

GREEN FINANCING, GREEN INNOVATION, AND FINANCIAL PERFORMANCE OF INDONESIAN LISTED BANKS

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ABSTRACT: This study examines the effect of Green Financing on financial performance through the mediating role of Green Innovation in Indonesian listed banking companies. It contributes to the sustainable finance literature by explaining how Green Innovation serves as a strategic mechanism linking Green Financing to financial performance. The study employs a quantitative approach using panel data from 14 banks listed on the Indonesia Stock Exchange during 2022–2024. Green Financing is measured by the natural logarithm of total sustainable financing, Green Innovation by the Green Innovation Disclosure Index (GIDI), and financial performance by Return on Assets (ROA), Return on Equity (ROE), and Capital Adequacy Ratio (CAR). Panel regression and Sobel mediation tests reveal that Green Financing significantly promotes Green Innovation. Green Innovation negatively affects ROA and ROE but positively influences CAR while significantly mediating the relationship between Green Financing and financial performance.

Keywords: Green Financing; Green Innovation; Financial Performance; Sustainable Banking; Panel Data Analysis

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INTRODUCTION

Sustainability issues have become a major concern on the global development agenda as the challenges of climate change, environmental degradation, and social and economic inequality increase (Khumairoh et al., 2025). To address these challenges, the United Nations (UN) introduced the Sustainable Development Goals (SDGs) as a global development framework that emphasizes a balance between economic growth, environmental protection, and social welfare. Over time, the concept of Environmental, Social, and Governance (ESG) has emerged as a key instrument for measuring a company's commitment to responsible and sustainable business practices (OECD 2022, n.d.). The integration of ESG principles has fostered the development of the concept of sustainable finance, which aims to direct capital flows toward economic activities that support sustainable development (Wu et al., 2026). This development is reflected in the rise of sustainable investment globally. The Global Sustainable Investment Alliance (GSIA) reports that the value of global sustainable investment assets will reach approximately USD 30.3 trillion in 2022 (Sustainable & Review, 2022). This significant investment value demonstrates that sustainability has become a strategic consideration in investment decision-making and corporate management across various countries.

In line with these global developments, Indonesia continues to strengthen the implementation of sustainable finance through various policies and regulations. The Financial Services Authority (OJK) issued the Sustainable Finance Roadmap Phase I (2015–2019) and the Sustainable Finance Roadmap Phase II (2021–2025) as guidelines for the financial services industry in supporting sustainable development (Purba et al., 2025). Furthermore, the OJK also developed the Indonesian Green Taxonomy, which was later refined into the Indonesian Taxonomy for Sustainable Finance (TKBI), as a reference for classifying economic activities that support environmental, social, and economic sustainability goals (UNEP 2023, 2023). The presence of these various regulations has encouraged increased implementation of green financing in the financial services sector. The OJK noted that the total sustainable financing portfolio disbursed by the Indonesian banking sector reached IDR 2,075 trillion by the end of 2024, or approximately 26.12% of total national banking credit (Otoritas Jasa Keuangan, 2022). This increase demonstrates the banking industry's growing role in supporting the transition to a green economy and sustainable development.

The phenomenon of green financing implementation is also evident in the banking companies that are the subjects of this study. Banks such as Bank Central Asia (BCA), Bank Rakyat Indonesia (BRI), Bank Negara Indonesia (BNI), Bank Mandiri, Bank Tabungan Negara (BTN), CIMB Niaga, Danamon, Permata Bank, OCBC NISP, BTPN, Bank Mega, Bank Sinarmas, Bank BJB, and Bank Jatim have integrated sustainability principles into their business strategies. This implementation is realized through increasing sustainable financing, developing green financial products, publishing sustainability reports, and integrating ESG principles into corporate governance (Appiah-kubi et al., 2024). This condition shows that the banking sector functions not only as a financial intermediary institution but also plays a role as a catalyst in supporting the transformation towards a low-carbon economy.

