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THE EFFECT OF GREEN ACCOUNTING, GREEN INTELLECTUAL CAPITAL, CARBON EMISSION DISCLOSURE, AND TAX RISK ON FIRM VALUE

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Abstract
This study examines the effect of green accounting, green intellectual capital, carbon emission disclosure, and tax risk on firm value in manufacturing firms listed on the IDX during 2021–2024. The research uses secondary data from annual and sustainability reports and applies panel data regression with the Random Effect Model. The results show that green accounting and green intellectual capital significantly affect firm value, while carbon emission disclosure and tax risk do not show a significant effect. Collectively, all variables significantly influence firm value. Overall, the findings indicate that environmental accounting practices and green-based intellectual capital contribute to improving firm value, whereas carbon disclosure and tax-related risk are not yet major determinants in investor valuation decisions.

Keywords: Firm Value, Green Accounting, Green Intellectual Capital, Carbon Emission Disclosure, Tax Risk

1. Introduction

Sustainability issues have increasingly become a key element in contemporary business development. Firms are no longer solely focused on achieving financial performance, but are also expected to integrate environmental and sustainability considerations into their operational activities. This situation is particularly significant in the manufacturing sector, which is characterized by high resource consumption and substantial carbon emissions, thereby creating greater demands for environmental transparency.

This phenomenon is reinforced by the growing attention of investors toward non-financial information in assessing corporate performance. Firm value serves as a key indicator that represents market perceptions of a company's future prospects, and in this study it is measured using Tobin's Q. Nevertheless, manufacturing firms in Indonesia continue to experience fluctuations in firm value, suggesting that market valuation is influenced by factors beyond financial performance alone.

From an empirical perspective, firm value is influenced by several determinants, including green accounting, green intellectual capital, carbon emission disclosure, and tax risk. Green accounting relates to the recognition and reporting of environmental-related activities within a company. Green intellectual capital reflects the firm's capability to manage knowledge-based assets that are oriented toward environmental sustainability. Carbon emission disclosure indicates the level of transparency regarding a company's greenhouse gas emissions, while tax risk refers to the uncertainty associated with corporate tax compliance. However, findings from previous studies on these variables remain inconsistent.

(Siera Fini, 2024) found that green accounting has a positive effect on firm value, whereas different results were reported by (Rismawanti & Sumarna, 2025) and (Alaika & Firmansyah, 2024). Similar inconsistencies are also observed in green intellectual capital, where (Siera Fini, 2024) and (Adelisa & Mayangsari, 2025) identified a negative effect, while (Vina & Murtanto, 2024) reported an insignificant relationship. In the case of carbon emission disclosure, conflicting findings are shown between (Susilawati et al., 2025) and (Aspian Noor, 2022). Likewise, tax risk also presents differing results between (Vianty & Sari 2024) and (Setyawan et al. 2023)

These inconsistent findings indicate a research gap in examining the relationship between sustainability-related variables, risk factors, and firm value. Moreover, most prior studies tend to analyze these variables separately rather than integrating them into a single comprehensive model.

Based on this gap, this study contributes novelty by combining green accounting, green intellectual capital, carbon emission disclosure, and tax risk within one integrated model to examine their effect on firm value in the Indonesian manufacturing sector during the 2021–2024 period.

This research aims to investigate the influence of green accounting, green intellectual capital, carbon emission disclosure, and tax risk on firm value. The study is expected to contribute theoretically to signaling theory and stakeholder theory, as well as provide practical implications for companies in enhancing transparency and for investors in decision-making processes.

2. Theoretical Background

2.1 Signaling Theory

Spence (1973) developed Signaling Theory, which explains that in conditions of information asymmetry, companies provide signals to external parties to reduce uncertainty in decision-making processes. Management, as the party with more complete information, discloses certain information to shape investors' perceptions of the company's condition and prospects. Ross (1977) stated that signals conveyed through information disclosure are assumed to influence how the market values a firm. In this study, green accounting, green intellectual capital, carbon emission disclosure, and tax risk are interpreted as signals sent by companies to investors, which reflect the firm's quality and overall condition.

