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The Influence of Eco-Efficiency, Carbon Emission Disclosure, and Green Innovation on Company Value in the Basic Materials Sector Companies Listed on the Indonesian Stock Exchange (2018–2022)

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Abstract: The purpose of this study is to determine how eco-efficiency, carbon emission disclosure, and green innovation influence company value in basic material sub-sector companies listed on the Indonesia Stock Exchange (IDX). The research method is quantitative and descriptive statistics. The tests carried out are classical assumption tests, namely tests for normality, multicollinearity, heteroscedasticity, and autocorrelation. The coefficient of determination analysis uses a correlation coefficient test using SPSS version 25. The sampling technique uses a non-probability method: 103 companies listed on the Indonesia Stock Exchange (IDX), 17 that meet the requirements, with 85 data points obtained over 5 years of observation. The results show that eco-efficiency and carbon emission disclosure do not affect company value, whereas green innovation has a positive and significant effect on company value. Simultaneously, eco-efficiency, carbon emission disclosure, and green innovation influence company value. In conclusion, eco-efficiency and carbon emission disclosure cannot reduce environmental impacts. At the same time, green innovation has proven successful in implementing measures to mitigate environmental damage, indicating that the company complies with social norms related to the environment.

Keywords: Eco-Efficiency, Carbon Emission Disclosure, Green Innovation, Company Value.

Research Background

The environment is a crucial topic in today's global economic discussions. High public expectations require companies to be more environmentally responsible. Alongside the development of the industrial world, environmental issues such as global warming and carbon emissions have also emerged. Global warming is a topic of discussion not only in Indonesia but also in various parts of the world regarding its management (Rahmanita, 2020).

Furthermore, climate change remains a significant issue being discussed worldwide. Natural gas and oil exploration, coal mining, and electricity production are major factors contributing to climate change. A company's activities should not involve activities that destroy or disrupt the surrounding area. Therefore, a company's annual report should include information on resource utilisation and programs implemented to protect the environment (Bahriansyah & Lestari Ginting, 2022).

Meanwhile, the UN implements sustainable development to meet current needs without compromising those of future generations, as reflected in the SDGs (Sustainable Development Goals). The SDGs came into effect in 2015 and are given a 15-year timeframe to implement 17 goals, with 169 targets to be achieved by 2030. Of these 17 goals, the focus is on Goal 7, namely affordable and clean energy, and Goal 13, addressing climate change (<https://sdgs.un.org/goals>).

. Furthermore, the company's CSR obligations are regulated by Law No. 40 of 2007 on Limited Liability Companies. Regarding the company's CSR obligations in Indonesia, Article 74 of the Limited Liability Companies Law states that: "Companies carrying out business activities in the field and/or related to natural resources are required to carry out social and environmental responsibilities" (Sanarta, 2023). One form of environmental responsibility is that companies will report on Corporate Social Responsibility (CSR), which is integrated with disclosures about business actors' efforts to reduce Greenhouse Gas emissions. Although Carbon Emission Disclosure in Indonesia remains

voluntary, the Government of the Republic of Indonesia also contributes to social responsibility, for example, by passing Law No. 17 of 2004, which ratified the Kyoto Protocol, as an effort to reduce Greenhouse Gas emissions. In addition, the government, through the Ministry of Environment & Forestry, issued Decree of the Minister of Environment No. Law No. 127 of 2002, which serves as the legal basis for the Performance Rating Assessment Program (PRAP), aims to increase stakeholder commitment to environmental conservation (Rahmanita, 2020).

Companies that generate waste and negatively impact the environment need to be aware that their activities should not only prioritise profit but also consider the surrounding environment (Dewi & Rahmianingsih, 2020).

Therefore, to implement sustainable development and contribute to efforts to reduce global greenhouse gas emissions, six greenhouse gases are targeted for reduction in the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrogen oxides (N₂O), hydrofluorocarbons (HFCs), fluorocarbons (PFCs), and sulfur hexafluoride (SF₆) (Law of the Republic of Indonesia Number 17 of 2004) (Bahriansyah & Lestari Ginting, 2022).

Companies need to pay attention to the community's needs so that all company activities align with those expectations. One way companies develop their businesses with healthy business competition is through innovation, which is linked to environmental conditions. The best innovation is that which realises environmental friendliness across all its activities, commonly referred to as green innovation (Dewi & Rahmianingsih, 2020).

Green innovation, a form of environmental innovation, is an indicator of a company's performance in improving environmental conditions through effective and efficient management mechanisms (Yuniarti et al., 2022). Innovation is an investment that requires high costs and time, but can have a positive impact on the company in the long term. Concern for the environment will lead companies to develop the latest innovations in environmentally friendly products, which can help businesses achieve sustainable development, improve product quality, and utilise local resources more efficiently (Dewi & Rahmianingsih, 2020).

In addition to green innovation, eco-efficiency is also an effort to protect the environment, demonstrating business responsibility in preventing environmental pollution. Eco-efficiency also stimulates creativity and innovation in finding new ways (Dewi & Rahmianingsih, 2020).

In addition to green innovation, efforts to protect the environment also include eco-efficiency, a form of business responsibility in preventing environmental pollution. Eco-efficiency also stimulates creativity and innovation in finding new ways (Dewi & Rahmianingsih, 2020).

A common phenomenon is the decline in the value of companies in the basic materials sector. The Jakarta Composite Index (JCI) fell 34.27 points, or 0.51%, to 6,701 at the close of the first trading session. Trading data from the Indonesia Stock Exchange (IDX) shows that the recorded stock transaction value reached IDR 5.75 trillion, with a transaction volume of 14,150 billion shares and a frequency of 844,753 shares changing hands. A total of 218 stocks rose, 316 stocks declined, and 200 stocks remained unchanged. Meanwhile, the JCI market capitalisation at the first session today was IDR 10,512 trillion. Eleven sectors on the IDX were mostly in the red zone. Stocks in the raw materials

sector led the decline, falling 1.08%. Meanwhile, stocks in the raw materials sector, such as PT Semen Indonesia Tbk (SMGR), also fell 0.41% to IDR 6,075 per share (Nabila, 2023).

Meanwhile, the phenomenon observed in the decline of companies' shares listed on the Indonesia Stock Exchange is as follows: PT Champion Pacific Indonesia experienced a decline in share price in 2019, from 384 per share in the previous year to 340 per share. PT Kirana Megatara Tbk experienced a decline in share price in 2022, from 334 per share in the previous year to 258 per share.

A common phenomenon that occurred in companies is PT Fajar Surya Winesa Tbk, which recorded a 16.8% year-on-year (yoy) revenue decline to IDR 8.27 trillion in 2019, down from IDR 9.94 trillion. Furthermore, FASW's net profit fell further, 31.06% year-on-year (yoy) to IDR 968.83 billion. In fact, in 2018, FASW posted a net profit of IDR 1.4 trillion. YTD, FASW shares rose 8.44% to IDR 7,050 per share (Rahmawati, 2020). Meanwhile, in 2022, PT Fajar Surya Wisesa Tbk (FASW) recorded a net profit of IDR 119.92 billion, a 80.7% drop from IDR 617.42 billion in 2021. Consequently, basic earnings per share fell to IDR 48.4 per share, compared to IDR 249.17 at the end of 2021. Furthermore, the paper company's net sales also declined 8.4% to IDR 10.98 trillion, driven by a 13.8% decline in sales to third parties to IDR 8.734 trillion.

However, sales to related parties grew 22.08% to IDR 2.178 trillion. Although the cost of goods sold decreased by 4.04% to IDR 9.898 trillion, gross profit fell 38.7% to IDR 991.96 billion. Meanwhile, total liabilities decreased 3.7% to IDR 7.866 trillion. Meanwhile, equity eroded 2.2% to IDR 5.011 trillion. The company had previously projected sales of IDR 11 trillion by the end of 2022. This target was not significantly different from the actual sales of IDR 11.93 trillion in 2021 (Nabhani, 2023).

Based on the phenomenon of declining company value caused by several factors, the following sample data from companies listed on the Indonesia Stock Exchange from 2019 to 2022 supports the phenomenon above. The measurement of company value uses Tobin's Q, where MVE (closing stock price x number of shares outstanding at the end of the year) is added to liabilities and then divided by total assets.

Table 1

Company Value using Tobin's Q

Issuer Code	Company Name	Tobin's Q				
		2018	2019	2020	2021	2022
DPNS	Duta Pertiwi Nusantara, Tbk	0,46	0,38	0,39	0,51	0,52
IGAR	Champion Pasifics Indonesia, Tbk	0,81	0,67	0,63	0,67	0,61
IPOL	Indopoly Swakarsa Industry, Tbk	0,58	0,57	0,60	0,64	0,62
LTLS	Lautan Luas, Tbk	0,82	0,68	0,72	0,74	0,87

Source: IDX (processed year 2024)

The primary goal of a company is not only to create shareholder value, but also to create value for stakeholders. A high firm value will attract investors (Roza Mulyadi & Maulana, 2022).

Based on company data from 2018 to 2022 listed on the Indonesia Stock Exchange (IDX), as shown in Table 1. Company value is measured using Tobin's Q ratio. If Tobin's Q increases, it is categorised as overvalued, offering a potentially high return relative to the assets issued. However, if Tobin's Q decreases, it is categorised as undervalued, with its book value exceeding its market value.

Several components influence company value, including:

1. Eco-efficiency, as a company's effort to gain a positive response from stakeholders, considers the environmental conditions that force companies to utilise environmental resources as efficiently as possible. Eco-efficiency is a positive signal to stakeholders that ultimately increases company value (Dewi & Rahmianingsih, 2020). In this study, eco-efficiency was measured through the 2006 WBCSD product value (net sales) divided by environmental costs (raw materials, electricity, water, gas, and fuel).

Table 1

Calculation of Eco-Efficiency against Company Value

Issuer Code	Company Name	Calculation	Year				
			2018	2019	2020	2021	2022
DPNS	Duta Pertiwi Nusantara, Tbk	Eco-Efficiency				2,30	1,72
		Tobin's Q	0,46	0,38	0,39	0,51	0,52
IGAR	Champion Pasifics Indonesia, Tbk	Eco-Efficiency	1,39	1,52	1,59	1,49	
		Tobin's Q	0,81	0,67	0,63	0,67	0,61
IPOL	Indopoly Swakarsa Industry, Tbk	Eco-Efficiency	1,58	1,65	1,82	1,65	
		Tobin's Q	0,58	0,57	0,60	0,64	0,62
LTLS	Lautan Luas, Tbk	Eco-Efficiency		4,14	4,12	3,67	3,32
		Tobin's Q	0,82	0,68	0,72	0,74	0,87

Source: IDX (processed year 2024)

Table 2 shows a discrepancy between eco-efficiency and company value, with one increasing while the other decreases. For DPNS, eco-efficiency decreased to 1.72 in 2021, from 2.30 in the previous year, and company value increased to 0.52 in 2021, from 0.51 in the previous year. For IGAR, eco-efficiency increased to 1.52 from 1.39 in 2019, while company value decreased from 0.81 to 0.67. In 2021, eco-efficiency decreased to 1.49 from 1.59 in 2020, and company value increased to 0.67 from 0.63 in 2020. In IPOL, eco-efficiency increased in 2019 compared to the previous year, from 1.58 to 1.65, while the company value decreased from 0.58 to 0.57 in 2018.

