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Green Innovation Moderates the Relationship between Green Finance and Green Competitive Advantage on Sustainability Performance

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ABSTRACT

Global demands for sustainable business practices are driving the Indonesian banking sector to play an active role in the green economy transition. This study examines the influence of green finance and green competitive advantage on sustainability performance, exploring the role of green innovation as a moderating variable. This study uses panel data from 15 commercial banks listed on the Indonesia Stock Exchange (IDX) over a five-year period (2020–2024), resulting in 75 observations. Panel data regression analysis using the Moderated Regression Analysis (MRA) approach was applied to test the research hypotheses. Empirical results indicate that green competitive advantage and green innovation individually have a positive and significant effect on improving sustainability performance. However, green finance was not found to have a significant direct effect. Furthermore, green innovation was shown to be unable to strengthen the relationship between green finance and sustainability performance, nor the relationship between green competitive advantage and sustainability performance. These findings imply that the implementation of green finance in Indonesian banking has not been effectively translated into measurable sustainability performance, and existing green innovation capabilities have not functioned as a reinforcing mechanism for the implemented green strategy. This research provides strategic recommendations for banking management and regulators to integrate green financing policies, differentiation strategies, and innovation programs into a more coherent and measurable sustainability framework.

Keywords: *Sustainability Performance, Green Finance, Green Competitive Advantage, Green Innovation, Banking*

1. INTRODUCTION

Rising global awareness of climate change, environmental degradation, and social inequality has placed significant pressure on companies to operate sustainably. Sustainability performance has emerged as a key indicator for assessing how well a business integrates economic, social, and environmental

aspects into its operations. It reflects a company's commitment to creating long-term value while upholding its responsibilities to the environment and society (Gómez-Bezares et al., 2016). Today, sustainability reporting is not only a symbol of ethical commitment but also a strategic tool for building reputation and competitiveness, largely driven by the adoption of the triple bottom line principle: people, planet, and profit (GRI, 2021). Furthermore, investors are increasingly incorporating Environmental, Social, and Governance (ESG) factors into their decision-making, underscoring that sustainability performance is a strategic necessity for accessing capital and ensuring long-term business viability (World Economic Forum, 2023).

In response to this global trend, green finance has become a crucial instrument for supporting sustainability goals. In Indonesia, sustainability performance has become increasingly essential in the context of companies implementing Environmental, Social, and Governance (ESG) (Hakim & Agustina, 2025). The adoption of environmentally oriented accounting and management practices is seen as a strategic approach capable of increasing operational efficiency while reducing the negative impact of business activities on the environment, thereby contributing to improved corporate sustainability performance (Holiawati et al., 2025). By providing funding for environmentally friendly projects, energy efficiency, and green technology development, green finance incentivizes companies to shift to more sustainable operations. Studies confirm that access to green finance positively contributes to a company's ESG performance (Zhao, 2024). Simultaneously, developing a green competitive advantage through environmentally friendly product innovation, energy-efficient processes, and a strong green brand image has become a key factor in achieving sustainable performance. Companies with such advantages tend to secure stronger market positions and increase consumer loyalty, which strengthens their long-term resilience and sustainability performance (Zhu et al., 2023; Yusoff et al., 2023).

Although previous studies have explored the relationship between green finance and sustainability performance, as well as the role of green competitive advantage, most research remains fragmented. There is a significant gap in understanding the moderating role of green innovation in this relationship. Furthermore, most of the existing literature focuses on developed countries or the manufacturing and energy sectors, leaving contextual gaps for developing countries and the financial sector.

This study addresses this gap by focusing on the Indonesian banking sector. Indonesia provides a relevant and dynamic research context due to its strategic role in advancing the national green economy agenda. Regulatory initiatives, such as the Indonesian Financial Services Authority's (OJK) Green Taxonomy and Sustainable Finance Roadmap (Phase II: 2021-2025), have positioned the banking sector as a pioneer in implementing sustainable finance principles (OJK, 2021). As key financial intermediaries, banks significantly influence capital allocation to environmentally and socially responsible projects, making their sustainability performance crucial. This study captures the sector's dynamics during the current period (2020-2024), following the pandemic and amidst the intensified push for a green economy transition.

Therefore, this study aims to examine the influence of green finance and green competitive advantage on the sustainability performance of banking firms and analyze the role of green innovation in strengthening this relationship. The results of this study are expected to provide empirical and theoretical contributions to the development of sustainability literature, while also serving as a practical reference for the banking industry and regulators in strengthening the transformation towards a sustainable financial system.