2.2 Stakeholder Theory

Stakeholder Theory posits that companies are responsible not only to shareholders but also to a broader group of stakeholders, including government, society, customers, and the environment (Freeman, 1984). Donaldson and Preston (1995) further argue that firms must maintain social legitimacy by fulfilling stakeholder expectations through transparent information disclosure. In this study, sustainability-related disclosures such as green accounting, green intellectual capital, carbon emission disclosure, and tax risk are viewed as forms of corporate accountability toward stakeholders.

2.3 Firm Value

Firm value represents the market's assessment of a company's performance and future growth prospects, which is typically reflected in stock prices and investor responses to corporate information (Aspian Noor, 2022). It is shaped by the degree of information transparency disclosed by firms, encompassing both financial and non-financial aspects

(Susilawati et al., 2025). In this study, firm value is used as the dependent variable to capture how the market responds to corporate performance and sustainability signals.

2.4 Green Accounting

Green accounting refers to an accounting approach that integrates environmental considerations into the company's recording and reporting system (Alaika & Firmansyah, 2024). This concept involves the identification, measurement, and disclosure of environmental impacts, including waste generation, carbon emissions, and energy usage. In this study, green accounting is used to reflect the extent of corporate transparency in disclosing environmental information.

2.5 Green Intellectual Capital

Green intellectual capital is an intangible asset that encompasses environmentally oriented knowledge, competencies, and organizational capabilities within a firm (Chen, 2008). This concept consists of three main components, namely green human capital, green structural capital, and green relational capital (Chang & Chen, 2012; Mohd et al., 2019). In this study, green intellectual capital is used to measure the extent to which companies manage and develop environmentally based intellectual resources to achieve sustainable competitive advantage.

(Haniyah, 2024) Green intellectual capital in this study is measured using the Green Intellectual Capital Disclosure Index (GICDI), which consists of 17 disclosure items covering three main categories: green human capital, green structural capital, and green relational capital. Each disclosed item is given a score of 1, while non-disclosure is given a score of 0. The total score is then divided by the total number of items to obtain the disclosure percentage of green intellectual capital.

Table 1. Intellectual Capital Disclosure Index (GICDI)

Category	Code	Item
Green Human Capital	GHC-1	Employees contribute positively to productivity and environmental protection.
	GHC-2	Employees have sufficient competencies in environmental protection.
	GHC-3	Employees deliver high-quality services and products related to environmental protection.
	GHC-4	Team cooperation related to environmental protection is at a high level within the organization.
	GHC-5	Managers strongly support employees in achieving environmentally responsible job performance.
Green Structural Capital	GSC-1	The company has a strong environmental management system.
	GSC-2	The company has established a committee to promote key environmental issues.
	GSC-3	The company has detailed regulations regarding environmental protection.
	GSC-4	The company makes sufficient investment in environmental protection facilities.
	GSC-5	The overall operational process related to environmental protection runs smoothly.

Category	Code	Item
	GSC-6	The knowledge management system effectively supports accumulation and sharing of environmental knowledge.
Green Relational Capital	GRC-1	The company designs products and services that meet customers' environmental expectations.
	GRC-2	Customers are satisfied with the company's environmental protection efforts.
	GRC-3	Environmental cooperation with suppliers is stable.
	GRC-4	Environmental cooperation with key customers or clients is stable.
	GRC-5	The company maintains strong and stable environmental partnerships with strategic partners.

Source: Adapted from prior literature on Green Intellectual Capital (2025)

The indicators presented in Table X describe the measurement of green intellectual capital based on three dimensions: human, structural, and relational capital. These indicators reflect the company's commitment to environmental sustainability through employee involvement, organizational systems, and external stakeholder relationships. A higher disclosure score indicates stronger environmental-oriented intellectual capital, which reflects better integration of sustainability principles into the company's operations and strategic relationships.

