International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

The Influence of Green Innovation on Firm Value: The Mediating Role of Financial Flexibility

Laura Cahya Putri[1], Ina Indriana, S.E, M.Si, Ph.D[2] ,Nana Nofianti S.E, M.Si [3]

[1,2,3,]Accounting Departement of Sultan Ageng Tirtayasa University, Indonesia

Correspondence E-mail: * lauracp3008@gmail.com

Abstract

The objective of this study is to analyze direct effect of green innovation on firm value and indirect effect of financial flexibibility as a mediating variable. This research was conducted on companies in the energy and basic materials sectors listed on the Indonesia Stock Exchange during the 2021–2023 period.This study employs panel data regression analysis, specifically multiple linear regression and the sobel test. The partial test shows that the green process has a significant effect on financial flexibility. Meanwhile, green products do not have a significant effect on financial flexibility. This study found that green innovation has no significant effect on firm value. These findings also indicate that financial flexibility has no significant effect as a variable that mediates between green innovation and firm value. This study also conducted additional tests to see the effect of each company sector. the existence of different characteristics shows different results as well. when sector testing is separated, it shows that simultaneously green innovation affects on firm value.

Keywords: Green innovation, green product, green process, financial flexibility, firm value

INTRODUCTION

Firm value is a primary indicator that attracts the main attention of shareholders, investors, and various stakeholders because it reflects the extent to which a company succeeds in creating wealth and maintaining the sustainability of its business in the capital market (Sholatika & Triyono, 2022). Firm value not only measures short-term financial performance but also represents the market's perception of the company's growth

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

potential and stability in the future. In other words, firm value reflects management's ability to implement effective strategies to maximize profits and maintain competitiveness amid increasingly intense global competition.

Various factors influence firm value, ranging from internal company conditions such as profitability, operational efficiency, and capital structure, to equally important external factors, including the social and physical environment surrounding the company. In recent decades, the focus on social and environmental responsibility has grown stronger as an integral part of sustainable business strategies. Companies that demonstrate commitment and positive performance in environmental aspects tend to gain greater trust from investors and the wider community, thus significantly increasing firm value (Gangi et al., 2020; Bukit & Nurlaila, 2019).

The phenomena of climate change and global environmental issues pose major challenges to companies worldwide, including in Indonesia. Global warming caused by greenhouse gas emissions from various human activities, especially the fossil fuel and mining industries, has resulted in widespread negative impacts such as an increased frequency of natural disasters, changing weather patterns, and ecosystem degradation (Singh & Singh, 2012). In Indonesia, the energy and basic materials sectors are major contributors to air pollution, water contamination, and soil degradation due to industrial waste. The pollution incident at Buyat Bay by PT Amman Mineral International (PT AMMN) is a concrete example of the negative environmental impacts of industrial activities, which not only damaged marine ecosystems but also caused public unrest and damaged the company's reputation.

These adverse environmental impacts ultimately affect the financial aspects of companies, particularly through regulatory pressures, consumer demands, and changing investor preferences that increasingly prioritize sustainability. Therefore, companies are required to innovate by implementing green innovation, which includes product, process, and system innovations aimed at reducing environmental impacts and using resources efficiently. Green innovation has been proven to not only help companies comply with environmental regulations but also increase firm value by reducing operational costs, enhancing corporate image, and opening new environmentally friendly market opportunities (Z. Xie et al., 2022a; Agustia et al., 2019; Sharma, 2016).

However, the implementation of green innovation is not without challenges, especially due to the high investment requirements and significant economic uncertainty caused by global market volatility, pandemics, and various other external risks (Naseer et al., 2024). Under such conditions, financial flexibility becomes crucial for companies.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

Financial flexibility refers to a company's ability to manage financial resources effectively so that it can respond to changing market conditions, seize investment opportunities, and withstand economic pressures (Denis, 2011). Companies with strong financial flexibility have a greater capacity to invest in green innovation while maintaining operational stability amid uncertainty.

Modern firm value management must balance traditional financial aspects with sustainable innovation, as both are closely related in creating long-term value. Previous empirical studies have shown that green innovation and financial flexibility simultaneously enhance firm value by creating synergy between environmental sustainability and the company's financial health (Novitasari & Agustia, 2023). Therefore, this study aims to analyze the influence of green innovation and financial flexibility on firm value, particularly in the energy and basic materials sectors, which play an important role in national economic development while facing significant environmental pressures.

