



DO GREEN FINANCE AND GREEN INNOVATION ENHANCE SUSTAINABLE INVESTMENT DECISIONS? IDENTIFYING THE PIVOTAL ROLE OF ARTIFICIAL INTELLIGENCE

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Abstract: *This quantitative study aims to empirically examine the effects of green finance and green innovation on sustainable investment decisions, as well as the role of artificial intelligence in moderating these relationships. The population consisted of non-cyclical consumer sector companies listed on the Indonesia Stock Exchange (IDX) from 2021 to 2024. Purposive sampling was employed to select 427 companies for observation. Data were analysed using CEM panel data regression. The results reveal that both green finance and green innovation positively affect sustainable investment decisions, and artificial intelligence can moderate these impacts. The study findings offer valuable insights for companies operating in Indonesia's non-cyclical consumer sector. Green innovation can be applied as a green finance policy to improve sustainable investment decisions. Furthermore, artificial intelligence can be used to strengthen the influence of green finance on sustainable investment decisions. This study, therefore, supports the triple bottom line and the Sustainable Development Goals, encouraging companies in Indonesia not only to focus on profits but also to increase their environmental awareness.*

Keywords: Green Finance, Green Innovation, Sustainable Investment Decisions, Artificial Intelligence

INTRODUCTION

Artificial intelligence (AI) has advanced rapidly and is now being incorporated into more aspects of life, from daily activities to the business world. This technology can process large-scale data quickly and accurately, causing significant changes in various industrial and economic sectors (Torrent-Sellens et al., 2025). Simultaneously, growing awareness of environmental and sustainability issues is driving the development of green finance as a financing tool for eco-friendly initiatives.

Green finance plays a critical role in allocating capital to reduce negative environmental impacts while accelerating the transition to a green economy (Ma et al., 2023). Congruent with this, green innovation occurs as

technological and process advancements that prioritise resource efficiency and reduced environmental impact. This not only supports environmental conservation but also enhances business competitiveness and sustainability (Bataineh et al., 2024). In the investment context, sustainable investment decisions are becoming increasingly crucial since they integrate environmental, social, and governance (ESG) factors. This approach requires investors to pursue not only financial returns but also consider the social and environmental impacts of their investments (Sciarelli et al., 2021).

Recent developments indicate that integrating artificial intelligence into green finance and green innovation has significant potential to encourage sustainable investment decisions. Artificial intelligence can enhance data analysis capabilities, predict risks, and accelerate informed decision-making, thereby strengthening the effectiveness of green finance and green innovation in supporting sustainable investment. Therefore, understanding the role of artificial intelligence in this context is crucial to optimising its contribution to sustainable development.

An AI-based technology system (AITS)—a new class of digital tools within the context of Industry 4.0—can process large amounts of data, make pattern-based predictions, and support efficient decision-making (Torrent-Sellens et al., 2025). Artificial intelligence encompasses techniques such as machine learning, data analytics, predictive modeling, robotic process automation, blockchain technology, and natural language processing, which enable systems to learn and adapt without direct human intervention (Hassanein & Tharwat, 2024). In finance and investment, artificial intelligence can be used to improve the quality of risk analysis, optimise portfolios, and accelerate complex decision-making processes.

Green finance is an innovative financial instrument that bridges the financial and environmental sectors, whose primary goal is to reduce financial support for highly polluting, energy-intensive companies and encourage the growth of environmentally friendly companies. It lessens the intensity of energy consumption, ultimately promoting harmonious progress between economic growth and environmental protection (Xu et al., 2024). Meanwhile, green innovation refers to the development and implementation of technologies, products, or processes that can minimise negative environmental impacts, including business and management model innovations that increase resource efficiency and reduce carbon emissions (Chen et al., 2020). It is described as a key element of corporate sustainability, which can be enhanced through digital leadership and top management innovation (Zada et al., 2025). Furthermore, it can also trigger ideas for combining actions through the adoption of practices aimed at sustainable development without sacrificing economic, social, and environmental benefits (Hossain et al., 2024).

Sustainable investment decisions incorporate Environmental, Social, and Governance (ESG) factors to achieve optimal financial returns while ensuring long-term sustainability (Azmat et al., 2022). This approach motivates investors to consider social and environmental impacts in addition to personal financial gains. Currently, global pressure on companies to be socially and environmentally responsible is making sustainable investment decisions increasingly essential.