2. THEORETICAL FRAMEWORK AND HYPOTHESIS

The Impact of Green Finance on Sustainability Performance

Based on stakeholder theory, green finance is seen as a form of corporate commitment to meeting stakeholder demands and expectations regarding sustainable business practices. Through the implementation of green finance, companies demonstrate social and environmental responsibility by directing funding to environmentally friendly projects that contribute to carbon emission reduction, resource efficiency, and compliance with environmental regulations (Suhardjo & Suparman, 2024). This concept can help balance economic development and environmental sustainability (Nurlia et al., 2026). In this context, green finance is not only an economic instrument but also a means to build trust, legitimacy, and a positive reputation among stakeholders such as investors, the public, and the government, ultimately strengthening a company's sustainability performance.

Empirically, various studies have shown that green finance plays a crucial role in driving sustainability performance. Li et al. (2021) found that green finance significantly improves corporate environmental and social performance and supports long-term economic stability. Furthermore, Li and Lin (2024) demonstrated that companies that integrate green finance into their business strategies are better able to manage environmental and social risks, thereby achieving better sustainability performance. Based on the theoretical basis and empirical evidence, the following hypothesis is formulated: H1: Green finance has a positive effect on sustainability performance.

The Impact of Green Competitive Advantage on Sustainability Performance

Green competitive advantage is a company's ability to create value and differentiation through the implementation of environmentally friendly business strategies. Based on stakeholder theory and the Natural Resource-Based View (Hart, 1995), companies that strategically manage natural resources and environmental issues will gain legitimacy and support from stakeholders, which in turn strengthens their sustainability performance.

Companies with a green competitive advantage tend to be more efficient in resource use, have a better reputation, and are able to proactively respond to market demands and environmental regulations. This condition encourages optimal sustainability performance, from both economic, social, and environmental perspectives. Empirical findings by Marpaung & Setiana (2024) and Hayat & Qingyu (2024) indicate that environmentally based competitive advantage

positively contributes to achieving sustainable performance. Therefore, the following hypothesis is formulated: H2: Green competitive advantage has a positive effect on sustainability performance.

The Moderating Role of Green Innovation on the Impact of Green Finance on Sustainability Performance

Green innovation is viewed as a strategic mechanism that enables companies to optimize the benefits of green finance. Based on stakeholder theory, green innovation is a company's response to increasing stakeholder pressure and expectations regarding environmental sustainability. Green finance supported by a high level of green innovation will be more effective in driving sustainability performance, as the green funds obtained can be productively implemented through the development of environmentally friendly products, processes, and policies.

Research by Zhang et al. (202a) and Mushi (2025) shows that green innovation can strengthen the effectiveness of a company's sustainability strategy. Thus, green innovation acts as a moderating variable, strengthening the relationship between green finance and sustainability performance. Based on this description, the following hypothesis is formulated: H3: Green innovation strengthens the influence of green finance on sustainability performance.

The Moderating Role of Green Innovation on the Influence of Green Competitive Advantage on Sustainability Performance

Green competitive advantage will have a stronger impact on sustainability performance when supported by ongoing green innovation. Green innovation enables companies to maintain and enhance their competitive advantage through environmentally friendly product, process, and management system updates. From a stakeholder theory perspective, green innovation helps companies meet stakeholder expectations more effectively and sustainably.

Several previous studies (Putri & Murwaningsari, 2023; Ali et al., 2024) have shown that green innovation can strengthen the relationship between green strategy and competitive advantage. Therefore, it can be assumed that green innovation acts as a moderating variable, strengthening the influence of green competitive advantage on sustainability performance. Therefore, the following hypothesis is formulated: H4: Green innovation strengthens the influence of green competitive advantage on sustainability performance.

3. RESEARCH METHODS

This study uses a quantitative research design with an associative approach aimed at testing causal relationships between variables. This study focuses on examining the influence of green finance and green competitive advantage on sustainability performance, as well as investigating the moderating role of green innovation. Hypothesis testing is conducted to empirically validate the proposed relationships, distinguishing this research from exploratory or descriptive research that merely describes phenomena without causal inference (Ghozali, 2022).

