

Driving Green Growth through Fintech Innovation: Examining the Moderating Role of Cryptocurrency Integration among NGOs in Malaysia

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Abstract

The current study intends to examine the moderating effect of cryptocurrency integration on the relationship between FinTech-enabled financing methods and green growth among Malaysian environmental NGOs. The analysis focuses on two financing methods, green financing and crowdfunding. A quantitative cross-sectional survey was conducted, and 151 usable responses were obtained from knowledgeable personnel from 48 registered and active environmental NGOs in Malaysia. The structural analyses were performed using SmartPLS 4. The findings show a significant positive relationship between green financing and green growth whereas the relationship between crowdfunding and green growth was not statistically significant. Cryptocurrency integration was not directly related to green growth at the 5% significance level. The interaction between cryptocurrency integration and green financing was significant and negative, indicating that the positive green financing-green growth association was weaker at higher levels of cryptocurrency integration. The corresponding interaction with crowdfunding was positive, but not statistically significant. Thus, green financing provides the clearest direct contribution to green growth among environmental NGOs, while cryptocurrency integration should be approached with caution as part of a broader strategy that takes into account governance, transparency, regulatory compliance, and environmental sustainability.

Keywords: Fintech Innovation, Green Growth, Cryptocurrency, Green Financing, Crowdfunding, Non-Governmental Organisations

Introduction

Green growth has become a mainstream strategy used by organisations to respond to extreme environmental degradation, resource exhaustion, and climate change (Abramova et al., 2024; Vergara & Agudo, 2021; Organisation for Economic Co-operation and Development [OECD], 2019). The implementation of green growth strategies will be able to reduce negative environmental impacts, enhance economic expansion, and create social change. To act on these negative impacts and enhance green growth initiatives organisations have turned to

financial technology (fintech) such as green financing and crowdfunding (Anwar et al., 2024; Boutbirt, & Adaskou, 2023).

Non-governmental organisations often face financial difficulties due to the lack of funding and depend on various fundraising sources (Nix et al., 2025; Vysochan & Івасюк, 2020). This is a constraint for the NGOs when implementing green growth. As such based on studies by (Ahmad et al., 2025; Torres et al., 2024; Khoma, 2023; Ramakrishnan et al., 2022; Mora et al., 2021) NGOs are adopting green financing and crowdfunding to improve their financial constraints. This helps the NGOs to diversify their funding sources, improve the fundraising speed and aid environmental projects. Green financing is significant for NGOs because it helps the NGOs to gain funds that could aid many environmental protection projects. This is evident in the Brazil's Amazon Fund which directed funds to the civil society and the NGOs also gained a portion of the funds based on studies by (Horn, 2023). Similarly, crowdfunding provides NGOs with an upper hand to receive financial resources from a large pool of credible financial contributors. Based on (Svidroňová et al., 2024) crowdfunding initiatives commissioned by NGOs frequently gain more funds compared to charitable events done through commercial promotions. But the question is to what extent the adoption of financial technology (fintech) tools enhances the green growth of NGOs in Malaysia. This remains partly unanswered.

Additionally, the integration of cryptocurrency was hypothesized in this study as a moderating factor that could augment or deteriorate the relationship between fintech and green growth. Moreover, scholars (Ahmad et al., 2025; Ramakrishnan et al., 2022; Kubo et al., 2021) asserted that cryptocurrency can influence green growth with the use of green financing and crowdfunding. This indicates that cryptocurrency as an innovative funding mechanism, which can moderate the relationship between fintech tools and green growth which helps to raise funds for environmental projects. Additionally, (Kwong et al., 2023; Bayram et al., 2022) found that the adoption of cryptocurrency can be a significant moderator to test the strengthening or weakening effect between the fintech tools and green growth relationship. These previous illuminations have prompted to design this study to investigate if the effect of green financing and crowdfunding on green growth could be modified with the implementation of cryptocurrency as a moderator by NGOs in Malaysia.

Research Problem

Obtaining funds is becoming increasingly difficult for non-profit environmental organizations. As such, NGOs are now looking for funding using FinTech mechanisms. FinTech platforms may allow NGOs to grow while at the same time achieve their sustainability goals. Based on previous studies by (Tamasiga et al., 2022; Abramova et al., 2024) FinTech could help expand and speed up access to green financing, and at the same time allow digital tools to enhance crowdfunding.

Complementarily, (Abramova et al., 2024; Vergara & Agudo, 2021) elucidated that FinTech focused syntheses on green growth emphasize that crowdfunding is part of the FinTech ecosystem relevant to green economic growth and sustainability transitions, alongside other technology elements such as cryptocurrency. However, while these researchers establish that green financing and crowdfunding are salient FinTech tools for sustainable funding, they do not resolve how NGOs' green-growth outcomes vary across different digital finance infrastructures and asset rails embedded in these tools especially when cryptocurrency is

present. Moreover, (Abramova et al., 2024; Vergara & Agudo, 2021) characterizes cryptocurrency as an integral component of contemporary FinTech architectures that can co-exist with, or it can be embedded into crowdfunding and other digital financing models. Additionally, the green-fintech research agenda further underscores that current fintech approaches concentrate on blockchain technology, while simultaneously calling for measurement frameworks that account for environmental concerns associated with blockchain technologies in cryptocurrency contexts. Previous studies by (Anwar et al., 2024; Bayram et al., 2022) discovered that cryptocurrency integration may alter green financing to gain environmental values. Therefore, cryptocurrency can be an enabler of innovative funding structures and also a source of environmental and governance concerns. Hence this creates a theoretically grounded basis for expecting a moderation effect rather than a uniform direct effect based on previous research by (Pawłowska et al., 2022; Bayram et al., 2022).

Despite this conceptual basis, a clear empirical and NGO focused problem remains whether cryptocurrency strengthens or weakens the effectiveness of NGO-oriented FinTech tools (green financing and crowdfunding) in generating green growth outcomes. Work on fintech environment linkages demonstrates that FinTech's environmental benefits can be context-dependent, with moderation effects documented in related settings such as income inequality moderating the FinTech environment relationship and income inequality moderating FinTech effects on renewable energy consumption (Boutbirt & Adaskou, 2023; Ashta, 2023). Moreover, past studies by (Kwong et al., 2023) found that FinTech explicitly frame green financing as intended to increase financing for nonprofit sustainable development programs. The study also describes cryptocurrency as a platform enabling secure transfer of finance in a mostly unregulated manner. This highlights that in NGOs cryptocurrency adoption could condition financing effectiveness and outcomes. But these studies do not directly test cryptocurrency as a moderator in the specific pathway from green financing and crowdfunding to green growth in NGOs. Additionally, these studies do not establish when cryptocurrency's potential benefits outweigh its risks (Pawłowska et al., 2022; Bayram et al., 2022; Teichmann et al., 2023).

Therefore, this study is designed and carried out due to the lack of conclusive, NGO centered evidence on the moderating role of cryptocurrency in the relationship between FinTech tools (green financing and crowdfunding) and the green growth of NGOs. Past studies (Tamasiga et al., 2022; Vergara & Agudo, 2021) recognise that FinTech enabled green financing and crowdfunding as sustainable funding mechanisms. Moreover, (Abramova et al., 2024; Bayram et al., 2022) emphasize that cryptocurrency is a significant component that can be integrated into such mechanisms. But based on (Anwar et al., 2024; Kwong et al., 2023, Teichmann et al., 2023; Boutbirt & Adaskou, 2023; Ashta, 2023) moderation as a plausible causal structure in FinTech environment dynamics still remains under-specified whether cryptocurrency amplifies or dampens the contribution of these tools to NGOs' environmentally aligned growth and sustainability performance.

