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Determinants of Firm Value: Evidence from Carbon Emission Disclosure, Green Innovation, and Cash Holding

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Abstract

Purpose – *This study aims to obtain empirical evidence on the influence of carbon Emission Disclosure, Green Innovation, and Cash Holding on Firm Value.*

Design/methodology/approach – *This study uses quantitative research. The sample in this study consist of 40 companies in the transportation and logistics, and infrastructure sectors listed on Indonesian Stock Exchange from 2021-2024. The analysis technique used to the hypothesis is multiple regression analysis using Eviews 9 software.*

Findings – *The results of this study found carbon emission disclosure had a negative and statictically insignificant effect on firm value, while green innovation had a negative and statistically significant effect on firm value, and cash holding had a positive and statistically significant effect on firm value*

Research limitations/implications – *This study discusses firm value and other such as carbon emission disclosure and green innovation focusing on trasnprotation and logistics, and infrastructure sectros.*

JEL : G32, M41, Q56

INTRODUCTION

Climate change is the greatest global challenge of the modern era, mainly due to increasing greenhouse gas emissions such as CO_2, which drive global warming (S. Chen et al., 2022). Data from Berkeley Earth (2023) shows that in 2023, global temperatures will increase by 1.54°C above the pre-industrial average of 1850–1900. In fact, the 2015 Paris Agreement has set a target of limiting the temperature increase to no more than 1.5°C. The failure to curb global warming has triggered natural disasters, rising sea levels, and pressure on the economy, prompting various countries to set net zero emission targets to reduce carbon emissions. Indonesia itself has set a target of carbon neutrality by 2060, although its implementation faces many challenges, particularly in the energy transition (IEEFA, 2024).

The transportation, logistics and infrastructure sector in Indonesia plays a strategic role in economic growth, but is the second largest contributor to emissions after the energy sector.

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In addition to environmental pressures, this sector faces a significant decline in financial performance. IHSG 2024 data shows a decline in the transportation & logistics sector index of 11.66% (YTD), with a decline in the share prices of large issuers such as PT Garuda Indonesia Tbk by 15.94% and PT Samudera Indonesia Tbk by 12.5%. This decline reflects weak demand for services, high operating costs, and global economic uncertainty, which also affect the firm value of related sectors.

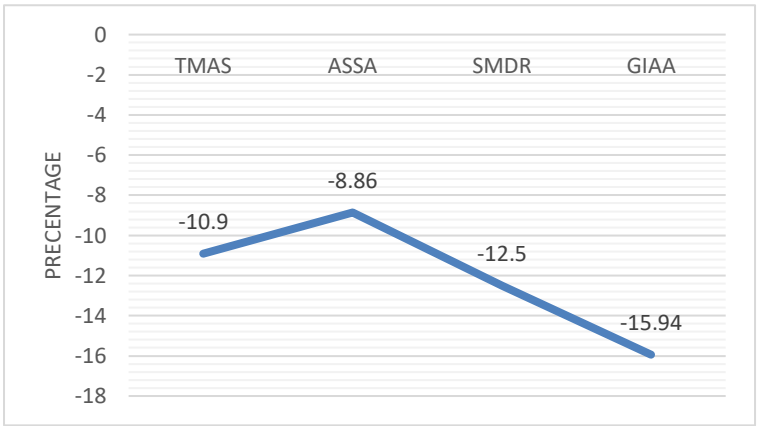

Figure 1 Financial Performance

Firm value is an important element in determining the working conditions of an organisation. The implementation of environmental strategies can support the operational balance of a company between economic and environmental aspects. In order to achieve the expected level of business productivity, companies need to be aware of the importance of ensuring that their business activities do not have a negative impact on the surrounding environment (Agustia et al., 2019). In the modern business environment, a company's value is greatly influenced by investors' perceptions of its efforts to integrate sustainability aspects, including environmental risk management and compliance with evolving regulations, as indicators of the company's future prospects. One aspect of efforts to mitigate environmental impacts and contribute to shaping corporate value is carbon emission disclosure, which reflects the extent to which companies are committed to environmental sustainability and transparency (Yuliandhari et al., 2023). Research by Khasanah & Anggraini (2024) and Azhari & Hasibuan (2023) states that carbon emission disclosure has a positive effect because it increases transparency and investor confidence. However, Shafira (2024) found a negative effect, while Pratami & Aryati (2023) showed an insignificant relationship.