The development of green financing is also driven by growing investor attention to companies that implement sustainability principles. Modern investors no longer solely consider profitability, but also pay attention to how companies manage environmental risks, social responsibility, and corporate governance (Z. Chen & Xing, 2025). This phenomenon is reflected in the growing demand for sustainable investment instruments such as green bonds, sustainability bonds, and green sukuk. Indonesia became the first country in the world to issue sovereign green sukuk in 2018 and by 2025 has raised more than USD 7.7 billion to finance various projects supporting climate change mitigation and sustainable development (Khumairoh et al., 2025). This development demonstrates that financial markets are increasingly appreciating institutions committed to sustainability, including the banking sector.

In addition to increasing green financing, the banking sector is also required to develop green innovation as part of its corporate sustainability strategy. In the banking industry, green innovation can be realized through the development of green financial products, the transformation of more environmentally friendly business processes through paperless banking and operational efficiency, and the use of digital technology to improve resource efficiency (Siagian & Siagian, 2025). The increasingly rapid development of digital banking is encouraging

banks in Indonesia to integrate technological innovation and sustainability principles simultaneously to improve operational efficiency and corporate competitiveness (Sapiri et al., 2023). Thus, green innovation is no longer viewed as a complementary activity but has become a strategic capability with the potential to create long-term competitive advantage.

On the other hand, financial performance remains a key indicator of a banking company's success. Investors and shareholders not only pay attention to a company's commitment to ESG and sustainability but also demand its ability to generate profitability and maintain financial stability (J. Chen et al., 2022). Therefore, the crucial question arises as to whether the implementation of green financing and green innovation by banks can deliver economic benefits reflected in improved financial performance. This question is all the more relevant because the implementation of various sustainability programs often requires significant initial investment, and their impact on corporate profitability remains a matter of debate in the academic literature.

Empirical evidence regarding the relationship between Green Financing and financial performance remains inconclusive. Previous studies have reported mixed findings. Several studies suggest that Green Financing enhances organizational performance by improving sustainability practices, reputation, operational efficiency, and access to financial resources (Sapiri et al., 2023; Afolabi, 2025). Conversely, other studies argue that the financial benefits of Green Financing may not be realized immediately because sustainable investments require substantial implementation costs and a relatively long payback period. These inconsistent findings indicate that the relationship between Green Financing and financial performance remains an open issue requiring further empirical investigation.

Moreover, prior studies have predominantly examined the direct relationship between Green Financing and organizational outcomes, including financial performance, sustainability performance, environmental performance, and sustainability reporting (Siagian & Siagian, 2025). Although several studies have introduced mediating variables such as pro-environmental behavior, limited attention has been given to Green Innovation as the strategic organizational capability through which Green Financing generates long-term financial value (Wu et al., 2026). Consequently, the internal mechanism linking Green Financing and financial performance remains insufficiently explained, particularly in the context of the banking industry.

One mechanism that could potentially explain this relationship is green innovation. Based on the Resource-Based View (RBV), green financing can be viewed as a strategic resource that enables companies to develop environmentally-based innovative capabilities (K. Chen et al., 2025). Green innovation encompasses the development of products, processes, and technologies that reduce environmental impacts while increasing resource efficiency. Global trends indicate a continued increase in green innovation activity, evidenced by an average annual growth of 9.3% in the number of green patents from 2016 to 2022 (Y. Chen et al., 2023). Various studies also demonstrate that green innovation can improve ESG performance, strengthen firm value, reduce business risks, and enhance financial performance through sustainable value creation. These findings indicate that green innovation has the potential to be a mechanism explaining how the implementation of green financing can lead to improved corporate financial performance.

Based on the above description, several research gaps form the basis of this study. First, research findings on the effect of green financing on financial performance are still mixed and have not yet reached a consensus. Second, most previous studies have focused on the direct relationship between green financing and company performance without explaining the underlying mechanisms. Third, research integrating green financing, green innovation, and financial performance into a single research model is still relatively limited, particularly in the Indonesian banking sector, which is the primary implementer of sustainable finance policies. Therefore, this study offers a novelty by examining the role of green innovation as a mediating variable in the relationship between green financing and financial performance in banking companies listed on the Indonesia Stock Exchange. Based on these gaps, this study aims to analyze the effect of green financing on financial performance and examine the mediating role of green innovation in banking companies listed on the Indonesia Stock Exchange.