Hence, it is not established whether higher cryptocurrency integration significantly changes the strength of the relationship between green financing and crowdfunding and the green growth outcomes of NGOs.

Research Questions

RQ1: Is there a significant relationship between green financing and green growth among NGOs in Malaysia?

RQ2: Is there a significant relationship between crowdfunding and green growth among NGOs in Malaysia?

RQ3: Is there a significant relationship between green financing and cryptocurrency integration among NGOs in Malaysia?

RQ4: Is there a significant relationship between crowdfunding and cryptocurrency integration among NGOs in Malaysia?

RQ5: Is there a significant relationship between cryptocurrency integration and green growth among NGOs in Malaysia?

RQ6: Is there a significant moderating effect of cryptocurrency integration on the relationship between green financing and green growth among NGOs in Malaysia?

RQ7: Is there a significant moderating effect of cryptocurrency integration on the relationship between crowdfunding and green growth among NGOs in Malaysia?

Research Objectives

RO1: To examine whether there is a significant relationship between green financing and green growth among NGOs in Malaysia.

RO2: To examine whether there is a significant relationship between crowdfunding and green growth among NGOs in Malaysia.

RO3: To examine whether there is a significant relationship between green financing and cryptocurrency integration among NGOs in Malaysia.

RO4: To examine whether there is a significant relationship between crowdfunding and cryptocurrency integration among NGOs in Malaysia.

RO5: To examine whether there is a significant relationship between cryptocurrency integration and green growth among NGOs in Malaysia.

RO6: To examine whether there is a significant moderating effect of cryptocurrency integration on the relationship between green financing and green growth among NGOs in Malaysia.

RO7: To examine whether there is a significant moderating effect of cryptocurrency integration on the relationship between crowdfunding and green growth among NGOs in Malaysia.

Underpinning Theory

In this study, the Technology-Organization-Environment (TOE) framework (Tornatzky et al., 1990; DePietro et al., 1990) is used to explain both cryptocurrency integration and its moderating role. TOE proposes that technology-related outcomes are shaped by technological characteristics, organizational readiness and environmental conditions. This is relevant to environmental NGOs because the use of green financing and crowdfunding can increase exposure to digital financial infrastructure, transparency requirements, platform-based transactions and changing donor expectations. At the same time, an NGO's internal capabilities determine whether additional digital financial technologies can be integrated effectively (Ezeudu & Bristow, 2024; Laeni et al., 2020).

Accordingly, the H3 and H4 paths are treated as adoption-oriented relationships. NGOs already engaged in green financing or crowdfunding may possess greater technological

exposure, digital capability and organizational readiness to integrate cryptocurrency-related mechanisms. The TOE framework also supports H6 and H7 because the relationship between a financing mechanism and green growth may vary according to the technological conditions represented by cryptocurrency integration. TOE therefore provides a consistent theoretical basis for examining both the antecedents of cryptocurrency integration and its conditional role in the green financing-green growth and crowdfunding-green growth relationships (Tornatzky et al., 1990; DePietro et al., 1990; Michael et al., 2022).

Literature Review And Hypothesis Development

This section provides the relevant literature and develops the hypothesis tested in this study.

The Relationship Between Green Financing And Green Growth

Green financing which is part of the FinTech innovation helps NGOs to gain prospects to heighten sustainability outcomes. Past study by (Wan et al., 2023) discovered that green finance has played a significant purpose of improving the rate of resources used for green growth. Moreover, a study by (Oanh et al., 2024) has found that green financing is a driver of green growth. Green financing helps to transfer capital toward green projects. Additionally, their study found that green financing has a positive relationship with green growth in green-GDP structure. Moreover, Provincial studies by (Dong et al., 2024; Zeng et al., 2023) proves that green finance can improve carbon-reduction initiatives. Similarly, (Chin et al., 2022) revealed that in BRI economies green finance alleviates environmental devastation and heightens economic growth. In another research (Liu et al., 2024) highlighted that in developing countries heightened green financing reduces carbon emanations, and when green investments surpass a certain point, this effect becomes much greater.

In contrast, not all studies report uniformly favourable outcomes. Hu and Wang (2023) found that the effects of green financial policy on regional economic growth differed across sectors, indicating that the economic consequences of green finance can vary by context. Evidence from African countries also shows that the relationship between green finance and sustainable or inclusive growth is not always uniform across economies and income groups (Djekonbé et al., 2026; Asongu et al., 2025). Moreover, Wang and Wang (2023) found that green finance policies may constrain technological innovation in heavily polluting enterprises when access to conventional financing becomes more restricted. These mixed findings show that the contribution of green finance to green growth can depend on the setting in which it is implemented. Thus, the differing previous findings have led to the development of the first research hypothesis.

H1: There is a significant relationship between green financing and green growth among NGOs in Malaysia.

The Relationship Between Crowdfunding And Green Growth

Crowdfunding has become a significant fundraising method used by NGOs to gather donations from the public and organisations to support various causes. Instead of relying only on traditional methods such as direct mail, print appeals and charity events, organisations increasingly use digital platforms and social media to reach potential contributors (Bondarenko et al., 2022; Abdeldayem & Aldulaimi, 2021). Moreover, (Mukherjee et al., 2024) show that crowdfunding can widen access to finance for renewable-energy initiatives,

indicating that it can support environmentally oriented projects when campaigns are effectively designed and managed.

While crowdfunding may raise funds for sustainable or renewable energy initiatives, it is by no means a guarantee of achieving green growth. Mukherjee et al. (2024) stated that such elements as campaign visibility, communication style and project characteristic have an impact on whether a crowdfunding campaign will be successful. Additionally, (Yang et al., 2019), demonstrated how successful green crowdfunding campaigns are based upon multiple project-specific elements. Therefore, the overall environmental value of crowdfunding is not just in generating funding to support a particular initiative, but in the quality of the project being crowdfunded, the design of the campaign and the ability to effectively utilize those funds raised. These differences in previous findings led to the formation of the second hypothesis.

H2: There is a significant relationship between crowdfunding and green growth among NGOs in Malaysia.

The Relationship Between Green Financing And Cryptocurrency Integration

A theoretical reason for specifying green financing as a predictor of cryptocurrency integration is that green financing increasingly relies on digital financial infrastructures that emphasise transparency, traceability and accountability. Shin et al. (2020) show that blockchain-based systems can enhance transparency and traceability in nonprofit donation processes, while (Li et al., 2025) explain how blockchain can support accountability in green finance and sustainable investment. From a TOE perspective, NGOs already engaged in green financing may therefore have greater technological exposure and organizational readiness for complementary digital financial mechanisms. Green financing is not assumed to mechanically cause cryptocurrency integration; rather, it may create enabling conditions such as demand for auditable transactions, stronger digital governance and greater innovation capability that make cryptocurrency integration more feasible.

The relationship is nevertheless conditional. Campbell-Verduyn (2023) notes that blockchain-based climate-finance initiatives can face sustainability tensions, while (Shin et al., 2020) stress that successful technology integration depends on innovation and technological resources. Karataş and Özgür (2026) further show that energy-intensive cryptocurrencies such as Bitcoin may conflict with green-finance objectives because of their electricity use and associated emissions. These considerations suggest that green financing may be positively related to cryptocurrency integration when the technology is compatible with sustainability goals and the organization has sufficient technological readiness. The combination of enabling conditions and implementation constraints provides the theoretical basis for testing the third hypothesis.

H3: There is a significant relationship between green financing and cryptocurrency integration among NGOs in Malaysia.

