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Relationship of Fintech Innovation with Green Growth Sustainability Moderated by Blockchain Smart Contracts Among Small and Medium Sized Enterprise in Selangor, Malaysia

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Abstract:

Purpose: *The purpose of this study is to investigate the adoption of financial technology on the green growth and sustainability of SMEs. The root issue is that despite the increasing attention of fintech exposure in business markets, Malaysian businesses are hesitant to fully adopt this emerging technology. This study aims to bridge the gap between the potential of fintech innovations and their practical implementation by adopting two theoretical approaches: 1) Research-based view model for green growth 2) Extended version of the technology acceptance model for the fintech dimension.*
Design/Methodology/Approach: *The research adopts a quantitative method using a cross-sectional survey design with a five-point Likert scale questionnaire. Data was collected from 247 decision-makers representing SMEs in Selangor, Malaysia, and the sampling technique uses stratified random sampling. The data were analyzed using SPSS and Smart-PLS.*
Findings: *Fintech factors of green financing and green investment significantly influence the green growth sustainability, while cryptocurrency is not significant towards it. Interestingly, the finding on the moderator role of blockchain smart contracts does not play a role in moderating all the fintech factors toward green growth sustainability.*
Practical Implication: *The direct relationship of green financing and green investment is driving the future innovation toward green growth sustainability, particularly for SMEs, but cryptocurrency gives a different insight on it. On the other hand, integrating blockchain smart contracts as the moderator for the fintech dimension does not allow the businesses to move toward green sustainability. It is essential for companies to provide platforms by offering knowledge and awareness about this technology. Aside from this, the study provides empirical implications for SMEs green growth sustainability using fintech platforms.*
Originality value: *The research findings reveal that the moderating effect of blockchain smart contracts was insignificant in driving green sustainability outcomes for SMEs. This innovation did not support green growth sustainability to enhance transparency and increase the accountability into the environmental claims. It challenges the technology-centric view*

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and emphasizes the importance of contextual factors, regulatory frameworks, and holistic sustainability strategies for SMEs.

Keywords: *Fintech, Green Growth Sustainability, Green Investment, Green Financing, Cryptocurrency, Blockchain Smart Contracts.*

JEL Classification: *O33, Q56, L26, G23, K24.*

Paper type: *Research article.*

1. Introduction

The role of small and medium enterprises (SMEs) is crucial in transitioning to a low-carbon economy in line with the Paris Agreement's goals to combat global warming. "Green growth" aims for economically sustainable development by efficiently using natural resources and minimizing environmental impacts, supporting long-term prosperity without harming the environment.

However, inadequate financial management, education facilities, technological support, restrictive laws, and limited financial aid have led to negative effects on SMEs. Poor financial management can result in sustainability, transparency, security, and validity issues within SMEs (Bix, n.d.; Haresankar *et al.*, 2018).

In Malaysia, small and medium-sized enterprises (SMEs) play a vital role in Malaysia's economy, contributing significantly to the GDP (Farouq, 2023). The study emphasizes the significant role played by small and medium enterprises (SMEs) in the economies of nations, specifically in Malaysia. It highlights that SMEs account for 98.5% of total business establishments, contributing 65.3% of total employment and 36.3% of GDP.

The HRDF Human Capital Report of 2019 identifies Selangor as having the highest concentration of SMEs, making up over one-third of all SMEs. Specific subsectors such as the computer industry, freight forwarding, and engineering support and maintenance have a substantial number of HRDF-registered employers in Selangor. The reliability of the data for SMEs in Selangor is underscored as the reason for choosing them as the unit of analysis for the study.

Recently, the concept of "green growth" has gained attention as a potential solution for achieving economic growth while ensuring environmental sustainability. (D'Alessandro *et al.*, 2020). Proponents of green growth argue that advancements in technology and resource substitutions can enable sustained economic growth without increasing resource use and carbon emissions.

The Organization for Economic Co-operation and Development (OECD) defines green growth as fostering economic development while maintaining the availability of natural resources and environmental services essential for human well-being. (OECD Work on Green Growth, January 2023).

The theory of green growth assumes that economic growth and environmental impact can be separated, and it is widely supported by prominent multilateral organizations. The underlying belief is that GDP development can be completely disconnected from resource consumption and carbon emissions, offering a potential solution to prevent catastrophic climate change and ecological collapse (Hickel and Kallis, 2019; Tyagi *et al.,* 2023).