THEORETICAL REVIEW

Resource Based View Theory

Resource-Based View (RBV), introduced by Barney (1991), explains that organizations achieve sustainable competitive advantage by effectively utilizing valuable, rare, inimitable, and non-substitutable resources. In the context of sustainable finance, Green Financing represents a strategic financial resource that enables banks to invest in environmentally friendly technologies, products, and operational systems (Hart & Dowell, 2011). However, these financial resources do not automatically improve organizational performance unless they are transformed into strategic organizational capabilities (Zhang et al., 2022). One important capability developed through Green Financing is Green Innovation. Sustainable financing provides banks with the capacity to develop green financial products, adopt environmentally friendly technologies, and improve operational efficiency, thereby enhancing organizational competitiveness.

H1: Green Financing has a significant effect on Green Innovation.

Green Innovation represents an organization's capability to develop environmentally sustainable products, processes, and technologies (K. Chen et al., 2025). Through these innovations, banks are expected to improve operational efficiency, strengthen risk management, and influence financial performance. Because financial performance is represented by three different indicators, the relationship is examined separately.

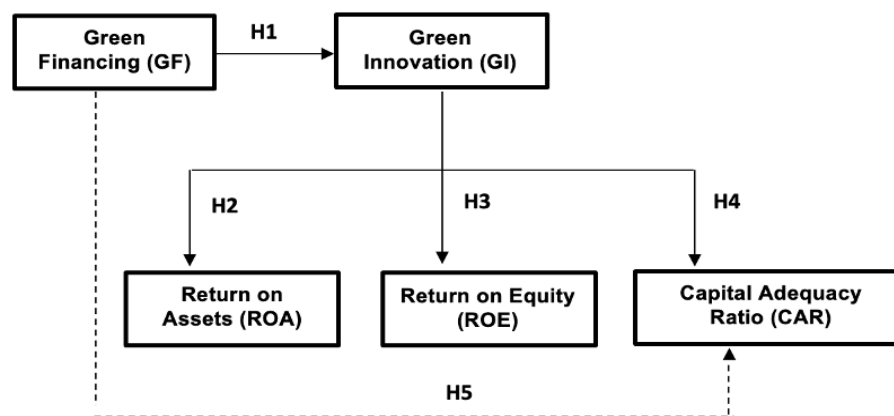
H2: Green Innovation has a significant effect on Return on Assets (ROA).

H3: Green Innovation has a significant effect on Return on Equity (ROE).

H4: Green Innovation has a significant effect on Capital Adequacy Ratio (CAR).

Legitimacy Theory explains that organizations seek legitimacy by aligning their activities with societal expectations regarding environmental responsibility and sustainable development (Degan, 2002). Green Financing reflects banks' commitment to sustainability, while Green Innovation represents the implementation of that commitment through environmentally responsible products, technologies, and operational practices. Accordingly, Green Innovation is expected to function as the mechanism through which Green Financing influences financial performance (see Figure 1 for model clarification).

H5: Green Innovation mediates the relationship between Green Financing and Financial Performance.



Green Innovation mediates the relationship between
Green Financing and Financial Performance

Figure 1. Conceptual Framework

Source: Processed by the authors (2026)

RESEARCH METHOD

This study employs a quantitative research approach using panel data to examine the relationship between Green Financing, Green Innovation Disclosure, and financial outcomes in Indonesian listed banking companies. The population of this study consists of banking companies listed on the Indonesia Stock Exchange (IDX) during the 2022–2024 period. The sample was determined using purposive sampling based on the following criteria: (1) banking companies that were consecutively listed on the Indonesia Stock Exchange during the 2022–2024 period; (2)

companies that published annual reports and sustainability reports during the observation period; and (3) companies that provided complete data related to the research variables. Based on these criteria, 14 banking companies were selected, resulting in 42 firm-year observations.

The research population was all banking companies listed on the Indonesia Stock Exchange. The sampling technique used purposive sampling with the following criteria: (1) banking companies consecutively listed on the Indonesia Stock Exchange during the 2022–2024 period; (2) publishing annual reports and sustainability reports during the research period; and (3) having complete data related to the research variables. Based on these criteria, 14 banking companies were obtained as research samples, namely Bank Central Asia (BBCA), Bank Rakyat Indonesia (BBRI), Bank Negara Indonesia (BBNI), Bank Mandiri (BMRI), Bank Tabungan Negara (BBTN), CIMB Niaga (BNGA), Danamon Indonesia (BDMN), Permata Bank (BNLI), OCBC NISP (NISP), Bank BTPN (BTPN), Bank Mega (MEGA), Bank Sinarmas (BSIM), Bank Pembangunan Daerah Jawa Barat dan Banten (BJBR), and Bank Pembangunan Daerah Jawa Timur (BJTM). With an observation period of three years, the total number of research observations was 42.

