

Green innovation and firm value: Does founder leadership really matter?

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ABSTRACT

This study examines the effect of green innovation on firm value and investigates whether CEO founders moderate this relationship. Using purposive sampling, the study analyzes 1,730 firm-year observations from 346 non-financial firms listed on the Indonesia Stock Exchange (IDX) during the 2019–2023 period. Generalized least squares (GLS) regression is employed as the primary estimation method to address heteroscedasticity and autocorrelation issues. To ensure the robustness of the findings, fixed-effects panel regression and generalized method of moments (GMM) estimations are conducted to control for unobserved heterogeneity, endogeneity, and potential reverse causality. The GLS and fixed-effects results indicate that green innovation is positively associated with firm value. However, the relationship becomes insignificant in the GMM estimations, suggesting that the positive association may be sensitive to endogeneity concerns. Furthermore, CEO founders do not significantly moderate the relationship between green innovation and firm value across all model specifications. These findings provide mixed evidence regarding the value implications of green innovation and highlight the importance of addressing endogeneity when examining the economic consequences of corporate sustainability initiatives. By investigating the moderating role of CEO founders in the green innovation–firm value relationship within an emerging market context, this study extends the corporate sustainability and upper echelons literature. The findings also suggest that firms should carefully evaluate the economic outcomes of green innovation initiatives while considering their broader strategic and sustainability objectives.

Introduction

As global economic competition intensifies and environmental concerns grow, firms are motivated to adopt sustainable business strategies. One key approach is green innovation, which involves developing new products and processes that minimize environmental impact by improving resource efficiency, utilizing renewable energy, and fostering environmentally friendly solutions. Green innovation is crucial for addressing ecological decline and maintaining the long-term sustainability of a firm's economic pursuits (Lestari & Soewarno, 2024; Xie et al., 2022; Zhang et al., 2020). Green innovation not only aims to enhance the firm's economic performance but also to reduce environmental harm and provide a competitive edge (Agustia et al., 2019; Asni & Agustia, 2022).

Today, green innovation has expanded broadly across different scales of business from microenterprises to national organizations and plays a crucial role in promoting sustainable development in many countries (Asni & Agustia, 2022; Lestari & Soewarno, 2024; Zhang et al., 2020). In modern business, green innovation is not only a form of corporate social responsibility but also a strategic tool to enhance corporate value by improving reputation, operational efficiency, and long-term competitiveness. However, amid intense market competition, relying solely on green innovations is insufficient to meet the diverse needs of stakeholders (Zhang et al., 2020).

Green innovation is a strategy to enhance a firm's performance and reputation by promoting environmental sustainability. It involves the efficient use of natural resources and can positively influence investor interest (Agustia et al., 2019; Hidayat et al., 2024). In Indonesia, the adoption of green innovation has been supported by government policies that promote sustainable business practices. Since the issuance of Government Regulation No. 47 of 2012, which mandates firms to fulfill social and environmental responsibilities, the government has continued to strengthen its efforts through follow-up regulations such as POJK No. 60/POJK.04/2017 concerning green bonds and SEOJK No. 16/SEOJK.04/2021, which oversees corporate sustainability reporting. However, the implementation of green innovation still varies significantly among firms. This raises important questions about how much green innovation adds to a firm's value in the Indonesian capital market.

However, the urgency of green innovation becomes more evident when viewed against the backdrop of escalating environmental problems, particularly in emerging economies such as Indonesia. In recent years, Indonesia has faced significant environmental challenges, including rising carbon emissions, industrial pollution, and waste management issues. According to the [World Bank \(2024\)](#), Indonesia's CO₂ emissions have shown a consistent upward trend, largely driven by energy consumption and industrial activities. Similarly, the [International Energy Agency \(2023\)](#) reports that Indonesia remains one of the largest energy-related carbon emitters in Southeast Asia, reflecting the heavy reliance on fossil fuels in industrial operations.

Furthermore, stakeholder pressure has intensified significantly in recent years. Global investors are increasingly incorporating Environmental, Social, and Governance (ESG) criteria into their decision-making processes. [MSCI \(2023\)](#) Research reports indicate that firms with strong ESG performance tend to attract higher investment inflows and demonstrate better risk resilience. Likewise, [Bloomberg \(2023\)](#) highlights the growing demand for ESG disclosure, particularly in emerging markets, as transparency becomes a key factor influencing investor confidence.

The results of previous research are mixed; several studies indicate that green innovation positively affects firm value ([Agustia et al., 2019](#); [Dai & Xue, 2022](#); [Hidayat et al., 2024](#); [Liu, 2024](#); [Zhang et al., 2020](#)). [Dai & Xue \(2022\)](#) revealed that green innovation efforts can enhance efficiency, reputation, and investor confidence in sustainability. Additionally, green innovation can motivate firms to turn production waste into valuable assets and achieve economic benefits if properly implemented ([Agustia et al., 2019](#); [Hidayat et al., 2024](#)).

Nevertheless, [Asni and Agustia \(2022\)](#), [Samhadi et al. \(2024\)](#), and [Xie et al. \(2022\)](#) argued that green innovation does not affect a firm's value. [Asni and Agustia \(2022\)](#) revealed that the implementation of green innovation serves as a form of legitimacy and compliance with government regulations, rather than being the primary factor in investors' decision-making. Additionally, implementing green innovation involves high costs and significant effort to develop environmentally friendly products ([Samhadi et al., 2024](#)).

Therefore, previous research on the link between green innovation and firm value remains mixed. These mixed findings suggest that the relationship may be contingent upon certain contextual or firm-specific factors that have not been sufficiently explored. Existing studies have predominantly focused on the direct effect of green innovation, with limited attention given to the role of internal governance mechanisms and leadership characteristics in shaping this relationship. In particular, the role of CEO founders has been largely overlooked, despite their unique influence on strategic decision-making and long-term orientation ([LeCounte, 2024](#); [Lu et al., 2025](#); [Sutrisno et al., 2022](#); [Wang et al., 2022](#)). According to the upper echelons theory ([Hambrick & Mason, 1984](#)), organizational outcomes are significantly influenced by the values and characteristics of top executives. However, empirical evidence examining how CEO founders affect the effectiveness of green innovation in enhancing firm value remains scarce.