Table 2 shows a discrepancy between eco-efficiency and company value, with one increasing while the other decreases. Es DPNS, eco-efficiency decreased to 1.72 in 2021 compared to 2.30 in the previous year, and company value increased to 0.52 in 2021 compared to 0.51 in the previous year. For IGAR, eco-efficiency increased to 1.52 from 1.39 in 2019, while company value decreased from 0.81 to 0.67. In 2021, eco-efficiency decreased to 1.49 from 1.59 in 2020, and company value increased to 0.67 from 0.63 in 2020. In IPOL, eco-efficiency increased in 2019 compared to the previous year, from 1.58 to 1.65, while the company value decreased from 0.58 to 0.57 in 2018.

For 2021, eco-efficiency decreased to 1.65 from 1.82 in 2020, and the company's value increased from 0.60 to 0.64. Meanwhile, LTLS' 2020 eco-efficiency was 4.12, down from 4.14 in 2019, and the company's value increased to 0.72 in 2020 from 0.68 in 2019. In 2022, eco-efficiency decreased to 3.32 from 3.67, and the company's value increased to 0.87 from 0.74.

2. Carbon emission disclosure, a way for companies to gain a positive response and image from the market, is through environmental disclosure. Investors will perceive this as good news for the company's sustainability and will be more interested in investing in the company (Hardiyansah et al., 2021). Carbon emission disclosure is calculated using measurements according to the Global Reporting Initiative (GRI) 103 and 305: the number of disclosed items is divided by the total number of disclosed items, then multiplied by 100%.

Table 2

Calculation of Carbon Emission Disclosure against Company Value

Issuer Code	Company Name	Calculation	Year				
			2018	2019	2020	2021	2022
DPNS	Duta Pertiwi Nusantara, Tbk	Carbon Emission Disclosure	0,27	0,27			
		Tobin's Q	0,46	0,38	0,39	0,51	0,52
IGAR	Champion Pasifics Indonesia, Tbk	Carbon Emission Disclosure		0,45	0,73	0,73	0,82
		Tobin's Q	0,81	0,67	0,63	0,67	0,61
IPOL	Indopoly Swakarsa Industry, Tbk	Carbon Emission Disclosure	0,09	0,36	0,64	0,64	
		Tobin's Q	0,58	0,57	0,60	0,64	0,62
LTLS	Lautan Luas, Tbk	Carbon Emission Disclosure	0,09	0,45	0,45		
		Tobin's Q	0,82	0,68	0,72	0,74	0,87

Source: IDX (processed year 2024)

Table 3 shows that some companies experienced a decrease in carbon emission disclosure, but their company value increased. Conversely, some companies experienced a decrease in value, but their carbon emission disclosure increased.

Table 3 shows that the DPNS carbon emission disclosure remained consistent at 0.27, while the company value decreased in 2019, falling to 0.38 from 0.46 in 2018. In the 2020 IGAR, carbon emission disclosure increased by 0.73, up from 0.45 in 2019, and the company value decreased by 0.67 to 0.63. Meanwhile, in 2022, carbon emission disclosure increased from 0.73 to 0.82, while the company value decreased from 0.67 to 0.61. The IPOL company showed an increase in carbon emission disclosure in 2019, namely 0.36, compared to 2018, namely 0.09, and the company value decreased to 0.57 in 2019. Meanwhile, for 2020 to 2021, carbon emission disclosure was stable at 0.64, and the company value decreased in 2022 to 0.62, down from 0.64. In LTLS, carbon emission disclosure increased by 0.45 in 2019 compared to the previous year, and the company value decreased by 0.82 to 0.68 in 2018, while in 2020, carbon emission disclosure remained stable at 0.45, with a 0.73 increase in the company value.

3. Green Innovation. A company's innovation is an effort to demonstrate its concern for the environment. In legitimacy theory, a company is not insulated from stakeholder demands, and it continuously strives to increase productivity through innovation strategies to reduce resource use (Dewi & Rahmianingsih, 2020). Green Innovation in this study is measured using four indicators,

following Agustia et al. (2019). The calculation method is to add the disclosed indicators and divide by the total number of indicators.

Table 3

Calculation of Green Innovation against Company Value

Issuer Code	Company Name	Calculation	Year				
			2018	2019	2020	2021	2022
DPNS	Duta Pertiwi Nusantara, Tbk	Green Innovation				0,25	0,25
		Tobin's Q	0,46	0,38	0,39	0,51	0,52
IGAR	Champion Pasifics Indonesia, Tbk	Green Innovation			0,25	0,25	0,25
		Tobin's Q	0,81	0,67	0,63	0,67	0,61
IPOL	Indopoly Swakarsa Industry, Tbk	Green Innovation		0,75	0,75	0,75	0,75
		Tobin's Q	0,58	0,57	0,60	0,64	0,62
LTLS	Lautan Luas, Tbk	Green Innovation	0,25	0,50			
		Tobin's Q	0,82	0,68	0,72	0,74	0,87

Source: IDX (processed year 2024)

Table 4 shows that several companies experienced an increase in green innovation, but their value decreased. Some companies also experienced an increase in value, but their green innovation declined.

If green innovation increases, the value should increase as well. The following is an explanation of several companies in Table 4. In the DPNS (National Development Planning Agency), green innovation remained stable at 0.25 in 2021 and 2022, while the company value increased from 0.51 to 0.52. The IGAR company remained consistent at 0.25 from 2020 to 2022, but its value increased in 2021, from 0.63 to 0.67, and decreased to 0.61 in 2022. In the IPOL (National Development Planning Agency), green innovation remained consistent at 0.75, increasing from 0.57 to 0.60 in 2020 and decreasing to 0.62 in 2022, compared to 0.64 in 2021.

For LTLS in 2019, green innovation increased from 0.25 to 0.5, while firm value decreased by 0.68, down from 0.82 in 2018.

A similar study was conducted by Atiningsih & Setiyono (2023), entitled "Eco-Efficiency on Firm Value with Profitability Dimensions and Moderated by Firm Size." The study concluded that eco-efficiency influences firm value.

A similar study by Kumala & Bakar (2021), entitled "The Effect of Green Innovation, Eco-Efficiency, Business Strategy, Information Technology Investment, and Profitability on Firm Value," concluded that eco-efficiency does not influence firm value. A study by Noor et al. (2022), entitled "The Effect of Eco-Efficiency on Firm Value with Financial Performance as a Moderating Variable," proved that eco-efficiency positively influences firm value.

Research conducted by Kurnia et al. (2020) entitled "Carbon Emission Disclosure, Good Corporate Governance, Financial Performance, and Firm Value." The analysis results show that carbon emission disclosure does not influence firm value.

Research conducted by Rahmanita (2020) examined the effect of carbon emission disclosure on company value, with environmental performance as a moderating variable (non-financial companies listed on the Indonesia Stock Exchange during the 2016-2018 period). The results of this study indicate that carbon emission disclosure has a positive effect on company value.

Research conducted by Rusmana & Purnaman (2020) titled "The Effect of Carbon Emission Disclosure and Environmental Performance on Company Value" demonstrates that carbon emission disclosure has a positive and significant effect on company value, both partially and simultaneously, in manufacturing companies listed on the Indonesia Stock Exchange (IDX) during the 2016-2018 period.

Previous research conducted by Dewi & Rahmianingsih (2020) titled "Increasing Company Value Through Green Innovation and Eco-Efficiency" indicates that green innovation has a positive effect on company value. The study (Damas et al., 2021) titled "The Effect of Eco-Efficiency, Green Innovation, and Carbon Emission Disclosure on Firm Value, with Environmental Performance as a Moderator." The results of this study concluded that green innovation significantly impacts firm value.

The study (Tonay & Murwaningsari, 2022) titled "The Influence of Green Innovation and Green Intellectual Capital on Firm Value, with Firm Size as a Moderating Factor" (Tonay & Murwaningsari, 2022). The results of this study indicate that green innovation has a negative influence on firm value.

Based on the background explanation above, the authors are interested in conducting a study entitled "The Influence of Eco-Efficiency, Carbon Emission Disclosure, and Green Innovation on Firm Value" (Case Study of Basic Materials Companies Listed on the Indonesia Stock Exchange for the 2018-2022 Period).

Theoretical Basis

Legitimacy Theory

Legitimacy theory is used to gain societal legitimacy for a company's long-term sustainability. Society will recognise a company's role if there is a social relationship with the environment (Ulum et al., 2020). When legitimacy is achieved, the company can continue its operations because the entity has considered prevailing norms and the conditions of society and the surrounding environment (Nisa, 2023). If a company can have a positive impact on the environment, society will respond positively to its existence. A positive public image can certainly increase a company's value (Khairiyani, 2020).

Based on legitimacy theory, Eco-Efficiency and Carbon Emission Disclosure are treated as independent variables, while company value is the dependent variable.

Signaling Theory

Signalling theory explains that potential investors receive better information from internal company sources regarding data that can influence company value. The greater the amount of information provided as a signal to other parties, the less information asymmetry among stakeholders (Tonay & Murwaningsari, 2022).

The party sending the signal must consider how to send it, and the party receiving the signal must consider how to interpret it. The information provided by the company becomes a signal. Disclosure of environmental performance information will be a positive signal to stakeholders because the company voluntarily provides the required information (Hardiyansah et al., 2021).

Based on the explanation of signalling theory above, Green Innovation is the independent variable, and company value is the dependent variable.

Eco-Efficiency

Eco-efficiency is an environmental sustainability concept implemented by companies to reduce the environmental impact of their operations by minimising operational costs (Aviyanti & Isbanah, 2019).

According to the World Business Council for Sustainable Development (WBCSD) (2006, p. 16), eco-efficiency is explained as follows:

“Eco-efficiency can be achieved by delivering competitively priced goods and services that meet human needs and improve quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with the estimated carrying capacity of the Earth.”

The following is an explanation of eco-efficiency indicators according to the World Business Council for Sustainable Development (WBCSD) (2006:16).