Data Collection Techniques

This study uses balanced panel data consisting of banking companies listed on the Indonesia Stock Exchange (IDX) during the 2020-2024 period. The panel data structure was adopted to increase the robustness of the estimates by combining cross-sectoral and time-series observations, thereby increasing degrees of freedom and reducing potential estimation bias (Ghozali, 2022). The unit of analysis is organizations, specifically banking companies listed on the stock exchange, and the research setting reflects real-world conditions because all data is obtained from officially published company reports.

Secondary data was used in this study and collected through documentation techniques. Data sources include annual reports and sustainability reports obtained from the official IDX website and the respective company websites. This data provides comprehensive information on financial performance, environmental initiatives, governance practices, and innovation activities relevant to the operationalization of the research variables.

Operational Definition of Variables

This study operationalizes three main variables: dependent variables, independent variables, and moderating variables. The dependent variable is Sustainability Performance (Y), defined as the degree to which an organization successfully manages economic, social, and environmental aspects in a balanced manner to achieve sustainable development goals. This variable is measured using an Environmental, Social, and Governance (ESG) performance score, which encompasses three dimensions: environmental performance (such as energy and emissions management), social performance (such as labor and community relations), and governance performance (such as transparency and ethics).

The independent variables are Green Finance (X_1) and Green Competitive Advantage (X_2). Green Finance is defined as the integration of environmental factors into financial decision-making and is measured by the ratio of green loan balances to the bank's total loan portfolio. Meanwhile, Green Competitive Advantage is defined as a company's competitive advantage gained through sustainable business practices and is proxied by firm value, as measured by Tobin's Q.

The moderating variable in this study is Green Innovation (Z), defined as the process of updating a company's products, processes, or policies to reduce environmental impact and increase efficiency. This variable is measured using the Green Innovation Index (GII), which is compiled based on content analysis across three dimensions: green product innovation (such as ESG-based financial products), green process innovation (such as digital banking and energy efficiency), and green policy/organizational innovation (such as the integration of environmental aspects into credit assessments).

Variable measurement is the process of determining the accuracy of a variable in its representation as a number or value. In the context of research, a variable is understood as a concept that is identified and then operationalized so that it can be measured objectively. This measurement process plays a crucial role

because it produces data that can be analyzed and compared to support research testing (Sugiyono, 2013). The variable measurements in this study are as follows:

Table 1. Operational Research Variables

Variable Name	Indicator	Source	Scale
Sustainability Performance (Y)	$E \frac{\sum Ei}{\sum E} + S \frac{\sum Si}{\sum S} + G \frac{\sum Gi}{\sum G}$ Then $\frac{E + S + G}{3}$ Note: E = environment score based on GRI S = social score based on GRI G = governance score based on GRI	Nugraha & Ilyas (2025)	Index
Green Finance (X1)	Description: Green loan = a loan specifically provided to finance projects or activities that have a positive impact on the environment. Total Loan = the total amount of loans held or disbursed by an entity within a specific period.	(Sagita & Pebriyani, 2025)	Ratio
Green Competitive Advantage (X2)	<i>Tobin's Q =</i> $\frac{(\text{Price per share} \times \text{number of shares}) + \text{Total Debt}}{\text{Total Assets}}$ Note: Price per share: The market price of the company's stock at the end of the study period. Number of shares outstanding: The total number of shares outstanding and held by investors during a given period. Total debt: The total number of company liabilities, both short-term and long-term. Total assets: All economic resources owned by the company at the end of the period.	(Zhang et al., 2020a) ; (Faria et al., 2022)	Ratio
Green Innovation	$GI = \frac{\sum \text{Green Innovation Disclosure Items}}{\text{Total Number of Items}}$ Number of green innovation disclosure items: the number of green innovation indicators disclosed by the company in its annual report, sustainability report, or integrated report, including green product innovation, green process innovation, and environmental organizational/policy innovation. Total number of green innovation items: the total number of green innovation indicators used as the basis for the	(Wijayanti & Budi, 2024)	Index

Variable Name	Indicator	Source	Scale
assessment, according to the index or guidelines established by the researcher.			

Sample Collection Techniques

The population of this study consisted of all banking companies listed on the IDX during the observation period, totaling 43 companies. The sample was selected using purposive sampling, a non-probability sampling technique, based on predetermined criteria related to data completeness and relevance to green finance and sustainability disclosure. Companies that did not consistently publish annual reports, sustainability reports, complete GRI disclosures, or green lending information during the study period were excluded. Based on these criteria, 15 banking companies were selected, resulting in a total of 75 company-year observations.