In addition to green innovation, executive leadership qualities are also believed to influence the effectiveness of implementing green strategies. The role of the CEO founder as the firm's founder is an intriguing factor to explore. The upper echelons theory holds that a leader's personal traits and values significantly influence an organization's strategic direction and performance ([Hambrick & Mason, 1984](#)). The CEO plays a crucial role in the firm's strategic decision-making, which ultimately affects the firm's value. The characteristics and personal values of the CEO founder significantly influence the firm's strategic choices ([LeCounte, 2024](#); [Lu et al., 2025](#); [Sutrisno et al., 2022](#); [Wang et al., 2022](#)), including the implementation of green innovation.

CEO founders often develop a strong emotional attachment and sense of ownership, leading them to think long-term and prioritize business sustainability. This mindset can encourage the use of investment as a strategy to increase value and uphold the firm's reputation ([Lu et al., 2025](#); [Sutrisno et al., 2022](#)). Leadership character is essential. CEO founders generally have a long-term vision, greater control, and are expected to have a stronger commitment to innovation and sustainability than non-founder CEOs ([Huang et al., 2009](#); [Lu et al., 2025](#)). Therefore, CEO founders are likely to enhance the link between green innovation and firm value by promoting more progressive, long-term strategic choices.

This study examines the relationship between green innovation and firm value by incorporating CEO founder as a moderating variable. It aims to explain how CEO founder characteristics shape the extent to which green innovation contributes to firm value, thereby providing insight into the varying outcomes reported in prior research.

The empirical analysis focuses on non-financial firms listed on the Indonesia Stock Exchange over the period 2019–2023. Indonesia provides a relevant setting given its increasing emphasis on sustainable practices and regulatory support for green innovation, as outlined in the Financial Services Authority (OJK)'s 2021 policies. As an emerging economy, Indonesia faces the challenge of balancing economic growth with environmental sustainability, making green innovation a critical strategy to maintain competitiveness and meet stakeholder expectations ([Lestari & Soewarno, 2024](#); [Hidayat et al., 2024](#)).

This gap is particularly relevant in emerging markets such as Indonesia, where firms face dual pressures of economic growth and environmental sustainability, and where ownership structures are often characterized by family dominance. In such contexts, CEO founders may play a more prominent role in aligning sustainability initiatives with long-term firm value creation.

Furthermore, Indonesia is among the countries where family ownership is prominently dominant ([Sutrisno & Karmudiandri, 2020](#); [Sutrisno et al., 2023](#)). Testing related to CEO founders, typically in firms with family dominance, will make a significant contribution. The 2019–2023 period encompasses both pre- and post-COVID-19 pandemic phases,

during which many firms revised their innovation and sustainability strategies. Analyzing this timeframe is crucial for examining the relationship between green innovation, firm value, and the influence of CEO founders in Indonesia.

This study makes several contributions to the literature. First, this study contributes to the literature by integrating the Resource-Based View and Upper Echelons Theory to explain the relationship between green innovation and firm value. Specifically, it extends the Resource-Based View by positioning green innovation as a strategic resource that enhances firm value. At the same time, it incorporates Upper Echelons Theory by examining the moderating role of CEO founders, thereby offering a more nuanced explanation for the mixed findings reported in prior studies. Additionally, it addresses methodological limitations in prior studies by employing a dynamic panel approach (System GMM), which allows for better control of endogeneity and provides more reliable empirical evidence. Third, it contributes to the emerging market literature by providing evidence from Indonesia, where institutional settings and ownership structures may influence sustainability outcomes differently compared to developed economies.

Second, this study provides practical implications for managers by highlighting that the effectiveness of green innovation in creating firm value depends on leadership characteristics. The findings suggest that firms should align their green innovation strategies with managerial capabilities, particularly by leveraging the strategic role of CEO founders in driving long-term value creation.

Third, this study offers implications for policymakers and regulators. The results indicate that policies aimed at promoting green innovation should consider firm-level heterogeneity, including leadership structure and strategic orientation. This may assist in designing more effective regulatory frameworks and incentive mechanisms to support sustainable business practices in emerging markets.

Literature Review

Resource-Based View Theory

The Resource-Based View theory states that a firm's competitive advantage derives from its scarce, hard to replicate, and irreplaceable internal resources (Barney, 1991). In the context of a resource-based view, green innovation is regarded as a valuable strategic resource. Green innovation encompasses the development of environmentally friendly products, processes, and business practices that enhance resource efficiency. According to Hart (1995), a firm's ability to proactively address environmental issues is a valuable asset that can lead to long-term competitive advantage. Green innovation is regarded as a strategic resource that can provide a competitive edge by increasing efficiency, differentiating green products, and enabling environmentally friendly technologies, ultimately enhancing the firm's value.

Theory Upper Echelon

This theory suggests that executives' traits and personal values influence their strategic decisions and the firm's performance outcomes (Hambrick & Mason, 1984). The firm's strategic decisions are shaped more by the values, experiences, cognitive biases, and personal backgrounds of decision makers than by purely rational or objective analysis. Consequently, the demographic and psychological traits of executives, such as age, education, experience, tenure, and whether they are founders, influence how they interpret situations and determine strategic direction (Hambrick, 2007).