2.6 Carbon Emission Disclosure

Carbon emission disclosure refers to the disclosure of information related to greenhouse gas emissions generated from a company's operational activities and the mitigation efforts undertaken to reduce the impact of climate change (Trimuliani & Febrianto, 2023). This disclosure reflects the level of corporate transparency in managing environmental risks and demonstrates the firm's commitment to sustainability and climate change issues. In this study, carbon emission disclosure is used to measure the extent of corporate transparency in reporting carbon emission-related information.

The measurement of carbon emission disclosure is conducted using a Carbon Emission Disclosure Index consisting of 18 disclosure items. Each disclosed item is assigned a score of 1, while non-disclosed items are assigned a score of 0. The total score is then divided by the total number of items to obtain the percentage level of carbon emission disclosure.

Table 2 Carbon Emission Disclosure Indicators

Category	Code	Item
Climate Change	CC-1	Assessment/description of climate change-related regulatory risks and their management actions.
	CC-2	Assessment/description of financial and business implications as well as opportunities arising from climate change.
Greenhouse Gas (GHG)	GHG-1	Method used to calculate carbon emissions (e.g., GHG Protocol or ISO standards).
	GHG-2	External verification of carbon emission quantities.
	GHG-3	Total carbon emissions produced (in metric tons of CO_2-e).
	GHG-4	Description of Scope 1, Scope 2, and/or Scope 3 emissions.

Category	Code	Item
	GHG-5	Carbon emission information based on sources (e.g., coal, electricity, etc.).
	GHG-6	Carbon emission information based on facilities or operational segments.
	GHG-7	Comparison of carbon emissions with previous years.
Energy Consumption (EC)	EC-1	Information on total energy consumption (in tera-joules or peta-joules).
	EC-2	Energy usage from renewable energy sources.
	EC-3	Energy disclosure by type, facility, or segment.
Reduction and Cost (RC)	RC-1	Plans or strategies for carbon emission reduction.
	RC-2	Stages of carbon emission reduction implementation.
	RC-3	Targets and realized investments related to emission reduction.
	RC-4	Capital expenditure planning related to future emission reduction costs.
Carbon Emission Accountability (ACC)	ACC-1	Management responsibility toward climate change issues.
	ACC-2	Management mechanisms for monitoring responses to climate change.

Source: Adapted from prior literature on Carbon Emission Disclosure (2025)

The results of carbon emission disclosure measurement indicate the level of corporate transparency in reporting carbon emission information and its management. A higher CEDI index value reflects greater transparency in environmental disclosure, which indicates stronger corporate commitment to sustainability and climate change mitigation.

2.6 Tax Risk

Tax risk is the risk arising from uncertainty in managing corporate tax obligations, which may affect financial condition and company reputation (Setyawan et al., 2023). This risk is influenced by tax aggressiveness, regulatory changes, and differences in interpretation of tax regulations. In this study, tax risk is used to measure the level of uncertainty related to corporate tax risk.

2.7 Hypothesis Development

Based on the theoretical foundation and previous empirical studies, this research formulates the following hypotheses:

H_1: Green accounting influences firm value.
H_2: Green intellectual capital influences firm value.
H_3: Carbon emission disclosure influences firm value.
H_4: Tax risk influences firm value.

3. Methods

3.1 Research Design

This study employs a quantitative research approach with an associative design to examine the influence of green accounting, green intellectual capital, carbon emission disclosure, and tax risk on firm value. Firm value is proxied using Tobin's Q. The object

of this research is manufacturing companies listed on the Indonesia Stock Exchange (IDX) during the 2021–2024 period. The data used are secondary data obtained from annual reports and sustainability reports. This sector is selected due to its significant environmental impact and its relevance to sustainability-related disclosures.