Another factor that plays a role in reducing environmental impact and has implications for firm value is green innovation. The proper implementation of green innovation is believed to increase company value through positive public perception of the company's commitment, as well as its impact on pricing strategy and financial performance (Zhang et al., 2020). In their research, Zhang et al. (2020) and Damas et al. (2021) found a positive effect on firm value, while Ananda & Taqwa (2024) and Yuliandhari et al. (2023) revealed a negative effect due to high innovation costs. In addition to the aspects mentioned above, there is another aspect that can strengthen a company's value, namely cash holdings. Cash holdings are an element of working capital that a company needs to carry out its daily operations (CP & Suzan, 2023). Research by

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Ismawati & Sukandani (2024) and Chandra & Feliana (2020) states that optimal cash holdings increase investor confidence and company value. However, several studies, such as those by Riyadi et al. (2021) and Rahmaniar & Rizky (2022), found insignificant or negative relationships, as large amounts of cash can pose the risk of misuse by management.

Based on the phenomenon, the uncertainty of research results, and the importance of environmental strategies on company performance, this study aims to analyse the effect of carbon emission disclosure, green innovation, and cash holding on firm value. This study is expected to provide empirical contributions to the development of literature on sustainable finance strategies, as well as practical considerations for companies and investors in responding to climate change issues and global economic challenges.

LITERATUR REVIEW

Legitimacy Theory

According to Dowling & Pfeffer (1975) legitimacy theory is defined as an asset or potential resource that enables a company to maintain sustainability. Legitimacy theory describes the dynamics of the relationship between companies and society through a social contract. This contract stipulates that society has the ability to withdraw its support or legitimacy if companies do not comply with requirements that are in line with public expectations and values (Deegan & Gordon, 1996; Dowling & Pfeffer, 1975). Legitimacy theory interprets carbon emission disclosure and green innovation as mechanisms for companies to respond to societal expectations and regulatory pressures while reinforcing their legitimacy.

Stakeholder Theory

Stakeholder are groups or individuals who influence or are influenced by the process of achieving an organisation's objectives (Freeman, 1984). Ghozali & Chariri (2014) state the sustainability of a company is highly dependent on stakeholder involvement, as stakeholders have access to and control over resources for business operations. According to stakeholder theory, a company's value is not solely the result of short-term financial achievements. This value is a balance created by how the company maintains relationships and fulfils its responsibilities to all stakeholders. This theory emphasizes that a firm’s success and value are determined by management’s ability to meet stakeholders’ interests, where mutually beneficial relationships enhance trust and support, thereby sustaining the company’s continuity and growth. In addition, this theory states that cash holdings reflect management's commitment to fulfilling its responsibilities to various stakeholders by maintaining a balance between the interests of shareholders, employees, and customers in strategic decision-making (Freeman, 1984).

Carbon Emission Disclosure

Carbon disclosure practices refer to companies' activities in systematically recording, assessing and reporting carbon emissions generated from all of their operational activities (Yuliandhari et al., 2023). Companies play an important role in mitigating climate change through the management of carbon emissions from their operational activities. Therefore, carbon emissions reporting is a crucial aspect that companies must undertake as a form of transparency and accountability for the environmental impact they cause. To assess the

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intensity of corporate carbon emission disclosure, Choi et al. (2013) employed a checklist-based approach developed from the information request sheet of the Carbon Disclosure Project (CDP), and subsequently categorized the disclosure indicators into five main areas related to climate change and carbon emissions, namely climate change risks and opportunities, greenhouse gas emissions, energy consumption, greenhouse gas reduction and cost, and carbon emission accountability.

Green Innovation

Green innovation is defined as a systematic effort to reduce the exploitation of natural resources and emissions of harmful substances. This effort is realised through the development of new products and processes, structural changes within organisations, and significantly improved marketing programmes to achieve a balance between environmental, social and economic aspects within a social system (E. R. Lestari, 2019). Green innovation is a key factor contributing to market share growth and enhanced corporate reputation in the context of business strategy. By integrating green innovation, companies are not only able to survive in a highly competitive market, but also create new opportunities to compete effectively. In addition, this innovation helps companies convey relevant information to stakeholders and strengthen their position in the global market (Kelvin et al., 2017).