Founder CEOs usually have a long-term focus, high dedication, and more control, which can enhance innovation efficiency and outcomes (Wang et al., 2022). The CEO-founder will play a crucial role in shaping the firm's strategic direction and sustainability focus because they possess a strong sense of ownership, a long-term vision, and the responsibility to uphold the firm's reputation (Amin et al., 2026; Sutrisno et al., 2022). CEO founders are also more likely to invest in green innovation and dedicate themselves to resource efficiency as part of their long-term growth strategy (Lu et al., 2025; Wang et al., 2022). A responsible CEO founder's leadership also fosters an ethical and sustainable culture within the organization, enhancing operational performance and building investor confidence in the firm's long-term prospects (Wang et al., 2024).

Green Innovation and Corporate Value

Resource-Based View (RBV) theory argues that firms can achieve competitive advantage and increase firm value by effectively utilizing valuable, rare, inimitable, and non-substitutable resources (Barney, 1991). In this context, green innovation can be considered a strategic internal resource because it enables firms to develop environmentally friendly products, production processes, and technologies that competitors find difficult to imitate. Through these innovations, firms may improve operational efficiency, reduce waste and energy consumption, and strengthen their long-term competitiveness.

Green innovation also contributes to firm value by enhancing corporate reputation and increasing stakeholder trust. Investors tend to perceive firms that implement green innovation as better able to manage environmental risks and sustain future business performance (Agustia et al., 2019). This positive perception can increase market confidence and ultimately improve firm value. Furthermore, the implementation of green

innovation signals a firm's commitment to sustainability, which becomes increasingly important amid rising environmental awareness among stakeholders (Samhadi et al., 2024).

From the stakeholder perspective, pressures from governments, consumers, and investors encourage firms to adopt environmentally responsible practices and engage in green innovation (Husnaini & Tjahjadi, 2021). For manufacturing firms in Indonesia, green innovation may help firms respond to environmental pressures while simultaneously improving product quality and market competitiveness (Lestari & Soewarno, 2024). As a result, firms that implement green innovation are expected to achieve better financial performance and higher firm value than those that do not adopt such practices.

Several previous studies found that green innovation positively affects firm value by enhancing competitive advantage and investor confidence (Agustia et al., 2019; Dai & Xue, 2022; Hidayat et al., 2024; Liu, 2024; Zhang et al., 2020). However, other studies reported insignificant effects of green innovation on firm value (Asni & Agustia, 2022; Samhadi et al., 2024; Xie et al., 2022). Prior research has documented varying findings on the relationship between green innovation and firm value across different institutional and industrial contexts. This variation highlights the need for further empirical evidence, particularly from emerging economies such as Indonesia. Therefore, the hypothesis of this study is formulated as follows:

H₁: Green innovation positively influences firm value.

Moderating Role of the CEO Founder

Upper Echelons Theory, proposed by Hambrick and Mason (1984), states that organizational outcomes are influenced by the characteristics, values, experiences, and cognitive perspectives of top executives. Strategic decisions taken by firms, including sustainability-oriented strategies such as green innovation, are therefore shaped by the background and orientation of the CEO. One important executive characteristic influencing strategic decisions is CEO founder status.

A CEO founder is an individual who establishes the firm and simultaneously serves as its CEO (Wang et al., 2022). Compared to non-founder CEOs, founder-CEOs generally possess a stronger emotional attachment, greater long-term commitment, and a deeper understanding of the firm's vision and strategic direction because they have been involved from the firm's early stages (Sutrisno et al., 2023). This strong attachment encourages CEO founders to prioritize long-term sustainability and organizational growth rather than short-term performance. In addition, CEO founders tend to have greater authority and influence in directing strategic initiatives, including investments in innovation and sustainability practices (Abebe et al., 2021).

In the context of green innovation, leadership support is essential because implementing environmentally friendly initiatives often requires substantial investment, organizational change, and a long-term orientation. Leaders who actively encourage collaboration, knowledge integration, and environmental commitment can improve the effectiveness of green innovation implementation (Indrawati et al., 2025). CEO founders are more likely to support green innovation initiatives because they tend to focus on maintaining the firm's long-term reputation, competitiveness, and survival. As a result, green innovation implemented under the CEO-founder's leadership may yield greater benefits in operational efficiency, environmental reputation, and stakeholder trust.

Furthermore, investors may perceive firms led by CEO founders as more visionary, stable, and committed to long-term sustainability goals. Consequently, when firms engage in green innovation, the market may respond more positively if the firm is led by a CEO founder, thereby strengthening the positive impact of green innovation on firm value (Lu et al., 2025; Wang et al., 2022). Thus, CEO founder is expected to strengthen the relationship between green innovation and firm value. Therefore, the hypothesis of this study is formulated as follows:

H₂: CEO founder strengthens the positive relationship between green innovation and firm value.

The conceptual framework and the hypothesized relationships of this study are illustrated in Figure 1:

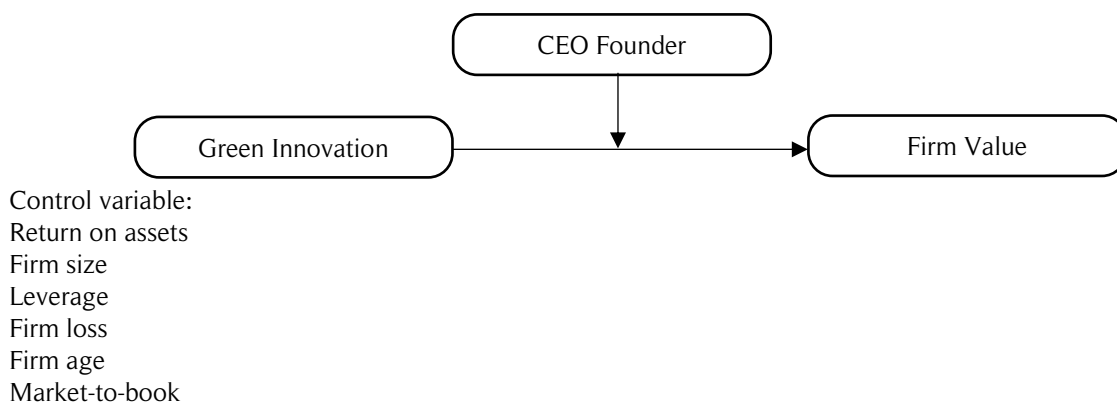


Figure 1. Research Model

Research Method

This study utilizes data from firms' annual reports and audited financial statements. The firm's annual reports and financial statements are obtained from their websites and the IDX. The research examines non-financial corporations listed on the IDX between 2019 and 2023. This observation analyzes the impact of newly instituted regulatory rules on ESG (Environmental, Social, and Governance) in Indonesia, to foster awareness of the Green Economy. The research used purposive sampling to obtain data. It excludes firms that did not routinely issue annual reports and financial statements from 2019 to 2023, especially those with fiscal periods ending on dates other than December 31, as well as those reporting in currencies other than Rupiah. According to these criteria, 346 firms meet the requirements, yielding a total of 1730 observations for this study. Table 1 outlines the specific criteria used for sample selection and the resulting number of observations.

Table 1. Data Selection Criteria

Sampling Criteria	Number of Firms	Number of Samples
Non-financial sector firms have consistently been listed on the IDX from 2018 to 2023.	467	2335
Firms that are inconsistent publish both annual and financial reports.	(39)	(195)
Firms that are inconsistent publish annual and financial reports as of December 31.	(5)	(25)
Firms that do not issue financial reports in Rupiah.	(77)	(385)
Number of Research Samples	346	1730
Missing value		(2)
Number of observations		1728

Source: IDX Statistics

Table 2. Operational Definition

Variable	Definition	Variable Measurement	Supporting Literature
Variable Dependency			
TobinsQ	Firm Value	The ratio of the total market value of ordinary stock is calculated by multiplying the closing price by the total market value of ordinary stock and dividing by total assets.	(Gao & Han, 2022)
Independent Variables			
GI	Green Innovation	1. Develop policies to reduce resource, water, and energy consumption, aiming to improve their efficient use. 2. Use recycled materials, recycling methods, and environmental technology. 3. Conduct environmental awareness campaigns. 4. Implement or adopt the latest technological equipment to reduce energy, water, and waste use. 5. Modify product designs to prevent contamination or the presence of toxic compounds during production. 6. Improve and design eco-friendly packaging for both existing and new products. 7. Create or update product designs to enhance energy efficiency during use. 8. Use materials that generate less pollution or are less harmful (environmentally friendly materials). 0 = When the indicator is not disclosed. 1 = When the indicator is disclosed but not in detail. 2 = When the indicator is detailed.	(Lestari & Soewarno, 2024)
Moderation Variables			
CEO	CEO Founder	A score of 1 is assigned to the founding CEO, and a score of 0 to the non-founding CEO.	(Kim & Kiymaz, 2023)
Variable Control			
ROA	Return on Assets	The ratio of net income to total assets.	(Liu, 2024)
SIZE	Firm Size	Total book value of assets expressed in logarithmic form.	(Shao et al, 2025)
LEV	Leverage	The ratio of total liabilities to total assets.	(Gao & Han, 2022)
LOSS	Firm Loss	Firms with net losses received a score of 1, while those with net gains received a score of 0.	(Sutrisno & Karmudiandri, 2020)
AGE	Firm Age	The natural logarithm of the difference between the observation year and the firm's founding year.	(Gao & Han, 2022)
MTB	Market To Book	The ratio is calculated as the market value of equity divided by its book value.	(Sutrisno & Karmudiandri, 2020)

Source: Previous research

This study investigates a dependent variable, Firm Value (Tobin's Q), and an independent variable, Green Innovation (GI), with CEO founder (CEOF) serving as a moderation variable. This study controls for several firm characteristics to mitigate omitted variable bias. Several control variables are also included: return on assets (ROA), firm size (SIZE), leverage (LEV), loss (LOSS), firm age (AGE), and market-to-book ratio (MTB). Profitability (ROA) is included as firms with stronger financial performance are more likely to enhance firm value and invest in sustainability initiatives (Liu, 2024). Firm size (SIZE) is controlled because larger firms possess greater resources and capabilities to engage in green innovation (Shao et al., 2025). Leverage (LEV) is included to account for financial risk and capital structure, which may constrain innovation investment (Gao & Han, 2022). A loss indicator (LOSS) is included to control for firms experiencing negative earnings, as financial distress may limit innovation investment and negatively affect firm valuation (Wu et al., 2010). Firm age (AGE) reflects organizational maturity that may influence adaptability to green innovation (Gao & Han, 2022). Finally, the market-to-book ratio (MTB) is used as a proxy for growth opportunities affecting firm valuation (Sutrisno & Karmudiandri, 2020). The specific measurement methods for these variables are detailed in Table 2.

This study employed fixed-effect panel data analysis, selected after conducting the Hausman test to identify the most suitable model. Below are the equations of the regression model used in this research:

$$Tobin'sQ_{it} = \alpha_0 + \beta_1 GI_{it} + \beta_2 CEOF_{it} + \beta_3 GI * CEOF_{it} + \sum_{i=6}^n \beta_i Controls_{it} + e_{it}$$

Information:

Tobin's Q : Firm Value

GI : Green Innovation

CEOF : CEO Founder

ROA : Return on Assets

SIZE : Firm Size

LEV : Leverage

LOSS : Loss

AGE : Firm Age

MTB : Market to Book

Result and Discussion

Descriptive Statistics Test

Table 3 displays the descriptive statistics for all research variables, which include Tobin's Q (a proxy for firm value), gender index (GI), CEO female (CEOF), return on assets (ROA), firm size (SIZE), leverage (LEV), loss condition (LOSS), firm age (AGE), and market-to-book ratio (MTB). The statistics include the mean, standard deviation, minimum, and maximum for each variable. These descriptive results are based on data processed after winsorizing the firm value (FV) and the control variables, ROA and leverage, at the 1% and 99% levels. The firm size variable (SIZE) was mean-centered to mitigate multicollinearity.

