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The Influence of Environmental Performance, Carbon Emissions Disclosure, Green Process Innovation, and Green Product Innovation on Firm Value in the Food and Beverage Sub-sector

Putra Rizky Prasetyo[1*], Sri Suryaningsum[2]
[1] Universitas Pembangunan Nasional (UPN) "Veteran" Yogyakarta, Sleman, Indonesia, putra.prasetyo14juni@gmail.com
[2] Universitas Pembangunan Nasional (UPN) "Veteran" Yogyakarta, Sleman, Indonesia, srisuryaningsum@upnyk.ac.id

*Corresponding Author: putra.prasetyo14juni@gmail.com[1]

Abstract: This study aims to empirically examine the effect of environmental performance, carbon emissions disclosure, green process innovation, and green product innovation on firm value in the food and beverage sub-sector listed on the Indonesia Stock Exchange (IDX) during the 2021–2024 period. This research employs a quantitative approach using a causal associative design, using secondary data from annual and sustainability reports of companies. The sample was selected using purposive sampling, resulting in 149 observations, and analyzed using multiple linear regression with SPSS version 26. The results show that environmental performance has a negative and significant effect on firm value, indicating that higher PROPER ratings are not always perceived positively and may be viewed as a cost burden by investors. Carbon emissions disclosure also has a negative and significant effect, indicating that transparency in carbon emissions is still viewed as a signal of risk and potential future costs. Meanwhile, green process innovation does not have a significant effect on firm value due to its internal nature and limited observability. In contrast, green product innovation has a positive and significant effect on firm value, demonstrating that consumer-oriented innovation can enhance market trust and firm valuation.

Keywords: Environmental Performance, Carbon Emissions Disclosure, Green Process Innovation, Green Product Innovation, Firm Value.

INTRODUCTION

The food and beverage sub-sector was among the key contributors to the manufacturing sector growth, which reached 5.54% in the third quarter of 2025, exceeding the national economic growth of 5.04% (BPS, 2025). This sub-sector directly interacts with consumers, making it particularly vulnerable to environmental sustainability demands, as its operational activities generate a substantial ecological footprint, with national waste dominated by food waste at 40.92% and plastic waste at 20.11% (KLH, 2025). The upstream stage in the food and

beverage industry, which involves the agricultural sector as the main supplier of raw materials, accounts for approximately 70% of global freshwater use, while in the downstream stage the decomposition of organic waste produces methane emissions with a global warming potential 80 times greater than carbon dioxide within the first 20 years after release into the atmosphere (FAO, 2024; UNEP, 2023). This condition creates a dilemma between economic performance and environmental preservation, requiring companies to manage both pressures simultaneously (Annesi et al., 2025). Consequently, companies are compelled to prioritize not only profitability but also sustainability, which is manifested through strong environmental performance, transparent carbon emission disclosure, as well as the implementation of green process innovation and green product innovation, so that these sustainability measures are expected to increase firm value.

Theoretically, this relationship can be explained through legitimacy theory, which states that companies are required to align the social values embedded in their activities with prevailing societal norms (Dowling & Pfeffer, 1975). In addition, signaling theory suggests that transparency in environmental disclosure serves as a credibility signal to reduce information asymmetry between management and investors (Spence, 1973). Nevertheless, previous studies yield highly inconsistent results. Research on environmental performance and carbon emissions disclosure shows conflicting positive, negative, and non-significant impacts on firm value (Darmawan & Firmansyah, 2025; Gunawan & Berliyanda, 2024; Khanifah et al., 2020; Rahmasari & Irwansyah, 2024). Similar contradictions plague green innovation studies, largely because previous research often treats it as a single aggregate variable or reports conflicting results when separated (Adi et al., 2025; Putri & Agustin, 2023; Yuliandhari et al., 2023).

This study addresses the inconsistency in prior findings by explicitly distinguishing between internal and external green strategies within the consumer-sensitive F&B sub-sector. Unlike previous studies that generally treat green innovation as a single aggregate construct, this study disaggregates it into green process innovation (internal) and green product innovation (external), recognizing that each follows a different mechanism in influencing firm value. By integrating these dimensions with environmental performance and carbon emissions disclosure, this study provides a more comprehensive explanation of how sustainability strategies are interpreted by investors. This approach enables the identification of which strategies receive stronger market responses, thereby offering a clearer understanding of the role of visibility in shaping firm value.