Firm Value

Indrarini (2019) states that firm value is a representation of investors' perceptions of the effectiveness of company managers in managing the assets and resources entrusted to them, which ultimately reflects the company's performance and potential for success in the market. Company value is an important benchmark for evaluating the performance of a business entity, both now and in the future. An increase in firm value will enhance its attractiveness to investors, which in turn can drive up the share price. This increase in share price has the potential to provide substantial profits for shareholders. Firm value can be measured by market ratios or valuation ratios. Valuation ratios are considered comprehensive indicators for assessing overall corporate performance, which includes several key elements, namely:

1. Price to Book Value
2. Market to Book Ratio
3. Market Value of Equity
4. Tobin's Q

Cash Holding

Cash holdings are highly liquid assets that can be used to invest in other assets, given their ease of storage and transferability. Therefore, companies must manage their cash holdings optimally, maintaining a proportional amount (neither excessive nor insufficient) to prevent liquidity problems and ensure the availability of funds for a specified period (Ye, 2018). Maintaining cash stability at a balanced level is an effective strategy for management to ensure business continuity and reduce financial risk (Asante-Darko et al., 2018). According to Keynes (1936) in Christina & Ekawati (2014), there are three motives for companies to make decisions on cash holdings, including:

1. Transaction motive
2. Precautioanry motive

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3. Speculative motive

Hypotheses development

Carbon Emission Disclosure on Firm Value

Carbon emission disclosure is the process of recording, reporting and communicating data related to the total carbon emissions produced by a company's operational activities. This disclosure is one of the strategies used by companies to build a positive image in the public eye (Yuliandhari et al., 2023). Transparency of information regarding carbon emissions plays an important role for stakeholders, especially investors who consider sustainability factors as a basis for investment decisions. In accordance with legitimacy theory, companies are required to demonstrate that their operational activities are within the framework of norms and values accepted by society. This effort aims to obtain social legitimacy that supports the company's survival. Disclosure of emissions demonstrates a company's accountability for its environmental impact. This shows that the more transparent a company is in disclosing its carbon emissions, the higher its value.

H_1: Carbon emission disclosure has a positive effect on firm value

Green Innovation on Firm Value

Green innovation is a sustainability strategy that encompasses energy efficiency, pollution reduction, waste recycling, and environmentally friendly product design. Agustia et al. (2019) explain that the main focus of companies now includes creating value not only for shareholders, but also for all stakeholders. To achieve this goal, competent managers are needed to improve environmental, social and economic performance for the sake of corporate sustainability. From the perspective of Legitimacy Theory, the application of green innovation shows that companies are proactively seeking to gain social legitimacy. A company's commitment to environmental conservation is key for highly ethical companies in minimising environmental risks and building their reputation (E. R. Lestari, 2019). Through this strategy, companies align their operational practices with societal values. In this context, a commitment to mitigating environmental impacts plays a dual role: as a form of social responsibility and as a strategic tool to strengthen the company's image.Therefore, the greater the company's efforts in implementing green innovation, the greater the company's potential to increase cost efficiency, create competitive advantages, and meet consumer needs that support sustainability, thereby increasing the firm value.

H_2: Green innovation has a positive effect on firm value

Cash Holding on Firm Value

A high level of cash holdings can strengthen a company's ability to act on investment opportunities that arise, thereby providing a competitive advantage to the company's long-term value. In addition, the company becomes more financially stable and attractive to investors because it does not rely on debt, which can lead to a decline in ownership or interest rate fluctuations (Halim, 2022). Cash holdings serve to support both operational and non-operational activities of the company. To avoid financial risks in the future, the company takes a more cautious approach in managing cash.

Cash holdings, from a stakeholder theory perspective, serve as a form of corporate

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response to the need to meet the expectations and interests of various stakeholders. Adequate cash holdings enable companies to respond to stakeholder needs, especially amid economic uncertainty. Cash holdings also provide strategic flexibility for management in dealing with economic uncertainty, such as regulatory changes, financial crises, and operational disruptions. By having adequate cash reserves, companies can quickly adapt to changing market conditions without having to wait for external funding, which takes time and incurs additional costs.