The study uses secondary data obtained from annual reports, sustainability reports, and financial reports published by the respective banking companies and the Indonesia Stock Exchange. The data were analyzed using panel data regression with EViews 13. The analytical procedures consisted of descriptive statistical analysis, correlation analysis, panel data model selection using the Chow test, Hausman test, and Lagrange Multiplier test, followed by panel regression and hypothesis testing. In addition, the Sobel test was employed to examine the mediating role of Green Innovation Disclosure in the relationship between Green Financing and the respective financial outcomes.

Table 1. Operational Definition of Variables

Variables	Operational Definition	Indicator	Measurement
Green Financing (GF)	Financing distributed by banking companies to support sustainable and environmentally friendly economic activities.	Total Sustainable Financing / Sustainable Business Finance Activities (KKUB)	$\text{LnGF} = \ln (\text{Total Sustainable Financing or KKUB})$
Green Innovation (GI)	The extent and specificity of banks' disclosure of environmentally oriented innovations in financial products, operational efficiency, and technology adoption.	Green Financial Products (GI1–GI5); Green Operational Efficiency (GI6–GI10); Green Technology Adoption (GI11–GI15)	Content analysis using 15 disclosure items. Each item is scored 0–2. $\text{GIDI} = \Sigma \text{GI}/30$
Return on Assets (ROA)	The ability of a bank to generate net income from its total assets.	Return on Assets (ROA).	$\text{ROA} = \text{Net Profit} / \text{Total Assets} \times 100\%$
Return on Equity (ROE)	The ability of a bank to generate net income from shareholders' equity.	Return on Equity (ROE).	$\text{ROE} = \text{Net Profit} / \text{Total Equity} \times 100\%$
Capital Adequacy Ratio (CAR)	The ability of a bank to maintain adequate capital relative to its risk-weighted assets.	Capital Adequacy Ratio (CAR)	$\text{CAR} = \text{Bank Capital} / \text{Risk-Weighted Assets} \times 100\%$

Source: Processed by the authors (2026)

The operational definitions and measurement of the research variables are presented. Green Financing was measured using the natural logarithm of total sustainable financing disclosed by each bank. Green Innovation was measured using the Green Innovation Disclosure Index (GIDI), developed through content analysis of sustainability and annual reports based on five dimensions of environmentally oriented innovation. Financial performance was measured using three accounting-based indicators, namely Return on Assets (ROA), Return on Equity (ROE), and Capital Adequacy Ratio (CAR). All data were obtained from the audited annual reports and sustainability reports of Indonesian banking companies during the 2022–2024 observation period.

RESULTS

Table 2 presents the descriptive statistics of the research variables. Green Financing (GF) has an average value of 2.301, indicating that the sampled banks have implemented sustainable financing at varying levels. Green Innovation (GI) has an average disclosure index of 0.898, suggesting that most banks have disclosed sustainability innovation practices. Regarding financial performance, the average ROA, ROE, and CAR are 1.845%, 12.562%, and 24.499%, respectively, indicating that the sampled banks generally maintain positive profitability and strong capital adequacy throughout the observation period.

Table 2. Descriptive Statistic

Variables	Obs.	Mean	Std. Dev.	Min	Max
Green Financing (GF)	42	2.301	0.944	0.110	4.080
Green Innovation (GI)	42	0.898	0.075	0.700	1.000
Return on Assets (ROA)	42	1.845	0.866	0.140	3.780
Return on Equity (ROE)	42	12.562	5.295	0.970	24.300
Capital Adequacy Ratio (CAR)	42	24.499	3.933	17.300	35.100

Source: Processed by the authors using Eviews 13 (2026)

Table 3 shows the Pearson correlation coefficients among the research variables. Green Financing is positively correlated with Green Innovation ($r = 0.376$), indicating that banks with higher sustainable financing tend to disclose more green innovation practices. The correlations between Green Financing and financial performance indicators are relatively weak, ranging from 0.038 to 0.193. Meanwhile, ROA and ROE exhibit a strong positive correlation ($r = 0.894$), which is expected because both variables measure profitability from different perspectives. Importantly, none of the correlation coefficients exceeds 0.90, indicating that there is no indication of severe multicollinearity among the independent variables used in this study. Therefore, the variables are considered suitable for panel regression analysis.

