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# GREENHOUSE GAS EMISSION AND THE SDGs: HOW ENVIRONMENTAL PERFORMANCE SHAPE CORPORATE VALUE

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**Abstract**

The research problem arises from growing investor concern over the environmental risks of greenhouse gas (GHG) emissions and the long-term value of strong Sustainable Development Goals (SDGs) practices. This study examines the effect of GHG emissions and SDG practices on firm value, with environmental performance as a moderating variable. The sample includes manufacturing companies listed on the Indonesia Stock Exchange (IDX) that consistently participate in the PROPER program. using purposive sampling and multiple linear regression analysis, the findings show that GHG emissions negatively affect firm value, while sustainability practices have a positive effect. Furthermore, environmental performance strengthens both the negative effect of GHG emissions and the positive effect of SDG practices on firm value. These results emphasize the theoretical role of environmental and sustainability factors in firm valuation and provide practical implications for managers and regulators to view environmental initiatives as value drivers.

## INTRODUCTION

In today's modern era, the term "global warming" has become commonplace among the public. In addition to knowing the causes and impacts on the environment. According to Satya (2019), although the impact of global warming is slow and over a fairly long period of time, it has had an impact on

society today. The Intergovernmental Panel on Climate Change has reported for years, namely since 1995-2006, which became the year that ranked the hottest in global instrumental records, with a surface temperature of 0.74°C (0.56 to 0.92)°C (IPCC, 2023). And it is predicted that in the next 70 years since 1940, the temperature on the earth's surface will continue to increase by approximately 0.50°C. According to Anggraeni (2015), the investors and stakeholders from Australia, America, Japan and others are increasingly value environmental responsibility alongside financial performance. The World Bank in 2021 reported that the top 10 largest greenhouse gas emitters including Indonesia. The World Bank in 2021 reported that the top 10 largest greenhouse gas emitters including Indonesia, with 780 million metric tons. Which was also stated by the Global Carbon Project, where Indonesia was ranked 7th with a total of 641 million metric tons of emissions, after Germany and Japan. Indonesia's efforts in the phenomenon of climate change are initiated by the establishment of laws and presidential regulations. Which are described in Presidential Regulation of the Republic of Indonesia (2021). Indonesia has set a commitment to reduce carbon emissions by 26 percent, or approximately 0.67 GT, for the forestry sector in the coming year, 2020. Not only that, the commitment continues and is planned for 2020-2030, is to reduce emissions by another 29 percent to 41 percent, or approximately 2.87 GT, in all sectors if supported by foreign aid.

Indonesia has issued binding provisions regarding the obligation of companies to prepare sustainability reports, as stipulated in the Presidential Regulation of the Republic of Indonesia (2007) concerning Limited Liability Companies (PT). Article 74, paragraph 1, states that “companies conducting business activities in the field of and/or related to natural resources are required to carry out social and environmental responsibilities.” Failure to comply with these obligations subjects to sanctions in accordance with prevailing laws and regulations. Anggraeni (2015) emphasized that corporate achievements or performance related to the environment can be disclosed through sustainability reports, which serve as valuable information for stakeholders and as a basis for decision-making to ensure long-term corporate sustainability. Similarly, Harymawan et al. (2019) highlighted that such disclosures are intended to provide essential information for interested parties. In relation to corporate responsibility for the environment, the Indonesian government has introduced the Company Performance Rating Program (PROPER), implemented by the Ministry of Environment and stipulated in the Presidential Regulation of the Republic of Indonesia 2009. According to Article 1 paragraph (1) of the Regulation of the Minister of State for the Environment No. 18 of 2010, PROPER is defined as a program for assessing corporate responsibility in controlling environmental pollution and damage. This study employs a sample of manufacturing companies in Indonesia, as sustainability and environmental issues in the country remain largely voluntary (Burhanuddin et al., 2025). Based on the evidence by the OJK report, in 2016 only 49 listed companies contributed to sustainability and environmental aspects. Such conditions indicate that the level of corporate involvement remains relatively low, consistent with the PROPER program that only began to be widely adopted in the early 2000s, particularly among large-scale industries, and the PROPER program is suitable for this study, as it provides a standardized measure of the environmental sustainability aspect linked to firm value (Damas et al., 2021).

Damas et al. (2022) provides a new understanding that, especially in Indonesia, the implementation of SDGs has had various positive influences on company value, especially in financial, reputational, and competitive aspects, because investors are increasingly paying attention to sustainability aspects in making investment decisions. In practice, the implementation of SDGs and carbon management is very important for companies and management because it helps improve business sustainability, attract investors, and strengthen reputation in the global market (Kurniawan et al., 2018). For companies, SDGs contribute to operational efficiency, product innovation, and regulatory compliance, which can increase long-term value. Meanwhile, for management, SDGs provide a framework for responsible strategic decision-making, ensuring a balance between profitability and social and environmental impacts. By implementing SDGs, companies not only meet stakeholder expectations but are also better prepared to face future business challenges (Yu & Zhao, 2015; Pujiningsih, 2020).

Choi & Luo (2021) and Octaceria & Rahardja (2020), which successfully proved that carbon emissions affect company value. Choi & Luo, (2021), which obtained significant results that GHGs have a positive effect on company value, which is in line with Anggraeni (2015) that adding a moderating variable, namely environmental performance, because it is able to moderate GHG emissions on company value. In addition, research on environmental performance has also been conducted by Dohrmann et al. (2025), Effendi (2021), Ratri & Dewi (2017), and Damas et al. (2021). Contrast this to Kurniawan et al. (2018), who obtained the results that only economic performance can influence company value positively and significantly.

Legitimacy theory emphasizes the dynamic interaction between companies and their surrounding environment, where legitimacy is achieved when a company's activities align with prevailing social values (Mousa et al., 2015; Baah et al., 2021). When public perception of a company's actions becomes negative, firms intensify efforts to manage these perceptions to maintain legitimacy, particularly in the eyes of external stakeholders such as the community and regulators. This view is closely connected to stakeholder theory, which, as described by Freeman (2004), recognizes stakeholders as individuals or groups that can influence or be influenced by corporate objectives. Baah (2020) further highlights that stakeholder support is crucial for organizational sustainability, while Gutterman (2023) underscores the company's duty to disclose relevant information to secure trust and legitimacy. In this context, signalling theory also plays an important role, as companies use both positive and negative disclosures to reduce information asymmetry between management and external stakeholders, thereby influencing perceptions of firm value (Choi & Luo, 2021; Anggraeni, 2015).