Previous studies have reported that both green finance and green innovation play a crucial role in driving sustainable investment (Debrah et al., 2023). Furthermore, artificial intelligence has been shown to increase the efficiency of green innovation and support corporate transformations towards sustainability (Liu et al., 2025). However, most studies have not empirically tested the role of artificial intelligence as a moderating variable that strengthens the effects of green finance and green innovation on sustainable investment decisions (Chen et al., 2025). This gap emphasises the need for novel research that integrates artificial intelligence into the model to comprehensively assess its impacts, particularly in the context of green investment decision-making in the digital era (Liu et al., 2025). Evaluating artificial intelligence as a moderating variable is critically important given its ability to improve the efficiency, accuracy, and quality of data-driven decision-making analysis. Artificial intelligence functions not only as a technological tool but also as a factor that can strengthen or weaken the influence of green finance practices on sustainable investment decisions (Georgescu et al., 2025). With its machine learning capabilities, artificial intelligence helps organisations assess sustainability risks, green investment opportunities, and corporate environmental performance more comprehensively through predictive analyses and real-time data processing (Ao, 2025). The use of AI is considered capable of strengthening the relationship between green finance and sustainable investment decisions. This prompts the investigation of its moderating role in this study.

Most prior studies have not explicitly tested the role of artificial intelligence as a moderating variable that can magnify the effects of green finance and green innovation on sustainable investment decisions. Several related studies on this topic are rather conceptual and lack empirical evidence. This signifies that comprehensive literature examining how artificial intelligence moderates and strengthens the effects of green finance and green innovation

in sustainable investment decision-making remains very limited. Meanwhile, Indonesia has great potential for the development of green finance and artificial intelligence, despite regulatory and infrastructure challenges. Therefore, this study is conducted to contribute contextually and empirically to the development of sustainable investment theory and practices in Indonesia.

This study aims to provide empirical evidence regarding the role of artificial intelligence in strengthening the influence of green finance and green innovation on sustainable investment decisions. By quantitatively examining this moderating variable, the analysis is expected to shed light on how artificial intelligence may increase the effectiveness of green finance and green innovation in driving sustainable investment decisions. This is essential, given the rapid advancement of artificial intelligence and the enormous potential of green finance in supporting sustainable development. This study has theoretical implications for enriching the academic literature, as well as practical insights for companies in Indonesia to improve the quality of sustainable investment decisions in line with the triple bottom line (profit, people, planet) principles and the Sustainable Development Goals (SDGs). The findings can be used as the basis for evidence-based business policies and strategies to accelerate the transition to a green economy.

THEORETICAL FRAMEWORK AND HYPOTHESES

Stakeholder Theory

Stakeholder theory—pioneered by Freeman (1984)—holds that organisational performance is determined not only by how the organisation can maximise shareholder value but also by its ability to manage relationships with diverse stakeholders, including employees, customers, suppliers, communities, and regulators. This notion has become a cornerstone in the discourse on strategic management and business ethics, underscoring the importance of balancing multiple interests for organisational sustainability (Goyal, 2020). From the perspective of stakeholder theory, the integration of green finance, green innovation, and AI ultimately contributes to sustainable investment decisions that no longer consider economic benefits alone but rather also pay attention to social values, the environment, and long-term stakeholder interests (Chen & Lim, 2025; Dhar & Sarkar, 2025; Liu et al., 2025). A clearer elaboration is needed when combining this theory with research constructs, particularly on how stakeholder pressures, expectations, and interests drive the adoption of green finance, the use of AI, and the development of green innovation, ultimately influencing sustainable investment decision-making.

Legitimacy Theory

Legitimacy theory examines how organisational entities strive to ensure that their actions and existence are perceived as "desirable, relevant, or appropriate" by prevailing social norms and values, a crucial prerequisite for survival and growth. While this analytical lens has made substantial contributions to explaining how organisations interact with their ecosystems, the existing literature often examines it discretely or explores only a small portion of the dynamic interconnections (Baba, 2024). From the perspective of legitimacy theory, the integration of green finance, green innovation, and AI can influence sustainable investment decisions, as investors are increasingly taking into account environmental legitimacy, sustainability credibility, and corporate innovative capabilities when making long-term investment decisions (Liu & Wu, 2023; Soewarno et al., 2019). The integration of this theory with conceptual models needs to be elaborated more explicitly, especially regarding how companies use green finance, green innovation, and AI as mechanisms to gain and maintain legitimacy, which, in turn, influences sustainable investment decisions.