H_3: Cash holding has a positive effect on firm value

RESEARCH METHOD

This study aims to determine the effect of independent variables, namely carbon emissions disclosure, green innovation, and cash reserves, on the dependent variable, namely company value. This study uses a correlation method, in which the research is conducted in an unregulated situation or without special intervention. The level of intervention used is minimal intervention. The methodology used in this study is quantitative. This study uses a non-probability sampling design with a purposive sampling technique approach (Sekaran, 2009).

Table 1. Selection Criteria

No	Criteria	Number of Companies
	Transportation, logistics, and infrastructure companies that are not listed on the Indonesia Stock Exchange 2021-2024	(22)
Kriteria 1	Transportation, logistics, and infrastructure companies listed on the Indonesia Stock Exchange from 2021-2024	85
	Companies in the transportation, logistics, and infrastructure sectors that did not publish audited annual reports for the years 2021-2024.	(26)
Kriteria 2	Companies in the transportation, logistics, and infrastructure sectors that have published audited annual reports for the years 2021-2024.	81
	Companies that did not publish sustainability reports for 2021-2024	(67)
Kriteria 3	Companies that have published sustainability reports for 2021-2024	40
Company Sample		40

Table 2. Variable measurement tools and sources

Type	Variable	Dimension / Formula	Source
	Carbon Emission	$\text{CED} = \frac{\text{Number of items disclosed}}{\text{Total disclosure items}}$	(Choi et al., 2013)

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Type	Variable	Dimension / Formula	Source
	Disclosure		
Independent Variables	Green Innovation	$GI = \frac{\text{Number of indicators disclosed}}{\text{Total disclosure indicators}}$	(Rachmawati, 2023)
	Cash Holding	$CH = \frac{Cash\ and\ cash\ equivalent}{Total\ Assets}$	(Tobisn' Q, 1969)
Dependent Variables	Firm Value	$Tobin's\ Q = \frac{MVE + Debt}{Total\ Assets}$	(T. U. Lestari & Hasanah, 2024)

Source: Author's work

Data Source

The data used in this study is secondary data, where the data sources in this study are derived from the financial reports of companies in the transportation & logistics and infrastructure sectors listed on the Indonesia Stock Exchange for the period 2021-2024, obtained from www.idx.co.id and company websites.

Data Collection Techniques

In collecting data for this study, the researcher applied two methods, namely literature study and field survey. Through literature study, the researcher obtained data relevant to the issue under study through various comprehensive literature studies, such as scientific journals or articles, relevant books, as well as data and publications accessed via the internet based on their relevance to the focus of the study. The field research conducted in this study involved secondary data. This study focused on companies in the transportation, logistics, and infrastructure sectors listed on the Indonesia Stock Exchange for the period 2021-2024, whose financial information has been comprehensively published and audited by independent public accountants, as well as officially published on the IDX.

RESULTS

Descriptive statistical analysis explains the independent and dependent variables used in this study, which include minimum, maximum, mean, and standard deviation values. Descriptive statistical analysis in this study describes the distribution of the variables used, namely the dependent variable (Y) in the form of firm value, and the independent variables (X) which include carbon emission disclosure, green innovation, and cash holdings. The following

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is a table of descriptive statistics:

Table 3. Descriptive Statistic

Variabel	N	Min	Max	Mean	Std. Dev
CED	160	0.000	1.000	0.868	0.136
GI	160	0.000	1.000	0.864	0.095
FV	160	0.400	7.593	1.566	1.282
CH	160	0.000	0.902	0.113	0.147

Source: Processed data (2025)

Hypothesis Test

This study tested the hypothesis using multiple regression analysis. To assess the significance of the test results, the t-test was used to test the partial effect of each independent variable, the F-test was used to test the simultaneous effect of all independent variables on the dependent variable, and the coefficient of determination (R^2) was used to measure how much of the variation in the dependent variable could be explained by the independent variables in the model.