In the pursuit of green growth, adopting environmentally friendly practices can enhance economic efficiency by reducing waste, optimizing resources, and fostering innovation in processes. This shift to a circular economy requires the establishment of sustainable environments supporting circular business models, ultimately promoting economic benefits through improved resource management and reduced operational costs over time (Bocken *et al.,* 2018; Nermend *et al.,* 2021).

This study investigates the relationship between fintech innovation and green growth sustainability among SMEs in Selangor, Malaysia. It addresses the gaps in policy and empirical and practical knowledge, prompting further technology implementation for assessing its effectiveness on SMEs.

This research explores how fintech innovation has the relationship with green growth sustainability among SMEs in Selangor, Malaysia. It is also overseeing the practical relationship of blockchain smart contracts toward fintech that influence green growth sustainability. The study aims to investigate these fintech dimensions to provide insight that could overcome the green issue towards SMEs that brings the issues of sustainability, transparency, security, and validity.

2. Literature Review

SMEs have been encouraging with the concept of ‘greening the economy’ to ease the environmental constraints, foster economic expansion, and improve social welfare (Lyytimaki *et al.,* 2017). Green technology supports sustainable development by pinpointing environmentally beneficial growth areas, encouraging the creation of eco-friendly industries, and advancing technologies and job opportunities that are kind to the environment. (Ghisetti and Quatraro, 2017)

The research identified three critical gaps. The first is policy gaps, where there are insufficient policies relating to financial technology, which can hinder progress or fail to address specific issues effectively. It is also to be a comprehensive global policy framework to ensure the SDG sustainable consumption and production patterns are complying with regulations (Benggtsson *et al.,* 2018).

Next are empirical gaps, for which the study aims to analyze the impact of new technologies on the financial sector. Despite a lack of analytical frameworks and empirical research, the study seeks to understand the structural and transformative changes brought by these technological shifts. (Shaharudin *et al.*, 2022).

Additionally, practical knowledge gaps, as the current research indicates, indicate a lack of data on the practical implications of AI and large-scale processing in finance. The financial firms are utilizing machine learning and big data to potentially enhance regulatory compliance (Thalassinos *et al.*, 2023; Grima *et al.*, 2020).

However, there is a limited understanding of how these advancements will impact the financial sector, consumer perception, regulation, and governance. Jagtiani, Wall, and Vermilyea (2018). This study also examines the relationship between the fintech dimension and green growth sustainability using two underpinning theories, which are the research-based view and the extended version of the technology acceptance model.

The resource-based theory highlights how companies can gain an edge over competitors by strategically utilizing their distinctive resources and abilities. Using quantitative analysis grounded in this theory, researchers can explore how businesses in Selangor use fintech innovations as strategic assets to boost their environmentally friendly growth efforts.

By examining the connections between fintech adoption, company performance, and measures of environmental sustainability, analysts can uncover the main factors driving the green growth. This information can be used to guide the decision-making processes. Other than that, the extended version of the Technology Acceptance Model (TAM), developed by Fred Davis, examines how people view and approach new technologies. By applying ETAM's quantitative methods, researchers can assess how businesses embrace and use fintech innovations to support environmentally sustainable growth (Fernando and Wah, 2017).

ETAM evaluates key factors like how useful and user-friendly people find a technology, which helps predict how likely Selangor's businesses are to adopt fintech solutions. This information is crucial for decision-makers and interested parties. Quantitative analysis through the ETAM framework allows researchers to evaluate the acceptance and use of fintech innovations by businesses to promote sustainable economic growth. (Fernando and Wah, 2017).

Researchers are increasingly focusing on technology adoption among small and medium-sized enterprises (SMEs). The Extended Technology Acceptance Model (ETAM) has proven to be a valuable tool for understanding this process, especially when analyzing SMEs' adoption of financial technology (FinTech) solutions. Studies, including Xiang *et al.* (2021) on Chinese SMEs and Firmansyah et al. (2022) through a literature review, have shed light on the factors influencing

FinTech adoption. These studies underscore the importance of perceived usefulness and ease of use in driving SMEs' intention to adopt innovative financial technologies.

- ***Fintech factor of green investment on green growth of SMEs in Selangor, Malaysia.***

Research conducted by Mirza *et al.* (2023) demonstrated that fintech leverages artificial intelligence, blockchain technology, and advanced data analytics to assist SMEs in evaluating and improving green growth sustainability. Technological progress enables SMEs to gain deeper insight into credit through improved information symmetry, thereby reducing financial barriers.

