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Robo-advisors, green finance, and greenwashing: effects on financial performance in the banking sector

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Abstract

Purpose – This study aims to investigate the relationship between robo-advisors, green finance, and banks' financial performance, with greenwashing as a mediating mechanism, in the Indonesian banking sector.

Design/methodology/approach – Using a non-experimental, survey-based design, data were collected from financial, environmental, and operations managers in Indonesian banks and analyzed using partial least squares structural equation modeling (PLS-SEM) to test the hypothesized relationships.

Findings – The results indicate that robo-advisors significantly enhance green finance investment, which subsequently improves banks' financial performance. Green finance also has a direct positive effect on financial performance, while greenwashing mediates this relationship, leading to short-term performance gains.

Originality/value – This study is among the first to empirically examine the interplay between robo-advisors, green finance, and financial performance through greenwashing in the banking sector. The findings advance theoretical understanding and offer actionable insights for managers and policymakers aiming to align technological innovation with sustainable finance.

Keywords Robo-advisors, Green finance, Greenwashing, Financial performance

Paper type Research article

1. Introduction

Over the past decade, the rapid advancement of digitization, automation, and data-driven technologies has fundamentally transformed the financial services industry. One of the most notable developments within this transformation is the emergence of financial technology (FinTech), which integrates artificial intelligence (AI) and big data analytics to deliver more efficient and innovative financial solutions compared to traditional practices (Barile *et al.*, 2026; Chen *et al.*, 2025b). Within this evolving ecosystem, robo-advisors have gained significant attention as a disruptive innovation in investment management. Unlike conventional advisory services, robo-advisors provide automated, algorithm-driven financial recommendations that assist investors in setting financial goals, evaluating risk tolerance, and managing diversified portfolios in real time (Belanche *et al.*, 2019; Hildebrand and Bergner, 2021). Drawing on insights from behavioral finance, which suggest that investment decisions are often influenced by cognitive biases and emotional factors, robo-advisors are increasingly viewed as tools that enhance decision-making by offering objective, consistent, and transparent investment guidance (Oehler *et al.*, 2022; Zhu *et al.*, 2025).

Recent studies have begun to extend this line of inquiry into the domain of sustainable finance, demonstrating that robo-advisors can facilitate environmentally responsible investment decisions by integrating environmental, social, and governance (ESG) criteria into portfolio management (Barile *et al.*, 2026; Kaur *et al.*, 2026; Chen *et al.*, 2025a). These contributions highlight the growing relevance of AI-driven financial technologies in advancing sustainable investing and improving access to green financial instruments.

Despite these advancements, the literature remains fragmented in explaining the mechanisms through which robo-advisors influence green finance outcomes, particularly

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within specific institutional and sectoral contexts. While green finance has attracted substantial scholarly and policy attention as a mechanism to support environmentally sustainable projects, such as renewable energy, green infrastructure, and clean technologies, there is still limited empirical evidence examining how robo-advisory systems interact with organizational practices and market dynamics to shape green finance outcomes, especially in emerging economies (Darsono *et al.*, 2025; Siddik *et al.*, 2024; Wang *et al.*, 2023). By channeling capital into sustainable ventures, green finance contributes to reducing carbon emissions, promoting inclusive economic growth, and addressing global environmental challenges (Kumar *et al.*, 2024; Shahzad *et al.*, 2024). Motivated by the Sustainable Development Goals (SDGs), many governments and corporations have introduced financial instruments such as green bonds and sustainability-linked loans to institutionalize environmental and social responsibility (Alhemimah *et al.*, 2025; Darsono *et al.*, 2025; Vardar *et al.*, 2025). As a result, academic interest in green finance has grown rapidly, highlighting its importance as both a strategic and ethical priority in modern financial systems.

However, the expansion of green finance also introduces inherent risks. The growing emphasis on environmental sustainability may encourage firms to overstate their environmental commitments, leading to misleading claims about sustainability performance, commonly referred to as greenwashing (Ferrón-Vílchez *et al.*, 2021). Greenwashing is defined as the deliberate dissemination of false or exaggerated environmental information to project a socially responsible image without implementing substantive changes (Delmas and Burbano, 2011). Prior research indicates that greenwashing increases information asymmetry, undermines stakeholder trust, and damages corporate reputation (Ali *et al.*, 2026; Heras-Saizarbitoria *et al.*, 2020; Li *et al.*, 2023). Importantly, recent studies have conceptualized greenwashing as a mediating mechanism linking sustainability initiatives to firm outcomes (e.g. Zhang, 2023a; Wang and Tian, 2025), suggesting that the effectiveness of green finance may depend on the extent to which firms engage in opportunistic disclosure practices. Thus, while green finance is intended to enhance corporate value and sustainability, it may also be exploited to generate short-term financial gains, ultimately undermining long-term firm performance (Zhang, 2023a; Wang and Tian, 2025).

Building on this background, this study investigates the role of robo-advisors in promoting green finance and examines how this relationship influences financial performance, with greenwashing acting as a mediating mechanism. Our study extends prior research by integrating insights from robo-advisory technologies, green finance, and greenwashing into a unified empirical framework. Existing research on robo-advisors has primarily focused on adoption factors, user trust, and behavioral barriers among retail investors (Chen *et al.*, 2025b; Eren, 2024; Roongruangsee *et al.*, 2025), while emerging studies on sustainable investing have yet to systematically examine the downstream financial implications of robo-advisory-driven green finance or the role of robo-advisors in advancing sustainable finance. Similarly, although prior studies have examined either the relationship between green finance and financial performance (Hussain *et al.*, 2024; Maqbool and Zamir, 2021) or the consequences of greenwashing on firm outcomes (Lee and Raschke, 2023; Li *et al.*, 2023), limited attention has been given to how greenwashing operates as an intervening mechanism in the FinTech–green finance–performance nexus, particularly within the banking sector.

Furthermore, this study focuses on the Indonesian banking sector, which provides a distinctive institutional context characterized by rapid FinTech adoption, evolving green finance regulations, and increasing regulatory emphasis on sustainable financial systems. Compared to more mature markets such as China and Europe (Barile *et al.*, 2025; Wang and Tian, 2025), Indonesia represents an emerging economy where digital financial infrastructure and green finance practices are still developing (Darsono *et al.*, 2026), making it a theoretically relevant setting to examine how technological innovation interacts with institutional

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conditions to shape sustainability outcomes. Accordingly, this study addresses the following research questions:

RQ1. To what extent do robo-advisors directly influence green finance?

RQ2. To what extent does green finance affect financial performance?

RQ3. To what extent does greenwashing mediate the relationship between green finance and financial performance?

To answer these questions, we analyze data from 515 managers of branch firms selected from the InfoBank15 Index. The findings reveal that robo-advisors significantly enhance green finance practices, which in turn improve financial performance. However, greenwashing partially mediates this relationship, weakening the positive impact of green finance on firm outcomes. These results underscore the dual role of FinTech as both an enabler of sustainable finance and a context in which opportunistic environmental claims may undermine long-term value creation.

This study makes several contributions to the literature. First, it extends prior research on robo-advisors by examining their role in shaping green finance outcomes within the banking sector, moving beyond the dominant focus on intention to adopt (Chen *et al.*, 2025a; Kaur *et al.*, 2026). Second, it builds on existing greenwashing literature by positioning greenwashing as a mediating mechanism in the relationship between green finance and financial performance, thereby offering a more nuanced explanation of how sustainability initiatives translate into firm outcomes (Zhang, 2023a; Wang and Tian, 2025). Finally, by focusing on Indonesia, this study provides empirical evidence from an underexplored emerging market context, enhancing the generalizability of FinTech and sustainability research (Darsono *et al.*, 2026).

The remainder of this paper is structured as follows. Section 2 presents the theoretical foundations and develops the study's hypotheses. Section 3 outlines the research methods, while Section 4 reports the empirical results. Finally, Section 5 concludes with a comprehensive discussion, highlighting the theoretical and practical implications of the findings, along with avenues for future research.

2. Theoretical background and hypotheses

2.1 Agency theory

Agency theory provides a theoretical foundation for understanding the strategic behavior of managers in the context of green finance and financial performance. According to agency theory, there is a separation between principals (e.g. shareholders and investors) and agents (e.g. managers), where differing objectives and information asymmetry can lead to opportunistic behavior (Jensen and Meckling, 2019). In the domain of green finance, managers are responsible for implementing sustainability initiatives and communicating environmental performance to stakeholders (Galloppo *et al.*, 2026). However, because investors cannot directly observe the true extent of these activities, managers may exploit this information gap to present an overly favorable image of the firm's environmental commitment (Jensen and Meckling, 2019). This creates conditions under which green finance initiatives may not always reflect genuine sustainability efforts, but rather strategic positioning aimed at securing financial or reputational benefits.

In this context, the adoption of robo-advisors and digital financial technologies can partially mitigate agency problems by enhancing transparency, standardization, and data availability (Belanche *et al.*, 2019; Eren, 2024). Robo-advisors rely on algorithmic decision-making and ESG-related data, which can reduce human bias and limit managerial discretion in presenting environmental information (Cardillo and Chiappini, 2024; Hong *et al.*, 2023). By improving the quality and accessibility of sustainability-related data, these technologies enable investors to better monitor firm behavior and make more informed decisions regarding

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green investments. As a result, the integration of robo-advisors into green finance systems can strengthen the alignment between managerial actions and shareholder interests, thereby improving financial performance through more efficient capital allocation (Barile *et al.*, 2026; Galloppo *et al.*, 2026).