Based on the phenomena, theories, and research gaps, this study aims to examine the effect of environmental performance, carbon emissions disclosure, green process innovation, and green product innovation on firm value in the food and beverage sub-sector listed on the Indonesia Stock Exchange during the 2021–2024 period. Firm value is measured using Tobin's Q (Khanifah et al., 2020), environmental performance is measured using PROPER ratings, carbon emissions disclosure is measured using the Carbon Disclosure Project index (Choi et al., 2021), and green innovation is measured based on the classification of (Xie et al., 2019). The research problem in this study is whether environmental performance, carbon emissions disclosure, green process innovation, and green product innovation affect firm value, both partially and simultaneously.

Literature Reviews

Legitimacy Theory

Legitimacy Theory, introduced by Dowling & Pfeffer, (1975), posits that companies must align their operations with societal values to maintain social acceptance, as any gap risks damaging corporate reputation and reducing firm (Lindawati & Puspita, 2015). In this study, environmental performance, carbon emissions disclosure, and green product innovation serve

as legitimacy mechanisms, particularly critical in the consumer-facing food and beverage sector where public scrutiny is intense.

Signaling Theory

Signaling Theory, proposed by Spence, (1973), explains how companies transmit credible and costly signals to reduce information asymmetry between management and investors (Yuliandhari et al., 2023). In this study, environmental performance, carbon emissions disclosure, and green process innovation function as market signals of sustainability commitment that reduce investor uncertainty and enhance firm value.

Firm Value

Firm value represents investors' perception of a company's future prospects not fully captured in financial statements (Gunawan & Berliyanda, 2024). Investors increasingly factor in environmental risk alongside financial performance (Rahmasari & Irwansyah, 2024). This study measures firm value using Tobin's Q, which captures intangible assets such as environmental reputation (Khanifah et al., 2020) and market appreciation for green innovation as a strategic advantage sustaining long-term profitability (Rahmasari & Irwansyah, 2024).

Environmental Performance

Environmental performance represents a company's ability to manage environmental impacts from its operations (Clarkson et al., 2008). In Indonesia, it is measured through PROPER ratings by the Ministry of Environment and Forestry, which are sequentially ranked into gold, green, blue, red, and black (Gunawan & Berliyanda, 2024). Since PROPER is independently administered, it eliminates greenwashing risk inherent in voluntary disclosures (Rani & Pramudyastuti, 2021) and verifies that operations exceed minimum standards, closing the legitimacy gap (Hapsoro & Adyaksana, 2020). These ratings credibly signal reliable risk management to investors, ultimately enhancing firm value (Santoso & Yanti, 2024).

Carbon Emissions Disclosure

Carbon emissions disclosure reflects emission management transparency, commonly measured using the Choi index based on the Carbon Disclosure Project (CDP) framework (Putri & Agustin, 2023). Comprehensive disclosure fulfills legitimacy expectations while reducing information asymmetry and strengthening investor confidence (Hardiyansah et al., 2021). Although some investors view disclosure as signaling high compliance costs (Muhammad & Aryani, 2021) non-disclosing firms face heavier valuation penalties, making transparency the rational strategy (Matsumura et al., 2014).

Green Process Innovation

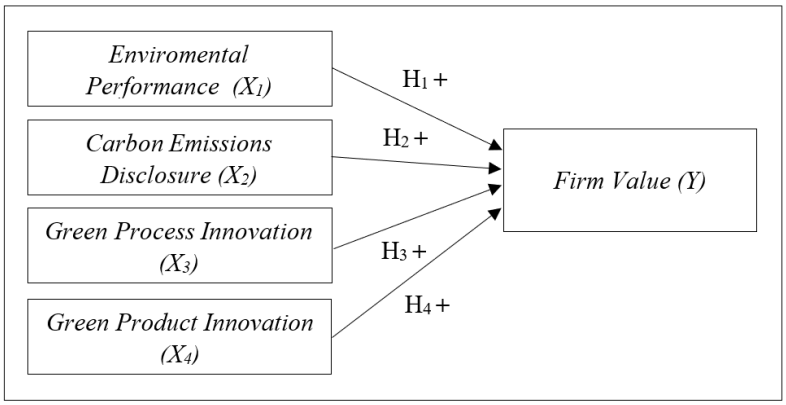
Green process innovation refers to improvements in production methods aimed at enhancing energy efficiency and minimizing environmental impact through resource efficiency technologies, pollution prevention, and waste recycling (Chen et al., 2006; Nurdiyanti & Sarumpaet, 2024). Anchored in Signaling Theory, investment in sustainable process technology signals managerial capability and regulatory readiness while reducing operational volatility and credit risk, which creates cost efficiencies that increase net profit and attract investor capital, ultimately elevating firm value (Putri & Agustin, 2023).