Green Finance

A novel financial instrument that connects the economic and environmental sectors is known as green finance. Its primary goal is to cut funding for highly polluting, energy-intensive companies and instead support environmentally friendly companies. Green finance plays a vital role in facilitating clean energy projects and sustainable infrastructure by reducing energy consumption intensity and aligning economic growth with environmental protection (Xu et al., 2024). Previous studies have emphasised that green finance contributes to the mobilisation of funds and capital needed for the green energy transition (Dong et al., 2025; Hossain et al., 2024). Instruments such as green bonds, carbon trading, and sustainable investment are designed to direct capital towards environmentally friendly investments.

Sciarelli et al. (2021) elaborate on this concept by defining socially responsible investment (SRI) as a process that integrates ethical values, environmental protection, improved social conditions, and good governance into traditional investment decision-making. However, various issues persist. Dong et al. (2025) caution that aligning green finance flows with global climate goals is challenging, particularly in ensuring investments reach the sectors and regions that need them the most. Despite increasing awareness of sustainable finance, commitments and

implementation of green finance still vary widely among market participants and asset management firms (Sciarelli et al., 2021). Furthermore, Hossain et al. (2024) highlight that digital finance (DF) expands the role of green finance by increasing diversification and real-time tracking of financial resources, thereby strengthening market stability and financial inclusiveness.

Green Innovation

Green innovation refers to the development and implementation of technologies, products, or processes that minimise negative environmental impacts, including innovations in business and management models that increase resource efficiency and reduce carbon emissions (Chen et al., 2021). It is described as a core element of corporate aspirations that can be enhanced through digital leadership and top management innovation (Zada et al., 2025). In addition, it can be used to generate ideas for action by implementing practices aimed at sustainable development without sacrificing economic, social, and environmental benefits (Hossain et al., 2024). Studies have reported that countries with better access to digital financial services tend to adopt green innovation more quickly. This is because easy access to capital and information enables companies to invest in new, cleaner technologies confidently. Furthermore, countries that allocate more funds to research and development (R&D) also show significant increases in their green innovation (Hossain et al., 2024).

Sustainable Investment Decisions

A sustainable investment decision is an investment decision-making strategy that takes into account Environmental, Social, and Governance (ESG) factors to maximise returns while ensuring long-term sustainability, encouraging investors to consider not only financial gains but also social and environmental impacts (Sciarelli et al., 2021). Currently, sustainable investment decisions are becoming increasingly important amid global pressure for companies to be socially and environmentally responsible.

Artificial Intelligence

An AI-based technology system (AITS) is a new class of digital tools within the context of Industry 4.0 (Torrent-Sellens et al., 2025). Artificial intelligence can process large amounts of data, make predictions based on data patterns, and support efficient decision-making. It encompasses various techniques such as machine learning, data analytics, predictive modeling, robotic process automation, blockchain technology, and natural language processing, enabling systems to learn and adapt without direct human intervention (Hassanein & Tharwat, 2024). In finance and investment, artificial intelligence can improve the quality of risk analysis and portfolio optimisation, as well as accelerate complex decision-making processes. Since it is capable of processing large-scale data quickly and accurately, the use of AI can trigger significant changes in diverse industrial and economic sectors (Torrent-Sellens et al., 2025).

Green Finance and Sustainable Investment Decisions

The implementation of green finance is expected to encourage investors to make more sustainable investment decisions. As a financial instrument that supports environmentally friendly and sustainable projects, green finance provides incentives for investors to consider environmental, social, and governance (ESG) aspects in their investment decision-making (Liu & Wu, 2023). Empirical studies show that green finance plays a major role in increasing investor awareness and commitment to investments that are not only financially profitable but also positively affect the environment and society (Madaleno et al., 2022). In this regard, the relationship between green finance and sustainable investment decisions is positive and significant, where investors are more likely to make desire-oriented investment decisions when green finance is implemented more effectively (Lei & Yu, 2024). Therefore, the first hypothesis is proposed as follows:

H1: Green finance influences sustainable investment decisions.