However, agency theory also explains why greenwashing may persist despite these technological advancements. Managers may still have incentives to engage in opportunistic disclosure practices to maximize short-term gains, such as attracting green investment or improving firm valuation, even if such actions are not supported by substantive environmental performance (Jensen, 2005). In this context, greenwashing serves as a strategic tool used by agents to manipulate stakeholder perceptions under conditions of incomplete monitoring (Sun *et al.*, 2025; Zhang *et al.*, 2025). Although this behavior may yield short-term benefits, it can ultimately weaken the effectiveness of green finance by eroding trust and increasing the risk of misallocation of resources (Wang *et al.*, 2025). Therefore, agency theory provides a critical explanation for the mediating role of greenwashing in the relationship between green finance and financial performance, highlighting the tension between managerial incentives and long-term sustainability outcomes.

2.2 Robo advisors and green finance

AI has transformed the financial services sector by enabling faster, smarter, and more adaptive decision-making processes that go beyond traditional human limitations (Belanche *et al.*, 2019; Lee *et al.*, 2026). Through expert systems, machine learning, and deep learning, AI can replicate human reasoning while overcoming constraints such as limited analytical capacity or cognitive biases (Huang and Rust, 2022). In finance, this technological capability is exemplified by robo-advisors, which autonomously design and manage investment portfolios tailored to investors' goals, financial conditions, and risk preferences (Aw *et al.*, 2024). These platforms can perform essential functions such as portfolio diversification, rebalancing, and tax optimization while continuously learning from user behaviors to refine investment strategies (Chen *et al.*, 2025b). Beyond efficiency, robo-advisors also enhance accessibility, allowing a wider pool of investors to receive professional-grade financial advice at lower costs.

In recent years, robo-advisors have increasingly been linked to sustainable finance, particularly as financial markets emphasize investments that align with environmental and social responsibility (Barile *et al.*, 2025). Green finance encompasses investment and financing activities directed toward environmentally beneficial projects, such as renewable energy, carbon reduction, and sustainable infrastructure. FinTech innovations like robo-advisors can serve as a catalyst for channeling funds toward these initiatives by helping investors identify credible sustainable options (Barile *et al.*, 2026).

From an agency theory perspective, robo-advisors can reduce information asymmetry between investors (principals) and financial intermediaries or managers (agents) by enhancing transparency, standardization, and data-driven decision-making (Jensen and Meckling, 2019). By relying on algorithmic processes and ESG-related data, robo-advisors limit managerial discretion and opportunistic behavior, thereby improving the credibility of green investment decisions (Galloppo *et al.*, 2026). This increased transparency can strengthen investor trust and facilitate greater allocation of capital toward genuine sustainable projects. Based on these arguments, we hypothesize:

H1. Robo-advisors have a positive direct effect on green finance.

2.3 Green finance and financial performance

Green finance refers to the deliberate allocation of capital toward projects, services, and investment products that promote ecological sustainability and contribute to mitigating climate risks (Chang *et al.*, 2024; Gao *et al.*, 2024). It represents an evolving financial

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paradigm where environmental considerations are systematically embedded into financial decision-making (Siddik *et al.*, 2024; Wang *et al.*, 2024). The scope of green finance extends beyond traditional investment instruments, encompassing green bonds, sustainable lending, and sustainability-linked financing (Hidayat-ur-Rehman and Hossain, 2025). Green bonds, for instance, channel funds toward renewable energy, waste management, and clean transportation projects, while sustainable lending mechanisms provide preferential access to capital for businesses that implement environmentally responsible practices (Tong *et al.*, 2022; Zhang, 2023b). These mechanisms collectively function to redirect capital flows toward entities that demonstrate credible commitments to sustainability, thereby reinforcing a financial ecosystem that rewards responsible corporate behavior (Khan *et al.*, 2024).

From a performance standpoint, green finance initiatives can strengthen firms' competitiveness and resilience by enhancing resource efficiency, reducing regulatory and reputational risks, and unlocking new growth opportunities in emerging sustainable markets (Lei and Yu, 2024; Maqbool and Zamir, 2021; Siddik *et al.*, 2024). Financial institutions and firms that actively pursue green strategies may also experience improved stakeholder trust and loyalty, as sustainability is increasingly viewed as a marker of long-term viability and ethical conduct (Kumar *et al.*, 2024). Moreover, adopting green finance practices can enhance transparency and accountability, since institutions are often required to disclose both sustainability progress and financial outcomes, fostering a virtuous cycle of credibility and performance (Hussain *et al.*, 2024). Such practices not only appeal to investors with sustainability preferences but also help organizations secure government incentives or preferential financing conditions, further strengthening their financial standing (Wang *et al.*, 2024).

Agency theory suggests that green finance can reduce conflicts of interest between managers (agents) and investors (principals) by aligning financial incentives with long-term sustainability objectives (Jensen, 2005). The requirement to disclose environmental performance, combined with increasing stakeholder scrutiny, constrains managerial opportunism and promotes more responsible decision-making (Jensen and Meckling, 2019). Consequently, firms that engage in genuine green finance practices are more likely to achieve superior financial performance through enhanced transparency, reduced information asymmetry, and greater investor confidence. Hence, the following hypothesis is formulated:

H2. Green finance has a positive direct effect on financial performance.

2.4 Greenwashing as a mediator between green finance and financial performance

Greenwashing refers to a firm's attempt to misrepresent or exaggerate its environmental initiatives to create a false perception of sustainability (de Vries *et al.*, 2015; Ferrón-Vílchez *et al.*, 2021). While intended to enhance a company's image, such practices can undermine authentic sustainability efforts by diminishing credibility and weakening stakeholder trust. In the context of green finance, greenwashing can distort the true value of firms' sustainability initiatives, as investors may view these practices with suspicion or skepticism (Bernini and La Rosa, 2024; De Novellis *et al.*, 2025; Venturelli *et al.*, 2025). As environmental concerns become more salient among investors and regulators (Neves Proença *et al.*, 2026), some firms may be tempted to rely on symbolic actions rather than substantive changes, even when their claims do not align with reality (Delmas and Burbano, 2011). Although greenwashing can sometimes generate short-term financial benefits, such as boosting investor interest and improving market valuation (Luhgiatno *et al.*, 2026), its long-term effects are often detrimental, leading to reputational damage, stricter regulations, and erosion of investor confidence (Li *et al.*, 2023; Torelli *et al.*, 2020).

From a financial performance perspective, the impact of greenwashing is therefore complex. On the one hand, when stakeholders do not immediately detect misrepresentation, firms may temporarily enjoy higher returns, as green finance initiatives appear credible and

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attractive (Li *et al.*, 2023). On the other hand, once investors or regulators uncover such practices, they tend to penalize the firm through divestment, reduced capital access, and declining share value (Huang *et al.*, 2025a; Santos *et al.*, 2024). This suggests that greenwashing may act as a channel through which green finance initiatives initially strengthen but later weaken financial performance, depending on how long stakeholders remain unaware of the misrepresentation. Ultimately, persistent reliance on greenwashing undermines the intended financial and reputational advantages of genuine green finance.

Agency theory provides a clear explanation for this mechanism. Under conditions of information asymmetry, managers (agents) may engage in greenwashing to present an inflated image of environmental performance, thereby attracting investment and enhancing short-term financial outcomes (Galloppo *et al.*, 2026; Luhgiatno *et al.*, 2026). However, as monitoring improves and information becomes more transparent, such opportunistic behavior is more likely to be detected, resulting in negative market reactions and reduced firm value. This dynamic highlights how greenwashing operates as a mediating mechanism through which green finance influences financial performance, reflecting the tension between managerial incentives and long-term stakeholder interests (Jensen and Meckling, 2019). Accordingly, we argue that greenwashing plays a mediating role in shaping how green finance influences corporate financial outcomes. On the basis of these insights, the following hypothesis is posited:

H3. Green finance has a positive indirect effect on financial performance through greenwashing.

Figure 1 provides an overview of the theoretical framework developed for this study.

3. Research design

3.1 Sample and data collection

This research employed a non-experimental, quantitative methodology, wherein data were gathered using a survey approach, consistent with the passive nature of field-based social research (Aguinis, 2024; Malhotra, 2020). To collect empirical data, the study utilized Qualtrics, a commercial-grade survey platform recognized for its secure infrastructure and

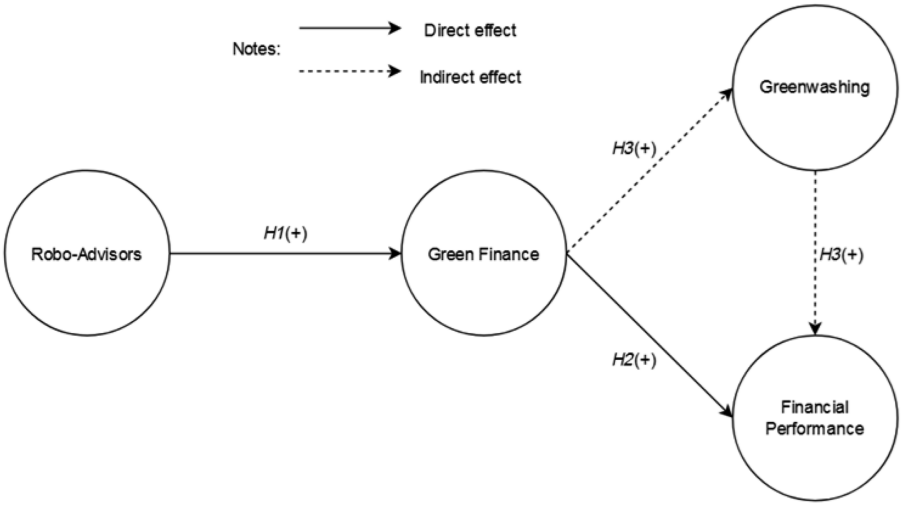


Figure 1. Path diagram of the theoretical framework illustrating relationships among latent constructs.
Source(s): Developed by the authors

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customizability, making it particularly suitable for academic and institutional research (Boas *et al.*, 2020; Owens and Hawkins, 2019). A purposive sampling technique was used to identify participants based on their organizational profiles and job positions.