3.2 Population and Sample

The population of this study includes all manufacturing companies listed on the Indonesia Stock Exchange (IDX) during the 2021–2024 period. A purposive sampling technique is applied to select the sample based on the following criteria:

1) Manufacturing firms listed on the IDX during 2021–2024
2) Firms that consistently provide complete annual reports during the study period
3) Firms that publish sustainability reports throughout 2021–2024
4) Firms that present complete data for all research variables
5) After applying these criteria, 20 firms are obtained as the final sample for analysis.

3.3 Data Collection Techniques

The data used in this study are secondary data sourced from annual reports and sustainability reports. These documents are obtained through the official website of the Indonesia Stock Exchange (www.idx.co.id) and the official websites of each respective company. The data collection procedure is carried out using a documentation technique, which involves identifying, collecting, organizing, and analyzing relevant information in accordance with the research objectives.

3.4 Operational Definitions of Research Variables

Table 3. Operational Definition of Variables

No	Variable	Operational Definition	Measurement	Scale
1	Firm Value	Firm value refers to how investors evaluate a company's overall performance and expected future growth, which is generally reflected in stock market valuations.	Tobin's Q = (Market Value of Equity + Total Debt) / Total Assets	Ratio
2	Green Accounting	Green accounting is an accounting practice that incorporates environmental dimensions into the processes of financial recording and corporate reporting.	GA = PROPER Score (Gold = 5, Green = 4, Blue = 3, Red = 2, Black = 1)	Ordinal
3	Green Intellectual Capital	Green intellectual capital represents intangible resources owned by a firm, including knowledge-based capabilities, organizational systems, and relational networks that support environmental sustainability initiatives.	GICDI = ∑ Disclosed Items Score / ∑ Total Disclosure Items × 100%	Ratio

No	Variable	Operational Definition	Measurement	Scale
4	Carbon Emission Disclosure	Carbon emission disclosure refers to the reporting of information related to greenhouse gas emissions generated from a company's operational activities and business processes.	CEDI = ∑ disclosed carbon emission items / ∑ total items × 100%	Ratio
5	Tax Risk	Tax risk is the level of uncertainty in fulfilling corporate tax obligations due to differences in tax regulation interpretations.	Volatility of Effective Tax Rate (ETR) = $\sqrt{\Sigma(ETR_t - \text{mean ETR})^2 / (n-1)}$	Ratio

Source: Various sources adapted for this research

4. Results and Discussion

4.1 Description of Descriptive Statistical Results

Table 4. Descriptive Statistical Test Results

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
FV	31.64363	1.014804	799.0689	0.221086	134.3998	80
GA	3.462500	3.000000	5.000000	3.000000	0.728163	80
GIC	0.470588	0.470588	0.764706	0.176471	0.144694	80
CEDI	0.652778	0.666667	0.888889	0.277778	0.117768	80
TR	0.134876	0.047944	2.230288	0.000496	0.349220	80

Source: EViews 13 (data processing)

Table 4 presents the descriptive statistical results. Firm Value (FV) shows a mean of 31.64363 with a standard deviation of 134.3998, indicating high variation across firms. Green Accounting (GA) records a mean of 3.462500 and a standard deviation of 0.728163, reflecting relatively low variation. Green Intellectual Capital (GIC) has a mean of 0.470588 with a standard deviation of 0.144694, indicating low dispersion. Carbon Emission Disclosure (CEDI) shows a mean of 0.652778 and a standard deviation of 0.117768, suggesting relatively consistent disclosure levels. Meanwhile, Tax Risk (TR) has a mean of 0.134876 and a standard deviation of 0.349220, indicating variation among firms.

4.2 Panel Data Regression Model Selection

Table 5. Panel Data Model Selection Test

Test Type	Statistic	Prob	Result	Decision
Chow	74.354531	0.0000	Prob < 0.05	FEM
Hausman	1.081288	0.8972	Prob > 0.05	REM
Lagrange Multiplier	106.2287	0.0000	Prob < 0.05	REM

Source: EViews 13 (data processing)

Table 5 summarizes the results of the panel data model selection tests, namely the Chow, Hausman, and Lagrange Multiplier tests. The Chow test supports the use of FEM over CEM ($p < 0.05$), while the Hausman test favors REM rather than FEM ($p > 0.05$). In addition, the LM test indicates that REM is more appropriate than CEM ($p < 0.05$). Overall, the REM is identified as the most suitable model for this study.