By gaining a deeper understanding of this relationship, it is expected to provide valuable contributions to company management, investors, and policymakers in formulating strategies that prioritize not only financial gains but also sustainable social and environmental responsibilities. Thus, companies can optimally maintain their value and competitiveness in facing increasingly complex economic and environmental challenges in the modern era.

LITERATURE REVIEW AND HYPOTHESES

Resource-Based View (RBV)

The Resource-Based View (RBV) is a strategic management perspective that focuses on the significance of a firm's internal assets and distinctive competencies in establishing and maintaining a long-term competitive edge. Initially proposed by Wernerfelt (1984) and later expanded by Barney (1991), the theory introduced the VRIN criteria Valuable, Rare, Inimitable, and Non-substitutable as essential attributes of resources that contribute to competitive advantage. Additionally, RBV underscores the role of dynamic capabilities, as articulated by Teece et al. (1997), referring to an organization's capacity to adapt, integrate, and transform its internal resources in response to evolving technological and environmental conditions.

According to Münter (2024) and Holz (2024), competitive advantage is derived not only from market positioning but also from the effective utilization of internal resources such as technology, information, and knowledge that are unique and difficult to imitate. The concept of resource heterogeneity is also emphasized, which suggests that not all

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

organizations possess resources of equal value. In the context of green innovation, RBV provides insights into how companies can leverage their technological capabilities and environmental organizational capabilities to develop eco-friendly innovations that are difficult to replicate, thereby supporting both sustainability and competitive advantage (Cai & Li, 2018). One of the key resources in RBV is financial flexibility, which refers to a company's ability to manage its finances adaptively, address financial challenges, and remain competitive in changing market conditions (Naseer et al., 2024).

Green Innovation and Firm Value

The implementation of green innovation refers to the company's efforts to integrate environmentally friendly principles into business operations, such as the use of green technology, reducing carbon emissions, increasing energy efficiency, and managing waste sustainably. Based on the Resource-Based View (RBV) approach, green innovation is seen as a strategic resource that is unique, valuable, and difficult to imitate, so that it can create a sustainable competitive advantage and increase company value, which reflects investors' perceptions of the company's long-term growth and performance prospects.

Green innovation consists of two main forms, namely green product innovation and green process innovation. Green product innovation focuses on product redesign using non-toxic and biodegradable materials, while green process innovation includes production process efficiency through emission reduction, water and energy savings, and switching to renewable energy. Several studies have shown that green process innovation contributes positively to operational efficiency, profitability, and increased firm value (Agustia et al., 2019; Kraus et al., 2020), while green product innovation has not shown a significant impact on firm value because it requires high investment and has not generated comparable returns (Husnaini & Tjahjadi, 2021). Thus, it can be concluded that the implementation of green innovation, especially in the form of green process innovation, has the potential to increase firm value through increased efficiency, reputation, and attractiveness in the eyes of investors who care about sustainability.

H1: Green innovation simultaneously has a positive effect on firm value
H1.a: Green process innovation has a positive effect on firm value
H1.b: Green product innovation has a positive effect on firm value

Green Innovation and Financial Flexibility

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

Green innovation, which includes the development and implementation of environmentally friendly products, processes and practices, is now an important strategy for companies to respond to ecological challenges and increasingly stringent regulatory pressures. In addition to reducing environmental risks, these initiatives can also open up new market opportunities, enhance brand reputation and provide a competitive advantage (Din et al., 2024; Ying et al., 2020). However, implementing green innovation often requires large investments and has a long payback period, which can strain a firm's financial resources and reduce short-term financial flexibility (Liu & Chang, 2020; Xie et al., 2022). Financial flexibility, or a firm's ability to access and utilize financial resources in the face of uncertainty and opportunity, is critical in this context (Tseng et al., 2012). Some studies also show the positive side of green innovation, such as the findings of Farooq et al. (2024) which show that companies that implement green innovation tend to manage cash holdings more efficiently. The differences in these findings indicate that the relationship between green innovation and financial flexibility is not entirely clear. Based on this description, the authors formulate the following hypothesis:
H2: Green innovation simultaneously has a positive effect on financial flexibility
H2.a: Green process innovation has a positive effect on financial flexibility
H2.b: Green product innovation has a positive effect on financial flexibility

