

The results of the multicollinearity test show that each variable has a VIF value <10 and a tolerance value above 0.1. The values above indicate that the assumptions are met so that multicollinearity does not occur in each variable.

c. Heteroscedasticity Test

A good regression model must be free from symptoms of heteroscedasticity. This indicates that the residual variance from one observation to another is fixed (homoscedasticity).

Table 4.3 Heteroscedasticity Test Results (Glesjser Test)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	std. Error	Betas		
(Const)	.461	.275		1673	.098
X1	.019	.187	012	.100	.921
X2	-.044	.030	-.217	-1,477	.144
X3	-.006	013	-.069	-.463	.645
Z	-.032	.106	-.035	-.297	.767

Source: Data processed with SPSS, 2023.

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Based on the Glejser test results, it was found that the significance value of each variable was > 0.05 so that the basis for decision making was fulfilled. This indicates that there is no heteroscedasticity problem in the regression model.

Hypothesis testing

a. Coefficient of Determination (R^2)

The coefficient of determination test (R^2) was conducted to assess the collective impact of the independent variables on the dependent variable. R^2 ranges from 0 to 1. A small coefficient value indicates that the independent variables' ability to jointly explain the dependent variable is limited, while a higher value suggests a stronger explanatory power of the independent variables on the dependent variable (Priyatno, 2016).

Table 4.4 Test Results for the Coefficient of Determination

Summary models				
Model	R	R^2	Adjusted R Square	std. Error
1	.780 [a]	.609	.594	.17550

Source: Data processed with SPSS, 2023.

From the data presented in the table, it is evident that the coefficient of determination is 0.609. This implies that the collective influence of the independent variables on the dependent variable accounts for 60.9%. The remaining 39.1% is influenced by other variables beyond the scope of this study.

t-test

Partial t test was conducted to find out whether each independent variable has an influence on the dependent variable, in this case the independent variables are Green Innovation, GHG Emission, Environmental Performance on the dependent variable, namely Firm Value .

Table 4.5 T-test results

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	std. Error	Betas		
(Const)	.103	.116		.890	.376

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X1	.589	076	.577	7,708	.000
X2	-.062	012	-.458	-4,951	.000
X3	006	006	.100	1058	.293

Source: Data processed with SPSS, 2023.

Based on the test results above, the resulting linear regression equation is:

$$Y = 0.103 + 0.589X_1 - 0.062X_2 + 0.006X_3 + e$$

The above equation is explained as follows:

a. The unstandardized coefficient (B) value for the constant is 0.103. This indicates that when the Green Innovation, GHG Emission, and Environmental Performance variables are assumed to have a value of 0, the Firm Value variable value will increase by 0.103.

b. The unstandardized coefficient (B) value for the Green Innovation variable (X1) is 0.589. This implies that if there is an increase of one unit in the Green Innovation variable value, the Firm Value variable value will increase by 0.589.

c. The unstandardized coefficient (B) value for the greenhouse gas emission variable (X2) is -0.062. This means that if there is an increase of one unit in the greenhouse gas emission variable value, the Firm Value variable value will decrease by 0.062.

d. The unstandardized coefficient (B) value for the Environmental Performance variable (X3) is 0.006. This signifies that if there is an increase of one unit in the value of the Environmental Performance variable, the Firm Value variable value will increase by 0.006

The results of partial hypothesis testing are as follows:

a. Green Innovation variable (X1) on Firm Value (Y)

The p-value for the green innovation variable is 0.000. This low p-value indicates that the green innovation variable (X1) significantly influences the firm value variable (Y), as the p-value is less than the significance level of 0.05. The coefficient value of 0.589 is positive, which implies a positive influence of variable X1 on variable Y. In other words, as the green innovation value increases, the firm value generated by the company also increases. Conversely, if the green innovation value decreases, the firm value generated by the company also decreases.

b. Effect of Greenhouse Gas Emissions (X2) on Firm Value (Y)

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The p-value for the greenhouse gas emission variable is 0.000. This small p-value indicates that the greenhouse gas emission variable (X2) significantly affects the firm value variable (Y), as the p-value is less than the significance level of 0.05. The coefficient value of -0.062 is negative, indicating a negative influence of variable X2 on variable Y. In other words, as the greenhouse gas emission value increases, the firm value generated by the company decreases. Conversely, if the greenhouse gas emission value is low, the firm value generated by the company increases.

c. Effect of Environmental Performance (X3) on Firm Value (Y)

The p-value for the environmental performance variable is 0.293. This value suggests that the environmental performance variable (X3) does not have a significant impact on the firm value variable (Y), as the p-value is greater than the significance level of 0.05. The coefficient value of 0.006 is positive, indicating a positive influence of variable X3 on variable Y. This implies that if the environmental performance value increases, the firm value generated by the company will also increase. On the contrary, if the environmental performance value is low, the firm value generated by the company will decrease. However, it's worth noting that this effect is very small or insignificant.