Eligible firms were selected using the InfoBank15 Index from the Indonesia Stock Exchange, with inclusion criteria based on active involvement in green financing, the use of robo-advisors, and ESG report disclosure within the last three fiscal years. This process yielded a list of 829 eligible branch firms, all of which were invited to participate. The survey targeted senior-level finance professionals, including financial, operational, and environmental managers. Prior to data collection, ethics approval was secured, and electronic informed consent was obtained to ensure voluntary participation and confidentiality (Aguinis, 2024; Saunders *et al.*, 2023). The survey was conducted between May and June 2025.

To minimize potential biases commonly associated with self-reported data, procedural remedies were incorporated into the survey design. These included randomizing the order of items, separating predictor and outcome variables, among other techniques (Podsakoff *et al.*, 2024). At the end of the data collection period, a total of 515 valid responses were obtained. An initial data audit did not identify any incomplete or patterned responses (Wulff *et al.*, 2023). A statistical power analysis using G*Power 3 confirmed the adequacy of the sample. With a power level of 0.95, an effect size of 0.15, and three primary predictors, the minimum required sample size was 119, indicating that the collected sample size was more than sufficient for robust analysis.

Regarding respondent demographics (Cox and Holcomb, 2022), the gender distribution was relatively balanced, with 60.58% male and 39.42% female participants. Most respondents had considerable professional experience: 49.13% reported 18–25 years, 29.32% had 9–17 years, and 14.95% had over 25 years. A majority held a bachelor's degree (71.65%), followed by those with a master's degree (14.37%) and doctoral degree (8.93%). The most represented age group was 39–46 years (51.15%), reflecting the seniority level of the target population (see Table 1 for details).

Table 1. Demographic distribution of survey participants

Characteristic	Category	Frequency (*f*)	Proportion (%)
Gender	Male	312	60.58%
	Female	203	39.42%
Education level	High school, equivalent diploma	26	5.05%
	Bachelor's degree	369	71.65%
	Master's degree	74	14.37%
	Doctorate	46	8.93%
Professional experience	Less than 8 years	34	6.60%
	9–17 years	151	29.32%
	18–25 years	253	49.13%
	More than 25 years	77	14.95%
Age	30 years or less	29	5.63%
	31–38 years	123	23.88%
	39–46 years	284	55.15%
	47 years or more	79	15.34%
Job position	Environmental manager	129	25.05%
	Operations manager	178	34.56%
	Financial manager	208	40.39%

Source(s): Developed by the authors

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3.2 Instrument and scale

All measurement instruments used in this study were derived from previously established scales in the literature. The initial pool of items, originally written in English, underwent a professional translation process by an Indonesian-speaking researcher with expertise in both finance and linguistics. This was done to ensure semantic equivalence and cultural appropriateness in the phrasing (Haws *et al.*, 2023).

To assess item clarity and interpretability, a small-scale cognitive test was conducted with three professionals. Feedback from this step informed several refinements in wording, structure, and item flow, enhancing both face and content validity (Aguinis, 2024; Malhotra, 2020). Additionally, a pilot study involving 58 postgraduate students was conducted to evaluate the psychometric robustness of the measurement items. The results showed strong internal consistency, with all constructs achieving Cronbach's alpha values above 0.741 and factor loadings exceeding the accepted thresholds (see Table 2 for details). Before full deployment, the survey underwent a quality control process to minimize ambiguity in item phrasing, reduce potential response bias, and ensure consistency in scale formatting.

Responses were collected using a 7-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). Four primary constructs were measured in the final instrument. First, robo-advisors were assessed using three indicators adapted from Oehler *et al.* (2022). Second, green finance was measured using four items adapted from Siddik *et al.* (2024). Third, greenwashing was captured with four indicators adapted from Ferrón-Vílchez *et al.* (2021). Lastly, financial performance was measured using five indicators adapted from Paulraj (2011).

3.3 Method of analysis

To analyze the proposed model and assess the relationships among latent variables, this study employed partial least squares structural equation modeling (PLS-SEM). This variance-based technique is particularly advantageous for exploratory studies, complex models, or when theoretical development is still emerging. Unlike covariance-based SEM (CB-SEM), which prioritizes model fit and parameter consistency, PLS-SEM emphasizes prediction-oriented research (Henseler, 2021; Cook and Forzani, 2024). PLS-SEM was chosen for this study due to its flexibility in handling non-normal data distributions, its suitability for medium-sized samples, and its effectiveness in addressing uncertainty in the relationships among latent variables (Rigdon *et al.*, 2020).

4. Results

4.1 Preliminary data analysis

Prior to conducting full model analysis using PLS-SEM, several preliminary checks were undertaken to ensure data quality and statistical assumptions. Given that PLS-SEM does not require multivariate normality, normality diagnostics were performed primarily to understand the distributional characteristics of the data. The Cramér–von Mises test indicated some deviations from normality ($p < 0.05$), reinforcing the appropriateness of PLS-SEM for this study. To address potential concerns arising from non-normal data, a non-parametric bootstrapping procedure with 10,000 resamples was applied to generate robust standard errors and confidence intervals, as recommended by Streukens and Leroi-Werelds (2016) for variance-based SEM under non-normal conditions.

Outlier screening was also performed to ensure the reliability of the dataset. Each observation was checked using standardized *Z*-scores, and all fell within the acceptable ± 2.58 range, suggesting no extreme values that could distort the results (Wooldridge, 2020). To further verify the assumption of homoscedasticity, a residual-based chi-square test was performed, which did not reveal any significant irregularities, confirming that error variance remained consistent across predicted values.

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Table 2. Measurement results pertaining to the reliability and validity of each construct

Survey item	Indicator	FactL	StdLoad	AVE	MaxSVar	AvgSVar	ω	ρ_c
A) Robo-Advisors (Source: Adapted from Oehler *et al.*, 2022*)*				0.660	0.184	0.162	0.853	0.853
Our firm utilizes robo-advisors that recommend investment options aligned with our environmental and sustainability objectives	RBA1	0.750	0.765					
The robo-advisory tools employed by our firm effectively identify environmentally responsible investment portfolios while maintaining financial viability	RBA2	0.827	0.815					
Our firm has confidence in the robo-advisor's capability to prioritize green investment opportunities that support our sustainability agenda	RBA3	0.857	0.854					
B) Green Finance (Source: Adapted from Siddik *et al.*, 2024*)*				0.609	0.318	0.254	0.862	0.862
Our firm is dedicating more funds to support renewable energy development	GFN1	0.765	0.773					
We are enhancing our financial commitment to alternative energy initiatives	GFN2	0.811	0.801					
We are raising our investment in waste management systems and eco-brick manufacturing	GFN3	0.803	0.810					
We are channeling greater financial resources into advancing the green sector	GFN4	0.742	0.736					
C) Greenwashing (Source: Adapted from Ferron-Vílchez *et al.*, 2021*)*				0.648	0.323	0.229	0.880	0.880
Our firm communicates vague or unclear statements about its approach to environmental responsibility	GRW1	0.742	0.734					
Our firm shares environmental claims that cannot be independently substantiated	GRW2	0.799	0.799					
Our firm tends to overstate its environmental accomplishments to appear more eco-friendly than it actually is	GRW3	0.812	0.813					
Our firm highlights certain green initiatives while withholding information about its harmful environmental impacts	GRW4	0.862	0.867					
D) Financial Performance (Source: Adapted from Paulraj, 2011)				0.664	0.271	0.207	0.908	0.908

(*continued*)

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Table 2. Continued

Survey item	Indicator	FactL	StdLoad	AVE	MaxSVar	AvgSVar	ω	ρ_c
Our firm has consistently achieved its financial goals over the past fiscal year	FNP1	0.782	0.805					
Compared to competitors, our firm has maintained strong revenue growth	FNP2	0.843	0.850					
Our firm has demonstrated steady improvement in return on investment (ROI)	FNP3	0.846	0.844					
The firm has effectively controlled operational costs while sustaining profitability	FNP4	0.809	0.796					
Our firm's financial performance has strengthened shareholder value over time	FNP5	0.794	0.776					

Note(s): FactL reflects the results of factor analysis; StdLoad refers to the standardized factor loading values; AVE indicates the average variance extracted; MaxSVar represents the maximum shared variance; AvgSVar denotes average shared variance; ω signifies McDonald's Omega coefficient; ρ_c refers to composite reliability

Source(s): Developed by the authors

Descriptive statistics revealed that the mean scores for all latent variables were less than five, and the standard deviation (SD) values were all below two. These results were within the acceptable limits outlined by Murphy (2021). To test for multicollinearity, both pairwise correlations and variance inflation metrics were examined. Inter-variable correlations were modest, remaining under 0.564, and the corrected variance inflation factor (cVIF) values were comfortably below the commonly accepted cutoff of 3.3, suggesting that collinearity among predictors was not problematic (Lindner *et al.*, 2022). Additional details are provided in Table 3.