Mediating Role of Financial Flexibility

Firm value is a key indicator in the financial world that reflects the total valuation of the company in the eyes of investors and stakeholders. This value can be influenced by financial and non-financial factors, one of which is financial flexibility, which is the company's ability to adjust financial strategies to deal with changes or take advantage of unexpected opportunities (Cai & Wu, 2020; Xiangyu & Zhao, 2020; Mirkhalili & Mahmoudabadi, 2018). Companies with a high level of financial flexibility, such as having large cash and unused debt capacity, tend to be more profitable, resilient to crises, and have a higher market value. One form of strategy that can be supported by financial flexibility is investment in green innovation, which is the development of environmentally friendly products, processes, or services. Green innovation is believed to not only enhance reputation and cost efficiency, but also strengthen regulatory compliance and reflect a company's commitment to sustainability, which in turn has a positive impact on firm value (Ghisetti & Pontoni). However, these initiatives require a large allocation of funds, which may weaken financial flexibility in the short term. Therefore, the relationship

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

between green innovation, financial flexibility, and firm value is important to be further investigated, given the potential reciprocal influence between the two.

H3: Financial flexibility has a positive effect on firm value

Financial flexibility facilitates financing for green innovation, thus increasing firm value.

H4: Financial flexibility mediates the effect of green innovation on firm value.

METHODE

This study The quantitative method, which is grounded in positivism, uses preset tools to examine a certain population or sample. Companies in the Energy and Basic Materials industries that were listed on the Indonesia Stock Exchange (IDX) in 2021–2023 make up the population. Purposive sampling was used to choose samples based on three criteria: (1) companies listed on IDX in the Energy and Basic Materials sectors between 2021 and 2023; (2) companies that released consecutive annual reports during this time; and (3) companies that released sustainability reports, either separately or integrated into the annual reports. The IDX website, official company websites, and other pertinent sources were used to access the companies' annual reports and sustainability reports, which provided secondary data. In accordance with the goals of the study, these data were utilized to examine the impact of the research variables. The sample used in this study totaled 261. The EViews software is used in this study's quantitative analysis of panel data. Time series and cross-sectional data are combined in panel data analysis. The tests carried out are descriptive test, regression model test, classical assumption test, hypothesis testing.

RESULTS

Descriptive Statistic

Table 1: Descriptive Statistic

	NP_Y	GPROD_X1A_	GPROC_X1B_	FF_Z_
Mean	0.996284	0.120153	0.659004	0.652414
Maximum	2.020000	0.670000	1.000000	1.460000
Minimum	0.070000	0.000000	0.000000	-0.150000
Std. Dev.	0.362516	0.191301	0.244252	0.290841
Observations	261	261	261	261

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

The analysis results show that the average Tobin's Q value of the companies is close to 1, indicating a fair market valuation and good managerial efficiency, although there is significant variation among companies. The implementation of green product innovation remains low, while the adoption of green processes is relatively better, with considerable differences between companies. The companies' financial flexibility is also limited on average, with some firms demonstrating very strong conditions and others facing significant constraints. Overall, there are notable differences in firm value, green innovation, and financial flexibility among the sampled companies.

Panel Data Regression Model Estimation

To choose the best model for the analysis, a number of models were compared in the panel data regression model estimation process. First, the Fixed Effect Model (FEM), Random Effect Model (REM), and Common Effect Model (CEM) were taken into consideration. FEM and REM were selected using the Hausman test after CEM and FEM were selected using the Chow test. Lastly, the Random Effect Model's suitability over the Common Effect Model was verified using the Lagrange Multiplier (LM) test. The Fixed Effect Model was chosen as the best fit based on the Hausman test results, indicating that fixed effects better capture individual differences, and therefore the LM test was not conducted.

Table 2: Lagrange Multiplier Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	7.383308	2	0.0249

Based on table 2 the Hausman test, a significant p-value was obtained (p = 0.0202 < 0.05). Therefore, H0 is rejected, indicating that the Fixed Effect Model is more appropriate than the Random Effect Model.

Classical assumption testing

The classical assumption test is a set of statistical tests required when using the Ordinary Least Squares (OLS) method in regression estimation. In panel data analysis, both the Common Effect Model (CEM) and Fixed Effect Model (FEM) apply OLS, thus

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

necessitating tests for classical assumptions, including multicollinearity and heteroscedasticity (Basuki & Yuliadi, 2014: 183).

- Multicollinearity Test

Table 4: Multicollinearity Test

	X1a	X1b	Z
X1a	1	0,263785	0,107277
X1b	0,263785	1	-0,00584
Z	0,107277	-0,005843	1

With a correlation value below 0.80, there is no multicollinearity between X1a X1b and Z, allowing both to be used together in the regression model without bias.