Table 3. Descriptive Statistics

Variable	Mean	Std. Dev	Minimum	Maximum
TobinsQ	1.201	1.989	0.026	15.826
GI	0.334	0.212	0.000	0.875
CEOF	0.173	0.378	0.000	1.000
ROA	0.028	0.101	-0.545	0.383
SIZE	12.40	0.789	7.810	14.649
LEV	0.505	0.380	0.040	3.388
LOSS	0.314	0.464	0.000	1.000
AGE	34.179	15.576	4.000	112.000
MTB	2.203	4.223	-6.186	39.829

Source: Data processed

The firm's average Tobin's Q is 1.201, with a high standard deviation of 1.989, showing a broad range of firm values from 0.026 up to 15.826. The mean green innovation (GI) score is 0.334, with a standard deviation of 0.212, meaning most firms have low levels of green innovation, though there is significant variation from 0.000 to 0.875. This suggests that while many firms have yet to fully adopt environmentally friendly innovations, some have achieved relatively high levels of implementation. The CEO Founder (CEOF) variable averages 0.173, indicating

that around 17.3% of firms are led by CEOs who are also founders, which implies that leadership has shifted mainly from founders to other professionals.

The average return on assets (ROA) of 0.028 indicates that the firm's profitability is generally low. The values range widely from -0.545 to 0.383, with a standard deviation of 0.101, reflecting significant variation in the firm's ability to generate profits from its total assets. The firm size (SIZE), averaging 12.40 with a standard deviation of 0.781, suggests relative homogeneity within the sample. Leverage (LEV) averages 0.505, meaning roughly 50.5% of the capital structure is debt-financed. The LOSS metric, with an average of 0.314, shows that about 31.4% of firms experienced losses during the period. The firm's age (AGE) averages 34.179 years with a standard deviation of 15.576, indicating most firms have been operating for a long time, though with considerable variation, from 4 to 112 years. The market-to-book ratio (MTB) has an average of 2.203 and a standard deviation of 4.223, implying that most firms have a market value higher than their book value.

This study used a Hausman test to determine the best panel-data estimation model. The results favored the fixed-effect model for data analysis. A classical assumption test was also conducted. As shown in Table 4, the multicollinearity test found no issues, with VIF values below 10 and 1/VIF values above 0.1. However, tests for heteroscedasticity and autocorrelation revealed problems, with $\text{Prob} > \chi^2 = 0.000 < \alpha$ and $\text{Prob} > F = 0.000 < \alpha$, respectively. Therefore, the study employed Generalized Least Squares (GLS) to ensure more reliable test results.

Table 4. Multicollinearity Test

Variable	VIF	1/VIF
AGE	4.13	0.242
GI	3.22	0.310
LEV	2.76	0.363
LOSS	1.63	0.614
MTB	1.23	0.814
CEOF	1.17	0.858
ROA	1.14	0.879
SIZE_C	1.03	0.972
Mean VIF	2.04	

Source: Data processed

Table 5 shows the correlation results among the research variables: Tobin's Q (firm value), green innovation (GI), CEO Founder (CEOF), return on assets (ROA), firm size (SIZE), leverage (LEV), loss condition (LOSS), firm age (AGE), and market-to-book ratio (MTB). The analysis aims to determine the direction and strength of linear relationships between these variables prior to conducting panel regression.

Table 5. Pairwise Correlation Analysis

Variables	TobinsQ	GI	CEOF	ROA	SIZE	LEV	LOSS	AGE	MTB
TobinsQ	1.000								
GI	-0.057**	1.000							
CEOF	-0.007	-0.124***	1.000						
ROA	-0.027	0.035	0.006	1.000					
SIZE	-0.222***	0.458***	-0.102***	0.121***	1.000				
LEV	0.094***	-0.073***	0.009	-0.156***	-0.087***	1.000			
LOSS	-0.032	-0.222***	-0.010	-0.246***	-0.295***	0.288***	1.000		
AGE	-0.102***	0.239***	-0.105***	0.015	0.183***	0.025	-0.088***	1.000	
MTB	0.565***	0.014	-0.065***	-0.035	-0.040*	-0.023	-0.023	-0.035	1.000

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Data processed

The correlation coefficient between Tobin's Q and GI is -0.057 at a 5% significance level ($p < 0.05$), revealing a small yet statistically significant negative relationship. This indicates that increased green innovation is associated with a slight decrease in the firm's market value. Nonetheless, the weak correlation suggests the relationship is modest and warrants further analysis via regression. The correlation between CEOF and Tobin's Q is -0.007, suggesting a very weak, statistically insignificant connection between the founding CEO's status and the firm's value. This means that the founder's leadership does not notably influence the firm's valuation. Green innovation (GI) correlates positively and significantly with SIZE (0.458), implying larger firms are more likely to

engage in green innovation. Conversely, GI shows a significant negative correlation with CEOF (−0.124), indicating that founder-led firms tend to exhibit lower levels of green innovation. Overall, most correlations among the independent variables are below 0.80, pointing to no evidence of multicollinearity.