Indicators are divided into two groups, based on an eco-efficiency formula that combines the two dimensions of eco-economics and ecology to relate the value of a product or service to its environmental impact. Generally accepted indicators for product value are the quantity of goods or services produced or provided to customers and net sales. Meanwhile, those related to the environmental impact of the product or service creation are energy consumption, material consumption, water consumption, greenhouse gas emissions, and emissions of ozone-depleting substances.”

The World Business Council for Sustainable Development (WBCSD) (2006:16) defines the key elements of eco-efficiency as follows:

- a. Process reengineering: Companies can reengineer their processes to reduce resource consumption, pollution, and risk while lowering costs.
- b. Revalorising by-products: By collaborating with other companies. Many businesses have found creative ways to revalorise their by-products. Striving for zero-waste or 100% product waste, they have discovered that so-called waste from their processes can be valuable to other companies.
- c. Product redesign: Their impact extends beyond product functionality and price. It also significantly affects the environmental impact of product production, maintenance, and disposal. Therefore, this suggests a third area of eco-efficiency opportunity: companies can become more eco-efficient by redesigning their products.
- d. Rethinking markets: Some innovative companies are not just redesigning products; they are finding new ways to meet customer needs. They are working with customers

or other stakeholder groups to rethink their markets and completely reshape supply and demand. Too many customer needs are currently met in material- and energy-intensive ways.

Carbon Emission

Carbon emissions are the release of carbon into the atmosphere. Carbon emissions are related to greenhouse gas emissions, a major contributor to climate change. One contributor to carbon emissions is a company's operational activities. Companies are now required to be more transparent with information about their operations. Companies demonstrate transparency and accountability by disclosing information in their annual reports. Disclosure of carbon emissions is one example of environmental disclosure, which is part of the supplementary report stipulated by law (Rusmana & Purnaman, 2020).

Carbon Emission Disclosure

Carbon emission disclosure is a company's activity in recording, acknowledging, disclosing, measuring, and presenting the extent of its carbon emissions (Damas et al., 2021).

Disclosure of carbon emissions is one example of environmental disclosure, which is part of the supplementary report stipulated by law (Rusmana & Purnaman, 2020).

Disclosure of carbon emissions demonstrates a company's commitment to environmental preservation. This disclosure is part of CSR and is derived from the company's sustainability report. Disclosure of carbon emissions covers three areas: direct emissions from industrial combustion sources, indirect emissions from the purchase and use of electricity, and emissions associated with the use of other goods, such as the purchase and repair of components, transportation equipment, and others. Carbon emission disclosure can be divided into voluntary and mandatory disclosures. Voluntary disclosures are disclosures not required by existing standards or regulations. Mandatory disclosures are based on existing standards or regulations (Arifah & Haryono, 2021).

Carbon dioxide (CO₂) is the gas that contributes the most to emissions compared to other gases, and this is inextricably linked to company activities. Information regarding carbon emissions disclosures, once published, can provide a signal to investors in making investment decisions. One such signal is the annual report, which contains both financial and non-financial information (Rahmanita, 2020). Disclosure of carbon emissions is included in environmental disclosures (Amaliya et al., 2019).

However, its voluntary nature means that not all companies in environmentally sensitive industries disclose carbon emissions (Amaliya et al., 2019).

Carbon emission disclosures, based on the Global Reporting Initiative (GRI)-305, are as follows:

1. Disclosure of management approach (this section refers to GRI 103)
2. Disclosure 305-1 Direct (Scope 1) GHG emissions
3. Disclosure 305-2 Indirect (Scope 2) GHG energy emissions
4. Disclosure 305-3 Other indirect (Scope 3) GHG emissions
5. Disclosure 305-4 GHG emission intensity

6. Disclosure 305-5 GHG emission reductions
7. Disclosure 305-6 Ozone-depleting substances (ODS) emissions
8. Disclosure 305-7 Nitrogen oxides (NOX), sulfur oxides (SOX), and other significant air emissions

One contributor to a company's carbon emissions is its operational activities. Disclosure of these activities is expected to improve the company's response to current climate change.

Green Innovation

Green innovation (environmentally friendly innovation) refers to new or modified techniques, practices, systems, and production processes designed to reduce environmental impact. Green innovation encourages companies to transform waste into viable products that can generate additional profits. This variable aims to reduce environmental impact, thereby promoting energy efficiency, pollution reduction, waste recycling, and the design of environmentally friendly products.

(Agustia et al., 2019). This concept has objectives similar to those of innovation systems in general, not only seeking economic benefits but also reducing the company's negative environmental impact. Companies that implement green innovation are perceived as environmentally responsible and utilise their resources efficiently, thereby increasing investor confidence and company value (Yuliandhari et al., 2023).

Green Innovation in this study refers to research by Agustia et al. (2019) obtained through analysis of annual reports or company sustainability reports. Several indicators will be used to determine whether a company has implemented green innovation. The results of this analysis will be quantified as ratios. The indicators that will be used in the content analysis are as follows: (1) The production process uses new technology to reduce energy, water, and waste, (2) The product uses fewer substances that do not cause pollution or are hazardous (eco-friendly materials), (3) Using environmentally friendly product packaging (e.g., paper and plastic), and (4) Components or materials in the production process can be recycled or reconditioned (Damas et al., 2021).

Company Value

Company value is an important aspect in assessing the performance of environmental and economic interests (Agustia et al., 2019).

This study uses the Tobin Q ratio to measure a company's value. Generally, Tobin's Q is a ratio that measures a company's value. Tobin's Q is a measurement tool that measures a company's value as the ratio of its market value to the value of its tangible and intangible assets. Tobin's Q can also illustrate a company's effectiveness and efficiency in utilising all its resources (Dzahabiyya et al., 2020).

Tobin's Q can be calculated using the following formula:

$$\text{Tobin's Q} = \frac{\text{MVS} + \text{Total Liabilities}}{\text{Total Assets}}$$

MVS is the market value of all outstanding shares, calculated by adding MVS to total liabilities and then dividing by total assets. If Tobin's Q is less than 1, the stock is undervalued; if Tobin's Q = 1, the stock is in average condition; and if Tobin's Q is greater than 1, the stock is overvalued.

Previous Research Review

The previous research review referred to in this study reviews several related research findings, namely Eco-Efficiency, Carbon Emission Disclosure, and Green Innovation and Firm Value. The following are some studies related to the author's research object:

Atiningsih & Setiyono (2023) conducted a study entitled "Eco-Efficiency on Firm Value with Profitability Dimensions and Moderated by Firm Size." In this study, eco-efficiency was measured using ISO 14001 certification, while firm value was measured using PBV. This study concludes that eco-efficiency influences firm value.

Yuliandhari et al. (2023) conducted a study entitled "The Effect of Carbon Emission Disclosure, Eco-Efficiency, and Green Innovation on Firm Value." Eco-efficiency in this study was measured by assigning a score of 1 if there was an ISO 14001 certificate and 0 if there was no ISO 14001 certificate. In contrast, company value was measured using Tobin's Q. The conclusion of this study is that eco-efficiency does not affect company value.

A study conducted by Damas et al. (2021) titled "The Effect of Eco-Efficiency, Green Innovation, and Carbon Emission Disclosure on Firm Value, with Environmental Performance as a Moderator," found that eco-efficiency has a significant negative effect on firm value.

A study conducted by Dewi & Rahmianingsih (2020), titled "Increasing Firm Value Through Green Innovation and Eco-Efficiency," showed that eco-efficiency has a positive effect on firm value.

A study conducted by Savitri & Abdullah (2023), titled "The Effect of Eco-Efficiency and Good Corporate Governance on Firm Value: Profitability as a Mediator," showed that companies implementing eco-efficiency strategies can increase their firm value.

A study conducted by Rais & Usman (2020) entitled "The Effect of Eco-Efficiency and Corporate Social Performance on Firm Value with Financial Performance as Intervening Variables (Study on Mining and Manufacturing Companies Listed on the Indonesia Stock Exchange)" found that increased eco-efficiency led to increased firm value in mining and manufacturing companies from 2015 to 2019.

A study conducted by Rais & Usman (2020) titled "The Effect of Eco-Efficiency and Corporate Social Performance on Firm Value with Financial Performance as an Intervening Variable (Study on Mining and Manufacturing Companies Listed on the Indonesia Stock Exchange) found that increased eco-efficiency led to increased firm value in mining and manufacturing companies from 2015 to 2019.

A study conducted by Kurnianta & Dianawati (2020) titled "The Impact of Eco-Efficiency on Firm Value and Firm Size: An Indonesian Study" found that eco-efficiency influences firm value.

A study conducted by Noor et al. (2022) titled "The Effect of Eco-Efficiency on Firm Value with Financial Performance as a Moderating Variable" demonstrated that eco-efficiency positively impacted the value of companies listed on the Indonesia Stock Exchange from 2019 to 2021.

The study, conducted by Kumala & Bakar (2021), was titled "The Effect of Green Innovation, Eco-Efficiency, Business Strategy, Technology Information Investment, and Profitability on Firm Value." The study concluded that eco-efficiency has no impact on firm value.

A study conducted by Zuhrufiyah & Anggraeni (2019) titled "Carbon Emission Disclosure and Firm Value (Case Study of Companies in Southeast Asia) found that Carbon Emission Disclosure (CED) has a proven effect on firm value.

A study conducted by Kurnia et al. (2020) titled "Carbon Emission Disclosure, Good Corporate Governance, Financial Performance, and Firm Value" showed that carbon emission disclosure did not affect firm value.

A study conducted by Rahmanita (2020) titled "The Effect of Carbon Emission Disclosure on Firm Value with Environmental Performance as a Moderating Variable" found that carbon emission disclosure had a positive effect on firm value.

A study conducted by Rusmana & Purnaman (2020) titled "The Effect of Carbon Emission Disclosure and Environmental Performance on Firm Value." The results of this study show that carbon emission disclosure has a positive and significant effect on company value, both partially and simultaneously, for manufacturing companies listed on the Indonesia Stock Exchange (IDX) during the 2016-2018 period.

A study conducted by Alfayerds & Setiawan (2021) titled "The Effect of Carbon Emission Disclosure and Annual Report Readability on Firm Value (An Empirical Study of PROPER-Rated Companies Listed on the IDX 2016-2018) found that carbon emission disclosure positively impacts firm value.

A study conducted by Rahmianingsih & Malau (2021) titled "Carbon Emission Disclosure and Firm Value: Does Eco-Efficiency Moderate This Relationship?" concluded that carbon emission disclosure positively impacts firm value.

A study conducted by Damas et al. (2021) titled "The Effect of Eco-Efficiency, Green Innovation, and Carbon Emission Disclosure on Firm Value, with Environmental Performance as a Moderating Factor." The results of this study indicate that carbon emission disclosure has a significant positive impact on firm value.