One area where these theoretical perspectives converge is in addressing environmental challenges, particularly GHG emissions. GHGs, including $CO_2$ and $CH_4$ as defined by the Presidential Regulation of the Republic of Indonesia (2021), are major contributors to global warming, with $CO_2$ being the dominant pollutant. In response, companies increasingly adopt sustainability reporting that discloses not only financial indicators, such as Earnings per Share (EPS), but also environmental and social impacts to strengthen accountability and reinforce legitimacy among stakeholders (Astuti & Juwenah, 2017). Environmental performance, therefore, becomes a strategic response to stakeholder expectations and a mechanism to enhance market value, particularly in high-impact industries such as construction (Utomo et al., 2020; Baah et al., 2021).

Research examining the relationship between emissions and company value has inconsistent findings. Anggraeni (2015) identified a positive relationship, indicating that disclosure of GHG emissions can enhance company value. In contrast, Perdichizzi et al. (2024) found a negative impact, suggesting that GHG emissions are perceived negatively by stakeholders, potentially reducing firm value (Ali, 2020). Supporting the positive perspective, Choi & Luo (2021) concluded that carbon emission disclosures positively influence market value. However, Harahap et al. (2018) and Sudibyo (2018) reported no significant relationship, though Perdichizzi et al. (2024) highlighted a positive link between environmental disclosure, including GHG emissions, and firm value. These mixed inconsistent findings can be explained through several theoretical perspectives. Legitimacy theory posits that companies disclose environmental information, such as GHG emissions, to align with societal expectations and maintain legitimacy Effendi (2021). Stakeholder theory emphasizes that transparent disclosure addresses the concerns of key stakeholders, thereby strengthening firm reputation and potentially increasing value. Meanwhile, signalling theory suggests that GHG emission disclosures serve as a credible signal of environmental responsibility and effective risk management to investors and the market Dohrmann et al. (2025).

Research on the impact of sustainability performance on company value has produced inconsistent results. Rajabi et al. (2022), Kurniawan et al. (2018), and Rahardja (2024) demonstrated a positive effect, indicating that companies with robust sustainability performance are rewarded by investors. Conversely, Astuti & Juwenah (2017) found that only the economic dimension of sustainability reporting has a significant effect on company value, while social and environmental aspects has not. Nonetheless, sustainability reporting is widely seen as a mechanism to support corporate legitimacy and enhance stakeholder trust by providing transparent information on social and environmental activities (Pujiningsih, 2020). From the legitimacy theory perspective, sustainability

performance enables companies to align their operations with societal expectations, thereby maintaining their social license to operate (Saidi et al., 2025). Stakeholder theory further explains that disclosing sustainability activities builds stronger relationships with stakeholders, which can translate into higher firm value. In line with signalling theory, such disclosures are also perceived as positive signals of responsible management and long-term value creation, thereby attracting investors. On the other hand, Nguyen (2020) alerts that sustainability efforts might drain financial resources and reduce shareholder value.

The role of environmental performance in moderating the relationship between GHG emissions and company value also remains debatable. Dohrmann et al. (2025) and Effendi (2021) suggest that environmental performance has a significant positive effect on firm value, indicating that proactive environmental management enhances corporate reputation and stakeholder confidence. However, Ratri & Dewi (2017) found that environmental performance does not significantly influence firm value. Drawing on legitimacy, signalling, and stakeholder theories, companies that effectively manage their environmental responsibilities are likely to receive positive community responses, strengthen their image, and increase investor loyalty, ultimately boosting firm value (Damas et al., 2021). Despite these assertions, Deswanto & Siregar (2018) obtained contrary findings, further highlighting the complexities of these relationships.

In this context, environmental performance becomes particularly relevant when examined as a moderating factor. High environmental performance ensures that disclosures of sustainability practices and GHG emission management are perceived as substantive rather than symbolic, thereby reinforcing their impact on firm value. Conversely, weak environmental performance may dilute the influence of such disclosures, as stakeholders might perceive them as lacking credibility. Lastly, environmental performance is also expected to moderate the relationship between sustainability performance and company value. Dohrmann et al. (2025), along with Choi & Luo (2021), emphasize that environmental policies can drive technological innovation, reduce environmental costs, and increase revenue, ultimately enhancing company value. This view aligns with legitimacy and stakeholder theories, wherein superior environmental performance serves as a signal of responsible management, enhancing stakeholder confidence and perceived firm value. However, Harahap et al. (2018), Ratri & Dewi (2017), and Utomo et al. (2020) reported that environmental performance does not always influence company value, underscoring the ongoing debate in the literature. Environmental performance is employed as a moderating variable because it strengthens the relationship between sustainability performance, greenhouse gas emissions, and firm value. Without adequate environmental performance, disclosures on sustainability and emissions may be perceived as symbolic rather than substantive, thereby weakening their impact on firm value. However, when environmental performance is strong, it provides legitimacy, enhances stakeholder trust, and ensures that sustainability efforts are translated into tangible improvements in firm value.

In addition, this study employs five control variables to capture other financial factors that may influence firm value beyond the main variables, employing multiple linear regression analysis. Beyond sustainability dimensions, several financial and governance factors also play a vital role in influencing firm value. EPS reflects a company's ability to generate profits per share and remains a primary concern for shareholders as key stakeholders (Arsal, 2021; Ichsani et al., 2021). Free cash flow (FCF) demonstrates the availability of net cash after operational and investment needs, providing assurance to investors, creditors, and other parties regarding long-term financial health (Hiya & Syafi, 2021). Capital structure represents a company's financing strategy, balancing risk and return, which increases the confidence of both shareholders and creditors in its financial stability (Bui et al., 2023; Handini & Susilo, 2025). Environmental costs, though often considered a financial burden, function as a legitimacy tool that enables companies to secure broader social support and strengthen their corporate image in the eyes of regulators, governments, and the public (Dinniyah & Nuzula, 2021; Fristianti & Komara, 2023). Meanwhile, managerial ownership aligns the interests of managers with those of shareholders, mitigating agency conflicts and enhancing decision-making quality (Bhakar et al., 2024; Haron et al., 2021). Overall, these factors also play an important role beyond sustainability aspects in influencing firm value (Figure 1).