- Heteroscedasticity Test

Table 5: Heteroscedasticity Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.138714	0.048103	2.883673	0.0044
GPROD_X1A_	0.090195	0.153760	0.586596	0.5582
GPROC_X1B_	0.003350	0.049130	0.068181	0.9457
FF_Z	-0.025138	0.067488	-0.372482	0.7100

All probability values are above 0.05, indicating no heteroscedasticity and that the homoscedasticity assumption is met.

Hypothesis Testing

Testing the Relationship Between the Independent Variable Green Innovation (Green Product and Green Process) and the Mediating Variable Financial Flexibility.

T Testing Substruktural 1

Table 6: T Testing Substruktural 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.543216	0.035187	15.43783	0.0000
GPROD_X1A_	0.136415	0.173410	0.786664	0.4326
GPROC_X1B	0.137342	0.054512	2.519470	0.0127

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

$$FF= \alpha\ 0.543215629232+ \beta_1\ 0.136415209526GPROD + \beta_2\ 0.137341510463GPROC +\varepsilon$$

Table 6 shows that green product has no significant effect on financial flexibility, while green process shows a significant value. Therefore the hypothesis H1a is rejected while H1b is accepted.

F Testing Substruktural 1

Table 7: F Testing Substruktural 1

R-Squared	0.313345
Adjusted R-squared	0.305732
S.E of regression	0.117721
Sum Squared id	2.383615
Log Likelihood	242.4723
F-statistic	5.150317
Prob (F-statistic)	0.000000

Table 7 shows that the significance value of 0.000000 is less than 0.05, and the computed f-value of 5.150317 is higher than the F-table value of 3.030788. This suggests that the company's financial flexibility is significantly impacted by the variables green product (gprod) and green process (gproc) at the same time. H2 is therefore approved.

R Testing Substruktural 1

Based on table 7 0.305732, or 30%, the adjusted R-squared value is found. According to this coefficient of determination, 30% of the variation in financial flexibility (ff) can be explained by the independent variables, which include green product (gprod) and green process (gproc). In the meantime, other factors not covered by this research model account for the remaining 70% (100% – adjusted R-squared).

Hypothesis Testing Substruktural 2

Testing the Relationship Between the Independent Variables Green Innovation (Green Product and Green Process) and Financial Flexibility on Firm Value.

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

T Testing Substruktural 2

Table 8: T Testing Substruktural 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.225215	0.112112	10.92852	0.0000
GPROD_X1A_	0.125573	0.358359	0.350412	0.7265
GPROC_X1B_	-0.234503	0.114506	-2.047963	0.0421
FF_Z_	-0.140409	0.157290	-0.892678	0.3733

NP = α 1.22521513802+ β_1 0.125573046433GPROD - β_2 0.234503061919GPROC - β_3 0.14040897637FF + ε

a. The Effect of Green Product on Firm Value

Table 8 indicates that GPROD_X1A has a coefficient of 0.125573 and p-value of 0.7265 (> 0.05), indicating no significant effect on firm value. Thus, H1a is rejected.

b. The Effect of Green Process on Firm Value

On table 8 shows that GPROC_X1B has a coefficient of -0.234503 with a p-value of 0.0421 (< 0.05), indicating a significant negative effect on firm value. Thus, H1b is rejected.

c. The Effect of Financial Flexibility on Firm Value

In table 8, it shows that financial flexibility has a coefficient of -0.140409 and a p-value of 0.3733 (> 0.05), indicating no significant effect on firm value. Thus, H3 is rejected.

F Testing Substruktural 2

Table 9: F Testing Substruktural 2

R-Squared	0.043504
Adjusted R-squared	0.041809
S.E of regression	0.242695
Sum Squared id	10.130980
Log Likelihood	53.6414
F-statistic	1.187245
Prob (F-statistic)	0.13465

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

On table 9 indicates the F-statistic is 1.187245, lower than the F-table value of 2.63959, with a significance level of 0.134646 (> 0.05). This indicates that green product and green process variables do not jointly affect firm value. Thus, H1 is rejected.

R-Testing Substrusktural 2

Based on Table 9 the R^2 value is 0.041809 (4%), indicating that the independent variables explain only 4% of the variation in firm value, while the remaining 96% is influenced by factors outside the model.

Path Analysis

a. Financial Flexibility Mediates the Relationship Between Green Product (GProd) and Firm Value

In figure 1 below shows the results a p-value > 0.05, therefore the mediation hypothesis is rejected. Green innovation (represented here by green product) does not indirectly affect financial flexibility through the mediator used in this test.