The Relationship Between Crowdfunding And Cryptocurrency Integration

Crowdfunding is specified as a predictor of cryptocurrency integration because it is already a digitally mediated form of fundraising. NGOs that use crowdfunding gain experience with

online payment flows, geographically dispersed donors, platform governance and digital transaction records, which can increase compatibility with cryptocurrency-based mechanisms. Chen and Murtazashvili (2024) document the use of cryptocurrency by Ukrainian nonprofits to broaden donor access, while (Alston et al., 2024) describe cryptocurrency-based giving and emergency fundraising. Additionally, (Rangone and Busolli, 2021) also show how blockchain can be incorporated into nonprofit fundraising processes, and (Novak, 2023) discusses the broader use of blockchain and cryptocurrency in charitable and humanitarian activities. From a TOE perspective, this prior digital fundraising experience may strengthen technological compatibility and organizational readiness for cryptocurrency integration, while donor preferences and platform innovation can provide environmental incentives for adoption. However, based on a past study by (Gupta et al., 2023) trust, fraud, and governance concerns in blockchain-based crowdfunding may constrain cryptocurrency integration. Likewise, (Trotter et al., 2020) suggested that cryptocurrency volatility may create uncertainty and limit integration efforts. These enabling and constraining factors provide the theoretical basis for testing the fourth hypothesis.

H4: There is a significant relationship between crowdfunding and cryptocurrency integration among NGOs in Malaysia.

The Relationship Between Cryptocurrency Integration And Green Growth

The relationship between cryptocurrency integration and green growth is mixed because the environmental consequences of cryptocurrency depend strongly on the underlying technology. Juškaitė and Tamošiūnienė (2024) note that more sustainable cryptocurrencies may rely on energy-efficient mechanisms and renewable energy, while (Škiljan and Mehmedović, 2025) discuss the potential role of cryptocurrencies in supporting a green transition. Mustafa et al. (2024), however, emphasise that cryptocurrency trading also creates environmental trade-offs. These studies suggest that cryptocurrency integration cannot be assumed to produce green outcomes automatically, but its contribution depends on the design and energy characteristics of the technology used.

Conversely, substantial evidence highlights the environmental risks associated with energy-intensive proof-of-work cryptocurrencies. Jones et al. (2022) show that Bitcoin mining can generate considerable climate damages because of its electricity requirements. Rădulescu et al. (2025) similarly examine the energy and water implications of Bitcoin mining, while (Sarkodie et al., 2023) report a substantial carbon footprint associated with Bitcoin. These findings indicate that the environmental implications of cryptocurrency integration can conflict with green-growth objectives when energy-intensive systems are used. These contradictory outcomes led to the formation of the fifth hypothesis.

H5: There is a significant relationship between cryptocurrency integration and green growth among NGOs in Malaysia.

The Moderating Effect Of Cryptocurrency Integration On The Relationship Between Green Financing And Green Growth

Green financing plays a significant role in enhancing green growth by channelling funds towards the green objectives of organisations. Based on a study by (Han & Gao, 2024) green financing positively influences green growth by augmenting the readiness of funds for

undertaking green initiatives. Likewise, (Liu et al., 2021) also discovered that green financing significantly impacts green growth of organisations by efficient use of energy and transiting towards low-carbon goals. This ensures that organisations give better green outputs and the economy becomes sustainable.

Direct evidence that cryptocurrency specifically moderates the relationship between green financing and green growth remains limited. Related research nevertheless provides a rationale for testing such an interaction. Wu et al. (2024) show that the contribution of FinTech to inclusive green growth varies with the development of green finance, while (Puteri et al., 2024) report a moderating role for blockchain smart contracts in the relationship between FinTech innovation and green-growth sustainability among Malaysian SMEs. Udeh et al. (2024) further discuss how blockchain can strengthen transparency and trust in green-finance markets. These studies do not investigate the exact moderation effect examined in this study, but they show that technology can condition how financing mechanisms translate into sustainability-related outcomes. At the same time, cryptocurrency integration can impose environmental costs when energy-intensive systems are used (Erdoğan et al., 2022; Gallersdörfer et al., 2020). Such costs may offset some of the environmental gains associated with green financing. Therefore, the direction of the moderating effect cannot be assumed in advance, which led to the formulation of the sixth hypothesis.

H6: There is a significant moderating effect of cryptocurrency integration on the relationship between green financing and green growth among NGOs in Malaysia.

The Moderating Effect Of Cryptocurrency Integration On The Relationship Between Crowdfunding And Green Growth

Evidence on blockchain-enabled crowdfunding provides a related basis for examining cryptocurrency integration as a moderator. Authors (Brandolt, 2023; Chen & Volz, 2021; Yoshino et al., 2020) describe how distributed-ledger technologies can improve transparency, traceability and access to sustainable financing. More specifically, (Chalmeta et al., 2025; Nikhate et al., 2023) discuss blockchain-based crowdfunding systems that reduce reliance on intermediaries and improve the visibility of transactions. Likewise, (Devi et al., 2025; Sutha et al., 2025) describe the use of smart contracts and blockchain mechanisms to improve fund utilisation and transparency in crowdfunding. These studies support the possibility that technology integration can alter how crowdfunding contributes to sustainability-related outcomes, although they do not directly test the moderation relationship proposed in this study.

At the same time, cryptocurrency can introduce environmental and financial constraints into fundraising systems. Studies by (Miśkiewicz et al., 2022; Mohsin et al., 2020) noted that cryptocurrency activity can be associated with increased energy use and environmental degradation. Likewise, (Sarkodie et al., 2023) documents the carbon footprint associated with Bitcoin, while (Shi et al., 2023) shows that moving from proof-of-work to proof-of-stake can substantially reduce blockchain-related carbon emissions. These studies suggest that the environmental effect of cryptocurrency enabled crowdfunding may depend on the technology used. This uncertainty led to the formation of the seventh hypothesis.

H7: There is a significant moderating effect of cryptocurrency integration on the relationship between crowdfunding and green growth among NGOs in Malaysia.

Proposed Conceptual Framework

Figure 1 presents the proposed conceptual framework. Green financing and crowdfunding are specified as predictor constructs (independent variables), cryptocurrency integration is specified as both an endogenous construct and a moderating variable, and green growth is the outcome construct (dependent variable). Green financing and crowdfunding are hypothesised to have direct relationships with green growth (H1 and H2) and to predict cryptocurrency integration (H3 and H4). Cryptocurrency integration is also hypothesised to have a direct relationship with green growth (H5) and to moderate the green financing-green growth and crowdfunding-green growth relationships (H6 and H7). The H3 and H4 paths reflect the proposition that prior engagement in these financing methods can provide the technological exposure and organizational readiness needed to integrate cryptocurrency-related mechanisms. This specification allows the study to distinguish the antecedents and direct role of cryptocurrency integration from its conditional role in the financing-green-growth relationships.

The moderation hypotheses do not assume that cryptocurrency integration is inherently beneficial or harmful. Rather, they test whether the relationship between each financing mechanism and green growth differs across levels of cryptocurrency integration. The Technology-Organization-Environment (TOE) framework (Tornatzky et al., 1990; DePietro et al., 1990) provides the theoretical context for this approach by recognizing that technology-related outcomes depend on technological characteristics, organizational readiness and environmental conditions. Accordingly, a significant interaction is interpreted as evidence that the financing-green growth relationship varies according to the level of cryptocurrency integration rather than as a direct causal effect.