Table 3. Correlation Matrix

Variables	GF	GI	ROA	ROE	CAR
Green Financing (GF)	1.000				
Green Innovation (GI)	0.376	1.000			
Return on Assets (ROA)	0.193	0.091	1.000		
Return on Equity (ROE)	0.151	0.150	0.894	1.000	
Capital Adequacy Ratio (CAR)	0.038	0.097	0.145	-0.148	1.000

Source: Processed by the authors using Eviews 13 (2026)

Table 4. Panel Data Model Selection

Regression Equation	Chow Test	Hausman Test	LM Test	Final Model
GI = GF	0.0001	0.0110	-	FEM
ROA = GF + GI	0.0000	0.1146	0.0000	REM
ROE = GF + GI	0.0000	0.0979	0.0000	REM
CAR = GF + GI	0.0000	0.8826	0.0000	REM

Source: Processed by the authors using Eviews 13 (2026)

Table 4 presents the results of the panel data model selection. The Chow Test indicates that all regression equations have probability values below 0.05, suggesting that the Fixed Effect Model is preferred over the Common Effect Model. For the first regression model (Green

Innovation), the Hausman Test produces a probability value of 0.0110, which is lower than 0.05. Therefore, the Fixed Effect Model (FEM) is selected as the most appropriate estimation model.

For the remaining regression models (ROA, ROE, and CAR), the Hausman Test produces probability values greater than 0.05, indicating that the Random Effect Model (REM) is preferred over the Fixed Effect Model. The subsequent Lagrange Multiplier Test also yields probability values below 0.05, confirming that the Random Effect Model is more appropriate than the Common Effect Model. Accordingly, the final estimation employs the Fixed Effect Model for the Green Innovation equation and the Random Effect Model for the ROA, ROE, and CAR equations.

Table 5. Panel Regression Results

Variables	Model 1 GI	Model 2 ROA	Model 3 ROE	Model 4 CAR
Green Financing	0.151 (3.296)	0.326 (1.525)	1.368 (1.050)	-0.321 (-0.505)
Green Innovation	--	-4747 (-3.964)	-23.926 (-3.252)	11.582 (4.636)
Contant	0.551 (5.227)	5.358 (5.302)	30.889 (4.976)	14.841 (6.490)
R ²	0.761	0.276	0.204	0.409
Adjusted R ²	0.637	0.238	0.163	0.379
F-statistic	6.141	7.415	4.989	13.521
Prob (F-statistic)	0.000	0.002	0.012	0.000
Model	FEM	REM	REM	REM

Source: Processed by the authors using Eviews 13 (2026)

Table 5 presents the estimation results of the panel regression models examining the relationships among Green Financing, Green Innovation, and Financial Performance. Based on the panel model selection, the Fixed Effect Model (FEM) was applied to Model 1, whereas the Random Effect Model (REM) was employed for Models 2–4. The results reveal that Green Financing has a positive and statistically significant effect on Green Innovation ($\beta = 0.150652$; $t = 3.296$; $p = 0.0027$). This finding indicates that an increase in sustainable financing activities encourages banks to strengthen the implementation and disclosure of green innovation practices.

Regarding financial performance, Green Financing does not have a statistically significant direct effect on ROA ($\beta = 0.325518$; $p = 0.1353$), ROE ($\beta = 1.368286$; $p = 0.3001$), or CAR ($\beta = -0.320660$; $p = 0.6165$). In contrast, Green Innovation significantly influences all financial performance indicators. Specifically, Green Innovation negatively affects ROA ($\beta = -4.747442$; $p < 0.01$) and ROE ($\beta = -23.925970$; $p < 0.01$), while exerting a positive effect on CAR ($\beta = 11.582130$; $p < 0.01$). The explanatory power of the estimated models varies across the dependent variables. The independent variable explains approximately 76.10% of the variation in Green Innovation, 27.55% in ROA, 20.37% in ROE, and 40.95% in CAR, indicating that the proposed models provide a moderate to high level of explanatory capability.