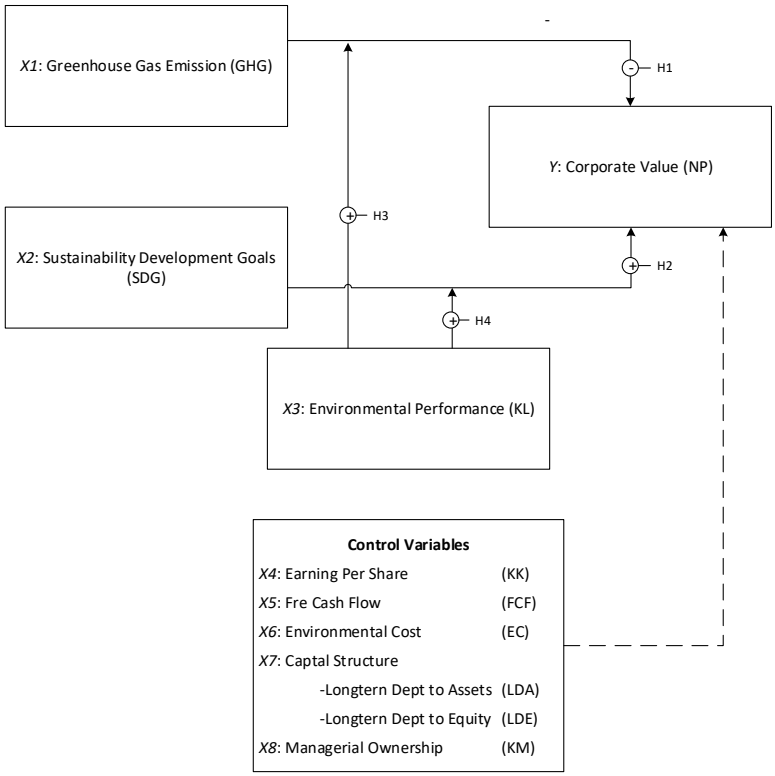


Figure 1. Research Framework

## METHOD

This study is quantitative research consisting of three main variables (two independent variables and one moderating variable) to examine their effect on firm value. This study uses environmental performance as a moderating variable because it strengthens the link between sustainability efforts, emissions reduction, and firm value. Without strong environmental performance, disclosures may look symbolic, but when the environmental performance is strong, it builds trust, legitimacy, and value. The model is tested using multiple regression analysis with secondary data. from various sources. First, the Ministry of Environment and Forestry's PROPER evaluation reports for the period 2019–2023, based on official decrees (SK) and publicly accessible, were used to obtain ordinal scale data for the environmental performance variable. Second, the financial reports and Yahoo Finance data were utilized to generate nominal- and ratio-scale data for variables such as firm value, earnings per share, free cash flow, environmental cost, and capital expenditure. Third, annual reports and sustainability reports were analysed to assess SDG performance and greenhouse gas emissions through content analysis, which was then quantified using a scoring method to produce ratio-scale data. In addition, certain qualitative information was transformed into dummy variables, particularly for managerial ownership.

Purposive sampling was employed to select samples based on specific criteria. Data was collected from manufacturing companies listed on the Indonesia Stock Exchange (IDX) during 2019–2023, using information from Invesnesia and the official IDX website. The list was cross-checked with the Ministry of Environment and Forestry's PROPER reports (2019–2023) to identify consistently participating companies and exclude inconsistent data. Further screening excluded companies with incomplete data, such as incomplete annual reports for 2019–2023, financial statements not reported in rupiah, or those reporting financial losses. A final sample of 100 companies that consistently participated in the PROPER program from 2019 to 2023 was considered most suitable for this study, as their consistent participation ensures completeness and comparable data across years, enhancing the validity of the analysis (Table 1).

Table 1. Total Sample

| No | Sampling Determination Criteria | Sources | Amount |
|---|---|---|---|
| 1 | Manufacturing Companies Listed on the IDX in 2019-2023 | Invesnesia and BEI Website | 193 |
| 2 | Number of Manufacturing Companies Listed on the IDX that not Consistently Participating in PROPER (2019–2023) | SK MENLHK | (155) |
| 3 | Companies that do not have complete data (Annual Report or Sustainability Report) 2019-2023 | Company and BEI website | (4) |
| 4 | Companies with negative gross profit (Loss) | Financial Report | (9) |
| 5 | Financial reports do not use the rupiah currency unit | Financial Report | (5) |
| 6 | Number of companies that meet the sample criteria | | 20 |
| 7 | Number of company data processed (20 × 5 year) | | 100 |
| **Number of sample observed studied in 2019-2023** | | | **100** |

Source: Data Processed

Additionally, the PROPER program provides a standardized measure of environmental performance, making it directly relevant for examining the role of environmental performance as a moderator between greenhouse gas emissions, sustainability performance, and firm value, while the sample size is adequate to provide sufficient statistical power and minimize bias from occasional participants. All collected data were subsequently analyzed through descriptive statistical tests, classical assumption tests, and hypothesis testing to provide an interpretation based on previous research using the regression model described in the following section.

Research Model → Multiple Regression

$$NP = \beta0 + \beta1GHG + \beta2SDR + \beta3GHG*KL + \beta4SDR*KL + \beta5KK + \beta6CFC + \beta7EC + \beta8LDA + \beta9LDE + \beta10KM + \varepsilon$$

The research model above represents the formulation used in the data processing and analysis stages of this study, which examines the factors influencing firm value. Coefficients β1 to β4 represent the design of the hypotheses, while β5 to β10 are control variables.

Papoutsi & Sodhi, (2020) stated that GHGs emission variable is measured using the Greenhouse Gas Reporting Index (GGRI) which has been used by Choi & Luo, 2021) as an earlier and update by Damas et al. (2021) by giving a score of 1 for the disclosed items, then dividing the total items disclosed by the expected number, which consists of 7 categories with a total of 29 items. This study identifies several limitations of the proxy used in previous research by Choi & Le Luo (2021) and Damas et al. (2021) that only tends to focus primarily on the completeness of information disclosure (Patrick Velte, 2020). Therefore, this research refines the existing measurement tool by adopting the approach proposed by Gunawan & Abadi (2017) and developing a scoring scale tailored to the contextual relevance of each disclosure item Table 2 with the final count of formulation is as follows:

$$GHG = \frac{\sum Item\ Valuation}{\sum Item\ Index}$$

Table 2. Greenhouse Gas Emisison Index

| Item Code | Item | Valuation |
|---|---|---|
| CC-1 | Assessment/description of risks (both specific and general regulations) related to climate change and actions taken to manage those risks. | 0 = Have No Action<br>1 = Have an Action |
| CC-2 | Current (and future) assessment/description of the financial implications of climate change. | 0 = No Disclose<br>1 = Decrease Assesment Result<br>2 = Increase Assessment Result |
| CC-3 | Current and future assessment/description of business implications and opportunities related to climate change. | 0 = No Disclose<br>1 = Decrease Assessment Result<br>2 = Increase Assessment Result |