4.3 Hypothesis Testing Result

Table 6. Hypothesis Testing Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Conclusion
C	-107.7476	68.72204	-1.567875	0.1211	
GA	53.10653	13.82596	3.841074	0.0003	Accepted
GIC	-131.0908	62.19180	-2.107847	0.0384	Accepted
CEDI	26.26057	65.50765	-0.400878	0.6896	Rejected
TR	0.424902	13.83170	0.030719	0.9756	Rejected

Table 7. Model Summary

R-squared	Adjusted R-squared	F-statistic	Prob (F-statistic)
0.587770	0.462352	4.278096	0.003582

Source: EViews 13 (data processing)

Based on the estimation results of the Random Effect Model, Green Accounting (GA) and Green Intellectual Capital (GIC) are shown to have a significant relationship with firm value. In contrast, Carbon Emission Disclosure (CEDI) and Tax Risk (TR) are not found to significantly affect firm value.

At the same time, the F-test result (Prob = 0.003582 < 0.05) indicates that the independent variables collectively have a significant effect on firm value. The R-squared value of 0.587770 implies that 58.77% of the variation in firm value can be explained by the model, while the remaining 41.23% is influenced by other variables outside the scope of this study.

4.4 Discussion

4.4.1 Impact of Green Accounting on Firm Value

The results indicate that H_1 is supported, showing a significant relationship between Green Accounting and firm value. This suggests that stronger implementation of environmental accounting practices leads to higher market valuation. Environmental disclosures serve as positive signals to investors, reflecting a firm's commitment to sustainability, which strengthens investor confidence and ultimately increases firm value.

4.4.2 Impact of Green Intellectual Capital on Firm Value

The findings show that H_2 is accepted, indicating that Green Intellectual Capital has a significant relationship with firm value. This implies that firms with stronger environmentally oriented intellectual resources, including knowledge, organizational systems, and relational capabilities, tend to achieve better market perception. Such resources enhance investor expectations regarding future performance, resulting in higher firm value.

4.4.3 Impact of Carbon Emission Disclosure on Firm Value

The results reveal that H_3 is rejected, meaning that Carbon Emission Disclosure does not significantly influence firm value. This suggests that the market has not fully incorporated carbon-related information into valuation decisions. Although firms provide emission disclosures, investors appear to give limited consideration to this information in assessing firm value.

4.4.4 Impact of Tax Risk on Firm Value

The findings indicate that H_4 is rejected, showing that Tax Risk does not have a significant relationship with firm value. This implies that tax-related uncertainty is not a

dominant factor in investor valuation decisions. Investors tend to focus more on financial performance indicators and other variables that more directly reflect profitability and firm stability.

5. Conclusion

The study investigates the influence of Green Accounting, Green Intellectual Capital, Carbon Emission Disclosure, and Tax Risk on firm value. The empirical results show that Green Accounting and Green Intellectual Capital significantly affect firm value. This indicates that improvements in environmental accounting practices and the development of sustainability-oriented intellectual resources play an important role in shaping positive market perceptions of companies.

On the other hand, Carbon Emission Disclosure and Tax Risk are not found to have a significant effect on firm value. This suggests that investors do not yet prioritize these factors in valuation decisions compared to other elements that are more closely associated with profitability and future growth potential.

In general, firm value is more strongly influenced by sustainability-related strategic factors, particularly Green Accounting and Green Intellectual Capital, rather than carbon disclosure and tax-related risk. These findings contribute to the literature in finance and sustainability studies and offer practical implications for firms in strengthening sustainability practices to enhance market valuation

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