Table 6. Hypotesis Testing Results

Hypothesis	Structural Relationship	Coefficient	t-value	p-value	Decision
H1	GF → GI	0.151	3.296	0.0027	Supported
H2	GI → ROA	-4.747	-3.964	0.0003	Supported
H3	GI → ROE	-23.926	-3.252	0.0024	Supported
H4	GI → CAR	11.582	4.636	0.0000	Supported
H5	Green Financing → Green Innovation → Financial Performance	Sobel Z = - 2.534 (ROA); - 2.315 (ROE); 2.687 (CAR)			

Source: Processed by the authors using Eviews 13 (2026)

The hypothesis testing results are summarized in Table 6. Green Financing has a positive and statistically significant effect on Green Innovation, supporting H1. Furthermore, Green

Innovation significantly affects all financial performance indicators. Specifically, Green Innovation negatively influences both ROA and ROE, while positively affecting CAR. Therefore, hypotheses H2, H3, and H4 are also supported.

Table 7. Mediation Analysis (Sobel Test)

Indirect Relationship	Coefficient (a)	Coefficient (b)	Sobel Z	Decision
Green Financing → Green Innovation → ROA	0.151	-4.747	-2.534	Significant Mediation
Green Financing → Green Innovation → ROE	0.151	-23.926	-2.315	Significant Mediation
Green Financing → Green Innovation → CAR	0.151	11.582	2.687	Significant Mediation

Source: Processed by the authors

The mediating role of Green Innovation in the relationship between Green Financing and financial performance was examined using the Sobel Test. The results are presented in Table 7. The Sobel Test indicates that the indirect effects of Green Financing on all financial performance indicators through Green Innovation are statistically significant. Specifically, the Sobel Z-values are -2.534 for ROA, -2.315 for ROE, and 2.687 for CAR, all of which exceed the critical value of ± 1.96 . These findings demonstrate that Green Innovation serves as a significant mediating mechanism through which Green Financing influences financial performance. Interestingly, the mediation effect differs across financial performance indicators. Green Innovation negatively mediates the relationship with profitability, as reflected by ROA and ROE, while positively mediating the relationship with CAR. This suggests that although investments in green innovation may reduce short-term profitability because of implementation costs, they contribute positively to banks' capital strength and long-term financial resilience.

DISCUSSION

The empirical results indicate that Green Financing has a positive and statistically significant effect on Green Innovation. This finding suggests that an increase in sustainable financing encourages banks to develop and implement environmentally friendly innovations, including green financial products, digital banking services that reduce paper consumption, environmentally efficient operational systems, and broader sustainability disclosure (Dangelico & Pujari, 2010; Wu et al., 2026; Q. Chen, 2025). From the perspective of the Resource-Based View (RBV), financial resources constitute strategic assets that enable firms to build new organizational capabilities (Peteraf, 1993). Sustainable financing provides banks with the financial capacity to invest in green technologies, improve operational efficiency, and introduce innovative financial products aligned with sustainability objectives (Houssam et al., 2023). Consequently, banks with greater green financing are more capable of transforming financial resources into green innovation, thereby strengthening their competitive advantage.

Furthermore, this finding is also consistent with Legitimacy Theory, which argues that organizations seek legitimacy by aligning their operations with societal expectations. Through green financing, banks demonstrate their commitment to sustainable development and environmental responsibility, thereby enhancing public trust and corporate legitimacy (Enda et al., 2025). The implementation of green innovation represents a practical manifestation of this commitment. This result is consistent with previous studies reporting that sustainable financing promotes innovation by encouraging investments in environmentally friendly technologies and sustainable banking practices (Afolabi, 2025; Wu et al., 2026; Appiah-kubi et al., 2024). Therefore, green financing not only serves as a financing mechanism but also acts as a strategic driver for organizational innovation.