Input:			Test statistic:	Std. Error:	*p*-value:
a	0.136415	Sobel test:	-0.68044739	0.04188755	0.49622122
b	-0.208938	Aroian test:	-0.57366997	0.0496841	0.56619115
s_a	0.173410	Goodman test:	-0.88355285	0.03225871	0.37693764
s_b	0.154084	Reset all	Calculate		

Figure 1: Sobel Analysis X1a to Z

b. Financial Flexibility Mediates the Relationship Between GProc and Firm Value

The results of the test in figure 2 show a p-value > 0.05, therefore the mediation hypothesis is rejected. Green innovation (represented here by green process) does not indirectly affect financial flexibility through the mediator used in this test.

Input:			Test statistic:	Std. Error:	*p*-value:
a	0.137342	Sobel test:	-1.19404664	0.02403253	0.23245972
b	-0.208938	Aroian test:	-1.12718568	0.02545806	0.25966398
s_a	0.054512	Goodman test:	-1.27441716	0.02251693	0.20251561
s_b	0.154084	Reset all	Calculate		

Figure 2: Sobel Analysis X1a to Z

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

The conclusion from both Sobel tests is that neither green product nor green process acts as a significant mediator in influencing financial flexibility. This is indicated by the p-values from both Sobel tests, which are greater than 0.05, meaning the mediating effects tested are not statistically significant at the 5% significance level. Therefore, hypothesis H3 is rejected.

ADDITIONAL TEST

To better understand the impact of green innovation on firm value through financial flexibility, an additional sector-based test was conducted. This helps reveal whether the relationships vary across sectors due to differing characteristics and strategies. The results highlight which sectors show significant effects, offering more specific insights for decision-making and policy.

Hypothesis Testing Substruktural 1

T Testing

Table 10: t Testing Sector Energy & Basic Material Sub1

Variable	ENERGY				BASIC MATERIAL			
	Coeff	Std.E	t	Prob	Coeff	Std.E	t	Prob
C	0,595021	0,034341	17,326720	0,0000	0,518255	0,067403	7,688947	0,000000
GPROD_X1A_	0,211232	0,143455	1,472455	0,1447	-0,173642	0,227363	-0,763722	0,447100
GPROC_X1B_	0,072903	0,059490	1,211846	0,2291	0,219290	0,092726	2,364998	0,020200

Based on the table 10 in the energy sector both green product innovation (GPROD_X1A_) and green process innovation (GPROC_X1B_) do not show a significant effect on financial flexibility, with p-values of 0.1447 and 0.2291 respectively (both greater than 0.05), thus H2a and H2b are rejected. Meanwhile, in the basic materials sector, green product innovation also does not have a significant effect (p-value 0.4471), so H2a is again rejected. However, green process innovation has a significant positive effect on financial flexibility (p-value 0.0202 and coefficient 2.364998), thus H2b is accepted.

F Testing

Table 11: F Testing Sector Energy & Basic Material Sub1

ENERGY				BASIC MATERIAL			
R-Squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	R-Squared	Adjusted R-squared	F-statistic	Prob (F-statistic)
0,318270	0,215900	6,98532	0,0000	0.464084	0.355070	1.043.475	0,0000

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

Based on the table 11 F-test results, in both the energy sector (F-statistic = 6.98532) and the basic materials sector (F-statistic = 1043475), the F-statistic is greater than the F-table value (2.63959), and the significance value is 0.00000 (< 0.05). This indicates that, simultaneously, the variables green product innovation (GPROD) and green process innovation (GPROC) have a significant effect on financial flexibility. Therefore, H2 is accepted in both sectors.

Adjusted-R

In table 11 suggests the coefficient of determination (R^2), the value is 0.318 or 32% in the energy sector, and 0.164 or 16% in the basic materials sector. This indicates that the independent variables in the model are only able to explain 32% of the variation in financial flexibility in the energy sector and 16% in the basic materials sector, while the remaining variation is influenced by other factors outside the scope of this study.

Hypothesis Testing Substruktural 2

T Testing

Table 12: t Testing Sector Energy & Basic Material Sub2

Variable	ENERGY				BASIC MATERIAL			
	Coeff	Std.E	t	Prob	Coeff	Std.E	t	Prob
C	1,073674	0,088729	12,100570	0,0000	1,315281	0,120733	10,894120	0,000000
GPROD_X1A_	0,028955	0,370653	0,078118	0,9379	-0,671250	0,407258	-1,648217	0,102900
GPROC_X1B_	-0,186229	0,153707	-1,211584	0,2292	-0,271324	0,166087	-1,633620	0,105900
FF_Z_	-0,190567	0,274546	-0,694117	0,4895	-0,216732	0,189483	-1,143806	0,255800

Based on the table 12 show regression results in both the energy and basic materials sectors, the variables green product innovation (GPROD_X1A_) and green process innovation (GPROC_X1B_) do not have a significant effect on firm value. This is evidenced by their p-values, which are greater than 0.05 in both sectors, leading to the rejection of H1a and H1b. Additionally, the variable financial flexibility (FF_Z) also does not show a significant effect on firm value in either sector, with p-values of 0.3733 (energy) and 0.2558 (basic), resulting in the rejection of H3.