Partial Test (T-Test)

Partial tests are used to identify the significance of the influence of independent variables individually on dependent variables. The significance level used in this analysis is 0.05. If the significance value is > 0.05, then H_0 is accepted and H_a is rejected, which means that there is no significant influence between the variables studied. For further details, here is the partial test table:

Table 4. T-Test (Random Effect Model)

Variabel	Prediksi	Coeficient	T-Statistik	Prob.
C		5.474	2.778	0.006*
CED	+	-0.728	-0.574	0.566
GI	+	-4.113	-2.268	0.024*
CH	+	2.552	3.460	0.000*
R-Square				0.096
Adjusted R-Square				0.078
F-Statistic				5.485
Prob (F-statistic)				0.001

Source: Processed data (2025)

The test results obtained through the Random Effect Model (REM) can be summarised as follows:

1. The first hypothesis (H1) proposed in this study states that carbon emission disclosure has a positive effect on firm value. However, the results of the analysis in this study obtained a beta coefficient value of -0.728, which is contrary to what was expected or shows a negative result, and the t-test result was 0.574 < t-table, which is 1.688. Furthermore, this study uses a one-tailed hypothesis, so the probability is divided by 2 (two), which is 0.566/2 = 0.283, which is much greater than the significance level α – 0.05 (5%). This means that there is no significant effect and shows that the results obtained are not in line with

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what is assumed in the hypothesis. Thus, H1 is rejected and H0 is accepted.

2. The second hypothesis (H2) proposed in this study states that green innovation has a positive effect on firm value. However, the results of the analysis in this study obtained a beta coefficient value of -4.113, which is contrary to expectations or shows a negative result, and the t-test results for the green innovation variable produced a t-value of -0.281 < t-table, which is 1.688. Furthermore, because this study uses a one-tailed hypothesis, the probability value is divided by 2 (two), namely 0.024/2 = 0.012, which is smaller than the significance level of 0.05 (5%). This indicates that there is a significant effect and shows results that contradict those assumed in the hypothesis. Thus, H2 is rejected and H0 is accepted.
3. The third hypothesis (H3) raised in this study states that cash holdings have a positive effect on firm value. The results of the analysis in this study support the hypothesis with a beta coefficient of 2.552, and the t-test results for the cash holdings variable produced a t-value of 3.460 > t-table of 1.688. Furthermore, because this study uses a one-tailed hypothesis, the probability value is divided by 2 (two), namely 0.000/2 = 0, which is smaller than the significance level of 0.05 (5%). This means that there is a significant effect of cash holdings on firm value. Therefore, H3 is accepted and H0 is rejected.

Coefficient of Determination Test (R-Square)

The adjusted R-square shows a value of 0.078, which means that 7.8% of the variables of carbon emission disclosure, green innovation, and cash holdings can explain the variable of firm value. The remaining 92.2% is explained by other factors as described by the variables in previous studies, including green investment, intellectual capital disclosure, environmental performance, green accounting, managerial ownership, ESG, eco-efficiency, and GCG.

DISCUSSIONS

The Effect of Carbon Emission Disclosure on Firm Value

The first hypothesis test (H1) indicates that carbon emission disclosure has a negative and statistically insignificant effect on firm value, thus rejecting hypothesis (H1). This implies that carbon emission disclosure, which is expected to increase company value through transparency and reputation, has not been able to increase value from an investor perspective. According to legitimacy theory, carbon emissions disclosure aims to demonstrate a company's social and environmental accountability in order to gain stakeholder support. However, in this study, carbon emissions disclosure had a negative and insignificant effect on company value, indicating that the legitimacy objective had not been achieved. This was because the market viewed the disclosure as a signal of environmental risk and an additional burden, thereby reducing investor confidence and firm value.

Efforts to reduce carbon emissions are in line with the Sustainable Development Goals (SDGs). In this case, Goal 13 (climate action) emphasises the need for concrete actions to reduce the impact of climate change, including from the industrial and transportation sectors. In addition, Goal 9 (Industry, Innovation and Infrastructure) encourages the application of innovations that support energy efficiency and the development of sustainable and environmentally friendly infrastructure. Therefore, carbon emission management by

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companies is not only a social responsibility, but also a global requirement in achieving sustainability. These findings are in line with research conducted by Shafira (2024), which states that there is a significant negative relationship between carbon emission disclosure and firm value. This is because investors consider increased carbon emission disclosure to reflect potential additional costs or strict regulations that could negatively impact company valuations.