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Based on the results of the partial test, it was observed that the green innovation variable had a positive impact on the firm value variable, as indicated by a significant value of 0.0000, which is less than the threshold of 0.05. Therefore, hypothesis 1 was accepted.

This finding aligns with the principles of legitimacy theory, which emphasize a company's alignment with societal norms and values in conducting its business. Implementing a green innovation strategy allows companies to establish legitimacy and enhance their long-term prospects by addressing environmental concerns. This is supported by the positive coefficient values, indicating that an increase in green innovation leads to a corresponding rise in firm value.

These results are in line with previous research by Dai & Xue (2022), Wicaksono et al. (2021), Zhang et al. (2020), Agustia et al. (2019), and Yao et al. (2019), all of which reported similar findings, further confirming that green innovation has a positive influence on firm value

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Based on the partial test results it was found that the greenhouse gas emission variable had a negative effect on the firm value variable , where the significant value was 0.0000 <0.05 so it could be concluded that hypothesis 2 was accepted.

This finding is consistent with the principles of stakeholder theory, which posit that a company operates not solely for its own benefit but also has an obligation to provide benefits to its stakeholders. The company's decision to address or ignore the issue of greenhouse gas emissions can significantly impact its goal of maximizing firm value. The study's results indicate a negative correlation between greenhouse gas emissions and firm value, meaning that higher greenhouse gas emissions produced by a company are associated with lower firm value. This aligns with previous research supporting these results, such as studies conducted by Choi & Luo (2020), Saka & Oshika (2018), and Cooper (2018).

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Based on the partial test results it was found that the environmental performance variable had no effect on the firm value variable , where the significant value was 0.1419 > 0.05 so it could be concluded that hypothesis 3 was rejected.

The observed relationship between environmental performance variables and firm value in the studied companies does not align with the theoretical predictions. Surprisingly, environmental performance does not appear to be a determining factor for the company's value. These findings contradict legitimacy theory, which suggests that improving environmental performance to meet societal expectations can grant companies access to markets and resources.

Furthermore, these results do not concur with previous research conducted by Bukit et al. (2018), Khanifah et al. (2020), and Uyar et al. (2022), all of which found a positive relationship between company performance and firm value. However, other studies by Soedjatmiko, Tjahyadi, and Soewarno (2021) and Ratri & Dewi (2017) support the current researchers' findings, indicating that there is no direct and significant impact between environmental performance and company value.

These results indicate that even though a company exhibits good environmental performance, it might not be sufficient to convince the market that the company is managing its natural resources effectively. Measuring company value requires considering factors beyond environmental performance alone.

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CLOSING

CONCLUSION

Based on the research objectives and the results of hypothesis testing as previously presented, it can be concluded that:

a. The green innovation variable positively influences the company value variable. This outcome is consistent with legitimacy theory, as green innovation strategies enable companies to establish legitimacy and improve long-term survival prospects by addressing environmental concerns.

b. The high emission variable negatively impacts firm value. This result is in line with stakeholder theory, which highlights that the introduction of regulations concerning greenhouse gases draws attention from various stakeholders, prompting companies to implement efficiency measures to reduce annual greenhouse gas emissions.

c. The environmental performance variable does not demonstrate a positive and significant effect on firm value. These findings contradict legitimacy theory, which suggests that enhancing environmental performance to gain legitimacy with both companies and society can facilitate access to products and market resources

RESEARCH IMPLICATIONS

The results of this study provide implications both theoretically and practically. The implications are as follows:

a. The findings in this study are expected to provide benefit on development of theory regarding environmental related factors that can influence firm value. Empirical evidence regarding several factors that affect company value can be used as a reference in further research related to green innovation, high emission, environmental performance, firm value, and sdgs disclosure variables.

b. This research is expected to be a consideration for parties who play a role in managing the company, especially regarding company activities that can damage the environment and have an impact on company value. In addition, it is hoped that the results of the research can also be taken into consideration by investors before making an investment.

RESEARCH LIMITATIONS

This study has several limitations, therefore the results obtained are not optimal. The limitations related to this research are as follows:

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a. This study only takes a population of companies that have been listed on the SRI-KEHATI index so that the results of this study cannot be generalized broadly.

b. The number of samples is also not large because some companies do not publish or do not have a complete sustainability report in the range of years of research so that the information needed for research is not available.

SUGGESTION

The following are suggestions from researchers related to this research:

a. Future researchers can expand the study population so that the results can be more generalizable

b. Future researchers can look for/develop other measurements in addition to using certain indices related to the variables being measured to avoid subjectivity in assessing variables.

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