Green Product Innovation

Green product innovation involves developing environmentally friendly products that minimize environmental impact across the full product lifecycle, using sustainable materials, pollutant-free designs, and recyclable packaging (Chen et al., 2006; Putri & Agustin, 2023).

Unlike green process innovation which is internally oriented, green product innovation is externally oriented, directly meeting the needs of environmentally conscious consumers (Xie et al., 2019). Anchored in Legitimacy Theory, this innovation strengthens social legitimacy particularly in the consumer-facing food and beverage sector, translating into positive market appreciation and enhanced firm value (Adi et al., 2025).

Environmental performance and carbon emissions disclosure address institutional legitimacy and market transparency, while green process innovation creates internal efficiency value and green product innovation builds external market differentiation. Collectively, these variables are predicted to positively influence firm value, as illustrated in Figure 1.



Source: Processed conceptual framework 2026

Figure 1. Conceptual Framework

METHODS

Methodology Study

This study uses a quantitative approach with a causal associative research design to examine the effect of environmental performance, carbon emissions disclosure, green process innovation, and green product innovation on firm value in the food and beverage sub-sector listed on the Indonesia Stock Exchange during the 2021–2024. Data were collected through documentation of secondary data from companies' financial and sustainability reports accessed via the IDX website. Data analysis employs multiple linear regression using SPSS 26, including classical assumption tests and hypothesis testing. Although the PROPER rating is an ordinal scale, its direct application in linear regression is a widely accepted empirical practice in accounting research, as demonstrated by Gunawan & Berliyanda, (2024).

Population and Sample

The population in this study consists of companies in the food and beverage sub-sector classified under the consumer non-cyclicals sector and listed on the Indonesia Stock Exchange (IDX) during 2021–2024. The sample was selected using purposive sampling (Sugiyono, 2023) with the following criteria:

1. Companies in the food and beverage sub-sector that listed on the Indonesia Stock Exchange (IDX) during 2021–2024.
2. Companies that publish complete annual reports and sustainability reports containing both financial data required to calculate Tobin's Q and non-financial data throughout the observation period.
3. Companies that participate in and are registered under the PROPER rating program issued by the Ministry of Environment and Forestry during the observation period.

Operational Definition of Variables

The explanation of each variable used in this study is presented in Table 1.

Table 1. Operational Definition of Variables

Variables	Measurement	Scale	Source
Firm Value (Y)	$Tobins'Q = \frac{(Market\ Value\ of\ Equity + Total\ Liabilities)}{Total\ Assets}$	Ratio	Khanifah et al. (2020)
Environmental Performance (X_1)	PROPER Rating: Score 5: Excellent, gold Score 4: Very good, green Score 3: Good, blue Score 2: Poor, red Score 1: Very poor, black	Ordinal	(Gunawan & Berliyanda, 2024)
Carbon Emissions Disclosure (X_2)	$CED = \frac{\sum disclosed\ items}{18}$ 1. Assessment/description of the risks (regulatory, physical or general) relating to climate change and actions taken or to be taken to manage the risks 2. Assessment/description of current (and future) financial implications, business implications and opportunities of climate change 3. Description of the methodology used to calculate GHG emissions (e.g. GHG protocol or ISO) 4. Existence external verification of quantity of GHG emission– if so by whom and on what basis 5. Total GHG emissions– metric tonnes CO2-e emitted 6. Disclosure of Scopes 1 and 2, or Scope 3 direct GHG emissions 7. Disclosure of GHG emissions by sources 8. Disclosure of GHG emissions by facility or segment level 9. Comparison of GHG emissions with previous years 10. Total energy consumed 11. Quantification of energy used from renewable sources 12. Disclosure by type, facility or segment 13. Detail of plans or strategies to reduce GHG emissions 14. Specification of GHG emissions reduction target level and target year 15. Emissions reductions and associated costs or savings achieved to date as a result of the reduction plan 16. Cost of future emissions factored into capital expenditure planning 17. Indication of which board committee (or other executive body) has overall responsibility for actions related to climate change 18. Description of the mechanism by which the board (or other executive body) reviews the company's progress regarding climate change	Ratio	Choi et al. (2021) Yuliandhari et al. (2023)
Green Process Innovation (X_3)	$Gr\ prosess = \frac{\sum disclosed\ items}{5}$ 1. Aiming to reduce the consumption of resources and energy and improve resource and energy efficiency 2. Using recycled materials, recycling techniques, and environmental technologies 3. Mel Applying environmental campaigns 4. Using pollution-control equipment 5. Adopting pollution-control projects and technologies	Ratio	Xie et al. (2019) Putri & Agustin (2023)