The study, conducted by Bahriansyah & Lestari Ginting (2022), titled "Carbon Emission Disclosure on Company Value with Media Exposure as a Moderating Variable," found that carbon emission disclosure influences company value.

A study conducted by Sari & Budiasih (2022) titled "Carbon Emission Disclosure and Firm Value." The results showed that carbon emission disclosure had a positive effect on the value of manufacturing companies listed on the Indonesia Stock Exchange during the 2018-2019 period.

A study conducted by Yuliandhari et al. (2023) titled "The Effect of Carbon Emission Disclosure, Eco-Efficiency, and Green Innovation on Firm Value." The results showed that carbon emission disclosure had a significant positive effect on firm value in high-profile industrial companies listed on the Indonesia Stock Exchange during the 2017-2021 period.

A study conducted by Hardianti & Susi Dwi Mulyani (2023) titled "The Effect of Carbon Emission Disclosure and Firm Size on Firm Value, with Environmental Performance as a Moderating Variable." The results showed that carbon emission disclosure had a positive effect on firm value.

The research conducted by Dewi & Rahmianingsih (2020) was titled "Increasing Company Value Through Green Innovation and Eco-Efficiency." The results showed that green innovation positively impacts company value.

A study conducted by Damas et al. (2021), titled "The Effect of Eco-Efficiency, Green Innovation, and Carbon Emission Disclosure on Firm Value, with Environmental Performance as a Moderating Factor," found that green innovation has a significant positive effect on firm value.

A study conducted by Tonay & Murwaningsari (2022), titled "The Effect of Green Innovation and Green Intellectual Capital on Firm Value, with Firm Size as a Moderating Factor," concluded that green innovation has a negative relationship with firm value.

A study conducted by Roza Mulyadi & Maulana. 2022, titled "The Effect of Green Innovation on Firm Value with Environmental Management Accounting as an Intervening Variable," (an empirical study of manufacturing companies and companies in the primary sector listed on the Indonesia Stock Exchange from 2014 to 2019), found that green innovation has no positive effect on firm value.

The research conducted by Putri Fabiola & Khusnah. 2022, entitled "The Influence of Green Innovation and Financial Performance on Competitive Advantage and Company Value from 2015 to 2020," found that Green Innovation has a positive effect on Company Value.

The study, conducted by Yuniarti et al. (2022), was titled "Green Innovation on Firm Value with Financial Performance as a Mediating Variable: Evidence of the Mining Industry." The population used was mining industry companies listed on the Indonesia Stock Exchange (IDX) for the period 2012-2018. The results of this study showed that Green Innovation had a significant positive effect on Firm Value.

The study, conducted by Yuliandhari et al. (2023), was titled "The Effect of Carbon Emission Disclosure, Eco-Efficiency, and Green Innovation on Firm Value." The results showed that Green Innovation had a significant negative effect on firm value in high-profile industrial companies listed on the Indonesia Stock Exchange for the period 2017-2021.

The study, conducted by Arini et al. (2023), was titled "The Effect of Tax Planning and Green Innovation on Firm Value with Profitability as a Mediator (An Empirical Study of Manufacturing Companies in the Consumer Goods Sector Listed on the Indonesia Stock Exchange for 2019-2021)." The results of this study indicate that green innovation affects company value.

A study conducted by Setyawan & Wijayanti (2023) titled "The Moderation Role of Financial Performance in the Relationship Between Green Innovation and Firm Value (Empirical Study of Manufacturing Companies in 2020-2021) concluded that green innovation significantly impacted the value of companies listed on the Indonesia Stock Exchange (IDX) during the 2020-2021 period.

A study conducted by Ramadhan et al. (2023) titled "Disclosure of Carbon Emissions, Covid-19, Green Innovations, Financial Performance, and Firm Value" concluded that green innovation did not influence firm value.

Research Identification

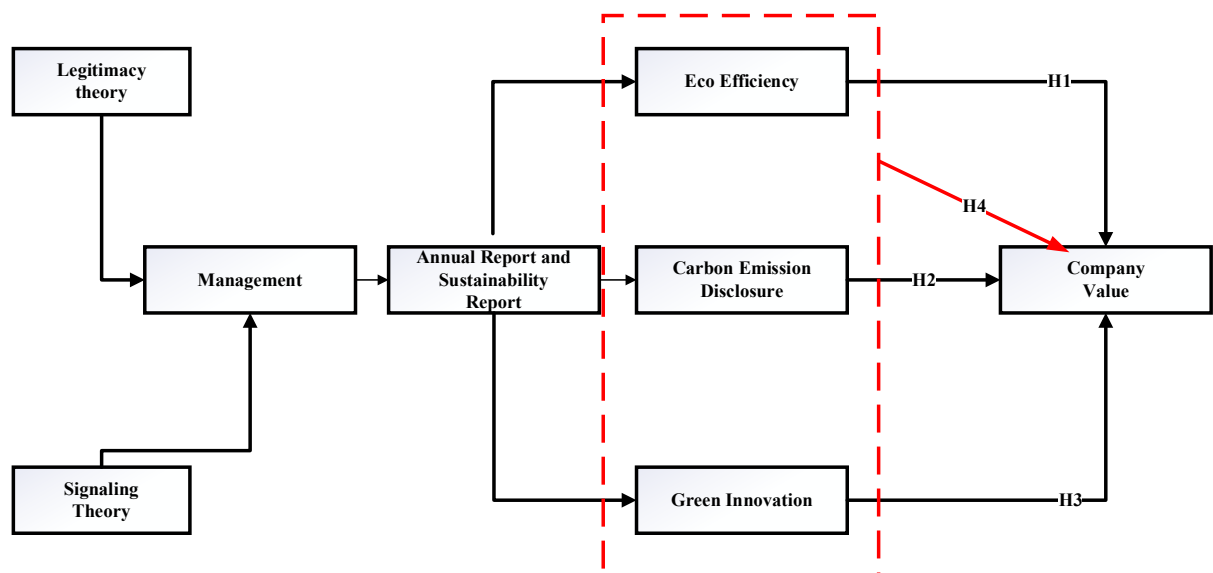
Based on the research background and theoretical basis, the research identification is as follows:

1. How Eco-efficiency, carbon emission disclosure, green innovation, and company value affect companies in the basic material sector listed on the Indonesia Stock Exchange (IDX) from 2018 to 2022.
2. How eco-efficiency influences companies' values in the basic material sector listed on the Indonesia Stock Exchange (IDX) from 2018 to 2022.
3. How carbon emission disclosure influences Companies' value in the basic material sector listed on the Indonesia Stock Exchange (IDX) from 2018 to 2022.
4. How green innovation influences Companies' value in the basic material sector listed on the Indonesia Stock Exchange (IDX) from 2018 to 2022.
5. How eco-efficiency, carbon emission disclosure, and green innovation simultaneously influence the value of companies in the basic material sector listed on the Indonesia Stock Exchange (IDX) from 2018 to 2022.

Research Model and Hypothesis Determination

Figure 1

Research Model and Hypothesis Determination



Hypothesis Establishment

Partially:

- a. Eco-Efficiency has a positive influence on firm value.

- $H_{01}: \beta_1 \geq 0$. Eco-Efficiency does not have a positive influence on firm value.
 $HA_1: \beta_1 < 0$. Eco-Efficiency has a positive influence on firm value.
- b. Carbon Emission Disclosure has a positive influence on firm value.
 $H_{02}: \beta_2 \geq 0$. Carbon Emission Disclosure does not have a positive influence on firm value.
 $HA_2: \beta_2 < 0$. Carbon Emission Disclosure has a positive influence on firm value.
- c. Green Innovation positively influences firm value.
 $H_{03}: \beta_3 \geq 0$. Green Innovation does not have a positive influence on firm value.
 $HA_3: \beta_3 < 0$. Green Innovation positively influences firm value.

Simultaneously:

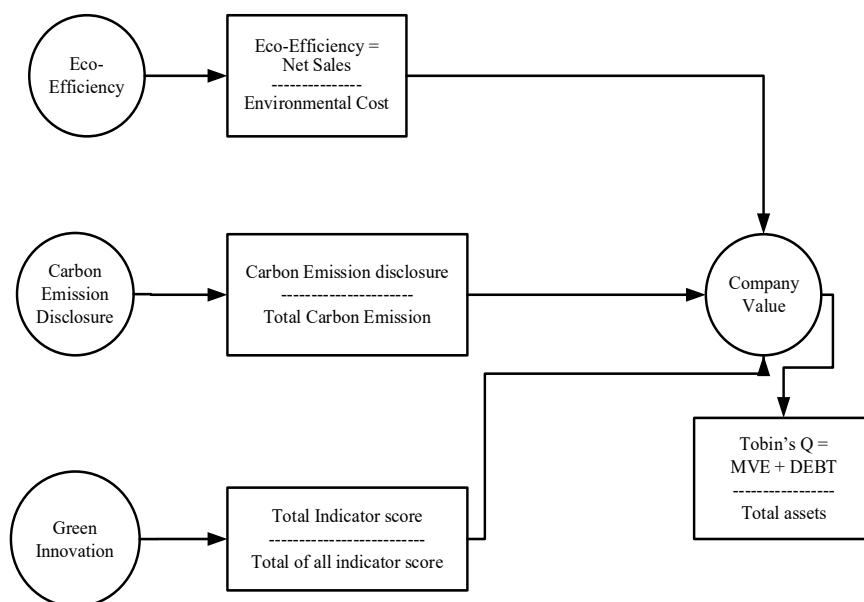
- d. $H_{04}: \beta_1 = \beta_2 = \beta_3 = 0$. Eco-Efficiency, Carbon Emission Disclosure, and Green Innovation do not simultaneously influence Firm Value.
 $HA_4: \beta_1 \neq \beta_2 \neq \beta_3 \neq 0$ Eco-Efficiency, Carbon Emission Disclosure, and Green Innovation simultaneously influence Firm Value.

Research Method

This research method is quantitative and statistical description. Data is obtained from annual reports and sustainability reports of the issuer listed on the Indonesia Stock Exchange from 2018 to 2022.

Figure 2

Research Design



Research Population

The population in this study comprised all basic materials companies listed on the Indonesia Stock Exchange (IDX) for the five years 2018-2022, totalling 103 companies.