| | | |
|---|---|---|
| CC-4 | Other information regarding climate change. | 0 = No Disclose<br>1 = Disclose |
| GH-1 | Description of the methodology used to calculate greenhouse gas emissions (e.g., GHG protocol or ISO). | 0 Have no Methode<br>1 = Have a Methode<br>2 = Improvement Methode |
| GH-2 | Presence of external verification for GHG emission quantification, by whom and on what basis. | 0 = Have no External Assurance<br>1 = Have an external assurance |
| GH-3 | Total greenhouse gas emissions (in metric tons) produced. | 0 = No disclose<br>1 = Increase of Amount t-1<br>2 = Decrease of Amount t-1 |
| GH-4 | Disclosure of GHG emissions based on their source (e.g., coal, electricity, etc.). | 0 = No disclose<br>1 = Increase of Amount t-1<br>2 = Decrease of Amount t-1 |
| GH-5 | Disclosure of GHG emissions by facility or segment level. | 0 = No disclose<br>1 = Increase of Amount t-1<br>2 = Decrease of Amount t-1 |
| GH-6 | Comparison of GHG emissions with previous years. | 0 = No disclose<br>1 = Increase of Amount t-1<br>2 = Decrease of Amount t-1 |
| GH-7 | Other information regarding greenhouse gases (e.g., awards). | 0 = No disclose<br>1 = Have supporting information |
| EC-1 | Amount of energy consumed (e.g., terajoules or petajoules). | 0 = No disclose<br>1 = Increase of Amount t-1<br>2 = Decrease of Amount t-1 |
| EC-2 | Calculation of energy used from renewable resources. | 0 = No disclose<br>1 = Increase of Amount t-1<br>2 = Decrease of Amount t-1 |
| EC-3 | Disclosure by type (e.g., coal, electricity, etc.). | 0 = No disclose<br>1 = Disclose |
| EC-4 | Disclosure by facility or segment. | 0 = No disclose<br>1 = Disclose |
| EC-5 | Comparison of energy usage with previous years or reduction target levels. | 0 = No disclose<br>1 = Increase of Amount t-1<br>2 = Decrease of Amount t-1 |
| EC-6 | Other information regarding energy consumption. | 0 = No disclose<br>1 = Have supporting information |
| RC-1 | Details of plans or strategies to reduce GHG emissions. | 0 = Have no Plans<br>1 = Have Plans<br>2 = Plant Development |
| RC-2 | Details of GHG emission reduction target levels and target years. | 0 = No disclose / no target<br>1 = Have lower Target<br>2 = Have higher target |
| RC-3 | Emission reductions and current cost savings achieved as a result of emission reduction plans. | 0 = No disclose / no saving<br>1 = Have Saving<br>2 = Have saving and future plans |
| RC-4 | Future emission costs considered in capital expenditure planning. | 0 = No disclose<br>1 = Have less Cost<br>2 = Have higher cost |
| RC-5 | Other information regarding GHG reduction and associated costs. | 0 = No disclose<br>1 = Have supporting information |
| EC-1 | Indication that the board committee (or other executive body) is responsible for actions related to climate change. | 0= No disclose<br>1 = Have disclose but have no responsibility<br>2 = Have disclose and responsibility |
| EC-2 | Description of the mechanism through which the board (or other executive body) reviews the company's progress related to climate change. | 0 = No disclose<br>1 = Have supervised |
| NT-1 | Type of news regarding the greenhouse gas emission / carbon issue | 0 = No Disclose<br>1 = Bad News<br>2 = Neutral<br>3 = Good News |
| SO-1 | Data and information sources | 0 = Annual report<br>1 = Sustainability report |

Sources: Choi & Luo (2021) and Damas (2021)

Gunawan & Abadi (2017) and (Papoutsi & Sodhi, 2020) stated that the sustainability performance variable is measured using the SDG Index guidelines, a measurement tool used to assess and compare achievements against the SDGs (Parmentola et al., 2022) Table 3. Based on (Aydoğmuş et al., 2022), measuring sustainability performance through the number of disclosed index items is more likely to reflect reporting quality rather than actual performance. Building upon the study conducted by (Jeffrey, 2022) Table 4 this research measures sustainability performance using the SDGs index. This research develops a transformation method that converts qualitative information data into quantitative form, based on the approach proposed by presents the following formulation:

Table 3. Sustainability Performance Proxies

| Score | Provision | Score Formula |
|---|---|---|
| 0 | Do not Implement SGDs Indicator | $= \frac{\sum Item\ Contribution}{\sum Item\ Index}$ |
| 1 | Implement SDGs Indicator in negative context | |
| 2 | Implement SDGs Indicator in positive context | |
| 3 | Implement SDGs Indicator in positive context with progress, improving target or support by graphic, picture or image | |

Source: Gunawa & Abadi (2017) and Papoutusi & Sodhi (2020)

Table 4. Sustainability Development Goals Index

| Index | Indicator | Item |
|---|---|---|
| 1 | No Poverty | Implementing CSR programs for poverty alleviation or similar MSME (Micro, Small, and Medium Enterprises) development initiatives. |
| 2 | Zero Hunger | Investing in the sustainable food sector or implementing food assistance programs. |
| 3 | Good Health and Well-being | Providing employee healthcare facilities and having training or a dedicated team for occupational health and safety (OHS) programs. |
| 4 | Quality Education | Regularly providing training for employees, as well as scholarship and certification programs. |
| 5 | Gender Equality | Maintaining gender equality in management representation and implementing equal anti-discrimination policies. |
| 6 | Clean Water and Sanitation | Able to reduce water consumption per unit of production and ensure proper wastewater management. |
| 7 | Affordable and Clean Energy | The percentage of the population with access to electricity and the share of renewable energy in total energy consumption. |
| 8 | Decent Work and Economic Growth | A fair wage policy in accordance with labor regulations, a high employee retention rate, and an adequate number of local workers. |
| 9 | Industry, Innovation, and Infrastructure | R&D investment aligned with revenue and focused on sustainable infrastructure projects. |
| 10 | Reduced Inequality | Having social inclusion programs and providing support to vulnerable groups. |
| 11 | Sustainable Cities and Communities | The company's contribution to public infrastructure and the development of environmentally friendly industrial zones. |
| 12 | Responsible Consumption and Production | Having solid waste management practices in place. |
| 13 | Climate Action | Having efforts or plans in place to mitigate climate change. |
| 14 | Life Below Water | Waste management related to marine disposal or policies for the protection of marine biodiversity (if relevant) |
| 15 | Life on Land | Responsible land use and deforestation practices for environmental rehabilitation (if applicable) |
| 16 | Peace, Justice, and Strong Institutions | Having good corporate governance (GCG) along with transparency and accountability. |
| 17 | Partnerships for the Goals | Having a sustainability report consistently published every year with external assurance to ensure compliance with GRI standards. |

*Source: Jeffrey, (2022)*

This study differs from Wendling (2022) that conducts a self-assessment of environmental performance based on the annual program known as PROPER, which is provided by the Indonesian Ministry of Environment and Forestry to measure environmental performance (Maharantika, 2022) which is done by giving a score based on the ranking (Figure 2 & Table 5).