Table 6. Hypothesis Test

Variables	Model 1	Model 2	Model 3
GI	0.948*** (0.000)	0.949*** (0.000)	1.010*** (0.000)
CEO		0.005 (0.962)	0.133 (0.449)
GI*CEO			−0.448 (0.375)
Control variables:			
ROA	0.093 (0.811)	0.093 (0.811)	0.105 (0.787)
SIZE	−0.660*** (0.000)	−0.660*** (0.000)	−0.663*** (0.000)
LEV	0.699*** (0.000)	0.699*** (0.000)	0.696*** (0.000)
LOSS	−0.503*** (0.000)	−0.502*** (0.000)	−0.505*** (0.000)
AGE	−0.008*** (0.001)	−0.008*** (0.001)	−0.008*** (0.001)
MTB	0.259*** (0.000)	0.259*** (0.000)	0.259*** (0.000)
Constant	8.896*** (0.000)	8.892*** (0.000)	8.902*** (0.000)
Year Fixed Effect	Yes	Yes	Yes
Observations	1,728	1,728	1,728
Number of id	346	346	346

*** p<0.01, ** p<0.05, * p<0.1

Source: Data processed

The R² (determination coefficient) indicates the proportion of variability in the dependent variables explained by the independent variables in this study: 0.324. This means that the model variables account for 32.4% of the variability in the dependent variables, while the remaining 67.6% is unexplained. Across all three test models, the R² values showed minimal differences, suggesting that adding variables to the model increased the explained variance only slightly.

According to Table 6, the regression results for models 1, 2, and 3 show that Green Innovation positively impacts the firm's value (p-values ≤ 0.01), supporting H1. The CEO-founder test in the second and third models indicates that the CEO-founder does not influence the firm's value (p-values ≥ 0.05). Specifically, in model 2, it confirms that the CEO founder does not affect the firm's value (p-value ≥ 0.05). Similarly, in model 3, the CEO founder does not modify the relationship between green innovation and firm value (p-value ≥ 0.05), so H2 is not supported.

Robustness Test

Robustness test using alternative firm performance measures

This study conducts a robustness test by examining the impact of green innovation on other firm performance measures, such as sales growth, to strengthen the research findings. Sales growth explicitly measures the increase in a firm's business activities. If a firm experiences sales growth, it indicates opportunities for expansion or improved performance, making sales growth a relevant indicator of opportunity, investment, or performance. Sometimes, using Tobin's Q raises concerns because the market value may already reflect future expectations or be affected by reverse causality in the dependent variable. Therefore, sales growth can be seen as a variable that more accurately describes operational performance or outcomes that better explain increases in a firm's value or performance. Table 7 presents the results of this robustness test.

Table 7. Robustness Test Using Alternative Firm Performance Measures

Variables	Model 1	Model 2	Model 3
GI	0.184*** (0.001)	0.177*** (0.002)	0.167*** (0.006)
CEOF		-0.037 (0.221)	-0.058 (0.275)
GICF			0.072 (0.632)
Control variables:			
ROA	-0.261** (0.026)	-0.262** (0.025)	-0.264** (0.025)
SIZE	-0.001 (0.927)	0.0001 (0.997)	0.0001 (0.995)
LEV	0.003 (0.922)	0.004 (0.896)	0.005 (0.888)
LOSS	-0.154*** (0.000)	-0.156*** (0.000)	-0.155*** (0.000)
AGE	-0.002*** (0.004)	-0.002*** (0.003)	-0.002*** (0.003)
MTB	-0.001 (0.781)	-0.001 (0.718)	-0.001 (0.711)
Constant	0.150*** (0.000)	0.162*** (0.000)	0.166*** (0.000)
R-squared	0.004	0.005	0.005

*** p<0.01, ** p<0.05, * p<0.1

Source: Data processed

The robustness test results strengthen the reliability of the initial findings for the first and second hypotheses. As shown in Table 7, green innovation (GI) has a positive effect on firm value (sales growth), with p-values ≤ 0.05 across all three testing models. These findings support the main results of this study. Thus, hypothesis 1 is confirmed, indicating that green innovation enhances a firm's value, as corroborated by the robustness check. The moderation analysis regarding the CEO-founder's role in the green innovation-firm value (sales growth) relationship also produced consistent results with the original test, with p-values ≥ 0.05 . This suggests that the CEO-founder does not affect the relationship between green innovation and firm value. Therefore, the findings for Hypothesis 2, that the CEO founder does not influence this relationship, are also validated by the robustness test.

Robustness test using fixed-effect robust estimation

To ensure the robustness of the main findings, this study re-estimated the regression model using a fixed-effect robust estimator with year fixed effects (i.year). The inclusion of year fixed effects controls for macroeconomic conditions and time-specific shocks that may simultaneously affect firm value across all firms during the observation period. The robust estimation also addresses potential heteroskedasticity issues. Table 8 outlines the regression results of the robustness test using the fixed-effect robust estimator across various model specifications.

The robustness test results consistently support the main findings obtained from the GLS estimation. Green innovation (GI) remains positively associated with firm value across all models. These findings indicate that firms engaging in green innovation activities tend to achieve higher firm value, even after controlling for unobserved firm heterogeneity and time effects. The consistency of these results confirms that the positive effect of green innovation on firm value is stable and not sensitive to alternative estimation methods.

The CEO founder (CEOF) variable shows an insignificant coefficient in Models 2 and 3. This finding suggests that founder-led firms do not exhibit significantly different firm value compared to non-founder-led firms. Similarly, the interaction term between green innovation and CEO founder (GICF) is statistically insignificant, indicating that CEO founders do not moderate the relationship between green innovation and firm value. Therefore, the effectiveness of green innovation in enhancing firm value does not depend on whether a CEO founder leads the firm.

Overall, the robustness test confirms the reliability and stability of the main GLS estimation results. The positive impact of green innovation on firm value remains consistent after applying fixed-effect robust estimation with year fixed effects, indicating that the findings are robust to alternative model specifications and potential heteroskedasticity concerns.