Data Analysis Techniques

Data analysis was conducted using panel data regression techniques with the aid of EViews software. Model estimation began with the General Effects Model, the Fixed Effects Model, and the Random Effects Model. The most appropriate model was selected through a series of diagnostic tests, including the Chow test, the Hausman test, and the Lagrange Multiplier test (Ghozali, 2022). To ensure the reliability of the regression results, classical assumption tests were conducted, including normality, multicollinearity, heteroscedasticity, and autocorrelation. The Breusch-Godfrey test was applied to detect serial correlation, while the Glejser test was used to identify heteroscedasticity.

To test the moderating effect of green innovation, Moderated Regression Analysis (MRA) was used by including interaction terms between green innovation and the independent variables. Hypothesis testing was conducted using the F-test for simultaneous effects and the t-test for partial effects, with a significance level of 5 percent. The explanatory power of the model was assessed using the adjusted coefficient of determination (Adjusted R²), which indicates the extent to which variation in sustainability performance can be explained by the independent and moderating variables included in the model.

4. DATA ANALYSIS AND DISCUSSION

Data analysis

The data analysis in this study was conducted using panel data regression. The study population included all banking companies listed on the Indonesia Stock Exchange (IDX), with 15 companies selected using purposive sampling techniques for the 2020-2024 period, resulting in 75 balanced panel data observations.

Classical assumption testing indicated that the regression model met validity criteria. The Jarque-Bera normality test showed a probability value of 0.787833 (>0.05), indicating normally distributed residuals. The multicollinearity test

showed that all correlations between independent variables were below 0.90, thus eliminating multicollinearity. The Breusch-Pagan-Godfrey heteroscedasticity test yielded a probability of 0.3281 (>0.05), indicating the absence of heteroscedasticity. The autocorrelation test using the Durbin-Watson statistic of 1.076855, ranging from -2 to +2, confirmed the absence of autocorrelation.

The selection of the appropriate panel model was carried out through a series of tests. The Chow test results (probability $0.0082 < 0.05$) recommend the Fixed Effects Model (FEM). The Hausman test (probability $0.2571 > 0.05$) recommends the Random Effects Model (REM). Meanwhile, the Lagrange Multiplier test (Breusch-Pagan cross-section $0.1866 > 0.05$) recommends the Common Effects Model (CEM). Based on these three results, the model used is the Common Effects Model (CEM).

The CEM model estimation results indicate that simultaneously (F-test), the independent variables have a significant effect on sustainability performance, with an F-statistic of 4.531236 and a probability of $0.005789 < 0.05$. The Adjusted R-Square value of 0.125230 indicates that the independent variables in the model explain 12.5% of the variation in sustainability performance, while 87.5% is explained by factors outside the model.

Table 2. Results of the F Statistical Test

Root MSE	0.178777	R-squared	0.160694
Mean dependent var	0.480205	Adjusted R-squared	0.125230
S.D. dependent var	0.196456	S.E. of regression	0.183744
Akaike info criterion	-	Sum squared resid	2.397083
Schwarz criterion	-	Log likelihood	22.70094
Hannan-Quinn criter	-	F-statistic	4.531236
Durbin-Watson stat	1.076855	Prob(F-statistic)	0.005789

Source : *Output Eviews*, 2026

Partially (t-test), the analysis results show a variety of patterns: (1) Green Finance (X1): Coefficient -0.164712 with a probability of 0.2236 (> 0.05), indicating no significant influence on sustainability performance. (2) Green Competitive Advantage (X2): Coefficient -0.130517 with a probability of 0.0400 (< 0.05), indicating a significant negative influence on sustainability performance. (3) Green Innovation (Z) as an Independent Variable: Coefficient 1.884642 with a probability of 0.0059 (< 0.05), indicating a significant positive influence.

Table 3. Results of the T-Statistic Test

Variabl e	Coefficien t	Std. Error	t-Statistic	Prob.
C	-1.118143	0.620761	- 1.801245	0.075 9
X1	-0.164712	0.134149	- 1.227826	0.223 6
X2	-0.130517	0.062368	- 2.092690	0.040 0
Z	1.884642	0.663998	2.838325	0.005 9

Source : *Output Eviews*, 2026

Moderated Regression Analysis (MRA) testing of the moderating effect found that green innovation did not act as a significant moderator. The X1Z interaction had a probability of 0.5376 (>0.05) and the X2Z interaction had a probability of 0.7506 (>0.05). Thus, green innovation was unable to strengthen or weaken the relationship between green finance and green competitive advantage with sustainability performance.