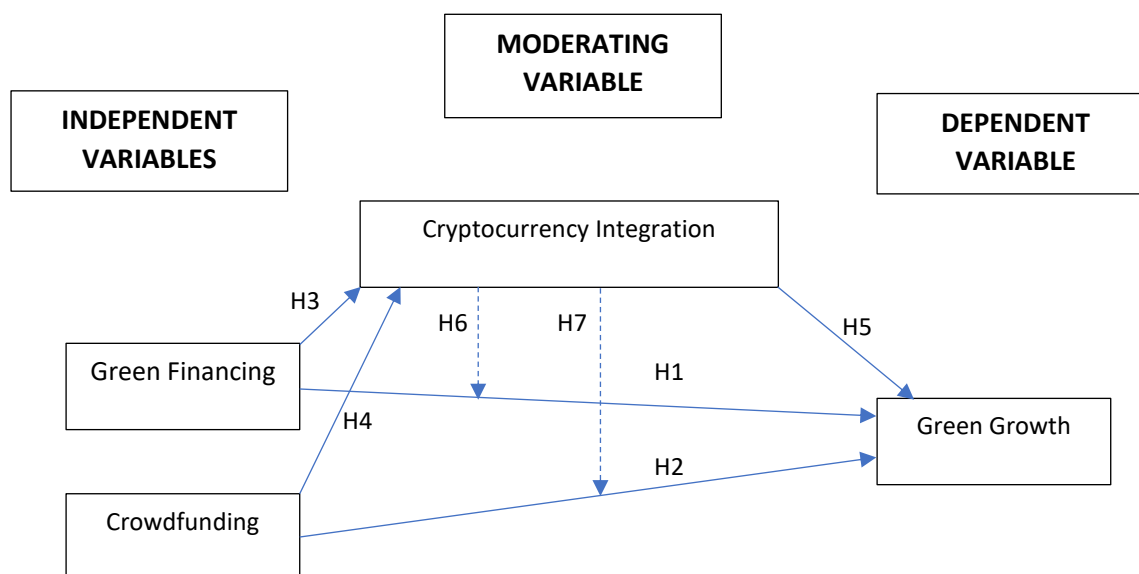


Figure 1: Proposed Conceptual Framework

Methodology

Research Design, Population and Sampling

This study used a quantitative, cross-sectional survey design to examine relationships among green financing, crowdfunding, cryptocurrency integration and green growth in the context of environmental NGOs in Malaysia. The sampling frame identified approximately 55 registered environmental NGOs. A two-stage organisational sampling procedure was used. First, purposive screening was applied to identify NGOs that were active in environmental protection and therefore relevant to the study. Second, 48 NGOs were selected from the eligible organisational pool. Within the selected NGOs, questionnaires were directed to knowledgeable personnel whose responsibilities included management, finance, technology, fundraising, sustainability or organisational decision-making.

Each of the 48 NGO's that participated in the study was given 4 copies of the survey instruments for a total of 192 surveys. A total of 151 usable surveys were completed which represents a response rate of 78.6%. Responses to the questionnaire were provided by individuals who had knowledge about their respective organisation and therefore could provide accurate responses. Therefore, data analysis occurred at the respondent level with respondents providing information about their organisations.

Unit Of Analysis And Level Of Inference

The 151 knowledgeable personnel were the units of analysis because each completed questionnaire represented one empirical record. The constructs primarily addressed organisational financing, technology integration and green-growth practices. Therefore, respondents served as organisational informants. As the data were analysed at the respondent level and were not aggregated into 48 NGO-level scores, the findings are interpreted as respondent level associations within a multi-informant NGO sample.

Research Instrument And Construct Definitions

A self-administered questionnaire using a five-point Likert response format was used. Before full administration, 5 FinTech experts reviewed the instrument for relevance, clarity and completeness, and a pilot test involving 30 respondents was conducted. The pilot study indicated satisfactory Cronbach's alpha reliability for the study constructs.

For interpretation in this study, green financing refers to financing directed toward environmentally aligned projects and sustainability-related activities; crowdfunding refers to digitally enabled fundraising from dispersed contributors; cryptocurrency integration refers to the extent to which cryptocurrency-related mechanisms are incorporated into an NGO's financing or fundraising operations; and green growth refers to environmentally aligned organisational outcomes rather than general organisational expansion. The questionnaire measured these constructs through respondents' reported organisational practices. Cryptocurrency integration was assessed at the construct level and did not include transaction level information such as specific cryptocurrency assets, transaction frequency, adoption duration or detailed implementation mechanisms.

Data Analysis

A combination of descriptive statistics for organizational and respondents profile data as well as Cronbach's Alpha, HTMT, VIF, Pearson Correlation were applied. To evaluate the reliability

(Cronbach's Alpha), discriminant validity (HTMT), multicollinearity (VIF) and relationship amongst variables from the data were used. A structural equation model was developed through the application of SmartPLS version 4. The direct linkages (H1-H5) and moderation effect of cryptocurrency integration on green growth (H6-H7) were analysed through standardized path coefficients, t-statistics and p-values. The total explanatory power of the model was found to be 55.6%, or ($R^2 = 0.556$).

Findings and Interpretation

Sample Profile

Table 1

NGO Size Profile (N = 48)

NGO size	Frequency	Percentage
Small	11	22.9%
Medium	13	27.1%
Large	24	50.0%

The organisational profile in Table 1 NGO Size Profile, indicates that 24 of the 48 NGOs (50.0%) were classified as large, 13 (27.1%) as medium and 11 (22.9%) as small. NGO size is reported at the organisational level and is therefore separated from respondent characteristics.

Table 2

Respondent Profile (N = 151)

Characteristic	Frequency	Percentage
Tenure: 0-2 years	5	3.3%
Tenure: 3-5 years	21	13.9%
Tenure: 6-10 years	28	18.5%
Tenure: 11-15 years	48	31.8%
Tenure: >15 years	49	32.5%
Board Member/Trustee	4	2.6%
Executive Director/CEO	27	17.9%
Program Manager	49	32.5%
Fundraising/Development Officer	34	22.5%
Finance/Operations Officer	37	24.5%

According to Table 2 Respondent Profile, most respondents had substantial organisational experience whereby 64.3% reported more than ten years of tenure. The sample also included personnel in management, program, fundraising and finance and operations roles. These roles are relevant to the subject matter of the questionnaire. Most respondents assumed the role as program manager which is 32.5%.

Measurement Model Assessment

Table 3

Internal Consistency of the Study Constructs

Construct	Number of items	Cronbach's alpha
Green Financing	6	0.819
Crowdfunding	6	0.830
Cryptocurrency Integration	7	0.856
Green Growth	7	0.820

Based on Table 3 Internal Consistency of the Study Constructs. the Cronbach's alpha values ranged from 0.819 to 0.856, indicating acceptable internal consistency across the four study constructs.

Table 4

Heterotrait-Monotrait Ratio (HTMT)

Construct	Green Financing	Crowdfunding	Cryptocurrency Integration	Green Growth
Green Financing	-			
Crowdfunding	0.663	-		
Cryptocurrency Integration	0.614	0.581	-	
Green Growth	0.665	0.535	0.603	-

From Table 4 Heterotrait-Monotrait Ratio (HTMT), the values ranged from 0.535 to 0.665. All values were below the commonly applied threshold of 0.85, providing evidence that the four constructs were empirically distinguishable.

Structural-Model Collinearity

Table 5

Structural-Model Collinearity

Predictor construct	Endogenous construct	Inner VIF
Green Financing	Green Growth	1.135
Crowdfunding	Green Growth	2.039
Cryptocurrency Integration	Green Growth	2.117
Cryptocurrency Integration x Green Financing	Green Growth	1.754
Cryptocurrency Integration x Crowdfunding	Green Growth	1.958

According to Table 5 Structural-Model Collinearity, the reported inner VIF values ranged from 1.135 to 2.117, while the interaction terms recorded VIF values of 1.754 and 1.958. These values do not indicate problematic structural collinearity.