Variables	Measurement	Scale	Source
Green Product Innovation (X_4)	$Gr\ product = \frac{\sum disclosed\ items}{3}$ 1. Making changes to product designs in order to avoid polluting or toxic compounds within production processes 2. Improving and designing environmentally-friendly packaging for existing and new products 3. Making product design modifications aimed to improve energy efficiency during usage	Ratio	Xie et al. (2019) Putri & Agustin (2023)

Source: Processed data 2026

RESULTS AND DISCUSSION

This study utilizes secondary data from companies in the food and beverage sub-sector listed on the Indonesia Stock Exchange (IDX) during the 2021–2024 period. The data were obtained in the form of annual financial reports accessed through the official website of the Indonesia Stock Exchange. Meanwhile, the sample selection in this study was conducted using a purposive sampling technique, as summarized in Table 2.

Table 2. Summary of Sample Selection Procedure

Sample Selection Criteria	Number of Samples			
	2021	2022	2023	2024
Food and Beverage Sub-sector Companies Listed on the Indonesia Stock Exchange (IDX)	72	84	95	102
Food and Beverage Sub-sector Companies Not Included in the PROPER Report	(36)	(46)	(57)	(63)
Food and Beverage Sub-sector Companies Not Publishing Annual and Sustainability Reports	(1)	(1)	(0)	(0)
Research Data	35	37	38	39
Total Research Data	149			

Source: Processed data 2026

Descriptive Statistical Analysis

Descriptive statistics are used to provide an overview of the data characteristics, including mean, maximum, minimum, and standard deviation for each variable. The results of the descriptive statistical analysis are presented in Table 3.

Table 3. Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Environmental Performance	149	1	5	2.97	.492
Carbon Emissions Disclosure	149	.0556	1.0000	.670393	.1965926
Green Process Innovation	149	.2000	1.0000	.837584	.1991456
Green Product Innovation	149	.0000	1.0000	.295296	.2754548
Firm Value	149	.5133	7.3480	1.643926	1.1124418
Valid N (listwise)	149				

Source: Processed data 2026

Frequency of Environmental Performance

Environmental performance is measured using the PROPER rating (scale of 1–5), as presented in Table 4.

Table 4. Frequency of Environmental Performance (X_1)

Environmental Performance					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	BLACK	1	.7	.7	.7
	RED	13	8.7	8.7	9.4
	BLUE	128	85.9	85.9	95.3
	GREEN	3	2.0	2.0	97.3
	GOLD	4	2.7	2.7	100.0
	Total	149	100.0	100.0	

Source: Processed data 2026

Based on Table 4, score 1 (black) is held by 1 company, score 2 (red) is held by 13 companies, score 3 (blue) dominates with 128 companies, score 4 (green) is held by 3 companies, and score 5 (gold) is held by 4 companies.

Classical Assumption Test

Normality Test

According to Ghozali (2021), the normality test aims to determine whether the regression model is normally distributed between the dependent and independent variables. In this study, the normality test was conducted using the One-Sample Kolmogorov–Smirnov test, as presented in Table 5.

Table 5. Normality Test Before Transformation (Log-Lin)

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		149
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	1.03666882
Most Extreme Differences	Absolute	.107
	Positive	.107
	Negative	-.088
Test Statistic		.107
Asymp. Sig. (2-tailed)		.000[c]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.