F Testing

Table 13: f Testing Sector Energy & Basic Material Sub2

ENERGY				BASIC MATERIAL			
R-Squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	R-Squared	Adjusted R-squared	F-statistic	Prob (F-statistic)
0,271817	0,190209	4,280835	0,0000	0,137926	0,107478	4,869013	0,0000

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Economics, Business and Innovation Research
https://e-journal.citakonsultindo.or.id/index.php/IJEBIR
E-ISSN : 2964-0865
IJEBIR

In table 13 indicates the simultaneous test results, in both the energy and basic materials sectors, the variables green product innovation (GPROD) and green process innovation (GPROC) jointly have a significant effect on firm value. This is indicated by the F-statistic values being greater than the F-table values (54.280835 and 4.869013 > 3.030788) and the significance value of 0.00000 < 0.05 in both sectors. Therefore, H1 is accepted.

Adjusted-R

Based on the table 13, the coefficient of determination (R^2) for the regression model is 0.271817 (27%) in the energy sector and 0.137926 (14%) in the basic materials sector. These values indicate that the independent variables collectively explain only 27% and 14% of the variation in the dependent variable, respectively, while the remaining 73% and 86% are influenced by other factors outside the model.

Sobel Test

Table 14: Sobel Test Sector Energy & Basic Material

	ENERGY			BASIC MATERIAL		
	Sobel test	Aroian test	Goodman test	Sobel test	Aroian test	Goodman test
GPROD_X1A_	0,530099	0,592667	0,426213	0,525329	0,607452	0,354888
GPROC_X1B_	0,546965	0,624336	0,388333	0,303149	0,335878	0,26548

Table 14 shows the results of the Sobel, Aroian, and Goodman tests, all obtained p-values for the mediation effect of financial flexibility in the relationship between green product and green process innovations and firm value are above 0.05. This indicates that financial flexibility does not serve as a significant mediator in the influence of these green innovation variables on firm value, both in the energy and basic materials sectors. Therefore, the effects of green product and green process innovations on firm value are not statistically mediated by financial flexibility. Therefore, H4 is accepted

DISCUSSION

The results of this study indicate that green innovation, especially in the process aspect (green process), has a significant influence on the company's financial flexibility. This is in line with previous findings which state that increasing operational efficiency through the adoption of environmentally friendly technologies and processes can reduce long-term costs and increase the company's capacity to meet its financial obligations (Zhang et al., 2020; Lin et al., 2021). On the other hand, green product innovation does

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

not have a significant effect on financial flexibility. This finding can be attributed to the high initial cost, slow market adoption, or lack of direct added value that can be felt by the company in the short term.

Simultaneously, green product and green process are statistically proven to affect the financial flexibility of the company. However, the relatively low value of the coefficient of determination (Adjusted R^2) indicates that other factors beyond green innovation also play an important role in determining the financial flexibility of the company, such as capital structure, operational cash flow, and risk management strategies. Furthermore, the test results on the direct effect of green innovation and financial flexibility on firm value do not show a statistically significant relationship. In fact, in some cases, the green process has a negative coefficient on firm value.

This reflects that investments in green processes may not have been able to provide a strong enough positive signal to investors or have not translated directly into an increase in firm value. This could also be due to the short-term orientation of investors or the lack of transparency in reporting the impact of green innovation on firm performance.

This finding is also reinforced by the results of the mediation test using the Sobel test approach, which shows that financial flexibility does not mediate the relationship between green innovation and firm value. Thus, financial flexibility does not act as a transmission path between green innovation policy and firm value creation. This indicates that the relationship between green innovation and firm value is more complex and may be influenced by other factors such as environmental reputation, stakeholder pressure, and the quality of sustainability disclosures.

Additional tests by sector show different dynamics. In the basic materials sector, green process has a positive and significant effect on financial flexibility, while in the energy sector, there is no significant effect. This finding indicates that the contribution of process innovation to financial flexibility is more relevant in industries that have high energy and resource intensity, such as basic materials. Meanwhile, the effect of green innovation and financial flexibility on firm value is not significant in both sectors, which underlines that firm value is more influenced by external factors such as energy market volatility, environmental regulations, and investor perceptions.