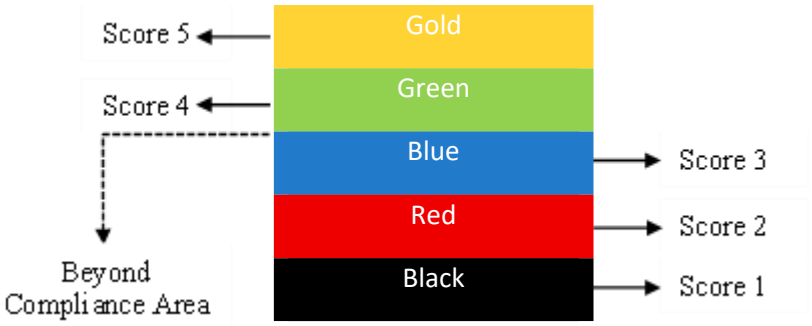

Figure 2. PROPER Trophy

Table 5. Measurements of Dependent and Control Variables

| Variable | Measurements and Scale | Source |
|---|---|---|
| Company Value | $\text{Tobin's Q} = \frac{\text{Average Market Value of Equity} + \text{Book Value of Liabilities}}{\text{Book Value of Assets}}$ | (Aydoğmuş et al., 2022), (Lim & Mali, 2023) and (Wicaksono & Tarisa, 2022) |
| Earnings Per Share | $\text{EPS} = \frac{\text{Net Profit After Interest and Tax}}{\text{Outstanding Share}}$ | (Ichsani et al., 2021), (Arsal, 2021), and (Effendi, 2023) |
| Free Cash Flow | FCF = Operating Cash - Capital Expenditure | (Dewi et al., 2019), (Hiya & Syafi, 2021), and (Anggraeni et al. 2023) |
| Environmental Cost | $\text{EC} = \frac{\text{CSR Cost}}{\text{Net Profit After Interest and Tax}}$ | (Fristianti & Komara, 2023), (Sianipar et al., 2023), and (Dinniyah & Nuzula, 2021) |
| Capital Structure | $\text{LDA} = \frac{\text{Longterm Debt}}{\text{Total Asset}}$<br>$\text{LDE} = \frac{\text{Longterm Debt}}{\text{Total Equity}}$ | (Abdul et al., 2019), (Handini & Susilo, 2025), and (Bui et al., 2023) |
| Managerial Ownership | 1 = for companies with managerial ownership.<br>0 = for companies without managerial ownership. | (Haron et al., 2021) and (Bhakar et al., 2024) |

## RESULTS

Based on the results of data processed of total amount of sample above, the analysis with multiple linear regression using SPSS, in general the results can be seen in Table 6 descriptive statistics, Table 7 classical assumption test, Table 8 hypothesis results test which will be described as follows:

Table 6. Descriptive Statistic

| VARIABLE | MIN | MAX | MEAN | Sd. Dev |
|---|---|---|---|---|
| NP | 0,379761 | 12,07113 | 2,655759 | 2,459243 |
| GHG | 0,000 | 0,655 | 0,236 | 0,153 |
| SRD | 0,107 | 0,691 | 0,280 | 0,120 |
| KL | 2 | 5 | 3,12 | 0,591 |
| KK | 2,946 | 4029,778 | 413,769 | 730,645 |
| FCF | -7465 | 156541995 | 8723288 | 2972180 |
| EC | 0,000 | 1,074 | 0,066 | 0,161 |
| LDA | 0,000 | 0,356 | 0,098 | 0,087 |
| LDE | 0,000 | 1,584 | 0,228 | 0,264 |
| KM | 0 | 1 | 0,45 | 0,500 |

Source: Processed Data

Note: NP: Corporate Value, GHG: Greenhouse Gas Emission, SRD: Sustainability Performance, KL: Environmental Value, KK: Earning Per Share, FCF: Free Cash Flow, EC: Environmental Cost, LDA: Long-term Debt to Assets, LDE: Long-term Debt to Equity, KM: Managerial Ownership Structure

Table 6 shows that the lowest firm value is 0.3797 (Indospring Tbk) in 2020, and the highest is 12.07113 (PT Multi Bintang Indonesia Tbk) in 2022, with an average value of 2.655759. A firm value proxied by this measure is considered favorable when it is close to 1 (Lim & Mali, 2023). The standard

deviation of 2.459243 indicates that the variation in firm value is relatively stable and well-controlled (Aydoğmuş et al., 2022).

The Greenhouse Gas Emission value varies between a minimum value of 0.000 to a maximum value of 0.655. The same is true for carbon emission disclosure, which means that there are still many companies in Indonesia that do not provide information on greenhouse gas emissions. This can be proven by the minimum value of 0.000, which means that there are still companies that do not provide information at all on GHG emissions as a form of corporate responsibility towards the environment for example PT Gudang Garam Tbk and PT Charoen Pokhpand Indonesia Tbk. Although the maximum value is 65.5% from PT Indocement Tunggal Prakarsa Tbk which shows that some companies provide more than half of the standard greenhouse gas emission disclosure index and still need to investigate the problems in disclosing the GHG emission.

The sustainability performance value varies with a minimum value of 0.107 (PT Wilmar Cahaya Indonesia Tbk) and a maximum value of 0.691 (PT Indocement Tunggal Prakarsa Tbk). With an average value (mean) of 0.280 and a standard deviation of 0.120, which means that manufacturing companies in Indonesia on average disclose sustainability report elements of 28% this value proves that companies in Indonesia are still lacking in disclosing its sustainable development (SDGs) implementation in sustainability reports. The reason might be that the sustainability report is still voluntary for most of the businesses except the oil and gas companies that are regulated by the Otoritas Jasa Keuangan (OJK).

The environmental performance value varies between a minimum value of 2 (PT Wilmar Cahaya Indonesia Tbk, PT Charoen Pokphand Indonesia Tbk, PT Delta Djakarta Tbk., PT Multi Bintang Indonesia Tbk, PT KMI Wire and Cable Tbk, PT Surya Toto Indonesia Tbk, PT Kalbe Farma Tbk, PT Japfa Comfeed Indonesia Tbk) and a maximum of 5 (PT Indal Aluminium Industry Tbk, PT Unilever Tbk, and PT Indocement Tunggal Prakarsa Tbk). No environmental performance scores were 0, and even a score of 1 indicates that the selected sample only includes companies meeting the established purposive criteria. In fact, the environmental performance scores of the sampled manufacturing companies in Indonesia ranged from a minimum of 2, meaning that none of the companies received a black PROPER rating, which indicates poor environmental performance. The average score was 3.12 with a standard deviation of 0.591, reflecting generally moderate to good environmental performance among the sample. Therefore, we need to support the companies in increasing their environmental performance through the activities and comply with the measurement of it.