Research Sample

The sampling technique used a non-probability sampling method with the following criteria:

- a. Basic materials companies listed on the Indonesia Stock Exchange (IDX) for the 2018-2022 period.
- b. Basic materials companies that published consecutive annual reports from 2018-2022.
- c. Basic materials companies that included the use of raw materials, electricity, water, gas, and fuel in their annual reports consecutively from 2018-2022.
- d. Companies that disclosed their carbon emissions for five consecutive years, as seen from their annual reports or sustainability reports (with at least one carbon emissions disclosure item).
- e. Companies that have listed green innovation business activities for five consecutive years, as seen from annual reports and sustainability reports (including at least one green innovation indicator)

Table 5

Sample Selection using Purposive Sampling

No	Description	Total
1	Basic materials companies listed on the Indonesia Stock Exchange (IDX) for the 2018-2022 period.	103
2.	Basic materials companies that did not publish annual reports consecutively from 2018-2022.	(37)
3.	Basic materials companies on the Indonesia Stock Exchange (IDX) that did not disclose their use of raw materials, electricity, water, gas, and fuel consecutively from 2018-2022.	(19)
4	Companies that did not disclose their carbon emissions for five consecutive years, as seen in their annual report or sustainability report (with at least one carbon emissions disclosure item).	(28)
5	Companies that did not disclose their green innovation business activities for five consecutive years, as seen in their annual report or sustainability report (with at least one green innovation indicator included).	(2)
	Total research sample	17

Source: IDX (data processed in 2024)

Based on the sample selection criteria described in Table 5, the selected sample comprised 17 basic materials companies listed on the Indonesia Stock Exchange between 2018 and 2022, with a five-year observation period, yielding 85 data points. The sample companies that met the specified criteria are as follows:

Table 6*Daftar Sampel Penelitian*

No	Issuer Code	Company name
1.	ANTM	Antam Tambang Tbk
2.	CTBN	Citra Tubindo Tbk
3.	DPNS	Duta Pertiwi Nusantara Tbk
4.	FASW	Fajar Surya Winesa Tbk
5.	IGAR	Champion Pasifics Indonesia Tbk
6.	INAI	Indai Alumunium Industry Tbk
7.	INRU	Toba Pulp Lestari Tbk
8.	INTP	Indocement Tunggul Prakasa Tbk
9.	IPOL	Indopoly Swakarsa Industry Tbk
10.	KMTR	Kirana Megatara Tbk
11.	LTLS	Lautan Luas Tbk
12.	NIKL	Pelat Timah Nusantara Tbk
13.	OKAS	Ancora Indonesia Resource Tbk
14.	SMBR	Semen Baturaja (Persero) TBK
15.	SMCB	Solusi Bangun Indonesia Tbk
16.	SMGR	Semen Indonesia (Persero) Tbk
17.	TKIM	Pabrik Kertas Tjiwi Kimia Tbk

Source: IDX (data processed in 2024)

Operationalization of Variable**Table 7***Operationalization Variable*

Variable	Consept	Indicator	Scale
Variable Independent (X ₁) <i>Eco-Efficiency</i>	Eco-efficiency is an environmental sustainability concept implemented by companies to reduce the environmental impact of company operational activities by minimizing company operational costs Aviyanti & Isbanah, 2019	WBCSD module published in 2006 Eco-Efficiency = $\frac{(\text{Net sales})}{(\text{Environmental Costs})}$ Environmental Costs: Raw materials, electricity, water, gas, and fuel. (Dewi & Rahmianingsih, 2020)	Ratio
Variable Independent (X ₂) <i>Carbon Emission Disclosure</i>	Carbon emission disclosure is a company's activity in recording, acknowledging, disclosing, measuring, and presenting the extent of its carbon emissions. (Damas et al., 2021)	$\frac{\text{Carbon Emission Disclosure}}{\text{Total Carbon Emission}} \times 100\%$ (Muhammad & Aryani, 2021)	Ratio
Variable Independent	Green innovation (environmentally friendly innovation) is: new or modified techniques, practices, systems, and	$\text{Green Innovation} = \frac{\text{Total indicator score}}{\text{Total of all Indicator Scores}}$	Ratio

Variable	Concept	Indicator	Scale
(X ₃) Green Innovation	production processes to reduce environmental impact. (Agustia et al., 2019)	(Agustia et al., 2019)	
Variable dependent (Y) Company Value	Company value is the assessment investors place on a company's success and performance, as reflected in its stock price. Company value, determined through market share price indicators, indicates the presence of good investment opportunities. (Hidayat & Khotimah, 2022)	$\text{Tobin's } Q = \frac{\text{MVE} + \text{DEBT}}{\text{Total Assets}}$ MVE: Market Value of Equity (Closing stock price X number of shares outstanding at year-end) DEBT: Total debt (Dzahabiyya et al., 2020)	Ratio

Table 8

Indicator Carbon Emission Disclosure

Category	Code	Item
Management Approach (GRI 103)	PM1	An explanation of why carbon emissions are a topic for companies.
	PM2	An explanation of how companies manage their carbon emissions.
	PM3	Statement of objectives for carbon emission management.
	PM4	Description of company policies or commitments related to carbon emissions.
	PM5	Evaluation of management approaches related to carbon emissions.
Emission (GRI 305)	CD1	Total carbon emissions are presented in metric tons.
	CD2	Disclosure of sources of carbon emission factors.
	CD3	Disclosure of base year of calculation.
	CD4	Disclosure of standards, methodologies, assumptions, and/or calculation tools used.
	CD5	Emission carbon intensity ratio.
	CD6	Reducing carbon emissions.

Source: Global Reporting Initiative (GRI) 103 and 305 (Muhammad & Aryani, 2021)

Table 9

Indicator Green Innovation

No.	Measurement Indicator
1.	The production process uses new technologies to reduce energy, water, and waste.
2.	Products use fewer non-polluting or hazardous substances (eco-friendly materials)
3.	Using environmentally friendly product packaging (e.g. paper and plastic)
4.	Components or materials in the production process can be recycled or reconditioned

Source: (Agustia et al., 2019)

Statistical Test Selection

Classical Assumption Test

1. Data Normality Test

Detecting whether residuals are normally distributed can be done in two ways: graphical analysis and statistical tests. In this study, the Kolmogorov-Smirnov test was used to assess normality in SPSS. This test is simple and does not cause differences in perception between observations. Graphs are often used in normality tests. The guidelines for making decisions based on the Kolmogorov-Smirnov test are as follows:

- 1) If the Sig value (significance or probability) is > 0.05 , then the distribution is normal.
- 2) If the Sig value (significance or probability) is < 0.05 , then the distribution is not normal.

2. Multicollinearity Test

The Variance Inflation Factor (VIF) is used to determine the presence or absence of multicollinearity using the following formula:

$$VIF = \frac{1}{1 - R^2}$$

R^2 is the coefficient of determination obtained by regressing one of the independent variables X against the other variables. If the VIF value is above or greater than 10, there are symptoms of multicollinearity among the independent variables.

Guidelines for decision-making in multicollinearity testing are as follows:

- a. Guidelines for decision-making based on the tolerance value.
 1. If the tolerance value is > 0.1 , then there is no multicollinearity in the regression model.
 2. If the tolerance value is < 0.1 , then there is multicollinearity in the regression model.
- b. Guidelines for decision-making based on the VIF (Variance Inflation Factor) value.
 1. If the VIF value is < 10 , then there is no multicollinearity in the regression model.
 2. If the VIF value is > 10 , then there is multicollinearity in the regression model.

3. Heteroscedasticity Test

The basis for heteroscedasticity analysis is as follows:

1. If there is a specific pattern, such as points forming a regular pattern (wavy, widening, then narrowing), heteroscedasticity has been identified in the regression model.
2. If there is no clear pattern, and the points are spread above and below 0 on the Y-axis, heteroscedasticity is not present in the regression model.

4. Autocorrelation Test

The Durbin-Watson (D-W) table is used to detect the presence or absence of autocorrelation. Autocorrelation can be determined by the following steps:

- If the DW value lies between the upper bound (d_u) and $(4-d_u)$, then the autocorrelation coefficient is zero, indicating no autocorrelation.
- If the DW value is lower than the lower bound (d_l), then the autocorrelation coefficient is greater than zero, indicating positive autocorrelation.
- If the DW value is greater than $(3-d_l)$, then the autocorrelation coefficient is less than zero, indicating negative autocorrelation.

The Durbin-Watson test can be assessed using the criteria shown in the following table:

Table 10

Durbin-Watson

Null hypothesis	Decision	If
No positive autocorrelation (<i>reject</i>)	Reject	$0 < d < d_l$
No positive autocorrelation (<i>reject</i>)	No Decision	$d_l \leq d \leq d_u$
No negative autocorrelation (<i>reject</i>)	Reject	$4 - d_l < d < 4$
No negative autocorrelation (<i>reject</i>)	No Decision	$4 - d_u \leq d \leq 4 - d_l$
No positive or negative autocorrelation (<i>don't reject</i>)	Accept	$d_u < d < 4 - d_u$

Source: Imam Ghozali (2018, p. 112)

Multiple Linear Regression Analysis

The formula for multiple regression, according to Sugiyono 2022, p. 188 is as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \varepsilon$$

Information:

- Y = Company Value
- a = Constant, if variable X is zero
- X_1 = Eco-Efficiency
- X_2 = Carbon Emission Disclosure
- X_3 = Green Innovation
- $b_1b_2b_3$ = Multiple regression coefficients between each variable
- ε = Standard error

Correlation Coefficient Analysis

According to Sugiyono (2019, p. 248), the level of relationship, based on the correlation coefficient value, provides an interpretation of the size of the correlation. This can be guided by the criteria in the following table:

Table 11

Guidelines for Interpreting Correlation Coefficients

Coefficient Interval	Level of relationship
0,00-0,199	Very low
0,20-0,399	Low
0,40-0,599	Moderate
0,60-0,799	Strong

0,80-1,000	Very strong
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Source: Sugiyono (2019, p. 248)

Analysis of the Coefficient of Determination

According to Sugiyono (2019, p. 231), the formula for the coefficient of determination is as follows:

$$Kd = r^2 \times 100\%$$

Information:

Kd: Coefficient of Determination

r²: Correlation coefficient

Table 12

Interpretation Guidelines: Coefficient of Determination

Statement	Information
<4%	Very low influence
5% - 16%	Low but definite influence
17% - 49%	Significant influence
50% - 80%	High or strong influence
>80%	Very high influence

Source: Sugiyono (2019, p. 223)

Drawing Conclusions

To determine whether the proposed hypothesis can be accepted or rejected, the following steps can be taken:

Hypothesis Testing (t-statistic)

The t-statistic test is a partial (individual) hypothesis test to determine the effect of each independent variable on the dependent variable. The t-test in this study was used to determine the effect of Eco-Efficiency, Carbon Emission Disclosure, and Green Innovation on company value and to draw conclusions regarding whether the related variables can be accepted or rejected.

According to Sugiyono (2022, p. 184), the t-test formula is as follows:

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Information:

t: Uji t

r²: Pearson correlation coefficient value

n: Number of Samples

The t-statistic test has the following guidelines for decision-making:

- Based on the significance value (Sig.).