Pearson's Correlation Analysis

Table 6

Pearson's Correlation Matrix

Variables	GF	CF	CI	GG
Green Financing (GF)	1			
Crowdfunding (CF)	0.589**	1		
Cryptocurrency Integration (CI)	0.641**	0.512**	1	
Green Growth (GG)	0.606**	0.586**	0.556**	1

** Correlation is significant at the 0.01 level (two-tailed).

Based on Table 6 Pearson's Correlation Matrix, all reported bivariate correlations were positive and statistically significant at the 0.01 level, ranging from 0.512 to 0.641. These coefficients indicate moderate respondent-level associations. They should not be interpreted

as evidence of causation, and the absence of correlations above 0.70 does not replace the structural VIF assessment reported above.

Structural Model And Moderation Analysis

Table 7

Structural and Moderation Results

Hypothesis	Relationship	β	t-value	p-value	Decision
H1	Green Financing $\rightarrow$ Green Growth	0.529	5.457	< 0.001	Supported
H2	Crowdfunding $\rightarrow$ Green Growth	0.074	0.822	0.411	Not supported
H3	Green Financing $\rightarrow$ Cryptocurrency Integration	0.606	9.289	< 0.001	Supported
H4	Crowdfunding $\rightarrow$ Cryptocurrency Integration	0.486	6.797	< 0.001	Supported
H5	Cryptocurrency Integration $\rightarrow$ Green Growth	0.198	1.786	0.074	Not supported
H6	CI $\times$ Green Financing $\rightarrow$ Green Growth	-0.409	5.628	< 0.001	Supported
H7	CI $\times$ Crowdfunding $\rightarrow$ Green Growth	0.144	1.592	0.111	Not supported

It is evident from table 7, that there was a significant relationship found for green financing and green growth ($\beta = 0.529$, $t = 5.457$, $p < 0.001$) indicating support for H1. Conversely, the findings indicated no significant relationship existed between crowdfunding and green growth ($\beta = 0.074$, $t = 0.822$, $p = 0.411$), therefore H2 is unsupported.

Additionally, it can be seen from Table 7, that there exists a significant positive relationship between green financing and cryptocurrency integration ($\beta = 0.606$, $t = 9.289$, $p < 0.001$), providing evidence to support H3. Furthermore, a significant positive relationship existed between crowdfunding and cryptocurrency integration ($\beta = 0.486$, $t = 6.797$, $p < 0.001$), thus supporting H4. Additionally, based on the findings presented in table 7, the direct relationship between cryptocurrency integration and green growth was not statistically significant ($\beta = 0.198$, $t = 1.786$, $p = 0.074$), resulting in H5 being unsupported.

In regard to the moderation effects examined in this study, it is clear from the results provided in Table 7 that the moderating variable, cryptocurrency integration significantly moderated the relationship between green financing and green growth ($\beta = -0.409$, $t = 5.628$, $p < 0.001$), which provides evidence to support H6. This indicates that the stronger the positive relationship that exists between green financing and green growth will become less strong as levels of cryptocurrency integration increase. In addition to this finding, it was observed that the moderating effect of cryptocurrency integration on the relationship between crowdfunding and green growth was both positive and statistically insignificant ($\beta = 0.144$, $t = 1.592$, $p = 0.111$), thus H7 is unsupported. Therefore, based on the analysis of the data collected for this study, H1, H3, H4 and H6 are supported; whereas H2, H5 and H7 are unsupported. Finally, the model used to collect these data explained 55.6% or ($R^2 = 0.556$) of the variability present in green growth.

Simple Slope Analysis

The simple slopes Figures 2 and 3 below elucidate the moderating effect of cryptocurrency integration at low (-1 SD) and high ($+1$ SD) levels, which was obtained from SmartPLS 4 using the standardized path and interaction coefficients.

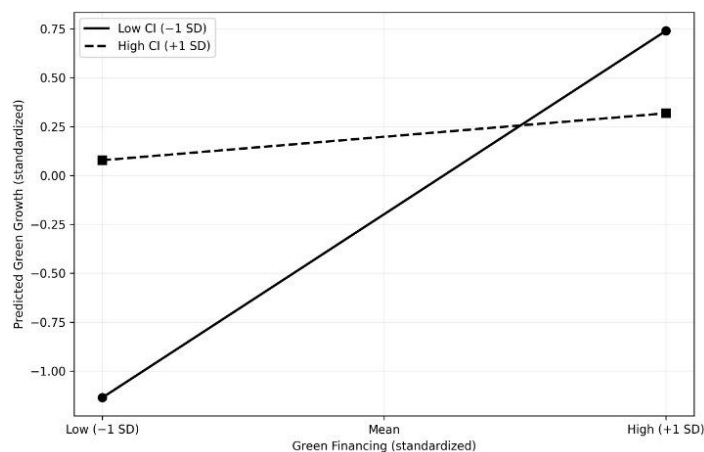


Figure 2. Simple-Slope Analysis of the Moderating Effect of Cryptocurrency Integration on the Relationship Between Green Financing and Green Growth

Figure 2 shows the role of cryptocurrency integration as a moderator that affects the relationship between green finance and green growth. The simple-slope graph shows that there is an increased strength to the association for low cryptocurrency integration and a reduced strength to the relationship for high cryptocurrency integration. For example, for low levels of cryptocurrency integration the relationship was 0.938 whereas it was 0.120 at high levels of cryptocurrency integration. The results show that these patterns are consistent with the significant negative interaction effects ($\beta = -0.409$, $t = 5.628$, $p < 0.001$). Therefore, this study has found that increasing levels of cryptocurrency integration have weakened the association between green finance and green growth.

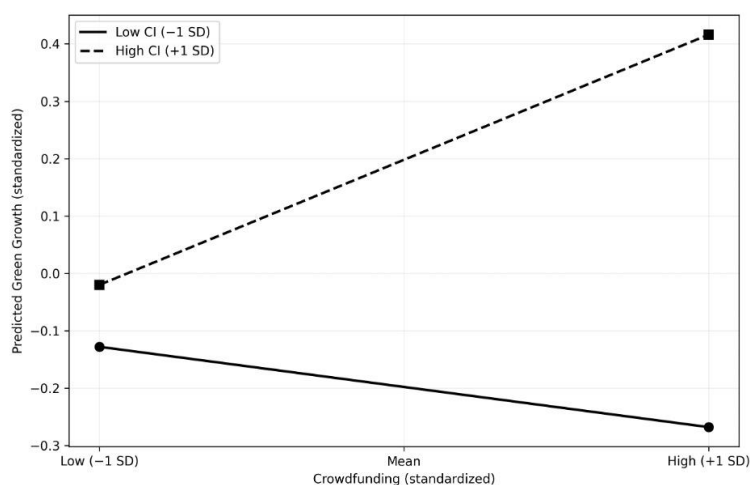


Figure 3. Simple-Slope Analysis of the Moderating Effect of Cryptocurrency Integration on the Relationship Between Crowdfunding and Green Growth

Figure 3 shows the moderating effect of cryptocurrency integration between crowdfunding and green growth relationship. It illustrates that higher cryptocurrency integration strengthens the positive relationship between crowdfunding and green growth. At lower cryptocurrency integration, there is a negative relationship (-0.070) between crowdfunding and green growth. But at higher cryptocurrency integration, the relationship becomes positive (0.218). Although, the results illustrated demonstrate an upward pattern for the interaction, but was not statistically significant ($\beta = 0.144$, $t = 1.592$, $p = 0.111$). Therefore, H7 cannot be supported.