The Earning per share value varies between a minimum value of 2.946 (PT Indospring Tbk) and a maximum value of 4029.778 (PT Gudang Garam Tbk). And the average value (mean) is 413.769, with a standard deviation of 730.645. This value shows that the sample has Earning per share with an average share value of 413,769. It indicates that the EPS gap is quite high, this might be because the sample is varied in manufacturing companies.

The FCF value varies between a minimum value of -746.582 (PT Kimia Farma Tbk) and a maximum value of 1,565.419 (PT Kalbe Farma). The average sample company has a free cash flow of 87,232.885 with a standard deviation of 297.218 indicating a variation in free cash flow. It means that the PT Kimia Farma Tbk is having problems in managing FCF, from the negative Investment return. The loss is reported in 2023, IDR126 Billions and 2023 IDR 1.8 Trillions. Financial and risk management director, Lina explained the reason for the loss. The company had manufacturing inefficiency, big capacity but low in utilization, products that did not sell and already expired date (Tempo, 2024).

The environmental cost value varies between a minimum value of 0.00001 (PT Wilmar Cahaya Indonesia Tbk) and a maximum value of 1.07438 (PT Indal Aluminium Industry Tbk) in environmental cost. The average sample company spends environmental costs of 0.0664870 with a standard deviation of 0.16140682 indicating a variation in environmental costs. Because the standard deviation is greater than the average cost incurred for the environment, it shows that environmental costs are heterogeneous. The sample company shows an average cost incurred for the environment of 6.6% of net profit after tax. It implies that the environmental cost is seen as an expense in the short-term, not in the long-term (Rahardja, 2024).

The long-term debt to asset value varies with a minimum value of 0.00044 (PT Sido Muncul Tbk) and a maximum value of 0.35601 (PT Japfa Comfeed Indonesia Tbk) in long-term debt to asset. The average sample of companies observed has a long-term debt to asset of 0.0981710 (PT Sido Muncul Tbk) with a standard deviation of 0.08768505 (PT Indal Aluminium Industry Tbk). The long-term debt to equity value varies with a minimum value of 0.00050 and a maximum of 1.58428 in long-term debt to equity. The average sample of companies observed has a long-term debt to equity of 0.2028783 with a standard deviation of 0.26423593. It means that PT Sido Muncul Tbk has better solvability because of low debts compared to PT Indal Aluminium Industry Tbk with heavy debts.

The value of the management ownership structure varies between a minimum value of 0 and a maximum value of 1. With an average value of 0.45 with a standard deviation of 0.50. Which means that the average sample of companies that have a managerial ownership structure in their company is 45%. It implies that the company is still influenced by the management ownership and will be impacted in decision-making.

Table 7. Classical Assumption Test

| Classical Assumption Test | Requirements | Notation | Result |
|---|---|---|---|
| Normality Test (Kolmogorov-Smirnov Test) | Asymp. Sig. (2-tailed) > 0,05 | | 0,200 |
| Autocorrelation Test (Durbin Watson) (α = 0,05) K-3 N-100 | (4-2,2636) 1,736 < Result < 2,264 (4-1,736) | | 1,965 |
| Multicollinearity Test | VIF Value < 10 | GHG | 2,267 |
| | | SRD | 4,943 |
| | | KL | 2,133 |
| | | KK | 2,491 |
| | | FCF | 5,573 |
| | | EC | 3,833 |
| | | LDA | 5,627 |
| | | LDE | 4,447 |
| | | KM | 1,386 |
| Heteroscedasticity Test | Sig t Value > 0,05 | GHG | 0,362 |
| | | SRD | 0,867 |
| | | GHG*KL | 0,886 |
| | | SRD*KL | 0,768 |
| | | KK | 0,268 |
| | | FCF | 0,397 |
| | | EC | 0,291 |
| | | LDA | 0,897 |
| | | LDE | 0,836 |
| | | KM | 0,372 |

Source: Processed Data

Note: GHG: Greenhouse Gas Emission, SRD: Sustainability Performance, KL: Environmental Value, KK: Earning Per Share, FCF: Free Cash Flow, EC: Environmental Cost, LDA: Long-term Debt to Assets, LDE: Long-term Debt to Equity, KM: Managerial Ownership Structure

Table 7 show an asymptotic two-tailed significance value of 0.200, which is greater than 0.05. Thus, it can be concluded that the data are normally distributed, and $H_0$ is accepted, indicating that the normality assumption has been met and the data are suitable for further analysis. The autocorrelation test using the Durbin–Watson statistic produced a value of 1.965, which is greater than the upper limit (dU = 1.7364) and less than 4 − dU (2.264). Therefore, it can be concluded that the model does not suffer from autocorrelation. The multicollinearity test results show that all variables have VIF values < 10, confirming the absence of multicollinearity, even though multiple regression analysis (MRA) models are generally prone to this issue. Finally, the heteroscedasticity test results indicate that all variables have significance values greater than 0.05, suggesting no evidence of heteroscedasticity.

Table 8. Hypothesis Test Result

| Model | Unstandardized Coefficients | Prob | Decision |
|---|---|---|---|
| **Independent Variable** | **B** | **Sig** | |
| GHG | -0,342- | 0,002* | Accepted |
| SRD | 0,215 | 0,016* | Accepted |
| **Moderation Variable** | | | |
| KL*GHG | -0,297- | 0,012* | Accepted |
| KL*SRD | 0,085 | 0,046* | Accepted |
| **Control Variable** | | | |
| KK | 0,291 | 0,029* | Accepted |
| FCF | 2,041 | 0,572 | Rejected |
| EC | -1,359- | 0,017* | Accepted |
| LDA | 2,308 | 0,025* | Accepted |
| LDE | 3,137 | 0,046* | Accepted |
| KM | 1,091 | 0,261 | Rejected |
| Adjusted R.Square | 0,423 | | |
| Regression F Sig | 0,000 | | |

Source: Processed Data
Note: NP: Company Value, GHG: Greenhouse Gas Emission, SRD: Sustainability Performance, KL: Environmental Performance, KK: Earning Per Share FCF: Free Cash Flow, EC: Environmental Cost, LDA: Longterm Dept to Assets, LDE: Long-term Debt to Equity, KM: Managerial Ownership Structure.