The results reveal that Green Innovation negatively affects Return on Assets (ROA). Although this finding may appear contrary to the initial expectation that innovation enhances profitability, it can be explained by the characteristics of investments in sustainable innovation. The implementation of green innovation generally requires substantial initial expenditures, including investments in digital infrastructure, green technology, environmentally friendly operational systems, employee training, and sustainability reporting. These expenditures

increase operational costs during the early stages of implementation and may temporarily reduce banks' profitability. According to the Resource-Based View, strategic investments often generate economic benefits only after organizational capabilities have matured. Therefore, while green innovation may reduce short-term profitability, it creates valuable intangible assets that contribute to sustainable competitive advantage over the long term.

This finding also reflects the reality of Indonesian banking during the 2022–2024 period. Many banks were still strengthening their ESG implementation and digital transformation strategies, implying that the financial benefits of green innovation had not yet been fully realized. Previous empirical studies have similarly reported that ESG-related investments may initially reduce profitability because organizations incur substantial implementation costs before efficiency gains become apparent. Consequently, the negative relationship observed in this study should be interpreted as a short-term adjustment rather than evidence that green innovation destroys firm value.

The empirical findings indicate that Green Innovation has a negative and statistically significant effect on Return on Equity (ROE). This result implies that although banks actively implement green innovation initiatives, these activities have not yet translated into higher returns for shareholders during the observation period (Siagian & Siagian, 2025; Xu & Li, 2024). One possible explanation is that green innovation requires substantial financial commitments, including investments in environmentally friendly technologies, digital banking infrastructure, employee competency development, and sustainability reporting systems. These expenditures increase operational and investment costs in the short term, thereby reducing the return generated from shareholders' equity. Consequently, the financial benefits of green innovation may only materialize after these investments generate operational efficiencies and competitive advantages.

From the perspective of the Resource-Based View (RBV), green innovation represents a strategic organizational capability that requires continuous investment before producing superior financial performance. The acquisition of valuable and difficult-to-imitate resources often involves significant initial costs, while the resulting competitive advantage is realized gradually over time (Barney, 1991; Hart & Dowell, 2011). Therefore, the negative effect observed in this study should be interpreted as a short-term financial consequence of strategic sustainability investment rather than as evidence of ineffective innovation. This finding is also relevant to the Indonesian banking industry during the 2022–2024 period, where many commercial banks intensified ESG implementation and digital transformation initiatives in response to sustainable finance regulations issued by the Financial Services Authority (OJK). Consequently, banks may have prioritized long-term sustainability objectives over short-term profitability, resulting in lower returns to shareholders during the transition period.

The findings are consistent with studies suggesting that sustainability-oriented innovation may temporarily reduce financial returns because of high implementation costs before long-term economic benefits become evident (Alsmadi & Alzoubi, 2022). However, this result differs from studies reporting a positive relationship between green innovation and profitability, indicating that the financial impact of sustainability initiatives depends on industry characteristics, implementation maturity, and observation period (Agmulia et al., 2023).

Unlike its impact on profitability, Green Innovation has a positive and statistically significant effect on Capital Adequacy Ratio (CAR). This finding indicates that banks with higher levels of green innovation tend to maintain stronger capital adequacy. A possible explanation is that green innovation enhances risk management practices and operational efficiency, enabling banks to strengthen their capital structure. Sustainable banking initiatives encourage institutions to improve governance mechanisms, optimize resource allocation, and develop environmentally responsible financial products, all of which contribute to greater financial stability (Abdallah et al., 2024). This finding is consistent with Legitimacy Theory, which argues that organizations gain legitimacy by adopting practices that align with societal expectations. By implementing green innovation, banks demonstrate their commitment to sustainable finance and responsible corporate governance. Such commitment strengthens stakeholder confidence, improves institutional reputation, and ultimately supports stronger capital positions (Dunlap, 2023).

Furthermore, regulatory developments in Indonesia have encouraged banks to integrate sustainability principles into their strategic planning. The implementation of sustainable finance regulations and ESG reporting requirements has motivated banks to improve governance quality

and strengthen capital resilience (Li et al., 2023). As a result, green innovation not only supports environmental objectives but also contributes to maintaining adequate capital buffers against potential financial risks. The positive relationship between green innovation and CAR is supported by previous studies highlighting that sustainable innovation improves organizational resilience and strengthens long-term financial stability (I Gusti & Madjid, 2024). Therefore, green innovation should be viewed not merely as an environmental initiative but also as a strategic instrument for enhancing banking resilience.