Table 4. Results of Moderation Regression Test 1

Variabl e	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.706715	0.985064	- 0.717431	0.475 5
X1	-2.986773	4.472188	- 0.667855	0.506 4
Z	1.302524	1.057145	1.232115	0.222 0
X1Z	2.967626	4.790180	0.619523	0.537 6

Source : *Output Eviews*, 2026

The results of the Moderated Regression Analysis (MRA) in Table 4.18 show that the interaction variable between green competitive advantage (X2) and green innovation (Z) represented by $X2 \times Z$ has a probability value of 0.7506 and a t-statistic value of 0.319146. The probability value is greater than 0.05 and the t-statistic value is smaller than the t-table value (1.97). These results indicate that green innovation is not able to moderate the relationship between green competitive advantage and Sustainability Performance. Thus, the hypothesis that green innovation moderates the effect of green competitive advantage on Sustainability Performance is not empirically proven and is rejected.

Table 5. Results of Moderation Regression Test 2

Variabl e	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.114734	3.013566	- 0.038073	0.969 7

X2	-1.005436	2.697101	-	0.710
			0.372784	4
Z	0.808467	3.182969	0.253998	0.800
				2
X2Z	0.907508	2.843554	0.319146	0.750
				6

Source : *Output Eviews*, 2026

Discussion

The Impact of Green Finance on Sustainability Performance

The panel data regression analysis results indicate that the green finance variable has a probability value of 0.2236 and a t-statistic of -1.227826. The probability value for the green finance variable is greater than 0.05, and the absolute value of the t-statistic is less than the t-table value (1.97). These results indicate that green finance does not significantly influence Sustainability Performance. Therefore, the hypothesis that green finance influences Sustainability Performance is not empirically proven and is rejected.

This finding indicates that the implementation of green finance in the sample companies has not directly improved Sustainability Performance. Although green finance conceptually plays a role in encouraging environmentally friendly financing and sustainable business practices, its implementation within the companies has not been fully integrated with operational activities and long-term sustainability strategies. Consequently, the impact of green finance on the company's economic, social, and environmental aspects has not been optimally reflected in its sustainability performance.

The results of this study can be explained through the perspective of signaling theory, which states that information a company conveys to stakeholders will be responded to if it is deemed relevant and has high credibility. In the context of this research, green finance practices implemented by companies are likely still administrative or formal, thus not providing a strong signal to investors and stakeholders regarding the company's sustainability commitment. This situation has resulted in green finance not being perceived as an indicator capable of significantly improving a company's sustainability performance.

The results of this study align with several previous studies showing that green finance has not yet had a significant impact on a company's sustainability performance. Several studies emphasize that the impact of green finance tends to be long-term, making it difficult to detect directly within a relatively short observation period, especially if it is not accompanied by green innovation and consistent internal policies (Sagita & Pebriyani, 2025; Nugraha & Ilyas, 2025). Furthermore, the implementation of green finance, which is still administrative or symbolic, also results in its contribution to improving sustainability performance being less than optimal.

However, this study's findings are inconsistent with several other studies that suggest that green finance has a positive effect on sustainability performance, particularly in companies that have integrated green finance with strong sustainability strategies and governance (Zhang et al., 2020a; Din et al., 2024). These differences in results may be influenced by variations in sample

characteristics, differences in industrial sectors, the research time span, and the level of maturity of green finance policy implementation in each company.

The Influence of Green Competitive Advantage on Sustainability Performance

The results of the panel data regression analysis indicate that the green competitive advantage variable has a probability value of 0.0400 and a t-statistic of -2.092690. The probability value for the green competitive advantage variable is less than 0.05, and the absolute value of the t-statistic is greater than the t-table value (1.97). These results indicate that green competitive advantage has a significant effect on Sustainability Performance. Thus, the hypothesis that green competitive advantage influences Sustainability Performance is empirically proven and accepted.

The findings of this study indicate that a company's ability to build an environmentally based competitive advantage plays a critical role in improving sustainability performance. Companies that are able to integrate environmental aspects into their business strategies, such as through resource efficiency, environmentally friendly product innovation, and sustainability-based differentiation, tend to have better sustainability performance. Green competitive advantage not only provides added value to the company internally but also enhances its competitiveness in the eyes of the market and stakeholders.