Discussion

This research indicates a statistically significant positive association exists between Green Financing and Green Growth. This is consistent with prior literature which suggests that environmentally directed funding will enable NGOs to enhance their sustainability related activity (Wan et al. 2023; Oanh et al. 2024). However, no statistically significant relationship was identified in this study between crowdfunding and green growth, implying the impact of crowdfunding may be dependent upon additional variables such as project quality, and campaign design relative to how funds are utilized (Yang et al., 2019; Mukherjee et al. 2024). Green financing and crowdfunding both had significant positive relationships with cryptocurrency integration, supporting H3 and H4. This suggests that NGOs already engaged in these financing methods may have greater technological exposure and organizational readiness to integrate cryptocurrency-related mechanisms. This interpretation is consistent with the TOE framework, which proposes that technology-related outcomes depend on technological characteristics, organizational readiness and environmental conditions (Tornatzky et al., 1990; DePietro et al., 1990). However, cryptocurrency integration did not have a statistically significant direct relationship with green growth, and H5 was therefore not supported. Its contribution to green growth appears to depend on how the technology is implemented and on its environmental characteristics (Juškaitė & Tamošiūnienė, 2024; Jones et al., 2022).

Finally, the moderation results provide useful insights. Cryptocurrency integration significantly weakened the positive relationship between green financing and green growth, supporting H6. This may be related to energy and environmental concerns associated with some cryptocurrency technologies (Erdoğan et al., 2022; Gellersdörfer et al., 2020). In contrast, the moderating effect of cryptocurrency integration on the relationship between crowdfunding and green growth was not statistically significant, and H7 was not supported. This indicates that the observed upward interaction pattern was insufficient to establish a significant moderation effect. Overall, the findings show that cryptocurrency integration does not directly improve green growth and that its role depends on the financing mechanism and technological context.

Conclusion

This study examined the relationships among green financing, crowdfunding, cryptocurrency integration and green growth among environmental NGOs in Malaysia. Green financing had a statistically significant positive relationship with green growth, supporting previous evidence that green financing can direct resources toward environmentally focused projects (Wan et al., 2023; Oanh et al., 2024). In contrast, crowdfunding did not have a statistically

significant direct relationship with green growth, suggesting that its contribution may depend on how projects are designed, communicated and implemented.

Cryptocurrency integration did not have a statistically significant direct relationship with green growth. More importantly, it significantly weakened the positive relationship between green financing and green growth, while its moderating effect on the crowdfunding-green growth relationship was not statistically significant. These findings suggest that cryptocurrency integration does not automatically improve environmental outcomes. Its contribution may depend on the technology used and its environmental characteristics, including energy consumption and whether more sustainable cryptocurrency mechanisms are adopted (Juškaitė & Tamošiūnienė, 2024; Jones et al., 2022).

The findings are also consistent with the TOE framework, which recognizes that technology-related outcomes are influenced by technological, organizational and environmental conditions (DePietro et al., 1990; Tornatzky et al., 1990). For environmental NGOs, green financing therefore appears to provide the clearest direct contribution to green growth, while cryptocurrency integration should be considered cautiously in relation to governance, transparency, regulatory requirements and environmental sustainability.

Limitations of the Study

The present study has two main limitations. First, the analysis was conducted using a cross-sectional design. All the data that are part of this study were collected at the same moment in time. Although this type of study design provides the ability to examine the relationship among variables studied, it is not possible to assess how these relationships have changed from one time period to another.

Secondly, respondents reported their own use of cryptocurrencies for NGO's. Due to this fact, the study did not collect information about which types of cryptocurrencies that each NGO uses. It also did not gather any information about the frequency of transactions, the length of time that an NGO had been using cryptocurrencies, or what methods were being utilized to carry out the organisation's cryptocurrency related activity.

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References

- Abdeldayem, M., & Aldulaimi, S. (2021). Entrepreneurial finance and crowdfunding in the middle east. *International Journal of Organizational Analysis*, 31(4), 927-944. <https://doi.org/10.1108/IJOA-03-2021-2684>
- Abramova, A., Popelo, O., Fedyshyn, M., Popova, L., Shchur, R., & Marych, M. (2024). Digital green finance architecture in the context of green deal implementation: Modern fintech tools and solutions under the sustainable development concept. *Journal of Lifestyle and SDGs Review*, 4(2), e02166. <https://doi.org/10.47172/2965-730X.SDGsReview.v4.n02.pe02166>
- Ahmad, F., Boumaiza, A., Sanfilippo, A., & Al-Fagih, L. (2025). A detailed comprehensive role of digital technologies in green finance initiative for net-zero energy transition. *Advanced Energy and Sustainability Research*, 6(10). <https://doi.org/10.1002/aesr.202500066>
- Alston, E., Murtazashvili, I., & Weiss, M. B. H. (2024). Introduction to the special issue: Blockchains and public administration. *Chinese Public Administration Review*, 15(1), 3–10. <https://doi.org/10.1177/15396754241228530>
- Anwar, H., Waheed, R., & Aziz, G. (2024). Importance of FinTech and green finance to achieve the carbon neutrality targets: a study of Australian perspective. *Environmental Research Communications*, 6(11), 115007. <https://doi.org/10.1088/2515-7620/ad853d>
- Ashta, A. (2023). How can fintech companies get involved in the environment? *Sustainability*, 15(13), 10675. <https://doi.org/10.3390/su151310675>
- Asongu, S., Pondie-Messie, T., & Bitoto, F. E. (2025). What role can alternative finance play in Africa's sustainable development trajectories? *Business Strategy & Development*, 8(3). <https://doi.org/10.1002/bsd2.70217>
- Bayram, O., Talay, I., & Feridun, M. (2022). Can fintech promote sustainable finance? Policy lessons from the case of Turkey. *Sustainability*, 14(19), 12414. <https://doi.org/10.3390/su141912414>
- Bondarenko, O., Tetiana, U., Zoreslava, L., Kateryna, H., Olena, N., & Oksana, S. (2022). Crowdfunding development in the social media marketing system. *WSEAS Transactions on Business and Economics* 19(2022), 1678-1688. <https://doi.org/10.37394/23207.2022.19.152>
- Boutbhart, N., & Adaskou, M. (2023). Financial innovation of small and medium enterprises in Morocco in the area of energy optimization: State of the art. *E3s Web of Conferences*, 412, 01084. <https://doi.org/10.1051/e3sconf/202341201084>
- Brandolt, L. M. D. (2023). The use of blockchain to foment the financing of sustainable projects in civil construction. *Grupo de Pesquisa Virtuhab*, 356–371. <https://doi.org/10.29183/2596-237x.ensur2023.v11.n3.p356-371>
- Campbell-Verduyn, M. (2023). Conjuring a cooler world? Imaginaries of improvement in blockchain climate finance experiments. *Environment and Planning C Politics and Space*, 42(5), 782–799. <https://doi.org/10.1177/23996544231162858>
- Chalmeta, R., Cabezas-Hernando, D., & Silva, J. dos S. (2025). Framework for crowdfunding sustainable development goals projects using blockchain. *Sustainable Development*, 33(2), 2740–2758. <https://doi.org/10.1002/sd.3260>
- Chen, W. D., & Murtazashvili, I. (2024). Is cryptoaltruism transforming the nonprofit sector? Lessons from the Ukrainian nonprofits during the Russia-Ukraine war. *Chinese Public Administration Review*, 15(1), 36–46. <https://doi.org/10.1177/15396754231222575>