Table 8 presents the results of the hypothesis testing. The t-test results indicate that all hypotheses are supported with significance levels below 5%. The adjusted $R^2$ value is 0.423, suggesting that Greenhouse Gas Emission and Sustainability Performance, Earnings per Share, Free Cash Flow, Environmental Cost, Long-term Debt to Asset, Long-term Debt to Equity, and Managerial Ownership explain 42.3% of the variation in firm value, while the remaining 57.7% is attributed to other factors not included in the model. Furthermore, the F-test shows a significant value of 0.000, confirming that the regression model is statistically fit and appropriate for this study.

## DISCUSSION

GHG emissions can negatively affect firm value due to regulatory risks, operational costs, and reputational impacts. According to legitimacy theory, companies need to act in accordance with societal norms, values, and expectations to maintain social legitimacy. High GHG emissions can create a perception that a company is environmentally irresponsible, thereby reducing its social legitimacy. Additionally, based on stakeholder theory, firms must consider the interests of various parties, including investors, consumers, society, and the government. High emissions can undermine stakeholder trust and support, ultimately affecting stock prices and firm value. From the perspective of signaling theory, GHG emissions act as a signal to the market about the company's environmental responsibility. Excessive emissions convey negative information to investors and stakeholders, signaling potential financial, operational, and reputational risks, which can further depress firm value. The results of this study indicate that GHG emissions have a negative effect on firm value, with a significant level of 0.002, supporting the initial hypothesis. These findings are consistent with Perdichizzi et al. (2024) and Choi & Luo (2021), stated that carbon emission disclosure negatively affects firm value (beta = –0.342). However, these results differ from Anggraeni (2015), stated a positive effect of GHG emission disclosure on firm value. The variation in findings highlights the complexity of investor reactions to environmental information: some studies (Álvarez et al., 2015; Sudibyo, 2018) reported that carbon volume and carbon management do not significantly affect firm value, while Anggraeni (2015) noted that investors often ignore global warming information due to concerns over high costs borne by the company.

Other studies (Harahap et al., 2018; Damas et al., 2021) emphasize that the public reacts more strongly to negative information, so disclosure of high GHG emissions can damage a company's image, reduce sales demand, and decrease stock prices. Perdichizzi et al. (2024) also found that the book value of assets and the company's operating cash flow were negatively and significantly affected by the implementation of GHG emission reduction plans. Therefore, high GHG emissions not only impact financial performance but also affect social legitimacy and stakeholder perceptions, ultimately reducing firm value.

The second hypothesis of this study tested whether sustainability performance influences firm value. The results showed that sustainability performance has a significant positive effect on firm value, with a significant level of 0.016. These findings align with Rajabi et al. (2022), who reported that sustainability reporting positively affects firm value (beta = 0.215), as well as Kurniawan et al. (2018), who found a positive effect of sustainability report performance on company value. Moreover, Rahardja (2024) indicated that corporate sustainability could create shared value over the next 2–3 years. Implementation of the (SDGs) positively affects firm value by aligning business strategies with global sustainability priorities. Sustainability performance through SDGs positively affects firm value by enhancing social legitimacy, stakeholder trust, and market signal. According to legitimacy theory, strong sustainability practices give a signal adherence to societal norms, while stakeholder theory emphasizes that considering the interests of investors, consumers, and the community builds loyalty and support. Moreover, signaling theory suggests that these practices convey responsible management and long-term commitment to the market, attracting investors and improving firm valuation.

Firms integrating SDGs such as quality education, gender equality, clean energy, and responsible consumption can enhance their reputation, attract long-term investors, and gain competitive advantage (Karaca, 2020; Parmentola et al., 2022). From a theoretical perspective, strong sustainability performance enhances social legitimacy in accordance with legitimacy theory and demonstrates consideration for stakeholder interests, as proposed in stakeholder theory. By addressing environmental, social, and governance (ESG) issues reflected in the SDGs, companies reduce regulatory risks, improve operational efficiency, and build stakeholder trust. These factors contribute to improved financial performance and higher firm valuation, as measured by indicators such as Tobin's Q (Wicaksono et al., 2025).

The third hypothesis of this study examined whether environmental performance moderates the relationship between (GHG) emissions and firm value. The results indicated a significant effect, with a significant level of 0.012. Specifically, environmental performance was found to strengthen the negative effect of GHG emissions on firm value, with a beta coefficient of –0.297. This finding suggests that firms with higher stronger environmental performance are more likely to elicit negative reactions from stakeholders when emission levels are high, as stakeholders expect these firms to uphold elevated environmental standards. In this regard, environmental performance functions as a "filter" that amplifies stakeholder responses, ensuring that sustainability disclosures are not merely symbolic but aligned with actual practices. These findings are supported by Dohrmann et al. (2025), stated that environmental performance affects firm value, and are consistent with Effendi (2021), stated that disclosure of environmental performance positively influences firm value (Burhanuddin et al., 2025). Thus, the hypothesis is supported, indicating that environmental performance strengthens the impact of GHG emissions on firm value by amplifying reputational and financial consequences through stakeholder perception and market signaling.

These results contrast with Utomo et al. (2020), stated that environmental performance measured through PROPER ratings does not affect firm value, and Deswanto & Siregar (2018), who argued that environmental aspects do not significantly influence investor assessments of firms. This discrepancy may suggest that environmental issues have not yet become a primary concern for investors in the Indonesian capital market. It may also be attributed to the limited scope of environmental initiatives in Indonesia, where PROPER remains the only government-led program and participation is often skewed toward firms with already strong environmental reputations. Nevertheless, environmental performance can play a broader role in creating shared value (Rahardja et al., 2021; Wibowo & Rahardja, 2025), as

proactive environmental management not only strengthens legitimacy but also enhances long-term competitiveness and stakeholder trust.

The fourth hypothesis of this study examined whether environmental performance moderates the relationship between sustainability report disclosure and firm value. The analysis revealed a significant moderating effect, with a significance level of 0.046. Specifically, environmental performance was found to enhance the positive influence of sustainability performance on firm value, with a beta coefficient of 0.085. This indicates that when firms exhibit strong environmental performance, the information disclosed in their sustainability reports is perceived as more credible and substantive rather than symbolic, thereby amplifying its impact on firm value. In this context, environmental performance functions as a legitimizing mechanism that signals to stakeholders that reported sustainability practices are backed by concrete actions. From the perspective of signaling theory, strong environmental performance conveys a clear message to the market and investors that the company is genuinely committed to sustainable practices, enhancing the credibility of disclosures. Simultaneously, stakeholder theory explains that stakeholders including investors, customers, regulators, and society are more likely to trust and support firms whose sustainability efforts are demonstrably effective. Collectively, these theoretical perspectives illustrate why environmental performance strengthens the positive influence of sustainability performance on firm value, turning responsible practices into tangible financial and reputational benefits.