Research indicates that fintech advancements foster ecosystem growth by expanding financial support, enhancing efficiency, simplifying processes, and lowering educational costs. (Nenavath and Mishra, 2023). Environmentally focused investment funds enable SMEs to use eco-friendly finance technologies that strongly suggest a trend towards sustainable economic growth. (Wang *et al.,* 2020). The findings from the literature suggest the hypothesis below:

H1: There is positive significant relationship between the fintech factor of green investment on green growth of SMEs in Selangor, Malaysia.

- ***Fintech factor of green financing on green growth of SMEs in Selangor, Malaysia.***

A study suggests that research and development activities, along with internet usage, foster green growth in many of Asia's most polluted nations. There is an insight that guides future strategies for promoting sustainable development in SMEs businesses by adopting highly efficient and low-emission advanced technology (Mo *et al.,* 2023).

In this phase of the business cycle, investors are increasing their priority in environmental sustainability, which leads to the green investment to adopt sustainable practices and development in business operations. This introduces green investment practices such as green technologies, green financial products, green supply chains, and energy-saving initiatives that relate to low carbon resilience. (Shamsi, Mariam and Nobanee, Haitham, 2023). The findings from the literature suggest the hypothesis below:

H2: There is positive significant relationship between fintech factor of green financing on green growth of SMEs in Selangor, Malaysia.

- ***Fintech factor of cryptocurrency on green growth of SMEs in Selangor, Malaysia.***

Digital money, cryptocurrency, and crowdfunding can be the central cornerstone of fintech (Kabaklarl, 2022). Cryptocurrency functions primarily as diversifiers rather than offering hedging or safe haven properties. Cryptocurrencies are generated through a process known as mining, which requires a substantial amount of electricity.

Therefore, to increase its supply, the cryptocurrency with the largest market share necessitated significant power. Oriekhoe et al. (2024) discovered that blockchain has the potential to enhance transparency and reliability within green supply chains, leading to positive environmental outcomes. The findings from the literature suggest the hypothesis below:

H3: There is a positive significant relationship between fintech factor of cryptocurrency on green growth of SMEs in Selangor, Malaysia.

- ***Fintech factor of blockchain smart contracts on green growth of SMEs in Selangor, Malaysia.***

Blockchain smart contracts play a role in green growth by ensuring data is anonymous, distributed, time-stamped, secure, and tailored to each company's needs. Malaysian SMEs have opportunities in this area, as this technology can be applied across various industries and sectors (Teoh *et al.,* 2021). Blockchain refers to a distributed ledger shared among all network computers, containing a record of every transaction that has occurred.

Saberi *et al.* (2019) assert that blockchain smart contracts foster green growth through ethical practices. Their analysis revealed that blockchain technology enhances operational cost efficiency and promotes green growth by improving environmental compliance. Malaysian SMEs can leverage blockchain for applications such as Islamic banking, data storage, remittances, and traceability. The report also proposes six long-term blockchain projects that could benefit Malaysian SMEs. The findings from the literature suggest the hypothesis below:

H4: There is positive significant relationship between fintech factor of blockchain smart contacts on green growth of SMEs in Selangor, Malaysia.

- ***Blockchain smart contracts moderated for green financing on green growth of SMEs in Selangor, Malaysia.***

Blockchain technology applied to green financing offers several key advantages, including flexibility, transparency, adaptability to policy changes, performance, practicality, and security. These attributes enable the creation of a token economy for digital assets, fostering greater interconnectedness and collaboration among participants.

Leveraging smart contracts, this token economy can serve as an effective compensation mechanism, incentivizing users and unlocking significant opportunities for innovation (Kannengießer *et al.,* 2020). In essence, blockchain technology has the potential to revolutionize financing systems across diverse economic sectors and business models (Kwok and Treiblmaier, 2023). The findings from the literature suggest the hypothesis below:

H5: There is positive moderating significance of blockchain smart contracts on the relationship between green financing on green growth of SMEs in Selangor, Malaysia.

- ***Blockchain smart contracts moderated for green investment on green growth of SMEs in Selangor, Malaysia.***

The integration of blockchain into green investment is still in its nascent stages, with regulatory frameworks evolving across different jurisdictions. Regulation is essential to ensure that blockchain smart contract technology effectively supports green investments and sustainability goals (Morgan, 2024). Essentially, blockchain smart contracts have the potential to transform how organizations manage digital identities, resulting in more secure, efficient, and sustainable practices. (Mulaji and Roodt, 2022). The findings from the literature suggest the hypothesis below:

H6: There is positive moderating significant of blockchain smart contracts on the relationship between green investment on green growth of SMEs in Selangor, Malaysia.