Table 8. Robustness Test Using Fixed-Effect Robust Estimation

Variables	Model 1	Model 2	Model 3
GI	0.800*** (0.013)	0.792*** (0.014)	0.685*** (0.040)
CEOF		-0.166 (0.216)	-0.322 (0.077)
GICF			0.6111 (0.157)
Control variables:			
ROA	-0.182 (0.699)	0.1885 (0.689)	0.186 (0.693)
SIZE	-2.940*** (0.005)	-2.931*** (0.006)	-2.926*** (0.006)
LEV	-0.511 (0.064)	-0.509 (0.065)	0.513 (0.063)
LOSS	-0.177 (0.055)	-0.180 (0.053)	-0.179 (0.053)
AGE	-0.179*** (0.001)	-0.182*** (0.003)	-0.125 (0.070)
MTB	0.167*** (0.000)	0.167*** (0.000)	0.167*** (0.000)
Constant	43.326*** (0.003)	43.362*** (0.003)	41.500*** (0.005)
Year Fixed Effect	Yes	Yes	Yes
R-squared	0.0869	0.0865	0.1081

*** p<0.01, ** p<0.05, * p<0.1

Source: Data processed

Robustness test using lagged independent variables

To mitigate potential reverse causality, the study also employs a lagged-independent-variable approach, regressing current firm value on a one-period lagged measure of green innovation. The results remain consistent, indicating that prior green innovation positively affects firm value. The detailed regression results of the lagged independent variable approach are presented in [Table 9](#).

Table 9. Robustness Test Using Lagged Independent Variables

Variables	Model 1	Model 2	Model 3
G _{it-1}	0.572*** (0.012)	0.563*** (0.013)	0.544*** (0.022)
CEOF		-0.104 (0.506)	-0.135 (0.479)
G _{it-1} CF			0.119 (0.776)
Control variables:			
ROA	-0.068 (0.803)	-0.066 (0.810)	-0.067 (0.807)
SIZE	-0.845*** (0.000)	-0.848*** (0.000)	-0.847*** (0.000)
LEV	0.374*** (0.003)	0.374*** (0.003)	0.375*** (0.003)
LOSS	-0.309*** (0.000)	-0.312*** (0.000)	-0.312*** (0.000)
AGE	-0.004 (0.338)	-0.004 (0.318)	-0.005 (0.317)
MTB	0.153*** (0.000)	0.153*** (0.000)	0.153*** (0.000)
Constant	11.354*** (0.000)	11.429*** (0.000)	11.422*** (0.000)
Year Fixed Effect	Yes	Yes	Yes
R-squared	0.3193	0.3185	0.3182

*** p<0.01, ** p<0.05, * p<0.1

Source: Data processed

Model 1 shows that one-period lagged green innovation (GI_{t-1}) has a positive effect on firm value at the 1% significance level ($\beta = 0.572$, $p < 0.01$). This finding suggests that green innovation implemented in the previous period continues to enhance firm value in the subsequent period. The result is consistent with the main analysis, confirming that firms engaging in green innovation are more likely to obtain higher market valuation and stronger investor confidence over time.

In Model 2, after incorporating CEO founder status, the coefficient of lagged green innovation remains positive and significant ($\beta = 0.563$, $p < 0.01$), while CEO founder status itself is not statistically significant. This result indicates that the positive impact of green innovation on firm value persists regardless of whether a CEO founder leads the firm.

Furthermore, Model 3 includes the interaction term between lagged green innovation and CEO founder status ($GI_{t-1}CF$). The interaction effect is statistically insignificant ($\beta = 0.119$, $p > 0.10$), suggesting that CEO founder status does not moderate the relationship between green innovation and firm value. The direction and significance of the results remain unchanged compared to the primary regression analysis.

Overall, these findings demonstrate that the lagged-variable approach yields conclusions that are consistent with the main model. The positive relationship between green innovation and firm value remains stable, while the moderating role of CEO founders remains unsupported. Therefore, the results provide additional evidence that the study's main findings are robust and are unlikely to be driven solely by reverse causality or simultaneity bias.

Endogeneity Test

To address potential endogeneity concerns arising from reverse causality, omitted-variable bias, and unobserved heterogeneity, this study conducts an additional endogeneity test using the Generalized Method of Moments (GMM) estimator. The relationship between green innovation and firm value may be confounded by reverse causality, as firms with higher market value may possess greater financial resources and incentives to invest in green innovation initiatives. Therefore, relying solely on static panel estimation may produce biased and inconsistent estimates. This study employs the dynamic panel GMM approach. The GMM approach controls for potential endogeneity by using lagged values of the explanatory variables as internal instruments. The lagged dependent variable is included to capture the dynamic nature of firm value. The dynamic model can be expressed as follows:

$$\text{TobinsQ}_{it} = \alpha_0 \text{TobinsQ}_{it-1} + \beta_1 GI_{it} + \beta_2 CEOF_{it} + \beta_3 GI \times CEOF_{it} + \sum \gamma \text{Control}_{it} + \varepsilon_{it}$$

Table 10. Endogeneity Test

Variables	Coefficient	Std. Error	t-Statistic	p-value
L.Tobin's Q	-0.002	0.188	-0.01	0.993
GI	-0.433	0.438	-0.99	0.324
CEOF	-0.352	0.265	-1.33	0.185
GICF	0.928	0.651	1.42	0.155
ROA	0.126	0.607	0.21	0.835
Size	-0.425***	0.160	-2.66	0.008
Leverage	0.117	0.468	0.25	0.803
Loss	-0.502***	0.154	-3.25	0.001
Age	-0.005	0.004	-1.22	0.224
MTB	0.235***	0.068	3.45	0.001
Constant	6.320***	2.014	3.14	0.002

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Data processed

The estimation results of the two-step System GMM are presented in Table 10. Regarding the main explanatory variables, GI exhibits a statistically insignificant effect on Tobin's Q ($\beta = -0.433$, $p > 0.10$), indicating that green innovation does not significantly influence firm value in the System GMM estimation after controlling for endogeneity. Similarly, CEOF and GICF are statistically insignificant, suggesting that CEO founder status and its interaction with green innovation do not significantly affect firm value. Interestingly, the lagged dependent variable is statistically insignificant, indicating weak dynamic persistence in Tobin's Q across periods. This suggests that the current firm value is not strongly driven by its previous-year level after controlling for endogeneity and firm-specific characteristics.