CONCLUSION

Based on the results of the analysis, this study concludes that green process innovation has a positive and significant impact on financial flexibility, indicating that firms implementing environmentally friendly production processes are better positioned to

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

adapt financially to dynamic business conditions. Although green product innovation does not show a significant effect on financial flexibility when tested individually, both green product and green process innovations, when examined simultaneously, significantly improve financial flexibility. This demonstrates that the integration of both types of green innovation is more effective in strengthening a company's financial stance than implementing either one in isolation.

Furthermore, while neither green product nor green process innovation shows a significant individual impact on firm value, their simultaneous implementation has a significant and positive influence on firm value in both the energy and basic materials sectors. This suggests that the combined effect of green innovation initiatives is strategically important in enhancing firm performance and market perception.

On the other hand, financial flexibility does not have a significant direct effect on firm value in this study. Consequently, the hypothesis that financial flexibility directly improves firm value is not supported. Additionally, the mediation tests using the Sobel, Aroian, and Goodman methods confirm that financial flexibility does not serve as a significant mediator in the relationship between green innovation and firm value. This indicates that the influence of green innovation on firm value occurs directly, rather than being channeled through financial flexibility.

Additional test results based on the energy and basic materials sectors show that the effect of green innovation on financial flexibility and firm value is not uniform across sectors. In particular, green process innovation is shown to have a significant effect on financial flexibility in the basic materials sector, but not in the energy sector. In contrast, green product and financial flexibility variables did not show a significant effect on firm value in both sectors. In addition, the Sobel mediation test also confirmed that financial flexibility does not mediate the relationship between green innovation and firm value, both in the energy and basic materials sectors.

These findings emphasize the importance of conducting additional sector-based tests. Without this sectoral testing, the research will only result in the general conclusion that green innovation does not significantly affect financial flexibility and firm value. In fact, the sectoral results show that there are important variations between sectors that can serve as a basis for more targeted policy strategies and decision-making. Therefore, a sector-based approach provides a more in-depth and contextualized understanding of the dynamics of the relationship between green innovation, financial flexibility, and firm value.

In conclusion, the study highlights that the synergy between green product and green process innovations plays a vital role in enhancing both financial flexibility and firm

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

value, even though financial flexibility does not act as a mediating variable in this relationship.

REFERENCES

Abdul Ghani, R., Abu Samah, A. R., Baharuddin, N. S., & Ahmad, Z. (2023). Determinants of Firm Value as Measured by the Tobin's Q: A Case of Malaysian Plantation Sector. International Journal of Academic Research in Accounting, Finance and Management Sciences, 13(2). https://doi.org/10.6007/IJARAFMS/v13-i2/17268

Agustia, D., Sawarjuwono, T., & Dianawati, W. (2019). The mediating effect of environmental management accounting on green innovation - Firm value relationship. International Journal of Energy Economics and Policy, 9(2), 299–306. https://doi.org/10.32479/ijeep.7438

Bukit, R. B., & Nurlaila. (2019). Environmental performance, voluntary disclosure, and corporate value. IOP Conference Series: Earth and Environmental Science, 260(1), 012081. https://doi.org/10.1088/1755-1315/260/1/012081

Cai, W., & Li, G. (2018). The drivers of eco-innovation and its impact on performance: Evidence from China. Journal of Cleaner Production, 176, 110–118. https://doi.org/10.1016/j.jclepro.2017.12.109

Dai, D., & Xue, Y. (2022). The Impact of Green Innovation on a Firm's Value from the Perspective of Enterprise Life Cycles. Sustainability (Switzerland), 14(3). https://doi.org/10.3390/su14031226

Denis, D. J. (2011). Financial flexibility and corporate liquidity. Journal of Corporate Finance, 17(3), 667–674. https://doi.org/10.1016/j.jcorpfin.2011.03.006

El-Kassar, A.-N., & Singh, S. K. (2019). Green innovation and organizational performance: The influence of big data and the moderating role of management commitment and HR practices. Technological Forecasting and Social Change, 144, 483–498. https://doi.org/10.1016/j.techfore.2017.12.016

Gangi, F., Daniele, L. M., & Varrone, N. (2020). How do corporate environmental policy and corporate reputation affect risk-adjusted financial performance? Business Strategy and the Environment, 29(5), 1975–1991. https://doi.org/10.1002/bse.2482