4.2 Bias diagnostics

To ensure the integrity of the data and reduce the risk of procedural artifacts, we implemented diagnostic procedures for two common sources of measurement error: non-response bias and common method variance (CMV). In the case of non-response bias, the timing of survey

Table 3. Analysis of discriminant validity, descriptive data, and correlations across latent constructs

Latent construct	1	2	3	4
Financial Performance	*(0.850)*	0.520**	0.449**	0.399**
Green Finance	0.627	*(0.850)*	0.564**	0.396**
Greenwashing	0.767	0.703	*(0.850)*	0.419**
Robo-Advisors	0.495	0.521	0.540	*(0.850)*
Mean	5.075	4.872	5.037	5.414
Standard Deviation (SD)	1.143	1.239	1.182	1.198
Corrected Variance Inflation Factor (cVIF)	–	1.468	1.468	1.000
Cramér–von Mises test	0.000	0.000	0.000	0.000

Note(s): HTMT values are displayed beneath the diagonal, while correlation coefficients are presented above it. italic figures along the diagonal indicate the HTMT threshold benchmarks. ** All correlations between constructs are statistically significant at the 0.01 level (two-tailed)

Source(s): Developed by the authors

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submission was used as a proxy variable. Respondents were divided into early and late groups, and mean comparisons across the main study variables were conducted. The absence of statistically significant differences between these two groups ($p > 0.05$) suggested that the likelihood of non-response bias affecting the results was minimal, as also supported in recent methodological literature (Huang, 2025; Oscarsson and Arkhede, 2020).

For CMV, the study adopted a proactive ex-ante strategy by integrating a theoretically irrelevant item into the questionnaire, a method endorsed by Miller and Simmering (2023). This marker variable was designed to be conceptually unrelated to the core constructs under investigation (Merkle, 2025). Correlational analysis showed that this marker exhibited no meaningful relationship with the primary variables ($r < 0.1$), well below the threshold of concern. These results imply that any inflation in the observed relationships due to shared method bias was unlikely, thereby reinforcing the validity of the construct measures.

4.3 Construct validity assessment

The study assessed convergent validity by examining item loadings and the average variance extracted (AVE) to determine whether the indicators effectively represented their underlying constructs. While Bandalos (2018) acknowledges that loading values exceeding 0.50 may suffice in early-stage research, more stringent recommendations by Roos and Bauldry (2022) suggest a cutoff of 0.70 for established studies. In this analysis, item loadings ranged from 0.734 to 0.867, and all AVE values met or exceeded the 0.50 threshold, indicating satisfactory convergence of items toward their respective constructs (see Table 2 for details).

For discriminant validity, the analysis drew on multiple diagnostic indices, including the heterotrait–monotrait ratio (HTMT), as well as comparisons between average and maximum shared variances versus AVE scores. The AVE for each construct was found to be greater than both its average shared variance (ASV) and maximum shared variance (MSV), satisfying key discriminant validity conditions. Additionally, all HTMT values—reported below the diagonal in Table 3—remained comfortably below the conservative threshold of 0.85, with none of their associated confidence intervals crossing the value of 1.0 (Rönkkö and Cho, 2022). These findings confirm that each construct maintains sufficient distinction from the others in the measurement model (Shaffer *et al.*, 2016).

4.4 Reliability of constructs

To assess the reliability of the measurement constructs, the study employed two widely accepted indicators: McDonald's Omega (ω) and composite reliability (ρ_c). These indices provide a more accurate estimate of internal consistency than Cronbach's alpha, especially for constructs with unequal item loadings. According to the thresholds recommended by Nunnally and Bernstein (1994), values above 0.70 are considered satisfactory. As reported in Table 2, both reliability metrics exceeded the recommended minimums across all latent variables. Specifically, McDonald's ω and ρ_c values ranged from 0.853 to 0.908. These figures confirm that the scale items consistently capture the intended constructs, indicating a high degree of internal consistency across the measurement model.

4.5 Assessing explanatory power

To evaluate the model's explanatory power, this study assessed the extent to which the independent variables accounted for variance in the dependent constructs by examining the coefficient of determination (R^2) values. Specifically, the model explained 16.1% of the variance in green finance, 31.9% of the variance in greenwashing, and 46.6% of the variance in financial performance, indicating a moderate level of predictive strength (Cohen *et al.*, 2003). While these R^2 values do not capture the full complexity of the phenomena under study, they reflect an acceptable level of explanatory adequacy in the context of organizational research,

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where high levels of explained variance are often difficult to achieve due to the multifaceted nature of relationships among variables.

4.6 Hypothesis evaluation

4.6.1 Assessment of direct effect. The results of the hypothesis testing provide empirical support for the proposed relationships between robo-advisors and green finance, as well as between green finance and financial performance. As detailed in Table 4 and visualized in Figure 2, the standardized path coefficients were $\beta = 0.402$ ($p < 0.001$) and $\beta = 0.222$ ($p < 0.001$), respectively, indicating strong and statistically significant associations. Furthermore, the robustness of these relationships is confirmed by the 95% bias-corrected confidence intervals: [0.317; 0.472] and [0.148; 0.294], both of which lie entirely above zero. These intervals reinforce the validity of the findings, suggesting that robo-advisors play a crucial role in influencing green finance decisions, which ultimately enhance financial performance. Based on this evidence, H1 and H2 are empirically supported.

4.6.2 Assessment of indirect effect. The third hypothesis (H3) explores whether greenwashing functions as a mediating mechanism in the pathway from green finance to financial performance. The empirical analysis reveals a statistically significant association between green finance and greenwashing ($\beta = 0.565$, $p < 0.001$), as well as between greenwashing and financial performance ($\beta = 0.532$, $p < 0.001$), indicating that greenwashing may serve as an explanatory bridge between the two constructs. The estimated indirect effect of green finance on financial performance through greenwashing was $\beta = 0.300$, with a 95% bias-corrected confidence interval of [0.249; 0.355]. This outcome affirms the presence of a meaningful mediating effect. Accordingly, the findings lend strong empirical support to H3, confirming that greenwashing plays a pivotal intermediary role in amplifying the financial outcomes of green finance initiatives.

4.7 Model robustness

To ensure the reliability of the model estimations and to minimize potential sources of analytical distortion, this study conducted several robustness checks. One of these assessments involved testing for endogeneity, which can stem from reverse causality, omitted variables, or measurement errors. The Gaussian copula approach (Liengaard *et al.*, 2025) was employed for this purpose. The analysis revealed no statistically significant copula terms ($p > 0.05$), suggesting that endogeneity bias did not affect the accuracy of the estimated parameters.

5. Discussion

Although a growing number of studies have explored the drivers of intention to use AI-powered robo-advisors (i.e. Chen *et al.*, 2025a; Roongruangsee *et al.*, 2025), empirical work investigating the interconnections between robo-advisors, green finance, and financial performance, particularly with greenwashing as a mediating mechanism, remains scarce. This gap is especially evident in the Indonesian banking sector, where interest in robo-advisors is steadily increasing. Our study sheds light on this underexplored domain by showing that robo-advisors represent not only an alternative to human financial advisors but also a strategic tool that can stimulate interest in green financial products. More specifically, we demonstrate that the use of robo-advisors can act as a catalyst, encouraging investors to allocate funds toward green finance offerings (Barile *et al.*, 2026; Luo *et al.*, 2024). From an economic perspective, this mechanism contributes to more efficient capital allocation by directing financial resources toward environmentally sustainable investments with long-term value potential. In addition, consistent with agency theory, robo-advisors can reduce information asymmetry between investors (principals) and financial intermediaries (agents), thereby improving transparency and investment decision quality. At the same time, we examine how green finance influences banks' financial performance directly and indirectly through greenwashing (Lee and Raschke,

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Table 4. Results of the tested hypotheses

Relationships between latent constructs	*UnStd β*	*Std β*	SD	f^2	Sig. Level	*t*-value	BCa CI (95%)	Conclusion
Direct effect								
Robo-Advisors → Green Finance	0.624	0.402	0.047	0.192	0.000^{***}	8.566^{***}	[0.317; 0472.]	H1 accepted
Green Finance → Financial Performance	0.224	0.222	0.044	0.163	0.000^{***}	5.039^{***}	[0.148; 0.294]	H2 accepted
Indirect effect								
Green Finance → Greenwashing → Financial Performance	0.441	0.300	0.032	0.260	0.000^{***}	9.284^{***}	[0.249; 0.355]	H3 accepted

Note(s): UnStd β refers to the unstandardized beta coefficient; Std β represents the standardized beta estimate; SD stands for standard deviation; BCa corresponds to the bootstrap confidence interval using the bias-corrected and accelerated method. Significance is denoted as follows: $^{*}|t| \geq 1.65$ for $p < 0.05$; $^{**}|t| \geq 2.33$ for $p < 0.01$; $^{***}|t| \geq 3.09$ for $p < 0.001$

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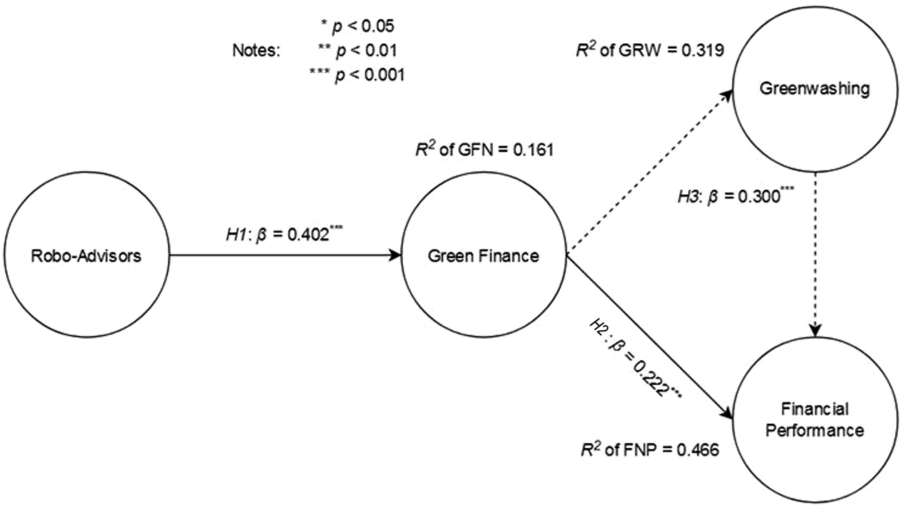


Figure 2. SEM path diagram illustrating standardized beta values and *p*-levels for latent constructs.
Source(s): Developed by the authors

2023), thereby moving the debate from simply asking what drives adoption to when and under what conditions these mechanisms yield meaningful outcomes.