Green Innovation and Sustainable Investment Decisions

The relationship between green innovation and sustainable investment decisions illustrates how green innovation, including the development of environmentally friendly technologies, products, and processes, can stimulate investor interest in sustainable investments. Green innovation helps companies comply with more stringent environmental regulations and enhances their reputation and competitiveness in a market increasingly concerned with environmental performance (Kuo et al., 2022). The presence of green innovation is an important indicator for investors in assessing the long-term potential and profitability of a company or project (Bataneh et al., 2024). Studies have shown that green innovation positively contributes to sustainable investment decisions by improving corporate environmental performance and reducing operational risks (Le, 2022). In encouraging environmentally responsible investments, the relationship between green innovation and sustainable investment

decisions is synergistic and mutually supportive (Zhao et al., 2023). Thus, the second hypothesis is constructed as follows:

H2: Green innovation influences sustainable investment decisions.

Moderating Effect of Artificial Intelligence on the Effect of Green Finance on Sustainable Investment Decisions

Several studies have indicated that the effects of green finance on sustainable investment decisions can be influenced by other factors that strengthen or weaken this relationship. As an advanced technology, artificial intelligence can improve data analysis and risk prediction, as well as manage ESG information more effectively (Nguyen et al., 2025). By adopting this technology, the sustainable investment decision-making process becomes more accurate and responsive to market dynamics and environmental issues (Wu et al., 2025). Artificial intelligence enables investors and financial institutions to identify green investment opportunities more effectively and manage risks more optimally, thus strengthening the influence of green finance on sustainable investment decisions. Therefore, the third hypothesis is formulated as follows:

H3: Artificial intelligence moderates the effect of green finance on sustainable investment decisions.

Moderating Effect of Artificial Intelligence on the Effect of Green Innovation on Sustainable Investment Decisions

Artificial intelligence also acts as a moderating variable that can strengthen the relationship between green innovation and sustainable investment decisions. This technology supports the development and implementation of green innovation by increasing research and development efficiency, automating production processes, and using predictive analytics to help companies alleviate environmental impacts (Kulkov et al., 2024). With the support of artificial intelligence, companies can implement green innovations that meet market demands and environmental regulations more quickly and accurately, ultimately increasing the attractiveness of sustainable investment (Sipola et al., 2023). In this regard, artificial intelligence strengthens the influence of green innovation on desire-oriented investment decisions. Thus, the fourth hypothesis is proposed as follows:

H4: Artificial intelligence moderates the effect of green innovation on sustainable investment decisions.

To comprehensively evaluate the relationships between the research variables, the conceptual framework of this study is established as follows:

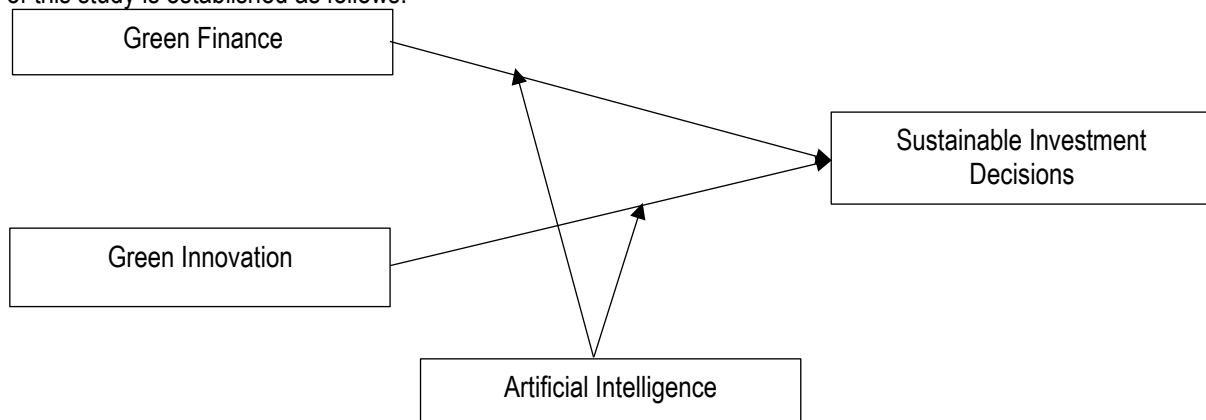


Figure 1. Conceptual Framework

RESEARCH METHODS

Research Design

The study population consisted of non-cyclical consumer sector companies listed on the Indonesia Stock Exchange between 2021 and 2024. Data were collected from the IDX website, individual company websites, and OSIRIS. Purposive sampling was used for sample selection, with inclusion criteria being companies that published their annual reports and financial statements during the research period. This resulted in a sample size of 427 companies. Description of the research samples is presented in Table 1.