The diagnostic and validity tests of the two-step System GMM estimation are presented in Table 11. Overall, the diagnostic statistics indicate that the estimated model is econometrically valid and does not suffer from major specification problems. First, the Arellano–Bond test for first-order serial correlation [AR(1)] is significant ($p = 0.016$), while the second-order serial correlation test [AR(2)] is insignificant ($p = 0.649$). This finding confirms

the absence of second-order autocorrelation in the differenced residuals, indicating that the model satisfies the consistency requirement of the System GMM estimator. Furthermore, the Hansen test of overidentifying restrictions yields a p-value of 0.410, suggesting that the instruments used in the estimation are valid and exogenous. The Difference-in-Hansen test is also insignificant ($p = 0.129$), further supporting the validity of the additional moment conditions used in the system GMM framework.

Table 11. *Validity Tests*

Diagnostic Test	Result
AR (1) p-value	0.016
AR (2) p-value	0.649
Hansen Test p-value	0.410
Difference-in-Hansen p-value	0.129

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Data processed

The results from the System GMM estimation indicate that the positive association between green innovation and firm value observed in the GLS and fixed-effects model is not robust to endogeneity controls. This finding suggests that the initial positive relationship may be driven by reverse causality or omitted variable bias. Accordingly, the System GMM results provide more reliable evidence for causal interpretation, indicating that green innovation does not have a statistically significant effect on firm value in this study.

This study provides mixed evidence regarding the relationship between green innovation and firm value. While the GLS and fixed-effects results indicate a positive association between green innovation and firm value, the System GMM estimation shows that this relationship becomes statistically insignificant after controlling for endogeneity. This finding suggests that the positive effect observed in baseline models is not robust and may be driven by reverse causality or omitted variable bias.

These findings differ from previous studies that report a positive relationship between green innovation and firm value (Agustia et al., 2019; Dai & Xue, 2022; Hidayat et al., 2024; Liu, 2024; Zhang et al., 2020). Although prior literature suggests that green innovation enhances firm value through improved efficiency, reputation, and investor signaling, the present study indicates that such effects are not consistently observed when endogeneity is addressed.

From the resource-based view (RBV), green innovation is considered a strategic capability that can potentially generate competitive advantage. It enables firms to develop environmentally friendly processes, improve resource efficiency, and enhance long-term sustainability performance. However, the empirical results of this study suggest that the value implications of green innovation are context-dependent and sensitive to methodological specification.

Green innovation has been widely argued to generate economic benefits through cost reduction, productivity improvement, and enhanced market perception (Tian et al., 2023; Yan & Zhang, 2021; Yuniarti et al., 2022). It also contributes to broader stakeholder value and environmental performance (Colombelli et al., 2020; Xie et al., 2022). Nevertheless, the findings of this study indicate that these advantages may not directly translate into higher firm value when endogeneity is controlled.

In the Indonesian context, regulatory support and sustainability policies encourage firms to adopt green innovation practices (Agustia et al., 2019; Asni & Agustia, 2022). However, high implementation costs, short-term investor orientation, and varying firm capabilities may limit its direct impact on market valuation (Lestari & Soewarno, 2024). These factors may explain why green innovation does not show a statistically significant effect in the System GMM estimation.

Furthermore, CEO founders do not significantly moderate the relationship between green innovation and firm value. This finding suggests that founder CEO status does not strengthen or weaken the effectiveness of green innovation in enhancing firm value. This is consistent with previous studies that report mixed or insignificant moderating effects of CEO characteristics on firm outcomes (Kongkaew et al., 2021; Sutrisno et al., 2022, 2023a, 2023b).

The upper echelons theory suggests that organizational outcomes are influenced by executives' cognitive bases and experiences. However, the insignificant moderating effect found in this study indicates that the impact of green innovation is likely driven more by organizational and institutional factors than by CEO founder characteristics alone.

Overall, consistent with the resource-based view, the effectiveness of green innovation depends on the firm's ability to develop and integrate strategic resources such as technological capability, financial strength, and organizational support. External pressures such as regulatory frameworks, market competition, and stakeholder expectations further shape its effectiveness. Therefore, the findings highlight that the relationship between green innovation and firm value is not robust to endogeneity and should be interpreted with caution.

Conclusion

This study examines the effect of green innovation on firm value and the moderating role of CEO founders in Indonesian listed non-financial firms. The empirical results provide mixed evidence. While the fixed-effects and GLS models suggest a positive association between green innovation and firm value, the System GMM estimation indicates that this relationship becomes statistically insignificant after controlling for endogeneity. This implies that the observed positive relationship is not robust and may be driven by reverse causality or omitted variable bias.

Furthermore, the results show that CEO founders do not have a significant moderating effect on the relationship between green innovation and firm value. This suggests that founder CEO status does not strengthen or weaken the impact of green innovation on firm value across different model specifications.

From a theoretical perspective, the findings provide a more nuanced understanding of the resource-based view, indicating that the value relevance of green innovation is contingent rather than automatic. In addition, the results do not provide empirical support for the moderating role of CEO founders as proposed by upper echelons theory in this context.

Practically, the findings suggest that firms should carefully evaluate the financial implications of green innovation initiatives, as their direct impact on market valuation is not statistically confirmed when endogeneity is addressed. Instead of relying on leadership attributes such as CEO founder status, firms should focus on strengthening organizational capabilities and institutional support for effective implementation of green innovation.

This study has important implications for the literature on corporate sustainability and firm value, particularly by providing evidence from an emerging market and highlighting the importance of addressing endogeneity in empirical research. Future studies are encouraged to explore alternative mechanisms, longer time horizons, or different institutional settings that may better explain how green innovation translates into firm value.

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