The empirical results provide strong support for all proposed hypotheses. First, our findings confirm that the use of robo-advisors significantly contributes to the growth of green finance. This suggests that by lowering barriers to entry, enhancing transparency, and reducing transaction costs, robo-advisors can encourage investors to channel their resources into sustainable projects. Such cost efficiencies and information transparency reduce market frictions and improve investment decision quality, thereby enhancing overall market efficiency. These findings are consistent with prior research emphasizing the complexity and credence qualities of financial advisory services, where service quality is difficult for clients to evaluate (Oehler *et al.*, 2022). In this context, robo-advisors provide a technological solution that increases accessibility and reduces reliance on human intermediaries. Aligned with Barile *et al.* (2026), our results further demonstrate that robo-advisors can accelerate the diffusion of green finance, which underscores their dual role as both efficiency-enhancing and sustainability-enabling instruments in the banking industry. This also implies that digital financial technologies can lower intermediation costs while expanding the scale of green investment markets.

Second, the study reveals that green finance has a direct and significant positive effect on banks' financial performance. This outcome highlights the capacity of sustainability-oriented investments to strengthen long-term profitability, not only by meeting rising investor demand for responsible finance but also by reducing risk exposure to environmentally harmful practices (Kumar *et al.*, 2024; Siddik *et al.*, 2024; Vardar *et al.*, 2025). Economically, this suggests that green finance can improve risk-adjusted returns by mitigating environmental liabilities and aligning portfolios with future regulatory and market trends. From an agency theory standpoint, this effect reflects improved alignment between managerial actions and shareholder interests, as increased disclosure and monitoring reduce opportunistic behavior and enhance firm performance. Our findings echo the growing consensus that banks embedding green finance into their portfolios can enhance financial stability, capture reputational gains, and secure competitive advantage in increasingly sustainability-conscious markets (Hidayat-ur-Rehman and Hossain, 2025; Maqbool and Zamir, 2021).

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Finally, we find robust support for the mediating role of greenwashing in the relationship between green finance and financial performance. While this result may seem counterintuitive when compared with earlier studies emphasizing the reputational risks of greenwashing in banking (De Novellis *et al.*, 2025; Venturelli *et al.*, 2025), our evidence points to the short-term benefits of symbolic alignment with sustainability goals. In institutional contexts where external monitoring and regulatory scrutiny remain limited, signaling commitment to green finance, even if partially symbolic, can enhance investor trust and improve performance outcomes (Lee and Raschke, 2023; Li *et al.*, 2023). From an economic standpoint, this reflects a signaling mechanism that temporarily reduces information asymmetry and attracts capital inflows, albeit with potential long-term efficiency losses if misallocation of resources occurs. Consistent with agency theory, such behavior reflects managerial opportunism under information asymmetry, where agents exploit limited monitoring to present inflated sustainability claims, generating short-term gains but potentially harming long-term performance (Luhgiatno *et al.*, 2026).

5.1 Conclusions

This study makes a significant contribution by integrating robo-advisory technologies, green finance, and greenwashing into a unified empirical framework within the context of the Indonesian banking sector. The findings demonstrate that robo-advisors play a crucial role in enhancing green finance adoption, which in turn improves financial performance, thereby highlighting the economic value of FinTech-driven sustainability initiatives. At the same time, the study reveals that greenwashing partially mediates this relationship, indicating that while sustainability signaling may generate short-term financial benefits, it also introduces risks that can undermine long-term value creation. By uncovering both the enabling and constraining mechanisms linking digital financial innovation to sustainability outcomes, this research advances current understanding of how green finance translates into firm performance, particularly in emerging market contexts characterized by evolving institutional frameworks.

5.2 Theoretical implications

This study advances theoretical discourse by offering several contributions to the existing literature. First, prior research on financial robo-advisors has largely concentrated on understanding individuals' behavioral intentions to adopt such technologies (Belanche *et al.*, 2019; Chen *et al.*, 2025b; Eren, 2024; Nourallah *et al.*, 2023; Roongruangsee *et al.*, 2025; Yeh *et al.*, 2023) or, conversely, on resistance toward them (Aw *et al.*, 2024; Lee *et al.*, 2026). However, empirical investigations linking robo-advisors with green finance and their subsequent influence on financial performance, particularly when mediated by greenwashing, remain absent. This study addresses this gap and extends existing knowledge by showing how robo-advisors, as technological intermediaries, shape perceptions of credibility, transparency, and sustainability practices. From an agency theory perspective, robo-advisors help reduce information asymmetry between principals (investors) and agents (financial managers) by enhancing transparency and standardizing information, thereby improving monitoring mechanisms and investment decision quality (Jensen and Meckling, 2019). This insight enriches theoretical understanding of their broader role in financial ecosystems.

Second, while prior works suggest that greenwashing may exert positive effects on financial outcomes by temporarily enhancing reputation and attracting investment (Li *et al.*, 2023; Lee and Raschke, 2023), the role of greenwashing as a mediating construct between green finance initiatives and financial performance remains underexplored (Bernini and La Rosa, 2024; Huang *et al.*, 2025b). Addressing this gap, the present study demonstrates how greenwashing can function as a mechanism that channels or distorts the benefits of green finance. In line with agency theory, greenwashing reflects opportunistic behavior by agents who exploit information asymmetry to present inflated sustainability claims, thereby influencing investor perceptions and short-term financial outcomes. By unpacking this

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mediation pathway, the paper enriches theoretical insights into the dual-edged nature of greenwashing, both as a potential strategic tool and as a risk to long-term sustainability. This contribution broadens our theoretical grasp of how financial institutions manage legitimacy and market perception in the context of sustainable finance.

Finally, the findings highlight the dual impacts of robo-advisors in promoting green finance and influencing financial outcomes. As noted by Barile *et al.* (2026), robo-advisors can foster investment alignment with sustainability objectives by improving access, transparency, and efficiency in green financial products. Our results build on this perspective by demonstrating that green finance can, in turn, enhance financial performance either directly or indirectly through greenwashing practices. From the lens of agency theory, this dual pathway illustrates the tension between value-creating activities (genuine green finance) and opportunistic incentives (greenwashing), where the effectiveness of monitoring and governance mechanisms determines the extent to which financial performance reflects true sustainability efforts. Theoretically, this study deepens understanding of the dynamic linkages among robo-advisors, green finance, and financial outcomes, offering a more holistic framework for analyzing technology–sustainability interactions. These insights open avenues for future research to further refine theories on digital finance, sustainability, and organizational legitimacy in evolving financial ecosystems.

5.3 Managerial and policy implications

This study provides several actionable insights for managers, FinTech developers, and policymakers. Specifically, the findings are particularly relevant for banking institutions in emerging markets, FinTech platforms offering robo-advisory services, and regulatory bodies overseeing sustainable finance ecosystems. For practitioners in the FinTech sector, the design and development of robo-advisory systems should emphasize transparency and the ability to guide investors toward credible green finance opportunities. Developers can enhance user confidence by embedding explainable AI features, tailoring recommendations to individual financial profiles, and integrating sustainability ratings directly into the platform interface (Chen *et al.*, 2025b; Roongruangsee *et al.*, 2025). In practice, these features can be applied in digital investment platforms, mobile banking applications, and wealth management systems to improve user adoption and decision quality. Incorporating adaptive learning algorithms that evolve with user preferences, as well as interactive dashboards that clarify the environmental impact of investment choices, could further strengthen trust in these technologies. Moreover, service providers in the banking sector should harness advanced analytics to ensure that robo-advisory recommendations reflect not only clients' financial goals but also their sustainability values. Practical tools such as real-time alerts, clear explanations for investment decisions, and loyalty-based incentives (e.g. reward points or tiered membership programs) may encourage greater engagement and foster long-term investor commitment. These practices ultimately benefit investors by reducing information asymmetry and improving the efficiency of capital allocation toward sustainable assets.