Source: Processed data 2026

Based on Table 5, the Asymp. Sig. (2-tailed) value is 0.000, indicating that the data are not normally distributed. According to Nachrowi & Usman (2006), non-normality caused by extreme data scales can be addressed using a Log-Lin model by transforming the dependent variable (firm value) into its natural logarithm (Ln), as shown in Table 6.

Table 6. Normality Test After Transformation (Log-Lin)

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		149
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	.52358577
Most Extreme Differences	Absolute	.057
	Positive	.057
	Negative	-.039
Test Statistic		.057
Asymp. Sig. (2-tailed)		.200[c,d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

Source: Processed data 2026

Based on Table 6, the Asymp. Sig. (2-tailed) value is 0.200 after transformation, which is greater than 0.05, indicating that the data are normally distributed.

Multicollinearity Test

The multicollinearity test aims to determine whether there is a correlation among independent variables in the regression model, as presented in Table 7.

Table 7. Multicollinearity Test

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Environmental Performance	.830	1.204
	Carbon Emissions Disclosure	.560	1.787
	Green Process Innovation	.464	2.155
	Green Product Innovation	.685	1.460

Source: Processed data 2026

Based on Table 7, the tolerance values for all independent variables are ≥ 0.10 and are supported by VIF values ≤ 10. Since both criteria are met, it can be concluded that there is no multicollinearity among the independent variables in this study.

Heteroscedasticity Test

The heteroskedasticity test aims to examine whether there is a variance inconsistency of residuals across observations. This study employs the Glejser test, as presented in Table 8.

Table 8. Heteroscedasticity Test (Glejser Test)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.485	.158		3.079	.002
	Environmental Performance	-.143	.052	-.238	-2.764	.006
	Carbon Emissions Disclosure	.267	.158	.176	1.685	.094
	Green Process Innovation	.176	.172	.118	1.026	.307
	Green Product Innovation	.151	.102	.140	1.477	.142

a. Dependent Variable: ABSRES

Source: Processed data 2026

Based on Table 8, the significance value for environmental performance (0.006) is less than 0.05, indicating the presence of heteroskedasticity. Subsequently, the Park test was conducted by incorporating squared residuals, with the results presented in Table 9.

Table 9. Heteroscedasticity Test (Park Test)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-2.436	1.148		-2.122	.036
	Environmental Performance	-.683	.378	-.161	-1.808	.073
	Carbon Emissions Disclosure	1.351	1.153	.127	1.172	.243
	Green Process Innovation	1.496	1.250	.143	1.197	.233
	Green Product Innovation	-.314	.744	-.041	-.422	.673

a. Dependent Variable: LN_RES3

Source: Processed data 2026

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Based on Table 9, the significance values for all variables are ≥ 0.05, indicating that heteroskedasticity is no longer present in the data.

Autocorrelation Test

The autocorrelation test aims to examine the correlation between error terms at time t and time t−1. This study uses the Durbin–Watson test, as presented in Table 10.

Table 10. Autocorrelation Test

Durbin-Watson	dU	dL	Decision
2.060	1.7876	1.6765	No autocorrelation

Source: Processed data 2026

Based on Table 10, the Durbin–Watson value is 2.060. With a sample size of 149 and 4 independent variables, the upper bound (dU) is 1.7876, and the value of 4 − dU is 2.2124. A regression model is considered free from autocorrelation if dU < DW < 4 − dU. Based on the results (1.7876 < 2.060 < 2.2124), the Durbin–Watson value lies within the acceptable range. Therefore, it can be concluded that there is no autocorrelation in the data.

Multiple Linear Regression Analysis Test

Multiple linear regression analysis is used to examine the relationship between one dependent variable and two or more independent variables, as presented in Table 11.