- Chen, Y., & Volz, U. (2021). Scaling up sustainable investment through blockchain-based project bonds. *Development Policy Review*, 40(3). <https://doi.org/10.1111/dpr.12582>
- Chin, M.-Y., Ong, S.-L., Ooi, D. B. Y., & Puah, C. (2022). The impact of green finance on environmental degradation in BRI region. *Environment Development and Sustainability*, 26(1), 303–318. <https://doi.org/10.1007/s10668-022-02709-5>
- DePietro, R., Wiarda, E., & Fleischer, M. (1990). *The context for change: Organization, technology and environment*. In L. G. Tornatzky & M. Fleischer (Eds.), *The processes of technological innovation*. Lexington Books. 151–175.
- Devi, M. N., Bhargavi, G., Pragna, G., Sai, G. V., & Gauthami, A. (2025). Secure and transparent crowdfunding systems: Blockchain's role in optimizing fund utilization. *International Journal Of Scientific Research In Engineering And Management*, 9(3), 1–9. <https://doi.org/10.55041/ijrem42845>
- Djekonbe, D., Brezeanu, P., Gherghina, Ș., & Djourabi, M. (2026). Exploring the effects of green finance on inclusive growth: Empirical evidence from African countries. *Journal of International Development* 38(3), 553–569. <https://doi.org/10.1002/jid.70069>.
- Dong, G., Xie, P., Zhang, Y., & Liao, C. (2024). Impact of green finance on carbon emission efficiency and spatial spillover effects: A case study of Guangzhou, China. *Sustainability*, 16(23), 10309. <https://doi.org/10.3390/su162310309>
- Erdoğan, S., Ahmed, M. Y., & Sarkodie, S. A. (2022). Analyzing asymmetric effects of cryptocurrency demand on environmental sustainability. *Environmental Science and Pollution Research*, 29(21), 31723–31733. <https://doi.org/10.1007/s11356-021-17998-y>
- Ezeudu, O. B., & Bristow, D. (2024). Financing methods for solid waste management: A review of typology, classifications, and circular economy implications. *Sustainable Development*, 33(2), 3062–3085. <https://doi.org/10.1002/sd.3256>
- Gallersdörfer, U., Klaaßen, L., & Stoll, C. (2020). Energy consumption of cryptocurrencies beyond bitcoin. *Joule*, 4(9), 1843–1846. <https://doi.org/10.1016/j.joule.2020.07.013>
- Gupta, V., Garg, N., Seth, S., Rastogi, N., Rawat, S. S., & Kumar, R. (2023). Crowdfunding using Blockchain Technology: A review. *Global Journal of Innovation and Emerging Technology*, 1(2), 8–14. <https://doi.org/10.58260/j.iet.2202.0107>
- Han, J., & Gao, H. (2024). Green finance, social inclusion, and sustainable economic growth in OECD member countries. *Humanities and Social Sciences Communications*, 11(1). <https://doi.org/10.1057/s41599-024-02662-w>
- Horn, C. (2023). Brazil's Amazon Fund: A “Green Fix” between offset pressures and deforestation crisis. *Antipode*, 55(6), 1686–1710. <https://doi.org/10.1111/anti.12932>
- Hu, C., & Wang, Y. (2023). Assessing regional economic growth through green financial policy: Insights from PSM-DID model on 107 cities of China. *Heliyon*, 9(9), e19568. <https://doi.org/10.1016/j.heliyon.2023.e19568>
- Jones, B. A., Goodkind, A. L., & Berrens, R. P. (2022). Economic estimation of bitcoin mining's climate damages demonstrates closer resemblance to digital crude than digital gold. *Scientific Reports*, 12(1), 14512. <https://doi.org/10.1038/s41598-022-18686-8>
- Juškaitė, L., & Tamošiūnienė, R. (2024). Cryptocurrencies investing trends in the context of Environmental, Social and Governance. *IOP Conference Series Earth and Environmental Science*, 1429(1), 12005. <https://doi.org/10.1088/1755-1315/1429/1/012005>
- Karataş, E., & Özgür, Ö. (2026). Blockchain in sustainable finance: Evidence from cryptocurrency, green bonds, and clean energy. *Istanbul Gelisim University Journal of Social Sciences*, 12(3), 889–904. <https://doi.org/10.17336/igusbd.1719352>

- Khoma, N. (2023). Crowdfunding and fundraising in the peacebuilding system: Ukraine's case. *Lithuanian Annual Strategic Review*, 20(1), 53-75. <https://doi.org/10.47459/lasr.2023.20.3>
- Kubo, T., Veríssimo, D., Uryu, S., Mieno, T., & MacMillan, D. C. (2021). What determines the success and failure of environmental crowdfunding? *Ambio*, 50(9), 1659–1669. <https://doi.org/10.1007/s13280-021-01522-0>
- Kwong, R., Kwok, M. L. J., & Wong, H. (2023). Green fintech innovation as a future research direction: A bibliometric analysis on green finance and fintech. *Sustainability*, 15(20), 14683. <https://doi.org/10.3390/su152014683>
- Laeni, N., Brink, M. van den, Busscher, T., Ovink, H., & Arts, J. (2020). Building local institutional capacities for urban flood adaptation: Lessons from the water as leverage program in Semarang, Indonesia. *Sustainability*, 12(23), 10104. <https://doi.org/10.3390/su122310104>
- Li, T., Lau, W. T., & Yahya, M. H. D. H. (2025). Blockchain applications in green finance for transparency and accountability in sustainable investments. *Sustainability*, 17(6), 2520. <https://doi.org/10.3390/su17062520>
- Liu, H., Yao, P., & Latif, S. (2021). Impact of green financing, fintech, and financial inclusion on energy efficiency. *Environmental Science and Pollution Research*, 29(13), 18955–18966. <https://doi.org/10.1007/s11356-021-16949-x>
- Liu, X., Fatema, N., Rahman, M., & Rahman, Md. M. (2024). Does green financing moderate the effect of trade openness on carbon emissions in emerging countries? *Sage Open*, 14(3). <https://doi.org/10.1177/21582440241285179>
- Michael, B., Koroleska, N., Tai, A. C., & Wong, D. W. H. (2022). A critical look at using financial technology policy to promote the sustainable development goals. *Sustainable Development*, 30(6), 1911–1920. <https://doi.org/10.1002/sd.2358>
- Miśkiewicz, R., Matan, K., & Karnowski, J. (2022). The role of crypto trading in the economy, renewable energy consumption and ecological degradation. *Energies*, 15(10), 3805. <https://doi.org/10.3390/en15103805>
- Mohsin, M., Naseem, S., Rehman, M. Z. ur, Baig, S. A., & Salamat, S. (2020). The crypto-trade volume, GDP, energy use, and environmental degradation sustainability: An analysis of the top 20 crypto-trader countries. *International Journal of Finance & Economics*, 28(1), 651–667. <https://doi.org/10.1002/ijfe.2442>
- Mora, H., Mendoza-Tello, J. C., Varela-Guzmán, E., & Szymański, J. (2021). Blockchain technologies to address smart city and society challenges. *Computers in Human Behavior*, 122, 106854. <https://doi.org/10.1016/j.chb.2021.106854>
- Mukherjee, A., Griffiths, P., Sinha, P., & Deol, S. (2024). Finance for sustainability: A systematic review on crowdfunding for renewable energy projects. *Review of Financial Economics*, 42(4), 467–490. <https://doi.org/10.1002/rfe.1211>
- Mustafa, F., Mordi, C., & Elamer, A. A. (2024). Green gold or carbon beast? Assessing the environmental implications of cryptocurrency trading on clean water management and carbon emission SDGs. *Brunel University Research Archive (BURA) (Brunel University London)*, 367, 122059. <https://doi.org/10.1016/j.jenvman.2024.122059>
- Nikhate, N., Raut, N., Sayankar, P., Sonwane, R., & Pawar, R. (2023). Securefund crowdfunding using blockchain. *International Journal for Research in Applied Science and Engineering Technology*, 11(3), 2019–2022. <https://doi.org/10.22214/ijraset.2023.49870>
- Nix, P. E., Goldstein, A., & Oppenheimer, M. (2025). Quasi-governmental organization under pressure: The connecticut green bank's response to a budget shock. *Environmental Policy and Governance*, 35(4), 647–661. <https://doi.org/10.1002/eet.2161>