From a managerial standpoint, this study also underscores the importance of integrating sustainability into corporate investment strategies. By aligning green finance initiatives with performance goals, managers can unlock dual benefits: enhancing environmental impact while achieving financial gains. This is particularly useful for executives, sustainability officers, and investment managers seeking to balance profitability with ESG objectives in competitive financial markets. However, firms must be cautious of resorting to superficial claims or symbolic actions (de Vries *et al.*, 2015). Overreliance on greenwashing may yield short-term financial boosts but risks damaging corporate reputation and investor trust in the long run (Venturelli *et al.*, 2025; De Novellis *et al.*, 2025). Managers should instead focus on robust ESG disclosure practices, verification mechanisms, and stakeholder communication strategies to ensure that green finance contributes meaningfully to financial performance. For example, firms can adopt independent third-party verification protocols for ESG disclosures

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and sustainability reports to enhance the credibility of environmental claims, improve transparency, and reduce the risk of greenwashing. In the Indonesian context, firms should align these practices with local regulatory frameworks issued by financial authorities and adopt internationally recognized ESG reporting standards to enhance credibility and comparability. In addition, firms can implement internal governance mechanisms, such as sustainability committees and independent audit functions, to balance short-term performance pressures with long-term sustainability objectives.

At the policy level, the findings highlight the urgency of developing a stronger regulatory framework in Indonesia for both FinTech innovations and green finance practices. These implications are particularly relevant for financial regulators, central banks, and government agencies responsible for sustainable economic development. Clearer guidelines on robo-advisory services are needed to safeguard investors, particularly around algorithmic transparency, data privacy, and accountability in automated decision-making. Regulators should also establish standards to differentiate authentic green finance products from misleading claims, thereby reducing the risks of greenwashing. Mandatory disclosure requirements, independent third-party auditing of sustainability reports, and stricter penalties for false claims could serve as deterrents. Such regulatory measures can be implemented not only in Indonesia but also in other emerging economies facing similar challenges in balancing financial innovation and sustainability governance. Policymakers should also encourage collaboration between regulators, financial institutions, and technology developers to ensure that innovation in robo-advisory tools advances financial inclusion and environmental sustainability simultaneously.

5.4 Limitations and directions for future research

Although this study provides important insights, it is not without limitations, which also open promising directions for further inquiry. First, the model developed here primarily emphasizes direct and mediating effects. However, the complex dynamics of green finance and greenwashing may also be shaped by contextual contingencies. Prior research (e.g. Delmas and Burbano, 2011; Khan *et al.*, 2024) highlights the relevance of moderating influences such as corporate social responsibility practices, institutional pressures, or organizational culture, which could alter the strength and direction of these relationships. Future work could therefore enrich our framework by adopting a moderated mediation perspective, offering a more holistic understanding of the mechanisms at play. For example, future research could examine the moderating role of institutional pressure in the relationships among green finance, greenwashing, and financial performance (Darsono *et al.*, 2026). Moreover, although this study adopts agency theory as its primary theoretical lens, future research could integrate complementary perspectives, such as signaling theory and legitimacy theory, to provide a broader explanation of firms' greenwashing behaviors and their potentially beneficial and detrimental consequences for different stakeholders. Testing non-linear effects is also recommended. Specifically, future studies could examine whether greenwashing exhibits nonlinear relationships with organizational outcomes, such that its effects may vary across different levels or contexts. Furthermore, this study relies on self-reported performance, which may introduce social desirability bias. Future research could address this limitation by incorporating qualitative approaches, such as interviews.

Finally, the findings of this research are drawn from a single-country context, which raises questions regarding external validity. As noted by Aguinis (2024), results obtained in one setting may not automatically apply elsewhere. To strengthen generalizability, future research could examine the interplay of robo-advisors, green finance, greenwashing, and financial performance across different institutional and cultural environments. Comparative studies between developed and emerging economies, or across multiple national contexts, would allow researchers to assess whether the observed relationships are universal or context-dependent, thereby producing richer and more nuanced insights. In addition, our study is

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limited in its ability to test and draw causal inferences. Future research could employ alternative approaches, such as CB-SEM using longitudinal or time-series data, to provide stronger causal validation of these relationships.

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References

Aguinis, H. (2024), *Research Methodology: Best Practices for Rigorous, Credible, and Impactful Research*, SAGE Publications, Thousand Oaks.

Alhemimah, A., Ali, M., Badghish, S., Latan, H. and Lopes de Sousa Jabbour, A.B. (2025), "The interplay of green capabilities, organizational culture and green marketing strategy to explain green competitive advantage", *Journal of Economic and Administrative Sciences*, Vol. 42 No. 4, pp. 1113-1135, doi: 10.1108/JEAS-04-2024-0107.

Ali, S., Zahid, R.A., Battisti, E. and Vincurova, Z. (2026), "Environmental innovation and corporate financial performance: the moderating role of greenwashing", *International Journal of Emerging Markets*, Vol. 21 No. 2, pp. 535-557, doi: 10.1108/IJOEM-09-2024-1611.

Aw, E.C.-X., Leong, L.-Y., Hew, J.-J., Rana, N.P., Tan, T.M. and Jee, T.-W. (2024), "Counteracting dark sides of robo-advisors: justice, privacy and intrusion considerations", *International Journal of Bank Marketing*, Vol. 42 No. 1, pp. 133-151, doi: 10.1108/ijbm-10-2022-0439.

Bandalos, D.L. (2018), *Measurement Theory and Applications for the Social Sciences*, Guilford Press, New York.

Barile, D., Secundo, G. and Bussoli, C. (2025), "Exploring artificial intelligence robo-advisor in banking industry: a platform model", *Management Decision*, Vol. 63 No. 10, pp. 3323-3349, doi: 10.1108/md-08-2023-1324.

Barile, D., Secundo, G., Mariani, M. and Brandonisio, A. (2026), "A new era: managing green investments through Robo-Advisors", *Management Decision*, Vol. 64 No. 6, pp. 2297-2323, doi: 10.1108/MD-06-2024-1268.

Belanche, D., Casaló, L.V. and Flavián, C. (2019), "Artificial Intelligence in FinTech: understanding robo-advisors adoption among customers", *Industrial Management and Data Systems*, Vol. 119 No. 7, pp. 1411-1430, doi: 10.1108/imds-08-2018-0368.

Bernini, F. and La Rosa, F. (2024), "Research in the greenwashing field: concepts, theories, and potential impacts on economic and social value", *Journal of Management and Governance*, Vol. 28 No. 2, pp. 405-444, doi: 10.1007/s10997-023-09686-5.

Boas, T.C., Christenson, D.P. and Glick, D.M. (2020), "Recruiting large online samples in the United States and India: facebook, mechanical Turk, and Qualtrics", *Political Science Research and Methods*, Vol. 8 No. 2, pp. 232-250, doi: 10.1017/psrm.2018.28.

Cardillo, G. and Chiappini, H. (2024), "Robo-advisors: a systematic literature review", *Finance Research Letters*, Vol. 62, 105119, doi: 10.1016/j.frl.2024.105119.

Chang, K., Luo, D., Dong, Y. and Xiong, C. (2024), "The impact of green finance policy on green innovation performance: evidence from Chinese heavily polluting enterprises", *Journal of Environmental Management*, Vol. 352, 119961, doi: 10.1016/j.jenvman.2023.119961.

Chen, A., Wang, S., Mehta, A.M., Asif, M., Xu, S. and Shahzad, M.F. (2025a), "FinTech adoption for ESG integration through robo advisors, personalization, and perceived trust", *Scientific Reports*, Vol. 15 No. 1, 31125, doi: 10.1038/s41598-025-17046-6.

Chen, Y., Aw, E.C.-X. and Tan, G.W.-H. (2025b), "Financial empowerment through robo-advisors: understanding the keys to trust and loyalty", *Industrial Management and Data Systems*, Vol. 125 No. 6, pp. 2178-2205, doi: 10.1108/imds-05-2024-0461.

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Cohen, J., Cohen, P., West, S.G. and Aiken, L.S. (2003), *Applied Multiple Regression/correlation Analysis for the Behavioral Sciences*, Lawrence Erlbaum Associates, Mahwah, NJ.

Cook, R.D. and Forzani, L. (2024), *Partial Least Squares Regression and Related Dimension Reduction Methods*, CRC Press, Boca Raton.

Cox, K.S. and Holcomb, Z.C. (2022), *Interpreting Basic Statistics: A Workbook Based on Excerpts from Journal Articles*, Routledge, New York.

Darsono, D., Hersugondo, H., Yuniawan, A., Kusumaningrum, H.P., Latan, H. and Ali, M. (2025), "Linking green finance to sustainability performance: the mediating role of CSR and the moderating effect of stakeholder pressures", *Journal of Economic and Administrative Sciences*, pp. 1-20, doi: 10.1108/jeas-04-2025-0221.

Darsono, D., Hersugondo, H., Yuniawan, A. and Latan, H. (2026), "Green finance and sustainable performance: the mediating roles of green innovation and green capabilities and the moderating effect of stakeholder pressure", *Business Strategy and Development*, Vol. 9 No. 2, e70317, doi: 10.1002/bsd2.70317.

De Novellis, G., Pedrazzoli, A., Pennetta, D. and Venturelli, V. (2025), "Greenwashing, greenhushing, and the path to green banking", *Global Finance Journal*, Vol. 67, 101147, doi: 10.1016/j.gfj.2025.101147.

de Vries, G., Terwel, B.W., Ellemers, N. and Daamen, D.D.L. (2015), "Sustainability or profitability? How communicated motives for environmental policy affect public perceptions of corporate greenwashing", *Corporate Social Responsibility and Environmental Management*, Vol. 22 No. 3, pp. 142-154, doi: 10.1002/csr.1327.