The Sobel Test confirms that Green Innovation significantly mediates the relationship between Green Financing and financial performance, as indicated by significant indirect effects on ROA, ROE, and CAR. An important finding of this study is that Green Financing does not directly influence financial performance, whereas it significantly influences Green Innovation, which subsequently affects financial performance (Yang, 2024). This pattern indicates an indirect-only mediation, meaning that Green Financing improves financial performance primarily through the development of green innovation rather than through direct financial mechanisms (Badi H. Baltagi, n.d.; Igartua & Hayes, 2021). From the Resource-Based View, Green Financing serves as an enabling resource that allows banks to invest in strategic capabilities such as green technology, environmentally friendly financial products, operational efficiency, and digital transformation. These capabilities, represented by Green Innovation, subsequently influence organizational performance. Therefore, financial resources alone are insufficient to improve performance unless they are transformed into productive organizational capabilities.

The findings also reinforce Legitimacy Theory. Sustainable financing demonstrates banks' commitment to environmental responsibility; however, stakeholders evaluate this commitment not only through financial allocations but also through tangible innovation and implementation. Consequently, Green Innovation functions as the mechanism through which sustainable financing generates organizational legitimacy and improves long-term financial outcomes. Interestingly, the mediating effects differ across financial performance indicators (Afolabi, 2025). Green Innovation negatively mediates the relationship between Green Financing and profitability (ROA and ROE), suggesting that the costs associated with sustainability investments temporarily reduce financial returns. Conversely, Green Innovation positively mediates the relationship between Green Financing and CAR, indicating that sustainability-oriented innovation strengthens banks' capital resilience and risk management capacity. These findings contribute to the sustainable finance literature by demonstrating that the financial benefits of Green Financing are realized primarily through innovation capability (Daneshmand et al., 2021; Mealy & Teytelboym, 2022). Therefore, banks should not expect immediate improvements in profitability following green financing initiatives but should instead focus on developing innovation capabilities that generate sustainable value over the long term.

CONCLUSION AND FURTHER STUDY

This study establishes Green Innovation as a critical mechanism linking Green Financing to financial performance among Indonesian listed banks. Green Financing significantly promotes Green Innovation, while its financial implications reveal contrasting outcomes. Green Innovation negatively affects Return on Assets (ROA) and Return on Equity (ROE), reflecting the short-term profitability pressures associated with sustainability investments, but positively influences the Capital Adequacy Ratio (CAR), indicating stronger capital resilience. The significant mediating effects further demonstrate that Green Financing influences financial outcomes through banks' innovation capabilities rather than through financing alone. These findings extend the Resource-Based View by illustrating how sustainable financial resources translate into organizational capabilities with distinct financial consequences. They also complement Legitimacy Theory by positioning Green Innovation as a strategic response to growing sustainability expectations. Importantly, the findings reveal a trade-off between short-term profitability and capital resilience, suggesting that sustainable banking performance cannot be adequately assessed through profitability indicators alone.

Despite these contributions, the study is limited by its three-year observation period, its focus on Indonesian listed banks, and its reliance on disclosure-based measures of Green Innovation that may not fully capture actual implementation. Future research should extend the observation period, incorporate Islamic and regional banks, and employ cross-country

comparisons to establish broader generalizability. Further studies may integrate ESG performance, corporate governance, digital transformation, and climate risk while applying dynamic panel estimation or robust mediation techniques to examine longer-term financial effects. From a managerial perspective, banks should prioritize green investments that generate measurable operational and environmental value while managing their short-term profitability implications. Regulators, particularly the Financial Services Authority (OJK), should strengthen sustainable finance frameworks that encourage substantive innovation rather than disclosure compliance alone, thereby supporting financial resilience and long-term banking competitiveness.

ETHICAL DISCLOSURE

This study was conducted in accordance with the ethical principles for research involving human participants. Responses were collected and stored anonymously, with no identifying information linked to individual questionnaires, and data were used solely for the aggregate statistical purposes reported in this study.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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