Table 1. Description of the Research Sample

Panel A: Sample Selection Process	
Sample Selection Process	Number of Observations
Initial number of observations (firm-year) from 2021–2024	516
Minus: Companies that did not present an annual report	(89)
Minus: Companies that did not release financial statements	(0)
Total observations used	427
Panel B: Sample Distribution by Year	
Year	Number of Observations
2021	91
2022	106
2023	120
2024	110
Total	427

Source: Researcher Data, 2025

Because of the panel data, EViews was utilised in the analyses. The best model was determined among the common effects model (CEM), fixed effects model (FEM), or random effects model (REM) using the Chow test, Hausman test, and Lagrange multiplier test. The regression equations are as follows:

$$SID_{it} = \alpha + \beta GF_{it} + \beta GI_{it} + e$$

$$SID_{it} = \alpha + \beta GF_{it} + \beta GI + \beta AI_{it} + e$$

$$SID_{it} = \alpha + \beta GF_{it} + \beta GI_{it} + \beta AI_{it} + \beta GF_{it} * AI_{it} + \beta GI_{it} * AI_{it} + e$$

where SID denotes sustainable investment decisions; GF stands for green finance; GI refers to green innovation; and AI is artificial intelligence.

Operational Definition of Variables

Dependent Variable

Sustainable Investment Decisions

Making a sustainable investment decision involves considering not only financial aspects but also environmental, social, and governance (ESG) impacts (Bihari et al., 2025). According to Park and Jang (2021), sustainable investment decisions can be assessed using indicators of environmental (carbon emissions and energy efficiency), social (employee welfare and corporate responsibility), and governance (transparency and management integrity) aspects. In this study, each indicator was given a score of "1" if it was disclosed in the annual report and "0" otherwise. The variable of sustainable investment decisions was measured by dividing the number of disclosed indicators by the total number of all indicators.

Independent Variables

Green Finance

Green finance refers to the financing or provision of funds for environmentally friendly investments, directed at both public and private initiatives relating to environmental protection, increased resource efficiency, emission reduction, and environmental risk mitigation (Hu & Gan, 2025). Several indicators can be used to assess green finance, including green credit, green securities, green insurance, green investment, and carbon finance (Chen et al., 2024). In this study, each indicator was given a score of "1" if it was disclosed in the annual report and "0" otherwise. The green finance variable was measured by dividing the number of disclosed indicators by the total number of all indicators.

Green Innovation

Green innovation involves green R&D activities, green process management, and green products and services (Dang & Wang, 2022). It is measurable through analyses of companies' annual reports with the following indicators and ratios: (1) production processes utilising new technologies to reduce energy, water, and waste; (2) products made using more non-polluting or non-hazardous substances (eco-friendly materials); (3) use of environmentally friendly products; and (4) use of recyclable or reconditionable components or materials in the production process (Novitasari & Agustia, 2023). In this study, each indicator was given a score of "1" if it was disclosed in the annual report and "0" otherwise. The green innovation variable was measured by dividing the number of disclosed indicators by the total number of all indicators.

Moderating Variable

Artificial Intelligence

Artificial intelligence is a system that uses algorithms and data to learn, reason, and make decisions independently, mimicking aspects of human cognition (Bunod et al., 2022). The indicators used to assess this variable are: (1) availability of infrastructure and skilled resources needed to adopt AI information processing systems; (2) implementation of artificial intelligence techniques to forecast and predict environmental behaviour; (3) development of statistics, self-learning, and predictions using artificial intelligence techniques; (4) use of artificial intelligence techniques at all levels of the supply chain; and (5) the existence of artificial intelligence results together to inform supply chain decision making (Belhadi et al., 2024). In this study, each indicator was given a score of "1" if it was disclosed in the annual report and "0" otherwise. The artificial intelligence variable was measured by dividing the number of disclosed indicators by the total number of all indicators.

RESULTS AND DISCUSSION

Results

Table 2 shows descriptive statistics for the dependent, independent, and moderating variables. All variables have a minimum score of 0.000, a maximum score of 1.000, and a mean score greater than the standard deviation, indicating that the data are homogeneous.