Delmas, M.A. and Burbano, V.C. (2011), "The drivers of greenwashing", *California Management Review*, Vol. 54 No. 1, pp. 64-87, doi: 10.1525/cmr.2011.54.1.64.

Eren, B.A. (2024), "Antecedents of robo-advisor use intention in private pension investments: an emerging market country example", *Journal of Financial Services Marketing*, Vol. 29 No. 3, pp. 683-698, doi: 10.1057/s41264-023-00229-5.

Ferrón-Vílchez, V., Valero-Gil, J. and Suárez-Perales, I. (2021), "How does greenwashing influence managers' decision-making? An experimental approach under stakeholder view", *Corporate Social Responsibility and Environmental Management*, Vol. 28 No. 2, pp. 860-880, doi: 10.1002/csr.2095.

Galloppo, G., Guida, R. and Urbani, R. (2026), "Green initiatives, financial performance, and institutional investors", *European Financial Management*, Vol. 32 No. 2, pp. 640-676, doi: 10.1111/eufm.70029.

Gao, D., Zhou, X. and Wan, J. (2024), "Unlocking sustainability potential: the impact of green finance reform on corporate ESG performance", *Corporate Social Responsibility and Environmental Management*, Vol. 31 No. 5, pp. 4211-4226, doi: 10.1002/csr.2801.

Haws, K.L., Sample, K.L. and Hulland, J. (2023), "Scale use and abuse: towards best practices in the deployment of scales", *Journal of Consumer Psychology*, Vol. 33 No. 1, pp. 226-243, doi: 10.1002/jcpy.1320.

Henseler, J. (2021), *Composite-based Structural Equation Modeling: Analyzing Latent and Emergent Variables*, Guildford Press, New York.

Heras-Saizarbitoria, I., Boiral, O. and Díaz de Junguitu, A. (2020), "Environmental management certification and environmental performance: greening or greenwashing?", *Business Strategy and the Environment*, Vol. 29 No. 6, pp. 2829-2841, doi: 10.1002/bse.2546.

Hidayat-ur-Rehman, I. and Hossain, M.N. (2025), "The impacts of Fintech adoption, green finance and competitiveness on banks' sustainable performance: digital transformation as moderator", *Asia-Pacific Journal of Business Administration*, Vol. 17 No. 4, pp. 987-1020, doi: 10.1108/APJBA-10-2023-0497.

Hildebrand, C. and Bergner, A. (2021), "Conversational robo advisors as surrogates of trust: onboarding experience, firm perception, and consumer financial decision making", *Journal of the Academy of Marketing Science*, Vol. 49 No. 4, pp. 659-676, doi: 10.1007/s11747-020-00753-z.

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Hong, X., Pan, L., Gong, Y. and Chen, Q. (2023), "Robo-advisors and investment intention: a perspective of value-based adoption", *Information and Management*, Vol. 60 No. 6, 103832, doi: 10.1016/j.im.2023.103832.

Huang, R. (2025), "Non-response bias in expectation surveys: different perceptions and expectations of financial matters from early quitters", *Finance Research Letters*, Vol. 82, 107624, doi: 10.1016/j.frl.2025.107624.

Huang, M.-H. and Rust, R.T. (2022), "A framework for collaborative artificial intelligence in marketing", *Journal of Retailing*, Vol. 98 No. 2, pp. 209-223, doi: 10.1016/j.jretai.2021.03.001.

Huang, F., Wu, J., Wu, Z., Fu, W., Guo, P., Zhang, Z. and Khan, F. (2025a), "Unpacking greenwashing: the impact of environmental attitude, proactive strategies, and network embeddedness on corporate environmental performance", *Journal of Environmental Management*, Vol. 373, 123625, doi: 10.1016/j.jenvman.2024.123625.

Huang, Z., Shi, Y. and Jia, M. (2025b), "Greenwashing: a systematic literature review", *Accounting and Finance*, Vol. 65 No. 1, pp. 857-882, doi: 10.1111/acfi.13352.

Hussain, S., Rasheed, A. and Rehman, S.u. (2024), "Driving sustainable growth: exploring the link between financial innovation, green finance and sustainability performance: banking evidence", *Kybernetes*, Vol. 53 No. 11, pp. 4678-4696, doi: 10.1108/k-05-2023-0918.

Jensen, M.C. (2005), "Agency costs of overvalued equity", *Financial Management*, Vol. 34 No. 1, pp. 5-19, doi: 10.1111/j.1755-053x.2005.tb00090.x.

Jensen, M.C. and Meckling, W.H. (2019), "Theory of the firm: managerial behavior, agency costs and ownership structure", in Mitchell, L.E. (Ed.), *Corporate Governance: Values, Ethics and Leadership*, University of Rochester, New York, pp. 77-132.

Kaur, H., Mago, M., Panwar, A. and Kaur, G. (2026), "Do robo-advisory services foster sustainable investment behaviour? A serial mediation and MGA approach", *South Asian Journal of Business Studies*, Vol. 15 No. 3, pp. 333-358, doi: 10.1108/SAJBS-01-2025-0020.

Khan, H.H.A., Ahmad, N., Yusof, N.M. and Chowdhury, M.A.M. (2024), "Green finance and environmental sustainability: a systematic review and future research avenues", *Environmental Science and Pollution Research*, Vol. 31 No. 6, pp. 9784-9794, doi: 10.1007/s11356-023-31809-6.

Kumar, J., Rani, G., Rani, M. and Rani, V. (2024), "Do green banking practices improve the sustainability performance of banking institutions? The mediating role of green finance", *Social Responsibility Journal*, Vol. 20 No. 10, pp. 1990-2007, doi: 10.1108/srj-02-2024-0096.

Lee, J., Jiang, S. and Tang, Y. (2026), "Examining the impacts of artificial intelligence characteristics on user resistance to financial robo-advisors", *Information Technology and People*, Vol. 39 No. 3, pp. 1117-1153, doi: 10.1108/ITP-07-2024-0921.

Lee, M.T. and Raschke, R.L. (2023), "Stakeholder legitimacy in firm greening and financial performance: what about greenwashing temptations?", *Journal of Business Research*, Vol. 155, 113393, doi: 10.1016/j.jbusres.2022.113393.

Lei, X. and Yu, J. (2024), "Striving for sustainable development: green financial policy, institutional investors, and corporate ESG performance", *Corporate Social Responsibility and Environmental Management*, Vol. 31 No. 2, pp. 1177-1202, doi: 10.1002/csr.2630.

Li, W., Li, W., Seppänen, V. and Koivumäki, T. (2023), "Effects of greenwashing on financial performance: moderation through local environmental regulation and media coverage", *Business Strategy and the Environment*, Vol. 32 No. 1, pp. 820-841, doi: 10.1002/bse.3177.

Liengaard, B.D., Becker, J.-M., Bennedsen, M., Heiler, P., Taylor, L.N. and Ringle, C.M. (2025), "Dealing with regression models' endogeneity by means of an adjusted estimator for the Gaussian copula approach", *Journal of the Academy of Marketing Science*, Vol. 53 No. 1, pp. 279-299, doi: 10.1007/s11747-024-01055-4.

Lindner, T., Puck, J. and Verbeke, A. (2022), "Beyond addressing multicollinearity: robust quantitative analysis and machine learning in international business research", *Journal of International Business Studies*, Vol. 53 No. 7, pp. 1307-1314, doi: 10.1057/s41267-022-00549-z.

Downloaded from www.emerald.com/jeas/article-pdf/doi/10.1108/JEAS-09-2025-0689/11967560/jeas-09-2025-0689en.pdf by Northumbria University user on 13 November 2026

Luhgiatno, L., Solovida, G.T., Lopes de Sousa Jabbour, A.B., Chiappetta Jabbour, C.J., Latan, H. and Adhi, D.K. (2026), "Greenwashing and firm performance in an emerging market: short-term gains vs long-term risks", *Journal of Cleaner Production*, Vol. 557, 148235, doi: 10.1016/j.jclepro.2026.148235.

Luo, H., Liu, X., Lv, X., Hu, Y. and Ahmad, A.J. (2024), "Investors' willingness to use robo-advisors: extrapolating influencing factors based on the fiduciary duty of investment advisors", *International Review of Economics and Finance*, Vol. 94, 103411, doi: 10.1016/j.iref.2024.103411.

Malhotra, N.K. (2020), *Marketing Research: An Applied Orientation*, Pearson, Harlow.

Maqbool, S. and Zamir, N. (2021), "Corporate social responsibility and institutional investors: the intervening effect of financial performance", *Journal of Economic and Administrative Sciences*, Vol. 37 No. 2, pp. 238-252, doi: 10.1108/jeas-08-2019-0089.

Merkle, A.C. (2025), "Item level correction: detecting, removing, and reporting common methods variance", *Journal of Marketing Analytics*, Vol. 13 No. 2, pp. 405-423, doi: 10.1057/s41270-025-00399-2.

Miller, B.K. and Simmering, M.J. (2023), "Attitude toward the color blue: an ideal marker variable", *Organizational Research Methods*, Vol. 36 No. 3, pp. 409-440, doi: 10.1177/10944281221075361.

Murphy, K.R. (2021), "In praise of Table 1: the importance of making better use of descriptive statistics", *Industrial and Organizational Psychology*, Vol. 14 No. 4, pp. 461-477, doi: 10.1017/iop.2021.90.