- i. If the significance value (Sig.) is <0.05, there is an effect between the independent variable (X) and the dependent variable (Y), or the hypothesis is accepted.
- ii. If the significance value (Sig.) is >0.05, there is no effect between the independent variable (X) and the dependent variable (Y), or the hypothesis is rejected.
- b. Based on comparing the calculated t value with the t table:
 - i. If the calculated t-value is > the t-table value, it can be concluded that there is an effect between the independent variable (X) and the dependent variable (Y), and the hypothesis is accepted.
 - ii. If the calculated t value is < the t table value, it can be concluded that there is no effect between the independent variable (X) and the dependent variable (Y), and the hypothesis is rejected.

Hypothesis Testing (F-Test)

The statistical test in this study used analysis of variance (ANOVA), which is used to determine whether the independent variables simultaneously influence the dependent variable. If the probability is less than 0.05, the hypothesis is accepted, meaning it can be concluded that the independent variables simultaneously have a significant influence on the dependent variable.

According to Sugiyono (2022, p. 192), the F-test formula is as follows:

$$F_h = \frac{R^2 / k}{(1 - R^2) / (n - k - 1)}$$

Information:

R^2 = Multiple correlation coefficient

k = Number of independent variables

n = Number of data members or cases

The simultaneous significance test (F-test) has the following guidelines for decision-making:

- a. Based on the significance value (Sig) from the ANOVA output
 - i. If the sig value (sig) < 0.05, the hypothesis is accepted
 - ii. If the sig value (sig) > 0.05, the hypothesis is not accepted
- b. Based on comparing the calculated t-value with the t-table
 - i. If the calculated F-value > F-table, the hypothesis is accepted
 - ii. If the calculated F-value < F-table, the hypothesis is not accepted

Results and Discussion

Data Description

1. Eco-Efficiency in basic materials companies listed on the Indonesia Stock Exchange from 2018 to 2022.

The following are the calculation results for the eco-efficiency variable from 2018 to 2022.

Table 13

Eco-Efficiency in Basic Materials Companies

Listed on the Indonesia Stock Exchange from 2018 to 2022

No	Issuer Code	Eco Efficiency					Average 5 Years
		2018	2019	2020	2021	2022	
1	ANTM	10,3	11,06	11,94	13,87	9,81	11,40
2	CTBN	1,31	1,64	1,91	1,42	1,44	1,54
3	DPNS	1,96	1,85	2,21	2,3	1,72	2,01
4	FASW	1,68	1,63	1,46	1,38	1,31	1,49
5	IGAR	1,39	1,52	1,59	1,49	1,44	1,49
6	INAI	1,8	1,69	1,56	1,71	1,62	1,68
7	INRU	1,58	1,22	1,63	1,46	1,69	1,52
8	INTP	2,15	2,41	2,63	2,37	2,15	2,34
9	IPOL	1,58	1,65	1,82	1,65	1,6	1,66
10	KMTR	1,16	1,14	1,15	1,09	1,19	1,15
11	LTLS	5,5	4,14	4,12	3,67	3,32	4,15
12	NIKL	1,12	1,23	1,18	1,2	1,14	1,17
13	OKAS	4,67	4,38	3,43	3,57	3,26	3,86
14	SMBR	2,62	3,04	3,15	3,15	3,04	3,00
15	SMCB	14,89	16,13	21,56	15,79	15,97	16,87
16	SMGR	3,31	3,7	3,71	3,53	3,25	3,50
17	TKIM	1,96	2,11	2,34	2,23	2,06	2,14
Average		3,47	3,56	3,96	3,64	3,29	3,58
Minimum		1,12	1,14	1,15	1,09	1,14	
Maximum		14,89	16,13	21,56	15,79	15,97	

Note: Results are expressed in units

Source: IDX (Data processed Year 2024)

Based on Table 13, the average eco-efficiency for the period 2018 to 2022 is 3.58. There are 4 companies (23.53%) above the average, namely: ANTM, LTLS, OKAS, and SMBC, while 13 companies (76.47%) are below the average.

As seen in Table 13, the eco-efficiency index with the highest score is SMCB, at 21.56 in 2020. This is due to increased net sales and more efficient use of raw materials, fuel, electricity, and water in 2020, which improved the company's operations. Meanwhile, the lowest score is KMTR, at 1.09 in 2021, due to a decrease in net sales and an increase in the use of raw materials, fuel, water, and electricity.

2. Carbon Emission Disclosure in Basic Materials Companies Listed on the Indonesia Stock Exchange, 2018-2022

This variable is measured using the Global Reporting Initiative (GRI) 103 and 105, which comprise 11 indicators.

Table 14

Carbon Emission Disclosure in Basic Materials Companies Listed on the IDX, 2018-2022

No	Issuer Code	Carbon Emission Disclosure					Average 5 Years
		2018	2019	2020	2021	2022	
1	ANTM	1	1	1	1	0,91	0,98
2	CTBN	0,55	0,55	0,55	0,82	0,82	0,66
3	DPNS	0,27	0,27	0,36	0,82	0,82	0,51
4	FASW	0,45	0,45	0,45	0,55	0,45	0,47
5	IGAR	0,45	0,45	0,73	0,73	0,82	0,64
6	INAI	0,27	0,27	0,27	0,55	0,55	0,38
7	INRU	0,27	0,27	0,27	0,27	0,27	0,27
8	INTP	1	1	1	1	0,91	0,98
9	IPOL	0,09	0,36	0,36	0,64	0,64	0,42
10	KMTR	0,09	0,45	0,45	0,45	0,45	0,38
11	LTLS	0,09	0,45	0,45	0,55	0,73	0,45
12	NIKL	0,18	0,18	0,18	0,27	0,27	0,22
13	OKAS	0,18	0,18	0,18	0,36	0,36	0,25
14	SMBR	0,55	0,55	0,82	0,82	0,82	0,71
15	SMCB	0,55	0,55	0,64	0,64	0,64	0,60
16	SMGR	1	1	1	1	0,91	0,98
17	TKIM	0,18	0,18	0,27	0,36	0,36	0,27
Average		0,42	0,48	0,53	0,64	0,63	0,54
Minimum		0,09	0,18	0,18	0,27	0,27	
Maximum		1	1	1	1	0,91	

Note: Results are expressed in units

Source: IDX (Data processed in 2024)

Based on Table 14, the average carbon emission disclosure is 0.54. There are 7 companies (41.18%) above the average, namely, ANTM, CTBN, IGAR, INTP, SMBR, and SMGR, while 10 other companies (58.82%) are below the average.

Table 14 shows that the basic materials company with the highest score for this variable is INTP. Its carbon emissions disclosures can indicate to investors that the company is environmentally conscious in its operations. Meanwhile, NIKL had the lowest score, at 0.18 from 2019-2020 and 0.27 from 2021-2022.

3. Green Innovation in Basic Materials Companies Listed on the Indonesia Stock Exchange, 2018-2022

This variable is measured using research-based indicators (Agustia et al., 2019), where the sum of the indicator scores is divided by the total indicator score (4).

Table 15*Green Innovation in the Basic Materials Sector**Listed on the IDX, 2018-2022*

No	Issuer Code	Green Innovation					Average 5 Years
		2018	2019	2020	2021	2022	
1	ANTM	0,5	0,5	0,5	0,5	0,5	0,50
2	CTBN	0,5	0,5	0,5	0,5	0,5	0,50
3	DPNS	0,25	0,25	0,25	0,25	0,25	0,25
4	FASW	0,75	0,75	0,75	1	1	0,85
5	IGAR	0,5	0,5	0,25	0,25	0,25	0,35
6	INAI	0,25	0,25	0,5	0,5	0,5	0,40
7	INRU	0,5	0,5	0,5	0,5	0,5	0,50
8	INTP	0,5	0,5	0,5	0,5	0,5	0,50
9	IPOL	0,75	0,75	0,75	0,75	0,75	0,75
10	KMTR	0,25	0,25	0,25	0,25	0,25	0,25
11	LTLS	0,25	0,5	0,5	0,5	0,75	0,50
12	NIKL	0,5	0,5	0,5	0,75	0,75	0,60
13	OKAS	0,5	0,5	0,5	0,5	0,5	0,50
14	SMBR	0,25	0,25	0,25	0,25	0,25	0,25
15	SMCB	0,5	0,5	0,5	0,5	0,5	0,50
16	SMGR	0,75	0,75	0,75	0,75	0,75	0,75
17	TKIM	0,5	0,5	0,5	0,5	0,5	0,50
Average		0,47	0,49	0,49	0,51	0,53	0,50
Minimum		0,25	0,25	0,25	0,25	0,25	
Maximum		0,75	0,75	0,75	1	1	

*Note: Results are expressed in units**Source: IDX (Data processed year 2024)*

Based on Table 15, the average green innovation for the period 2018 to 2022 is 0.50. There are 12 companies (70.59%) above the average, namely: ANTM, CTBN, FASW, INRU, INTP, IPOL, LTLS, NIKL, OKAS, SMCB, SMGR, and TKIM. While 5 companies (29.41%) are below the average.

Table 15 shows that the basic materials company with the highest score for this variable is FASW, with a score of 0.75 in 2018-2020 and 1 in 2021-2022. The company's green innovations can serve as a signal to investors when making investment decisions. Meanwhile, the lowest score is found in DPNS, which remained stable at 0.25 from 2018 to 2022.

4. Company Value of Basic Materials Companies Listed on the Indonesia Stock Exchange in 2018-2022

This variable is measured using the Tobin's Q indicator, which is the total market value plus the total book value of liabilities, then divided by the total book value of assets.

Table 16*Company Value of Basic Materials Companies**Listed on the IDX, 2018-2022*

No	Issuer Code	Company Value					Average 5 Years
		2018	2019	2020	2021	2022	
1	ANTM	1	1,07	1,87	2,01	1,71	1,53
2	CTBN	1,89	1,46	1,64	1,33	0,98	1,46
3	DPNS	0,46	0,38	0,39	0,51	0,52	0,45
4	FASW	2,37	2,25	1,99	2,03	1,74	2,08
5	IGAR	0,81	0,67	0,63	0,67	0,61	0,68
6	INAI	0,97	0,97	0,92	0,87	0,92	0,93
7	INRU	0,71	0,85	0,9	0,81	0,84	0,82
8	INTP	2,61	2,69	2,14	1,85	1,56	2,17
9	IPOL	0,58	0,57	0,6	0,64	0,62	0,60
10	KMTR	1,17	1,15	1,13	1,13	1,03	1,12
11	LTLS	0,82	0,68	0,72	0,74	0,87	0,77
12	NIKL	4,95	1,51	2,6	1,63	1,23	2,38
13	OKAS	1,03	1,19	1,13	1,13	1,09	1,11
14	SMBR	3,51	1,16	2,25	1,6	1,14	1,93
15	SMCB	1,43	1,11	1,03	1,19	1,05	1,16
16	SMGR	1,7	1,44	1,46	1,02	0,94	1,31
17	TKIM	1,39	1,3	1,21	0,96	0,77	1,13
Average		1,61	1,2	1,33	1,18	1,04	1,27
Minimum		0,46	0,38	0,39	0,51	0,52	
Maximum		4,95	2,69	2,6	2,03	1,74	

Note: Results are expressed in units

Source: IDX (Data processed year 2024)

Based on Table 16, the average company value for the period 2018 to 2022 is 1.27. There are 7 companies (41.18%) above the average, namely: ANTM, CTBN, FASW, INTP, NIKL, SMRB, and TKIM, while the other 10 companies are below the average.