Table 2. Descriptive Statistics

	Minimum	Maximum	Mean	Std Deviation
GF	0.000	1.000	da0.651752	0.205639
GI	0.000	1.000	0.633423	0.348823
AI	0.000	1.000	0.743396	0.409255
SID	0.000	1.000	0.743396	0.415673

Source: Researcher Data, 2025

The results of Pearson correlation tests for the dependent, independent, and moderating variables are displayed in Table 3. The correlations between green finance and sustainable investment decisions, between green innovation and sustainable investment decisions, and between artificial intelligence and sustainable investment decisions are all positive at a 5% significance level.

Table 3. Pearson Correlation

	GF	GI	AI	SID
GF	1			
GI	0.388**	1		
AI	0.410**	0.427**	1	
SID	0.408**	0.414**	0.979**	1

Source: Researcher Data, 2025

Model selection was conducted to determine the appropriate specification for panel data regression. Table 4 presents the results of panel model tests for the dependent, independent, and moderating variables. Three tests were conducted to compare panel data models. The common effects model (CEM) has been identified as the most appropriate for capturing the relationships between the variables in this study.

Table 4. Panel Model Tests

Test	Prob. Value	Conclusion
Chow Test	0.000	FEM better than CEM
Hausman Test	1.000	REM better than FEM
Lagrange Multiplier Test	0.193	CEM better than REM

Source: Researcher Data, 2025

Based on the results of the panel model tests, the final model used in this study is a common effects model (Pooled OLS). The estimation uses Ordinary Least Squares (OLS), thereby requiring classical assumption tests for multicollinearity, heteroscedasticity, and autocorrelation. This study evaluated a sufficiently large sample, and the statistical inference relied on asymptotic properties rather than strict normality of the residuals. Thus, a normality test was not necessary. Table 5 shows the results of the classical assumption tests for the dependent, independent,

and moderating variables, indicating no multicollinearity, heteroscedasticity, or autocorrelation. Therefore, the proposed hypotheses can be tested.

Table 5. Classical Assumption Tests

Test	Prob. Value	Conclusion
VIF	<10	No multicollinearity
Glejser	0.4852	No heteroscedasticity
Breusch-Godfrey	0.3021	No autocorrelation

Source: Researcher Data, 2025

Table 6 displays the results of the F-tests and t-tests for the dependent, independent, and moderating variables. The F-tests yielded a probability of 0.000 (<5%), indicating a good fit. Thus, t-tests were performed. The result for the green finance variable shows a probability of 0.000 (<5%), supporting H1. Likewise, the result for the green innovation variable reports a probability of 0.000 (<5%). Thus, H2 is also accepted.

Table 6. F Tests and T Tests

Variable	Coef	t-stats	Prob	Conclusion
Constant	-0.159	12.052	0.003	
GF	1.062422	12.41775	0.000***	H1 accepted
GI	0.305736	6.061665	0.000***	H2 accepted

Prob. F Statistic: 0.000

Note: ***1%, **5%, *10% significance

Source: Researcher Data, 2025

The results of the moderation test and adjusted R-squared for the dependent, independent, and moderating variables are presented in Table 7. The first moderation test reveals that artificial intelligence can moderate the effect of green finance on sustainable investment decisions with a probability of 0.056 (<10%), thereby supporting H3. Similarly, the result of the second moderation test suggests that artificial intelligence can moderate the effect of green innovation on sustainable investment decisions with a probability of 0.026 (<5%). Thus, H4 is also accepted. Furthermore, the adjusted R-squared value is 0.955, meaning that the model explains 95.5% of the variance in sustainable investment decisions. Meanwhile, the remaining 4.5% is due to other factors not included in the model.

Table 7. Moderation Tests and Adjusted R-squared

Variable	Coef	t-stats	Prob	Conclusion
Constant	-0.027	-1.963	0.051	
GF	0.038	2.569	0.011	
GI	0.003	0.207	0.836	
AI	0.984	59.145	0.000	
GF*AI	0.024	1.916	0.056*	H3 accepted
GI*AI	0.025	2.236	0.026**	H4 accepted

Adjusted R-Squared: 0.955

Note: ***1%, **5%, *10% significance

Source: Researcher Data, 2025

Discussion

This study examines the moderating role of artificial intelligence on the effects of green finance and green innovation on sustainable investment decisions. The findings confirm that the rapid development of artificial intelligence technology can significantly enhance the effectiveness of green finance and green innovation in driving sustainable investment decisions (Hassanein & Tharwat, 2024). Artificial intelligence has the potential to improve the quality and speed of investment processes that incorporate environmental, social, and governance (ESG) aspects by increasing large-scale data analysis capabilities, predicting risks, and accelerating more accurate and effective decision-making processes (Kwilinski et al., 2025).