Neves Proença, C.A., Coelho, A.F.D.M., Fernandes, C. and Ferreira, J.J.M. (2026), "Differentiating between a genuine environmental strategy and greenwashing: evidence from the cooperative banking sector", *International Journal of Bank Marketing*, Vol. 44 No. 5, pp. 943-969, doi: 10.1108/IJBM-09-2024-0555.

Nourallah, M., Öhman, P. and Amin, M. (2023), "No trust, no use: how young retail investors build initial trust in financial robo-advisors", *Journal of Financial Reporting and Accounting*, Vol. 21 No. 1, pp. 60-82, doi: 10.1108/jfra-12-2021-0451.

Nunnally, J.C. and Bernstein, I.H. (1994), *Psychometric Theory*, McGraw-Hill, New York.

Oehler, A., Horn, M. and Wendt, S. (2022), "Investor characteristics and their impact on the decision to use a robo-advisor", *Journal of Financial Services Research*, Vol. 62 No. 1, pp. 91-125, doi: 10.1007/s10693-021-00367-8.

Oscarsson, H. and Arkhede, S. (2020), "Effects of conditional incentives on response rate, non-response bias and measurement error in a high response-rate context", *International Journal of Public Opinion Research*, Vol. 32 No. 2, pp. 354-368, doi: 10.1093/ijpor/edz015.

Owens, J. and Hawkins, E.M. (2019), "Using online labor market participants for nonprofessional investor research: a comparison of MTurk and Qualtrics samples", *Journal of Information Systems*, Vol. 33 No. 1, pp. 113-128, doi: 10.2308/isys-52036.

Paulraj, A. (2011), "Understanding the relationships between internal resources and capabilities, sustainable supply management and organizational sustainability", *Journal of Supply Chain Management*, Vol. 47 No. 1, pp. 19-37, doi: 10.1111/j.1745-493x.2010.03212.x.

Podsakoff, P.M., Podsakoff, N.P., Williams, L.J., Huang, C. and Yang, J. (2024), "Common method bias: it's bad, it's complex, it's widespread, and it's not easy to fix", *Annual Review of Organizational Psychology and Organizational Behavior*, Vol. 11 No. 1, pp. 17-61, doi: 10.1146/annurev-orgpsych-110721-040030.

Rigdon, E.E., Sarstedt, M. and Becker, J.M. (2020), "Quantify uncertainty in behavioral research", *Nature Human Behaviour*, Vol. 4 No. 4, pp. 329-331, doi: 10.1038/s41562-019-0806-0.

Rönkkö, M. and Cho, E. (2022), "An updated guideline for assessing discriminant validity", *Organizational Research Methods*, Vol. 25 No. 1, pp. 6-14, doi: 10.1177/1094428120968614.

Roongruangsee, R., Srisomwongse, R. and Patterson, P. (2025), "Modelling client adoption of robo-advisors in Thailand: the impact of trust and situational factors", *Asia Pacific Business Review*, Vol. 31 No. 3, pp. 416-440, doi: 10.1080/13602381.2024.2405696.

Downloaded from www.emerald.com/jeas/article-pdf/doi/10.1108/JEAS-09-2025-0689/11967560/jeas-09-2025-0689en.pdf by Northumbria University user on 13 November 2026

Roos, J.M. and Bauldry, S. (2022), *Confirmatory Factor Analysis*, SAGE Publications, Thousand Oaks.

Santos, C., Coelho, A. and Marques, A. (2024), "The greenwashing effects on corporate reputation and brand hate, through environmental performance and green perceived risk", *Asia-Pacific Journal of Business Administration*, Vol. 16 No. 3, pp. 655-676, doi: 10.1108/apjba-05-2022-0216.

Saunders, M.N.K., Lewis, P. and Thornhill, A. (2023), *Research Methods for Business Students*, Pearson, New York.

Shaffer, J.A., DeGeest, D. and Li, A. (2016), "Tackling the problem of construct proliferation: a guide to assessing the discriminant validity of conceptually related constructs", *Organizational Research Methods*, Vol. 19 No. 1, pp. 80-110, doi: 10.1177/1094428115598239.

Shahzad, M.F., Xu, S., An, X., Asif, M. and Haider Jafri, M.A. (2024), "Effect of stakeholder pressure on environmental performance: do virtual CSR, green credit, environmental and social reputation matter?", *Journal of Environmental Management*, Vol. 368, 122223, doi: 10.1016/j.jenvman.2024.122223.

Siddik, A.B., Yong, L. and Sharif, A. (2024), "Do sustainable banking practices enhance the sustainability performance of banking institutions? Direct and indirect effects", *International Journal of Bank Marketing*, Vol. 42 No. 4, pp. 672-691, doi: 10.1108/ijbm-02-2023-0109.

Streukens, S. and Leroi-Werelds, S. (2016), "Bootstrapping and PLS-SEM: a step-by-step guide to get more out of your bootstrap results", *European Management Journal*, Vol. 34 No. 6, pp. 618-632, doi: 10.1016/j.emj.2016.06.003.

Sun, Z., Sun, X., Wang, W. and Wang, W. (2025), "Digital transformation and greenwashing in environmental, social, and governance disclosure: does investor attention matter?", *Business Ethics, the Environment and Responsibility*, Vol. 34 No. 1, pp. 81-102, doi: 10.1111/beer.12585.

Tong, L., Chiappetta Jabbour, C.J., belgacem, S.b., Najam, H. and Abbas, J. (2022), "Role of environmental regulations, green finance, and investment in green technologies in green total factor productivity: empirical evidence from Asian region", *Journal of Cleaner Production*, Vol. 380, 134930, doi: 10.1016/j.jclepro.2022.134930.

Torelli, R., Balluchi, F. and Lazzini, A. (2020), "Greenwashing and environmental communication: effects on stakeholders' perceptions", *Business Strategy and the Environment*, Vol. 29 No. 2, pp. 407-421, doi: 10.1002/bse.2373.

Vardar, G., Aydoğan, B. and Gürel, B. (2025), "Investigating the ecological footprint and green finance: evidence from emerging economies", *Journal of Economic and Administrative Sciences*, Vol. 41 No. 5, pp. 1821-1843, doi: 10.1108/JEAS-05-2023-0124.

Venturelli, V., Pedrazzoli, A., Pennetta, D. and De Novellis, G. (2025), "Assessing the influence of ESG washing on bank reputational exposure: a cross-country analysis", *Business Ethics, the Environment and Responsibility*, Vol. 34, pp. 1540-1560, doi: 10.1111/beer.12727.

Wang, Z. and Tian, X. (2025), "From greenwashing to sustainability: the mediating effect of green innovation in the agribusiness sector on financial performance", *Agriculture [Online]*, Vol. 15 No. 12, p. 1316, doi: 10.3390/agriculture15121316.

Wang, L., Ur Rehman, A., Xu, Z., Amjad, F. and Ur Rehman, S. (2023), "Green corporate governance, green finance, and sustainable performance nexus in Chinese SMES: a mediation moderation model", *Sustainability*, Vol. 15 No. 13, p. 9914, doi: 10.3390/su15139914.

Wang, Y., Feng, J., Shinwari, R. and Bouri, E. (2024), "Do green finance and green innovation affect corporate credit rating performance? Evidence from machine learning approach", *Journal of Environmental Management*, Vol. 360, 121212, doi: 10.1016/j.jenvman.2024.121212.

Wang, S., Shen, H., Zhang, H., Asif, M. and Shahzad, M.F. (2025), "From greenwashing to genuine sustainability: insights from FinTech and banking executives in emerging market experience", *Journal of Environmental Management*, Vol. 373, 123690, doi: 10.1016/j.jenvman.2024.123690.

Wooldridge, J.M. (2020), *Introductory Econometrics: A Modern Approach*, Cengage Learning, South-Western.

Downloaded from www.emerald.com/jeas/article-pdf/doi/10.1108/JEAS-09-2025-0689/11967560/jeas-09-2025-0689en.pdf by Northumbria University user on 13 November 2026

Wulff, J.N., Sajons, G.B., Pogrebna, G., Lonati, S., Bastardoz, N., Banks, G.C. and Antonakis, J. (2023), "Common methodological mistakes", *The Leadership Quarterly*, Vol. 34 No. 1, 101677, doi: 10.1016/j.leaqua.2023.101677.

Yeh, H.-C., Yu, M.-C., Liu, C.-H. and Huang, C.-I. (2023), "Robo-advisor based on unified theory of acceptance and use of technology", *Asia Pacific Journal of Marketing and Logistics*, Vol. 35 No. 4, pp. 962-979, doi: 10.1108/apjml-07-2021-0493.

Zhang, D. (2023a), "Does green finance really inhibit extreme hypocritical ESG risk? A greenwashing perspective exploration", *Energy Economics*, Vol. 121, 106688, doi: 10.1016/j.eneco.2023.106688.

Zhang, T. (2023b), "Can green finance policies affect corporate financing? Evidence from China's green finance innovation and reform pilot zones", *Journal of Cleaner Production*, Vol. 419, 138289, doi: 10.1016/j.jclepro.2023.138289.

Zhang, D., Wang, C., He, Y. and Vigne, S.A. (2025), "Does FinTech efficiently hamper manipulating ESG data behavior?", *The British Accounting Review*, Vol. 58 No. 3, 101494, doi: 10.1016/j.bar.2024.101494.

Zhu, Q., Han, C., Liu, S., Li, Y. and Che, J. (2025), "Artificial intelligence-driven financial innovation: a robo-advisor system for robust returns across diversified markets", *Expert Systems with Applications*, Vol. 274, 126881, doi: 10.1016/j.eswa.2025.126881.

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