Table 11. Multiple Linear Regression Analysis Test

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.195	.295		4.045	.000
	Environmental Performance	-.194	.097	-.169	-2.000	.047
	Carbon Emissions Disclosure	-.753	.297	-.261	-2.538	.012
	Green Process Innovation	.029	.322	.010	.091	.928
	Green Product Innovation	.643	.191	.313	3.362	.001

a. Dependent Variable: LN_Y

Source: Processed data 2026

The regression equation in this study is formulated as follows:

$$Y = 1.195 - 0.194X_1 - 0.753X_2 + 0.029X_3 + 0.643X_4$$

The regression constant of 1.195 indicates that when environmental performance, carbon emissions disclosure, green process innovation, and green product innovation are equal to zero, firm value is 1.195. Environmental performance has a coefficient of −0.194, indicating that a one percent increase in environmental performance is associated with a 19.4% decrease in firm value, assuming other variables remain constant. Carbon emissions disclosure has a coefficient of −0.753, indicating that a one percent increase in disclosure is associated with a 75.3% decrease in firm value. Green process innovation has a coefficient of 0.029, indicating that a one percent increase is associated with a 2.9% increase in firm value. Green product innovation has a coefficient of 0.643, indicating that a one percent increase is associated with a 64.3% increase in firm value.

Hypothesis Testing

Coefficient of Determination Test

The coefficient of determination test aims to assess how well the independent variables collectively explain the variation in the dependent variable, as presented in Table 12.

Table 12. Coefficient of Determination Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.382[a]	.146	.122	.5308080

Source: Processed data 2026

Based on Table 12, the Adjusted R Square value is 0.122 (12.2%), indicating that environmental performance, carbon emissions disclosure, green process innovation, and green product innovation explain 12.2% of the variation in firm value, while the remaining 87.8% is explained by other variables not included in this study.

F Test

The F-test aims to examine the simultaneous effect of all independent variables on the dependent variable and to assess the overall feasibility of the regression model, as presented in Table 13.

Table 13. F Test

ANOVA[a]						
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.941	4	1.735	6.159	.000[b]
	Residual	40.573	144	.282		
	Total	47.514	148			

a. Dependent Variable: LN_Y

b. Predictors: (Constant), Green Product Innovation, Environmental Performance, Carbon Emissions Disclosure, Green Process Innovation

Source: Processed data 2026

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Based on Table 13, the significance value is 0.000, which is less than 0.05, indicating that the regression model is appropriate.

t-Test

The t-test aims to examine the partial effect of each independent variable on the dependent variable, as presented in Table 14.

Table 14. t-Test

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.195	.295		4.045	.000
	Environmental Performance	-.194	.097	-.169	-2.000	.047
	Carbon Emissions Disclosure	-.753	.297	-.261	-2.538	.012
	Green Process Innovation	.029	.322	.010	.091	.928
	Green Product Innovation	.643	.191	.313	3.362	.001

a. Dependent Variable: LN_Y

Source: Processed data 2026

Based on Table 14, the results are as follows:

1. **Hypotesis Test - Effect of Environmental Performance (X_1) on Firm Value (Y)**
   Environmental performance has a significance value of 0.047 (< 0.05) with a negative coefficient. Therefore, the first hypothesis is rejected, indicating that environmental performance has a negative effect on firm value.
2. **Hypotesis Test - Effect of Carbon Emissions Disclosure (X_2) on Firm Value (Y)**
   Carbon emissions disclosure has a significance value of 0.012 (< 0.05) with a negative coefficient. Therefore, the second hypothesis is rejected, indicating that carbon emissions disclosure has a negative effect on firm value.

3. **Hypotesis Test - Effect of Green Process Innovation (X_3) on Firm Value (Y)**
   Green process innovation has a significance value of 0.928 (> 0.05). Therefore, the third hypothesis is rejected, indicating that green process innovation has no significant effect on firm value.
4. **Hypotesis Test - Effect of Green Product Innovation (X_4) on Firm Value (Y)**
   Green product innovation has a significance value of 0.001 (< 0.05) with a positive coefficient. Therefore, the fourth hypothesis is accepted, indicating that green product innovation has a positive effect on firm value.

Discussions

The Effect of Environmental Performance (PROPER) on Firm Value

The results show that environmental performance has a negative and significant effect on firm value. This indicates that the higher the PROPER ratings, the lower the firm value. In other words, achieving higher environmental ratings has not functioned effectively as a legitimacy instrument or a positive signal for investors, thus not supporting legitimacy and signaling theories. This condition may be explained by the tendency of investors in the Indonesian capital market to prioritize short-term profitability than environmental sustainability initiatives (Hapsoro & Adyaksana, 2020).