Green finance plays a vital role in shifting capital from environmentally damaging sectors to more environmentally friendly companies through various instruments such as green bonds, carbon trading, and sustainable investments (Sciarelli et al., 2025). In this regard, the adoption of artificial intelligence is essential to

optimising such capital allocation by improving the accuracy of risk evaluation and the efficiency of sustainable investment portfolio management (Hassanein & Tharwat, 2024).

Green innovation—which encompasses environmentally friendly technologies, products, and processes—not only minimises the negative impacts of corporate activities on the environment but also boosts company competitiveness and attracts investors interested in sustainable investments (Cheng et al., 2025). Through advanced analytics and process automation, artificial intelligence facilitates green innovation and increases its efficiency (Hassanein & Tharwat, 2024).

Empirical findings in the Indonesian context highlight the importance of artificial intelligence as a catalyst for strengthening the synergy between green finance and green innovation, ultimately making investment decisions that are not only financially profitable but also socially and ecologically responsible (Kwilinski et al., 2025). This is particularly relevant in developing countries like Indonesia, which are striving to optimise the transition to a green economy and financial sustainability while facing various regulatory and infrastructure challenges. The moderating role of artificial intelligence, however, remains underexplored in prior studies, particularly in empirical contexts, necessitating more in-depth and focused research on this topic (Chan & Yung, 2025). Therefore, this study contributes to enriching the academic literature and providing practical insights for companies and policymakers in designing effective AI-based sustainable investment strategies (Elias et al., 2024).

The integration of artificial intelligence into green finance and green innovation is not merely a technological opportunity; it is also a key strategy for addressing global sustainability challenges (Elias et al., 2024). The synergistic combination of these three elements contributes to the optimal and measurable achievement of the triple bottom line (profit, people, planet) and the Sustainable Development Goals (Zada et al., 2025).

CONCLUSION

The rapid development of artificial intelligence technology plays a crucial role in enhancing the effectiveness of green finance and green innovation applications in driving sustainable investment decisions (Hassanein & Tharwat, 2024). Artificial intelligence improves big data analysis capabilities, risk prediction, and decision-making, thus optimising capital allocation to environmentally friendly sectors and increasing the efficiency of sustainable investment portfolio management (Chan & Yung, 2025). Green finance is an innovative tool that shifts capital from polluting sectors to green companies through various instruments such as green bonds and carbon trading. In this regard, artificial intelligence serves as a crucial moderator that links green finance, green innovation, and sustainable investment decisions by boosting corporate competitiveness and attracting ESG-oriented investors through environmentally friendly technologies and processes (Yang et al., 2024).

In the Indonesian context, artificial intelligence is a key catalyst strengthening the synergy between green finance and green innovation, resulting in investment decisions that are not only financially profitable but also socially and environmentally responsible (Cheng et al., 2025). However, there are still limited empirical studies on the moderating role of artificial intelligence, so more in-depth research is needed to enrich the literature and practice of artificial intelligence-based sustainable investment (Kwilinski et al., 2025). The integration of artificial intelligence, green finance, and green innovation is a crucial strategy in supporting the achievement of the triple bottom line (profit, people, planet) and the Sustainable Development Goals (SDGs) to ensure a more optimal and measurable transition to a green economy (Zada et al., 2025).

The findings of this study support stakeholder theory, confirming that artificial intelligence helps companies meet stakeholder demands and reinforces stakeholder trust by providing transparent analytical data, risk prediction, and environmental impact measurement to drive more evidence-based decision-making. The study findings also agree with the legitimacy theory, which holds that the use of artificial intelligence in sustainability reporting, carbon analysis, and data transparency legitimizes the company's commitment to sustainable practices. Furthermore, this study has practical implications for companies to utilise artificial intelligence to present transparent ESG performance reports to investors, governments, and the public. Artificial intelligence can be used in predictive analytics to assess the environmental impact of projects, thus increasing stakeholder trust in company decisions.

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