Grassmann, M. (2021). The relationship between corporate social responsibility expenditures and firm value: The moderating role of integrated reporting. Journal of Cleaner Production, 285, 124840. https://doi.org/10.1016/j.jclepro.2020.124840

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

Holz, H. F. (2024). The Resource-Based View of the Firm. In Reference Module in Social Sciences. Elsevier. https://doi.org/10.1016/B978-0-443-13701-3.00383-2

Kam-Sing Wong, S. (2012). The influence of green product competitiveness on the success of green product innovation. European Journal of Innovation Management, 15(4), 468–490. https://doi.org/10.1108/14601061211272385

Khan, P. A., & Johl, S. K. (2019). Nexus of Comprehensive Green Innovation, Environmental Management System-14001-2015 and Firm Performance. Cogent Business & Management, 6(1). https://doi.org/10.1080/23311975.2019.1691833

Khan, P. A., Johl, S. K., & Johl, S. K. (2021). Does adoption of ISO 56002-2019 and green innovation reporting enhance the firm sustainable development goal performance? An emerging paradigm. Business Strategy and the Environment, 30(7), 2922–2936. https://doi.org/10.1002/bse.2779

Kraus, S., Rehman, S. U., & García, F. J. S. (2020). Corporate social responsibility and environmental performance: The mediating role of environmental strategy and green innovation. Technological Forecasting and Social Change, 160. https://doi.org/10.1016/j.techfore.2020.120262

Lin, R.-J., Tan, K.-H., & Geng, Y. (2013). Market demand, green product innovation, and firm performance: evidence from Vietnam motorcycle industry. Journal of Cleaner Production, 40, 101–107. https://doi.org/10.1016/j.jclepro.2012.01.001

Liu, D., Yu, X., Huang, M., Yang, S., Isa, S. M., & Hu, M. (2022). The Effects of Green Intellectual Capital on Green Innovation: A Green Supply Chain Integration Perspective. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.830716

Münter, M. T. (2024). Resource-Based View. In Reference Module in Social Sciences. Elsevier. https://doi.org/10.1016/B978-0-443-13701-3.00203-6

Naseer, M. M., Khan, M. A., Bagh, T., Guo, Y., & Zhu, X. (2024). Firm climate change risk and financial flexibility: Drivers of ESG performance and firm value. Borsa Istanbul Review, 24(1), 106–117. https://doi.org/10.1016/j.bir.2023.11.003

Novitasari, M., & Agustia, D. (2023). COMPETITIVE ADVANTAGE AS A MEDIATING EFFECT IN THE IMPACT OF GREEN INNOVATION AND FIRM PERFORMANCE. Business: Theory and Practice, 24(1), 216–226. https://doi.org/10.3846/btp.2023.15865

Sharma, N. (2016). Innovation in Green Practices: A Tool for Environment Sustainability and Competitive Advantage. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2861530

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

Sholatika, N. I., & Triyono. (2022). The Effect of Profitability, Liquidity and Leverage on Company Value with Dividend Policy as Moderating Variables on Consumer Companies Listed on the Indonesia Stock Exchange 2018-2020. https://doi.org/10.2991/aebmr.k.220602.046

Silaban, D., & Dewi, R. R. (2023). The Effects of Green Innovation, Eco-Efficiency, Business Strategy, Technology Information Investment, and Profitability on Firm Value. Ilomata International Journal of Tax and Accounting, 4(3), 470–490. https://doi.org/10.52728/ijtc.v4i3.791

Sugiyono. (2013). Metode Penelitian Kuantitatif, Kualitatif, dan R&D. ALFABETA.

Tseng, M.-L., Wang, R., Chiu, A. S. F., Geng, Y., & Lin, Y. H. (2013). Improving performance of green innovation practices under uncertainty. Journal of Cleaner Production, 40, 71–82. https://doi.org/10.1016/j.jclepro.2011.10.009

Wang, Y. Z., & Ahmad, S. (2024). Green process innovation, green product innovation, leverage, and corporate financial performance; evidence from system GMM. Heliyon, 10(4). https://doi.org/10.1016/j.heliyon.2024.e25819

Xie, X., Huo, J., & Zou, H. (2019). Green process innovation, green product innovation, and corporate financial performance: A content analysis method. Journal of Business Research, 101, 697–706. https://doi.org/10.1016/j.jbusres.2019.01.010

Xie, X., & Zhao, J. (2020). Analysis of the Influence of Financial Flexibility on Enterprises. Open Journal of Business and Management, 08(04), 1917–1922. https://doi.org/10.4236/ojbm.2020.84117

Copyright at authors some right reserved this work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.