This is reflected in 85.9% of observations in the food and beverage sub-sector being concentrated in the blue PROPER rating, representing minimum compliance, thereby reducing its relevance as a competitive signal. Additionally, the high costs associated to achieve higher environmental ratings are perceived as a burden by investors, potentially reducing profitability. This finding is consistent with Khanifah et al. (2020) and Ramadhana & Januarti (2022), which show that strong environmental performance is not always appreciated by the market in the form of increased firm value.

The Effect of Carbon Emissions Disclosure on Firm Value

The results show that carbon emissions disclosure has a negative and significant effect on firm value. This indicates that the broader the disclosure of carbon emissions, the lower the firm value, reflecting the failure of signaling and legitimacy theories, where environmental information is not perceived as a credible sustainability commitment. This condition reflects a “bad news effect”, where carbon disclosure is interpreted as financial risk exposure due to high costs of measurement, implementation, and compliance, which may reduce profitability (Muhammad & Aryani, 2021).

The characteristics of the Indonesian capital market, which emphasize short-term profitability, operational efficiency, and dividends, further explain why long-term sustainability benefits are not a primary consideration in investment decisions. This finding is consistent with Muhammad & Aryani (2021) and Darmawan & Firmansyah (2025), suggesting that without clear value creation and standardized reporting, carbon disclosure is still perceived as a negative signal.

The Effect of Green Process Innovation on Firm Value

The results show that green process innovation has no significant effect on firm value. This indicates that improvements in environmentally oriented process are not directly reflected in market valuation, reflecting the failure of information transmission within the signaling theory framework, where internal environmental initiatives are not perceived by the market as positive signals. The closed nature and low observability of process innovation are the main factors behind this failure. The front-loaded cost structure, increased production costs, and the need for dedicated research funding further reinforce investor perceptions that process

innovation represents a burden on short-term profitability rather than source of value creation (Hidayah & Sibarani, 2023; Muwaffaq Helmi & Erna Widiastuty, 2023).

In the food and beverage sector, process improvements that are merely oriented toward basic regulatory compliance (beyond compliance) further emphasize the inability of process innovation to generate valuable sustainability signals for the market. This finding is consistent with Adi et al. (2025) and Hidayah & Sibarani (2023), which confirm that low observability and high investment costs become the main barriers to process innovation in increasing firm value.

The Effect of Green Product Innovation on Firm Value

The results show that green product innovation has a positive and significant effect on firm value. This indicates that the higher levels of environmentally friendly product innovation, the higher the firm value. This finding supports legitimacy theory, where environmentally friendly products with high observability and direct distribution to consumers are able to build public trust. The trust drives increased customer loyalty and sales volume, which ultimately strengthens the company's financial fundamentals. Investors then perceive this as a positive signal of sustainable growth prospects, leading the market to respond higher stock valuations. This finding is consistent with Fathoni et al. (2025), Adi et al. (2025), also Hidayah & Sibarani (2023), which consistently demonstrate that green product innovation serves as an effective strategic legitimacy instrument in enhancing both consumer trust and investor valuation.

CONCLUSION

This study aims to examine the influence of environmental performance, carbon emissions disclosure, green process innovation, and substantive green product innovation on the firm value of Food and Beverage companies listed on the Indonesia Stock Exchange (IDX) during 2021-2024. The findings reveal that collectively, all four independent variables have a significant impact on firm value. Unilaterally, environmental performance and carbon emissions disclosure have a negative and significant effect on firm value, as investors may perceive high environmental compliance and emissions transparency as signals of heavy cost burdens and potential future financial risks. Furthermore, green process innovation does not have a significant effect on firm value, indicating that internally oriented and less observable innovations do not directly influence market valuation. Conversely, green product innovation has a positive and significant effect on firm value, demonstrating that tangible innovations directly perceived by consumers successfully enhance market confidence. This study supports Legitimacy Theory, illustrating that visible external initiatives such as eco-friendly products effectively secure social legitimacy and market appreciation, whereas internal processes or mere disclosures may be penalized by cost-conscious investors. For future research, expanding the sample across other industries for comparison is recommended. Additionally, future studies should use alternative measurements for environmental performance and carbon emissions disclosure, and incorporate financial control variables to yield a more comprehensive analysis.

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