- Novak, M. (2023). Crypto altruism: Applying blockchain to charitable and humanitarian activities. *Chinese Public Administration Review*, 15(1), 11–23. <https://doi.org/10.1177/15396754231175173>
- Oanh, T. T. K., Bui, T. D., & Dao, L. K. O. (2024). The impact of green finance on green growth: The role of green energy and green production. *Heliyon*, 10(16), e36639. <https://doi.org/10.1016/j.heliyon.2024.e36639>
- Organisation for Economic Co-operation and Development [OECD]. (2019). Towards green growth in emerging market economies: Evidence from environmental performance reviews. *OECD Green Growth Papers No. 2019-01*. OECD Publishing. <https://doi.org/10.1787/d5e5b5d7-en>
- Pawłowska, M., Staniszewska, A., & Grzelak, M. (2022). Impact of FinTech on Sustainable Development. *Financial Sciences*, 27(2), 49–66. <https://doi.org/10.15611/fins.2022.2.05>
- Puteri, Mursyidatul, N., & Paramasivam, G. (2024). Relationship of fintech innovation with green growth sustainability moderated by blockchain smart contracts among small and medium sized enterprise in Selangor, Malaysia. *International Journal of Economics and Business Administration*, XII(3) 51–81. <https://doi.org/10.35808/ijeba/853>
- Rădulescu, M., Mohammed, K. S., Nassani, A. A., & Dascalu, N. (2025). Evaluating the environmental effects of bitcoin mining on energy and water use in the context of energy transition. *Scientific Reports*, 15(1), 8230. <https://doi.org/10.1038/s41598-025-92314-z>
- Ramakrishnan, S., Joghee, S., Kabiraj, S., & Bishnoi, M. M. (2022). Fintech innovations in the financial service industry. *Journal of Risk and Financial Management*, 15(7), 287. <https://doi.org/10.3390/jrfm15070287>
- Rangone, A., & Busolli, L. (2021). Managing charity 4.0 with blockchain: A case study at the time of Covid-19. *International Review on Public and Nonprofit Marketing*, 18(4), 491–521. <https://doi.org/10.1007/s12208-021-00281-8>
- Sarkodie, S. A., Amani, M. A., Ahmed, M. Y., & Owusu, P. A. (2023). Assessment of bitcoin carbon footprint. *Sustainable Horizons*, 7, 100060. <https://doi.org/10.1016/j.horiz.2023.100060>
- Shi, X., Xiao, H., Liu, W., Lackner, K. S., Buterin, V., & Stocker, T. F. (2023). Confronting the carbon-footprint challenge of blockchain. *Environmental Science & Technology*, 57(3), 1403–1410. <https://doi.org/10.1021/acs.est.2c05165>
- Shin, E.-J., Kang, H.-G., & Bae, K. (2020). A study on the sustainable development of NPOs with blockchain technology. *Sustainability*, 12(15), 6158. <https://doi.org/10.3390/su12156158>
- Škiljan, A., & Mehmedović, H. (2025). Kriptovalute kao alat u tradicionalnim finansijama za zelenu tranziciju i održivi razvoj / cryptocurrencies as a tool in traditional finance for green transition and sustainable development. *Zbornik Radova*, 14(1), 198–205. <https://doi.org/10.58952/zr20251401198>
- Sutha, R. T., Alsalam, V., Sruthi, Z., Desai, P. M., & Egambergan, K. (2025). Innovative blockchain-integrated crowdfunding solution for sustainable business startups. *2025 International Conference on Metaverse and Current Trends in Computing (ICMCTC)*, 1–4. <https://doi.org/10.1109/ICMCTC62214.2025.11196570>
- Svidroňová, M. M., Kaščáková, A., & Muthová, N. J. (2024). Charitable versus commercial crowdfunding: Which is more successful on Startlab? *Journal of Philanthropy and Marketing*, 29(2). <https://doi.org/10.1002/nvsm.1848>

- Tamasiga, P., Onyeaka, H., & Ouassou, E. houssin. (2022). Unlocking the green economy in African countries: An integrated framework of fintech as an enabler of the transition to sustainability. *Energies*, 15(22), 8658. <https://doi.org/10.3390/en15228658>
- Teichmann, F., Boticiu, S., & Sergi, B. S. (2023). Compliance Concerns in Sustainable Finance: An Analysis Of Peer-To-Peer (P2P) Lending platforms and sustainability. *Journal of Financial Crime*, 31(4), 993–1001. <https://doi.org/10.1108/jfc-11-2022-0281>
- Tornatzky, L. G., Fleischer, M., & Chakrabarti, A. K. (1990). *The processes of technological innovation*. Lexington Books.
- Torres, B., Serrasqueiro, Z., & Oliveira, M. (2024). Crowdfunding versus traditional banking: Alternative or complementary systems for financing projects in Portugal? *International Journal of Financial Studies*, 12(2), 33. <https://doi.org/10.3390/ijfs12020033>
- Trotter, L., Harding, M., Shaw, P., Davies, N., Elsdon, C., Speed, C., Vines, J., Abadi, A., & Hallwright, J. (2020). Smart donations: Event-driven conditional donations using smart contracts on the blockchain. *OzCHI '20: Proceedings of the 32nd Australian Conference on Human-Computer Interaction*. 546 – 557. <https://doi.org/10.1145/3441000.3441014>
- Udeh, E. O., Amajuoyi, P., Adeusi, K. B., & Scott, A. O. (2024). The role of blockchain technology in enhancing transparency and trust in green finance markets. *Finance & Accounting Research Journal*, 6(6), 825–850. <https://doi.org/10.51594/farj.v6i6.1181>
- Vergara, C. C., & Agudo, L. F. (2021). Fintech and sustainability: Do they affect each other? *Sustainability*, 13(13), 7012. <https://doi.org/10.3390/su13137012>
- Vysochan, O., & Івасюк, Т. (2020). Accounting and analytical support of fundraising operations in organizations of non-profit sector of the economy. *Economics Entrepreneurship Management*, 7(2), 91–101. <https://doi.org/10.23939/eem2020.02.091>
- Wan, Y.Y., Sheng, N., Wei, X.Y., Tan, M., & Ling, J. (2023). Effect of green finance reform and innovation pilot zone on improving environmental pollution: An empirical evidence from Chinese cities. *Environmental Science and Pollution Research* 30(29), 75058–75077. <https://doi.org/10.1007/s11356-023-27657-z>
- Wang, B., & Wang, C. (2023). Green finance and technological innovation in heavily polluting enterprises: Evidence from China. *International Journal of Environmental Research and Public Health*, 20(4), 3333. <https://doi.org/10.3390/ijerph20043333>
- Wu, B., Ding, Y., & Xie, B. (2024). FinTech and inclusive green growth: A causal inference based on double machine learning. *Sustainability*, 16(22), 9989. <https://doi.org/10.3390/su16229989>
- Yang, J., Liu, L., & Yin, C. (2019). A non-liner decision model for green crowdfunding project success: Evidence from China. *International Journal of Environmental Research and Public Health*, 16(2), 187. <https://doi.org/10.3390/ijerph16020187>
- Yoshino, N., Schloesser, T., & Taghizadeh-Hesary, F. (2020). Social funding of green financing: An application of distributed ledger technologies. *International Journal of Finance & Economics*, 26(4), 6060–6073. <https://doi.org/10.1002/ijfe.2108>
- Zeng, S., Fu, Q., Haleem, F., Shen, Y., & Zhang, J. (2023). Carbon-reduction, green finance, and high-quality economic development: A case of China. *Sustainability*, 15(18), 13999. <https://doi.org/10.3390/su151813999>