Table 16 shows that the basic materials company with the highest score for this variable is NIKL, with a score of 4.95, reflecting its high share price. Meanwhile, DPNS has the lowest score, at 0.38 since 2019, due to its low share price.

Data Test Results

Descriptive Statistics Test Results

Descriptive statistics are used to provide an overview of the results for the variables in this study, including the minimum, maximum, mean, and standard deviation. This data was processed using SPSS version 25. The results of the descriptive statistics test are as follows:

Table 17*Descriptive Statistics*

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Eco-Efficiency	85	1.09	21.56	3.5859	4.15147
Carbon Emission Disclosure	85	.09	1.00	.5396	.28142
Green Innovation	85	.25	1.00	.4971	.18296
Company Value	85	.38	4.95	1.2729	.71908
Valid N (listwise)	85				

Source: SPSS 25 (data processed year 2024)

Based on Table 17, the descriptive test results show a maximum value of 21.56 for the eco-efficiency variable and a minimum value of 1.09. The mean value is 3.5859, and the deviation value is 4.15147. It can be concluded that eco-efficiency is heterogeneous, as the standard deviation exceeds the mean.

Furthermore, the carbon emission disclosure variable ranges from 0.09 to 1.00. The mean value is 0.5396, and the standard deviation is 0.28142. It can be concluded that carbon emission disclosure is homogeneous, as the standard deviation is lower than the mean.

The next independent variable, green innovation, ranges from 0.25 to 1.00. The average value is 0.4971, and the standard deviation is 0.18296. It can be concluded that green innovation is homogeneous, as the standard deviation is lower than the mean.

Furthermore, the dependent variable, company value, ranged from 0.38 to 4.95. The average value was 1.2729, and the standard deviation was 0.71908. It can be concluded that the company's value is homogeneous, as the standard deviation is smaller than the mean.

Classical Assumption Test Results

The Classical Assumption Test consists of four tests: data normality, multicollinearity, heteroscedasticity, and autocorrelation. These four tests aim to determine the certainty of the regression equation, ensuring it is unbiased and consistent.

1. Data Normality Test Results

The Kolmogorov-Smirnov test was used to test for normality in this study. Data can be considered normally distributed if the significance level is greater than 0.05, but if it is less than 0.05, the data is not normally distributed. The results of the normality test are as follows:

Table 18*Normality Test Results**One-Sample Kolmogorov-Smirnov Test*

		Unstandardiz ed Residual
N		85
Normal Parameters ^{a,b}	Mean	.0000000
	Std. Deviation	.70354391
Most Extreme Differences	Absolute	.142
	Positive	.142
	Negative	-.115
Test Statistic		.142
Asymp. Sig. (2-tailed)		.000 ^c

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

Source: Output SPSS 25 (data processed in 2024)

Table 18 shows the results of the Kolmogorov-Smirnov Asymp. Sig. (2-tailed) test of 0.000, which is less than 0.05, indicating that the residual data is not normally distributed. Therefore, corrections are needed by outlining the data, which involves removing outliers. After corrections were made to the data for the variables eco-efficiency, carbon emission disclosure, green innovation, and company value, the normality test results were as follows:

Table 19*Kolmogorov-Smirnov Test Results*

One-Sample Kolmogorov-Smirnov Test		
		Unstandardiz ed Residual
N		64
Normal Parameters ^{a,b}	Mean	.0000000
	Std. Deviation	.50170860
Most Extreme Differences	Absolute	.087
	Positive	.087
	Negative	-.062
Test Statistic		.087
Asymp. Sig. (2-tailed)		.200 ^{c,d}

a. Test distribution is Normal.

b. Calculated from data.

Source: Output SPSS 25 (data processed 2024)

Based on the retesting, the results of the normality test using the Kolmogorov-Smirnov test showed a value of 0.200, which is greater than 0.05, so the data can be concluded to have a normal distribution.

1. Multicollinearity Test

To determine whether there is a correlation between variables, a VIF (Variance Inflation Factor) of less than 10 and a tolerance value of more than 0.10 can be considered as no multicollinearity. The results of the multicollinearity test are as follows:

Table 20

Multicollinearity Test Results

<i>Coefficients^a</i>			
Model		Collinearity Statistics	
		Tolerance	VIF
1	Eco-Efficiency	.971	1.030
	Carbon Emission Disclosure	.953	1.049
	Green Innovation	.980	1.020

a. Dependent Variable: Company Value

Source: Output SPSS 25 (data processed in 2024)

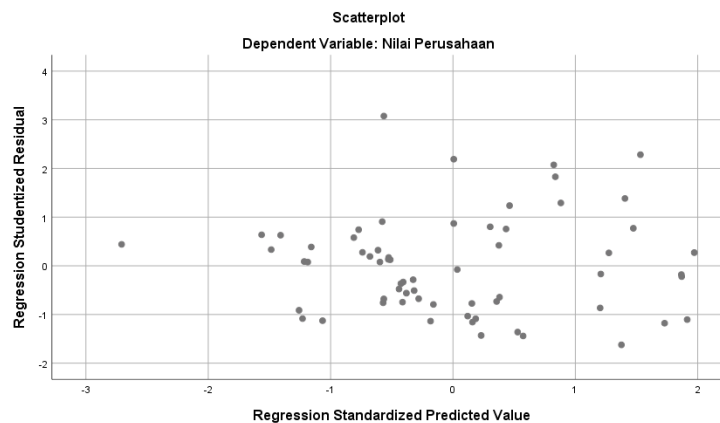
Based on Table 20, the independent variables eco-efficiency, carbon emission disclosure, and green innovation have tolerances of 0.971, 0.953, and 0.980, respectively. These three variables can be said to have met the tolerance value of more than 0.10. Meanwhile, the VIF values for the eco-efficiency variable, carbon emission disclosure, and green innovation are 1.030, 1.049, and 1.020, respectively. All three variables have met the VIF criterion because their VIFs are less than 10. Therefore, there is no multicollinearity.

2. Heteroscedasticity Test

According to Imam (2018), heteroscedasticity can be detected by examining the plot of the dependent variable (ZPRED) against its residuals (SRESID). Detection can be done by examining the presence or absence of a pattern formed through a scatterplot. If there is no clear pattern, and the points are spread between the top and bottom of the 0 on the Y-axis, then heteroscedasticity cannot be concluded.

Figure 3

Result Heterocedasticity test



Source: Output SPSS 25 (data processed year 2024)

It can be seen that the scatterplot above does not form a clear pattern but is spread out and does not accumulate at a single point. Therefore, it can be concluded that there is no heteroscedasticity, making it suitable for predicting the independent variable on the dependent variable and allowing for the next classical assumption test.

3. Autocorrelation Test

The autocorrelation test was conducted to determine whether the linear regression model has a correlation between the error confounding period t and the error confounding period $t-1$ (previous). Autocorrelation in this study was measured using the Durbin-Watson (DW) test, which compares the Durbin-Watson (DW) value with the d_U value.

Good autocorrelation is when the Durbin-Watson value is in the range $d_U < d_W < 4 - d_U$. The following are the results of the autocorrelation test in this study:

Table 21

Autocorrelation Test Results

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.372 ^a	.139	.096	.51410	2.504

a. Predictors: (Constant), Green Innovation, Eco-Efficiency, Carbon Emission Disclosure

b. Dependent Variable: Company value

Source: Output SPSS 25 (data processed in 2024)

Table 21 shows multicollinearity, as the Durbin-Watson value is 2.504. Based on the DW table for $k=3$ and $n=64$, the lower limit, or d_1 , is 1.6946. The Durbin value does not fall between the d_U value of 1.6946 and the $4-d_U$ value of 2.3054. Therefore, there is autocorrelation in this regression

equation. Therefore, the Cochrane-Orcutt method should be used for treatment. The following are the Cochrane-Orcutt results:

Table 22

Cochrane-Orcutt Results

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.366 ^a	.134	.090	.47630	2.183

a. Predictors: (Constant), Lag_X₃, Lag_X₁, Lag_X₂

b. Dependent Variable: Lag_Y

Source: Output SPSS 25 (data processed in 2024)

Table 22 shows that after applying the Cochrane-Orcutt treatment, the new DW value was 2.183. Based on the DW table for k=3 and n=64, the lower limit, or d₁, is 1.6946. The Dw value obtained through Cochrane-Orcutt, 2.183, lies between the DW value of 1.6946 and the 4-du value of 2.3054. Therefore, it can be concluded that there is no autocorrelation in the variables in this study.

Results of Multiple Regression Analysis

To determine the effect of eco-efficiency (X₁), carbon emission disclosure (X₂), and green innovation (X₃) on firm value (Y) in Basic Materials companies listed on the Indonesia Stock Exchange (IDX) from 2018 to 2022, a Multiple Linear Regression analysis was conducted. The results of the multiple linear regression analysis are as follows:

Table 23

Results of Multiple Regression Analysis

Coefficients^a

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	.653	.293		2.228	.030
	Lag_X ₁	.042	.056	.092	.747	.458
	Lag_X ₂	.303	.217	.174	1.398	.167
	Lag_X ₃	.838	.376	.274	2.227	.030

Source: Output SPSS 25 (data processed in 2024)

a. Dependent Variable: Lag_Y

Based on Table 23, the multiple linear regression equation can be concluded as follows:

$$Y = 0.653 + 0.042X_1 + 0.303X_2 + 0.838X_3 + \epsilon$$

This indicates the influence of the independent variables on the dependent variable. The explanation of the influence of each variable is outlined as follows:

- The constant value of 0.653 indicates the magnitude of the firm value coefficient for basic materials companies listed on the Indonesia Stock Exchange (IDX) from 2018-2022, which is influenced by eco-efficiency, carbon emission disclosure, and green innovation. If the independent variable is absent, changes in the independent variable will occur.
- The eco-efficiency regression coefficient (X_1) of 0.042 indicates a significant positive influence on firm value. A one percent increase in eco-efficiency will result in a 0.042 increase in firm value, assuming the other independent variables in the regression model remain constant.
- The regression coefficient value for carbon emission disclosure (X_2) of 0.303 indicates a significant positive effect on firm value. A one per cent increase in carbon emission disclosure will result in a 0.303 increase in firm value, assuming the other independent variables in the regression model remain constant.
- The regression coefficient value for green innovation (X_3) of 0.838 indicates a significant positive effect on firm value. A one per cent increase in green innovation will result in a 0.838 increase in firm value, assuming the other independent variables in the regression model remain constant.