The Effect of Green Innovation on Firm Value

Testing of the second hypothesis (H2) indicates that green innovation has a negative and statistically significant effect on firm value, thus rejecting the second hypothesis (H2). This implies that companies' efforts to implement green innovation have not yet had a fully positive impact on investor perceptions. Based on legitimacy theory, companies implement green innovation not only for efficiency and environmental protection, but also to maintain legitimacy in the eyes of stakeholders, regulators, and the public. This is supported by Indonesian government regulations, such as Law No. 32 of 2009 concerning Environmental Protection and Management and Minister of Transportation Regulation No. 64 of 2021, which encourages the use of battery-powered vehicles in the logistics and transportation sectors.

The implementation of green innovation can reduce a company's value in the short term if it is not supported by strategic planning and efficient cost management, especially due to the high investment and financial risks involved, particularly in the transport, logistics and infrastructure sectors. Uncertainty surrounding new technologies and a lack of market understanding can also trigger negative responses from investors. Therefore, green innovation must be optimally integrated into a company's business model so that it is not merely a symbol of environmental commitment, but also supports competitive advantage and holistic economic goals. This findings is consistent with Ananda & Taqwa (2024) and Yuliandhari et al. (2023), which show that green innovation can have a negative impact on firm value because the substantial costs incurred have the potential to reduce the financial flexibility of companies in facing economic pressures.

The Effect of Cash Holding on Firm Value

Testing of the third hypothesis (H3) indicates that cash holdings have a positive and statistically significant effect on firm value, thus the third hypothesis (H3) is accepted. High cash holdings increase firm value because they demonstrate the company's financial flexibility. With optimal cash, companies can fund investments, take advantage of business opportunities, and reduce uncertainty risks without relying on external financing, thereby earning better rewards from the market.

Based on stakeholder theory, it emphasises that a company has a responsibility to all stakeholders involved in its operational activities, not just to shareholders. Managerial decisions regarding cash holdings are important because they reflect the company's commitment to maintaining stability and the trust of its stakeholders. Adequate cash holdings also enable companies to meet their financial obligations to various parties and provide flexibility in overcoming market uncertainty and short-term investment needs. These findings are in line with Fitri & Oktavianna, (2024) and Oktaviana & Wuryani, (2024), which both show that adequate cash holdings have a positive relationship with firm value, as sufficient cash availability signals to investors that the company is able to withstand economic pressures and

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maintain its financial performance.

CONCLUSIONS

Conslusions

This study shows that carbon emission disclosure has a negative but insignificant effect on firm value. This explains that although carbon emission disclosure reflects a company's transparency in environmental management, investors do not yet view this as a determining factor in assessing firm value. Meanwhile, green innovation has a significant negative effect, indicating that the implementation of green innovation is still perceived as a high cost burden or has yet to provide direct economic benefits, thereby impacting firm value. Conversely, cash reserves have been proven to have a significant positive effect on firm value. This can be explained by the fact that adequate cash reserves reflect a company's ability to maintain liquidity and financial flexibility, as well as increase investor confidence in the company's stability and prospects.

Implications

The implications of this study emphasise that liquidity management plays a strategic role in facilitating sustainability strategies. Therefore, companies are advised to integrate cash ownership considerations into the formulation of environmental policies to optimise long-term value creation. At the macro level, regulators need to review the policy framework to stimulate carbon emissions disclosure and provide financial incentives for entities that invest in green innovation.

Suggestions

This study is expected to serve as a foundation for future research in examining the relationship between sustainability practices and firm value by considering several aspects, such as incorporating additional variables (e.g., environmental performance, greenhouse gas emission disclosure, green accounting, and green intellectual capital) as well as moderating variables (e.g., firm size, good corporate governance, growth opportunity, and dividend policy). Future studies may also extend the scope by comparing the transportation, logistics, and infrastructure sectors with other industries such as energy, manufacturing, and industrials to identify whether the effects of these variables on firm value differ across sectors. In addition, employing a longer observation period could provide more accurate and in-depth findings that reflect real conditions, while firm value measurement may be enriched using various proxies such as price to book value, market to book ratio, price earning ratio, and market value of equity

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