These findings are consistent with Choi & Luo (2021), demonstrated that environmental performance positively strengthens the relationship between sustainability performance and firm value. Similarly, the results align with Dohrmann et al. (2025) and Effendi (2021), reported that environmental performance exerts a significant direct positive effect on firm value, highlighting its role in reinforcing the impact of sustainability performance through both moderating and legitimizing functions. By ensuring that sustainability disclosures reflect actual practices, strong environmental performance enhances stakeholder trust including investors, consumers, and the broader community thereby facilitating the translation of sustainability initiatives into tangible increases in firm value (Haryono et al., 2016). Conversely, these results differ from Harahap et al. (2018), that environmental performance does not significantly moderate the effect of sustainability performance on firm value, underscoring ongoing debate regarding the contextual factors that influence the moderating role of environmental performance.

One of the control variables in this study is investment return. This study tested whether Earnings per Share (EPS) has an influence on firm value, with a significant level of 0.029. The results stated that EPS has a significant positive influence on company value (Ermawati et al., 2017). EPS affects firm value because it reflects the profit earned for each outstanding share, signaling strong financial performance to investors. Higher EPS often leads to higher stock prices assuming the price to earnings ratio is stable which increases market capitalization. It also conveys positive signals about future profitability and enables greater dividend distribution, both of which boost investor confidence and, in turn, enhance firm value. (Arsal, 2021; Ichsani et al., 2021). The results of this study also showed the result that earning per share does affect company value.

This study tested whether free cash flow influences firm value, with a significant level of 0.572. The results of this study state that free cash flow does not affect company value which is not in accordance with Suartawan & Yasa (2016) free cash flow do not affect firm value when it is not utilized for productive investments, is perceived as non-recurring, or is associated with agency problems such as overinvestment and inefficient spending. In some markets, investors focus more on earnings or dividends than on FCF, and in capital-intensive industries, low or negative FCF may simply reflect growth stages rather than poor performance, making its direct impact on firm value insignificant (Hiya & Syafi, 2021). The results of the study in line with (Dewi et al., 2019) that free cash flow does not affect the value of the company.

The next control variable in this study is environmental cost. This study tested whether environmental cost influences firm value. The results indicate that environmental cost has a significant negative effect on firm value, with a significant level of 0.017 and a beta coefficient of –1.359. These findings are consistent with Buana & Nuzula (2017), reported that environmental cost has a significant

negative effect on firm value. However, the results of this study are not consistent with Pratama et al. (2017), stated that CSR costs have a significant positive effect on firm value.

The results of this study are in line with Antwi et al. (2015), who stated that capital structure has a significant positive effect on firm value, with significance levels of 0.025 for LDA and 0.046 for LDE. The results of this study state that the capital structure, either proxied by long-term debt to asset and long-term debt to equity affect firm value by showing how much a company relies on debt compared to its assets or equity. Moderate debt can increase value by funding growth and providing tax benefits, but too much debt raises financial risk and can reduce investor confidence, leading to a lower firm value (Handini & Susilo, 2025) and contrary to the result of Putri (2016) that does not affect firm value.

This study tested whether managerial ownership structure influences firm value. The results indicate that managerial ownership structure does not have a significant effect on firm value, as shown by the significance level of 0.261, which is in accordance with (Zaminor et al., 2021). Managerial ownership may not affect firm value when the proportion of shares owned by managers is either too small to influence decisions or already high enough that additional ownership does not change their incentives. In some cases, managers may prioritize personal interests over shareholder wealth, leading to agency problems despite ownership. Additionally, market conditions, industry characteristics, or investor focus on other performance indicators can weaken the observable link between managerial ownership and firm value (Suriawinata & Nurmalita, 2022). However, this study is not in accordance with Bhakar et al., 2024; Haron et al., 2021 showed that several corporate governance variables associated with company value were proven to be insignificant, although the theoretical direction showed results that were consistent with previous studies. These variables are managerial ownership and the board of commissioners.

## CONCLUSION

This study concludes that GHG emissions have a significant negative impact on firm value, indicating that increased disclosure of GHG emissions may reduce investor confidence and company valuation. Conversely, sustainability performance has a significant positive effect on firm value, highlighting the market's recognition of corporate commitment to sustainable practices. Environmental performance, serving as a moderating variable, has been proven to strengthen the influence of both GHG emissions and sustainability performance on firm value, emphasizing its role as a strategic lever for enhancing corporate reputation and attracting investor loyalty. Moreover, the findings indicate that earnings per share and capital structure positively affect firm value, while environmental costs have a significant negative impact, suggesting that high environmental expenditures are perceived as a burden by the market. On the other hand, firm value appears unaffected by free cash flow and managerial ownership structure.

From a theoretical perspective, this study enriches the discourse on legitimacy theory, stakeholder theory, and signaling theory by demonstrating how environmental and sustainability disclosures, reinforced by environmental performance, contribute to shaping market perceptions and firm value. Practically, these findings provide insights for corporate management to view environmental and sustainability activities not as expenditures but as long-term investments that can enhance firm value.

Furthermore, the study emphasizes the need for regulators and professional accounting organizations to establish clearer and more comprehensive environmental disclosure guidelines, not limited to the oil and gas sector but applicable to all public companies. Governments are also encouraged to strengthen environmental regulations by setting net-zero carbon emission targets, improving green taxation policies, providing financial incentives for ESG adoption, and ensuring transparency through standardized sustainability reporting. Collaborative efforts from business associations and non-profit organizations are equally essential to provide education, training, and foster cross-sector partnerships that support companies in integrating the SDGs into their core business strategies. Such synergy is expected to promote broader adoption of sustainable business practices,

contributing not only to corporate value creation but also to sustainable economic and social development.

Despite these contributions, this study acknowledges several limitations. Although many Indonesian companies have started to publish sustainability reports by the end of 2024, inconsistencies remain, particularly among companies participating in the PROPER program. Because this study was conducted using panel data, it did not include manufacturing companies that only participated in PROPER occasionally during the period. Therefore, the sample consists of a few of companies, which means that not all manufacturing companies in Indonesia consistently participated in PROPER for environmental performance. Consequently, the study incorporates SDGs-related disclosures from integrated or annual reports, which may pose comparability challenges during content analysis. Additionally, although efforts were made to ensure objectivity, the use of content analysis inherently carries subjective elements, particularly in interpreting narrative disclosures.

Based on these limitations, future research is encouraged to focus on specific industries to obtain more granular insights, extend the research period to capture long-term effects, and consider using the average of the closing stock prices over a year to achieve a more representative measure of company value and environmental performance can also be measured using alternative proxies such as ISO 14001 certification or cross sectional non panel, which allows for an expanded sample and can be applied across countries.

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