Correlation Analysis Results

The results of the partial correlation analysis are as follows:

Table 24

Correlation Analysis

		Correlations			
		Lag_X1	Lag_X2	Lag_X3	Lag_Y
Lag_X 1	Pearson Correlation	1	.155	.001	.119
	Sig. (2-tailed)		.225	.995	.353
	N	63	63	63	63
Lag_X 2	Pearson Correlation	.155	1	.163	.233
	Sig. (2-tailed)	.225		.201	.066
	N	63	63	63	63
Lag_X 3	Pearson Correlation	.001	.163	1	.302*
	Sig. (2-tailed)	.995	.201		.016
	N	63	63	63	63
Lag_Y	Pearson Correlation	.119	.233	.302*	1
	Sig. (2-tailed)	.353	.066	.016	
	N	63	63	63	63

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Output SPSS 25 (data processed in 2024)

Based on Table 24, the relationship between the independent and dependent variables is known through guidelines for determining the level of relationship between variables. The results of the correlation analysis above can be seen in the following table:

Table 25

Interpreting Results of the Partial Correlation Test

Variable Independent	Correlation Coefficient	Interval Coefficient	Level of Relationship
Eco-Efficiency (X_1)	0,119	0,00-0,199	Very low
Carbon Emission Disclosure (X_2)	0,233	0,20-0,399	Low
Green Innovation (X_3)	0,302	0,20-0,399	Low

Source: Output SPSS 25 (Data processed in 2024)

Based on Table 25, the relationship between eco-efficiency and firm value is very low, with a positive coefficient, indicating that an increase in firm value accompanies any increase in eco-efficiency. Meanwhile, the relationship between carbon emission disclosure and firm value is low, with a positive coefficient, indicating that an increase in firm value accompanies any increase in carbon emission disclosure. Furthermore, the relationship between green innovation and firm value is low, with a positive coefficient, indicating that any increase in green innovation is accompanied by an increase in firm value.

Results of the Coefficient of Determination Analysis

The results of the coefficient of determination test are as follows:

Table 26

Coefficient of Determination Analysis

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.366 ^a	.134	.090	.47630

a. Predictors: (Constant), Lag_ X_3 , Lag_ X_1 , Lag_ X_2

b. Dependent Variable: Lag_Y

Source: Output SPSS 25 (data processed year, 2024)

Based on Table 26, the R-Square value is 9%. This value indicates that the variables eco-efficiency, carbon emission disclosure, and green innovation can predict company value by 13.4%, while the remaining 91% is influenced by other variables not examined in this study.

Research Results

Partial Hypothesis Test Results (t-Test)

The results of the partial hypothesis test (t-test) are as follows:

Table 27*Partial Hypothesis Test (t-Test)*

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	.653	.293		2.228	.030
Lag_X1	.042	.056	.092	.747	.458
Lag_X2	.303	.217	.174	1.398	.167
Lag_X3	.838	.376	.274	2.227	.030

a. Dependent Variable: Lag_Y

Source: Output SPSS 25 (data processed year 2024)

Based on Table 27, the error rate is 5% with degrees of freedom $df = n - k - 1$, where $n = 64$ data samples and $k = 3$ independent variables, resulting in $df = 63 - 3 - 1 = 59$, and a t-value of 1.67109.

a. Results of the Independent Variable X_1

The calculated t-value for the independent variable eco-efficiency is $0.747 < 1.67109$, with a significance level of $0.458 > 0.050$. This means that H_0 is accepted and H_a is rejected, thus concluding that eco-efficiency does not influence firm value.

b. Results for Independent Variable X_2

The calculated t-test for the independent variable carbon emission disclosure is $1.398 < 1.67109$ with a significance level of $0.167 > 0.050$. This means that H_0 is accepted and H_a is rejected. Therefore, it can be concluded that carbon emission disclosure does not influence firm value.

c. Results for Independent Variable X_3

The calculated t-test for the independent variable green innovation is $2.227 > 1.67109$ with a significance level of $0.030 < 0.050$. This means that H_0 is rejected and H_a is accepted. Therefore, it can be concluded that green innovation has a positive and significant effect on firm value.

Simultaneous Hypothesis Test Results (f-Test)

This F-test hypothesis can be tested by comparing the calculated F-value with the table F-value, with a d-distribution and degrees of freedom (df) = $n - k - 1$, using a significance level of 5%, where n = the number of research samples, namely 64 data, and k = the number of independent variables, totalling 3. This yield, $63 - 3 - 1 = 59$, resulting in a table F-value of 2.761. The results of the F-test hypothesis are as follows:

Table 28*Simultaneous Hypothesis Test (F-Test)*

ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
-------	----------------	----	-------------	---	------

1	Regression	2.071	3	.690	3.042	.036 ^b
	Residual	13.385	59	.227		
	Total	15.455	62			

a. Dependent Variable: Lag_Y

b. Predictors: (Constant), Lag_X₃, Lag_X₁, Lag_X₂

Source: Output SPSS 25 (data processed in 2024)

Based on Table 28, the F-test value is $3.042 > 2.761$, meaning the calculated F-value is greater than the table F-value, and the significance value is less than 0.050 ($0.032 < 0.050$). This means that H₀ is rejected and H_a is accepted. Therefore, it can be concluded that the independent variables in this study, namely eco-efficiency, carbon emission disclosure, and green innovation, simultaneously influence the dependent variable, namely firm value.

Discussion of Results

The Effect of Eco-Efficiency on Firm Value

The results from the t-test or partial test indicate that eco-efficiency does not influence firm value. This is evidenced by a significance value of $0.458 > 0.050$ and a calculated t-value of $0.747 < 1.67109$. This means that the calculated t-value is smaller, so H₀ is accepted and H_a is rejected. The results of this study are in line with the research of Yuliandhari et al. (2023), which showed that eco-efficiency does not influence company value.

Eco-efficiency, as demonstrated in this study, failed to efficiently reduce the environmental impact of company operations. Furthermore, the company failed to increase public trust through its management practices.

The results of this study are similar to those of Kumala & Bakar (2021), entitled "The Effect of Green Innovation, Eco-Efficiency, Business Strategy, Technology Information Investment, and Profitability on Firm Value." This study concluded that eco-efficiency had no impact on firm value.

The Effect of Carbon Emission Disclosure on Company Value

The results show a significance level for the carbon emission disclosure variable of $0.167 > 0.05$, and a calculated t-value of $1.398 < 1.67$. The calculated t-value is smaller than the t-table value.

Therefore, H₀ is accepted, and H_a is rejected. Therefore, it can be concluded that carbon emission disclosure does not influence company value.

These results align with research (Kurnia et al., 2020) that found carbon emission disclosure does not influence company value.

Carbon emission disclosure is still voluntary. This voluntary nature means that not all companies in environmentally sensitive industries disclose carbon emissions. This may be due to the high cost of disclosing these emissions, which could be detrimental to the company, and to the voluntary nature of disclosure, which encourages companies to consider carbon emission disclosure (Amaliya et al., 2019).

The results of this study differ from those of Yuliandhari et al. (2023), who found that carbon emission disclosure has a significant positive effect on company value.

The Effect of Green Innovation on Company Value

The results obtained from the hypothesis test indicate that the green innovation variable is significant, with a p-value of $0.030 < 0.05$ and a calculated t-value of $2.227 > 1.67109$. The calculated t-value is greater than the t-table, and the significance is less than 0.05. Therefore, H_0 is rejected, and H_a is accepted. Therefore, it can be concluded that green innovation influences company value.

Based on the research results above, it can be seen as evidence that environmentally friendly innovations implemented to reduce environmental damage can increase company value. Companies that implement green innovation will be perceived as environmentally responsible and able to utilise their resources efficiently, which will increase investor confidence and company value (Yuliandhari et al., 2023).

The research results are consistent with those of Dewi & Rahmianingsih. (2020), Damas et al. (2021), Putri Fabiola & Khusnah. (2022), Yuniarti et al. (2022), Arini et al. (2023), (Setyawan & Wijayanti. (2023).

Research Limitations

Based on the research conducted, there are several limitations in conducting this research, as follows:

- a. The case study used in this research focuses only on the basic materials sector listed on the Indonesia Stock Exchange (IDX).
- b. This research only uses three independent variables: eco-efficiency, carbon emission disclosure, and green innovation, for the dependent variable, firm value. While many other independent variables can influence the dependent variable, firm value, this research only uses three independent variables.
- c. The observation period in this study is only five years, from 2018 to 2022.
- d. In this study, the coefficient of determination for the adjusted R-square is only 9%. Thus, the ability of the independent variables to explain the dependent variable is still limited.

Conclusion

Based on the research results, the following conclusions can be drawn:

Eco-efficiency does not influence company value, thus demonstrating that companies that implement efficient operational costs will increase company value. Carbon emission disclosure does not influence company value. The high cost of disclosing carbon emissions, coupled with the voluntary nature of disclosure, still makes companies consider disclosing them. Green innovation has a positive and significant influence on company value, demonstrating that environmentally friendly innovations implemented to reduce environmental impacts can increase company value. Eco-efficiency, carbon emission disclosure, and green innovation simultaneously influence company value in basic materials companies listed on the Indonesia Stock Exchange from 2018 to 2022.

Suggestions for Future Research

The following suggestions are expected to be useful for future research:

- a. The case study used in this research focused only on the basic materials sector. Therefore, future research should include other sectors to assess the influence of the independent and dependent variables in this study on those sectors.
- b. Companies are expected to pay greater attention to environmental impacts related to their operations by implementing efficient resource use and reducing operational costs, in addition to disclosing their carbon emissions.
- c. This study shows that eco-efficiency, measured using the World Council for Sustainable Development (WBCSD) 2006 indicator, has no effect on company value, so it is recommended to use other indicators.
- d. This study shows that carbon emission disclosure does not affect company value using the Global Reporting Initiative (GRI) 103 and 305 indicators, so it is recommended to use other indicators to measure this variable.

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Conflicts of Interest

None.

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