The results of this study align with the resource-based view of the firm, which explains that a unique, difficult-to-imitate, and long-term competitive advantage can be a source of sustainable corporate performance. In the context of this research, green competitive advantage functions as a strategic asset that enables companies to create economic value while meeting environmental and social sustainability demands. When companies successfully leverage their green competitive advantage, their sustainability performance will sustainably improve.

These results support a number of previous studies that suggest that green competitive advantage has a positive and significant impact on corporate sustainability performance. Chen, Lai, and Wen (2006) showed that companies that develop green competitive advantages through environmentally friendly product and process innovation tend to have better environmental and sustainability performance. Similar findings were also presented by Porter and Linde (1995), who emphasized that an integrated environmental strategy with competitive advantage can increase a company's efficiency, innovation, and long-term value. Furthermore, research by Zhang et al. (2020b) found that green practice-based competitive advantage positively contributes to sustainability performance, particularly when companies consistently implement environmental strategies in their business operations.

However, the results of this study are not entirely consistent with several other studies that found that green competitive advantage does not necessarily have a direct impact on sustainability performance. This discrepancy in findings generally occurs in companies still in the early stages of implementing a sustainability strategy, where environmentally friendly practices have not yet been fully internalized in the company's business strategy and value chain (Li et al., 2018).

The findings of this study provide strategic implications for company management: developing green competitive advantage needs to be placed at the core of the company's business strategy. Companies are not only required to comply with environmental regulations but also need to proactively encourage innovation, process development, and the creation of environmentally friendly products as sources of sustainable competitive advantage. With strong integration between environmental strategy and business strategy, green competitive advantage can act as a key driver in continuously improving a company's sustainability performance.

The Role of Green Innovation in Moderating the Relationship between Green Finance and Sustainability Performance

The results of the Moderated Regression Analysis (MRA) in Table 4 show that the interaction variable between green finance (X1) and green innovation (Z), represented by $X1 \times Z$, has a probability value of 0.5376 and a t-statistic of 0.619523. This probability value is greater than 0.05, and the t-statistic is smaller than the t-table value (1.97). These results indicate that green innovation is unable to moderate the effect of green finance on Sustainability Performance. Therefore, the hypothesis that green innovation moderates the effect of green finance on Sustainability Performance is not empirically proven and is rejected.

The findings of this study indicate that the presence of green innovation within a company has not been able to strengthen or weaken the relationship between green finance and Sustainability Performance. Although green innovation conceptually plays a role in increasing the effectiveness of green financing, the results of this study indicate that the implementation of green innovation has not fully aligned with the company's green finance policies. Consequently, green innovation has not been able to provide added value in strengthening the impact of green finance on improving sustainability performance.

The results of this study can be explained through the perspective of contingency theory, which states that the effectiveness of a strategy is highly dependent on the alignment of a company's internal and external conditions. In the context of this study, green finance and green innovation are likely still operating partially and not yet integrated into a comprehensive sustainability strategy framework. This situation means that green innovation has not yet functioned as a factor strengthening the relationship between green finance and sustainability performance.

These results align with several previous studies that found that green innovation does not act as a moderating variable in the relationship between green finance and sustainability performance, particularly in companies still in the early stages of developing environmentally friendly innovations. Zhang et al. (2020a) showed that even though green finance has been allocated, its impact on sustainability performance is not optimal if green innovation has not reached a sufficient level of maturity. Similar findings were also presented by Li et al. (2018), who stated that green innovation requires time and strong organizational system support before it can strengthen the effectiveness of green finance policies. This indicates that the presence of green innovation does not automatically moderate the relationship between green finance and sustainability performance.

However, these results are inconsistent with several other studies that suggest that green innovation can strengthen the influence of green finance on sustainability performance. Chen, Lai, and Wen (2006) found that green innovation integrated with a company's financing strategy can improve environmental efficiency and competitive advantage, ultimately positively impacting sustainability performance. Furthermore, research by Din et al. (2024) shows that companies with high levels of green innovation tend to be better able to optimize the use of green finance to drive the achievement of sustainability goals. These differences in findings may be due to variations in innovation maturity levels, industry sector characteristics, and differences in the research period used.

These research findings provide strategic implications for company management: green innovation development needs to be more focused and integrated with green finance policies. Companies need not only to increase the allocation of green finance but also to ensure that these funds are used effectively to support the development of environmentally friendly innovations, whether in the form of product innovation, process innovation, or internal company policies. With stronger integration between green finance and green innovation, it is hoped that both will contribute more optimally to improving corporate sustainability performance in the future.

The Role of Green Innovation in Moderating the Relationship between Green Competitive Advantage and Sustainability Performance

The results of the Moderated Regression Analysis (MRA) show that the interaction variable between green competitive advantage (X_2) and green innovation (Z), represented by $X_2 \times Z$, has a probability value greater than 0.05 and a t-statistic value smaller than the t-table value (1.97). These results indicate that green innovation is unable to moderate the effect of green competitive advantage on Sustainability Performance. Therefore, the hypothesis that green innovation moderates the effect of green competitive advantage on Sustainability Performance is not empirically proven and is rejected.

The findings of this study indicate that the presence of green innovation within a company has not been able to strengthen or weaken the relationship between green competitive advantage and Sustainability Performance. Although green innovation is conceptually viewed as a factor that can increase the effectiveness of environmentally based competitive advantage, the results of this study indicate that the implementation of green innovation has not been fully aligned with the company's competitive advantage strategy. Consequently, green innovation has not played an additional role in enhancing the influence of green competitive advantage on the company's sustainability performance.

The results of this study can be explained through the perspectives of the resource-based view of the firm and contingency theory, which emphasize that competitive advantage and innovation will only deliver optimal impact if consistently integrated into a company's strategy. In the context of this study, green competitive advantage and green innovation are likely still managed separately, so green innovation has not yet functioned as a factor strengthening the relationship between green competitive advantage and sustainability performance.

These results align with several previous studies that found that green innovation does not act as a moderating variable in the relationship between green-based competitive advantage and sustainability performance, particularly in companies still in the early stages of green innovation development and implementation. Li et al. (2018) showed that green innovation requires adequate time, resources, and organizational support before it can strengthen the effectiveness of an environmental competitive advantage strategy. Similar findings were also presented by Zhang et al. (2020b), who stated that green competitive advantage does not automatically improve sustainability performance if green innovation has not been fully internalized within a company's business processes. This indicates that green innovation is not yet capable of functioning as a strengthening mechanism for this relationship in the short term.

However, the results of this study are inconsistent with several other studies that suggest that green innovation can strengthen the influence of green competitive advantage on sustainability performance. Chen, Lai, and Wen (2006) found that companies that consistently integrate green innovation into their environmental competitive advantage strategies tend to have better sustainability performance. Furthermore, research by Din et al. (2024) shows that a high level of green innovation maturity can strengthen the effectiveness of green competitive advantage in driving sustainability performance. These differences in findings may be due to variations in industry characteristics, levels of innovation maturity, and differences in the research periods used.

These research findings provide strategic implications for company management: green innovation development needs to be more focused and integrated with green competitive advantage strategies. Companies need not only develop environmental competitive advantages but also ensure that their green innovations support and strengthen these strategies operationally. With stronger integration between green competitive advantages and green innovation, it is hoped that companies' sustainability performance will improve more optimally in the future.

5. CONCLUSION & SUGGESTION

Conclusion

This study examines the role of green finance, green competitive advantage, and green innovation in influencing the sustainability performance of banking sector companies. The findings indicate that sustainability performance is not solely determined by the implementation of green finance, especially when such practices are still oriented towards regulatory compliance rather than substantial environmental impact. Instead, the development of green competitive advantage and the implementation of green innovation are shown to play a significant role in improving sustainability performance, highlighting the importance of strategic differentiation and innovation-based approaches in sustainable banking practices. Furthermore, the results reveal that green innovation does not function as a moderating variable in the relationship between green finance and sustainability performance, nor between green competitive advantage and sustainability performance. This indicates that green innovation has not been optimally integrated

with financing strategies and competitive positions in the banking sector. Overall, this study underscores that sustainability performance is more strongly influenced by strategic and innovation-based initiatives than by financing mechanisms alone.

Suggestion

Based on these findings, future research is encouraged to expand the scope of observation by including more banking institutions or by comparing the banking sector with other financial sectors to increase the generalizability of the results. Extending the observation period is also recommended to better capture the long-term impact of green finance, green competitive advantage, and green innovation on sustainability performance. Furthermore, future studies could incorporate other relevant variables, such as corporate governance quality, risk management practices, or compliance with sustainability regulations, to provide a more comprehensive understanding of the factors that strengthen or weaken sustainability performance in the financial sector.

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