- ***Blockchain smart contracts moderated for green investment on cryptocurrency of SMEs in Selangor, Malaysia.***

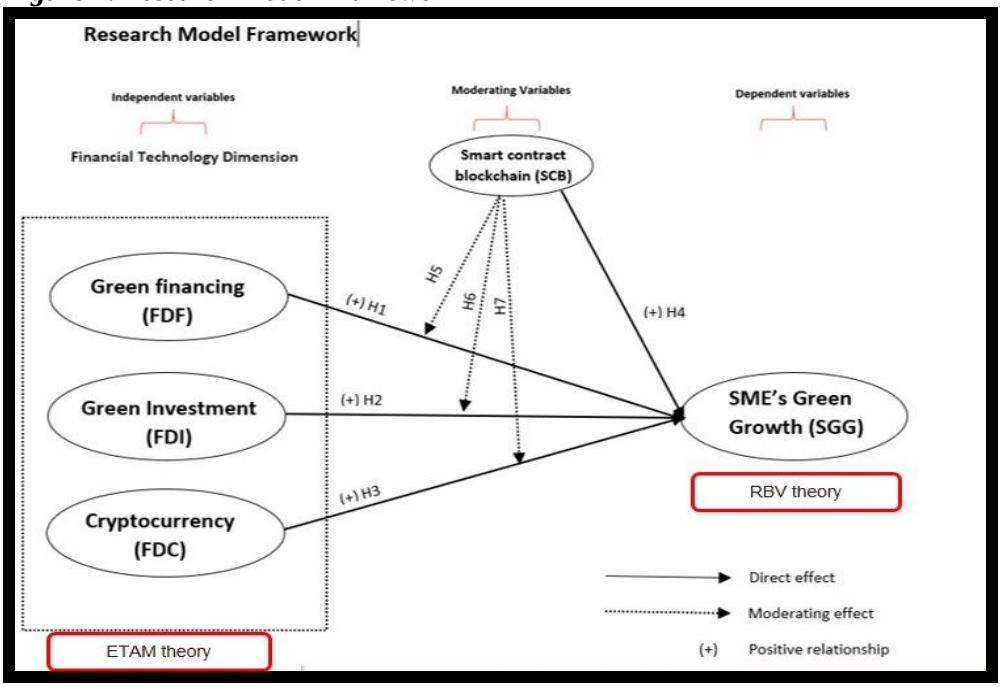
Studies have shown that from an Islamic finance perspective, cryptocurrency exhibits elements of uncertainty (gharar) (Bakar *et al.,* 2017). In Islamic practices, the economic transaction must be based on real and physical assets, which makes the cryptocurrency considered not to be compliant with Islamic shariah (Najeeb, 2014).

Cryptocurrency practices resemble gambling and may even have a greater impact. This issue arises from the inherent uncertainty of the currency, as its price volatility amplifies market fluctuations. Mills & Nower, 2019). The findings from the literature suggest the hypothesis below:

H7: There is positive moderating significance of blockchain smart contracts on the relationship between cryptocurrency on green growth of SMEs in Selangor, Malaysia.

The research framework shown in Figure 1 is formulated based on the literature review findings and the hypothesis development.

Figure 1. *Research Model Framework*



Source: *Own study.*

3. Researcch Methodology

This study used a quantitative methodology to investigate how the relationship between fintech innovation and green growth sustainability moderated by blockchain smart contracts among small and medium-sized enterprises in Selangor Malaysia. A total of 300 questionnaires were distributed among the management level in SMEs, indicating the systematic problem-solving aspect of study methodology as described by Patel and Patel (2019).

A 247-item structured questionnaire was used to collect data in an organized manner. Using a stratified random selection technique, participants were chosen at random after the population of SME registered and active in Selangor, Malaysia (HRDF Report, 2019), which is 179,599 of SME. SME is divided into 5 sectors, such as services, manufacturing, construction, agriculture, mining, and quarrying. (Companies Commission of Malaysia Statistics, 2019).

A minimum sample size of 150 respondents was established using Taro Yamane's formula and recommendations from Hair et al. (2006), and the study successfully reached a sample size of 247.

The SME decision-makers in Selangor from positions of executive level to CEO level (HRDF Report, 2019) are chosen as the respondents in this research. The

questionnaire used a 5-point Likert scale to determine how well respondents understood green growth and financial technology, namely the blockchain and smart contracts. Not every SME participant is knowledgeable about this research issue.

SPSS was used for descriptive analysis of the data, while smart PLS was used to determine the inferential analysis through Pearson correlation coefficient, multiple regression, ANOVA, and bootstrapping for the relationship factors. A pilot test with 35 respondents validated the research instrument.

The demographic profile included positions, gender, type of SME business, and number of employees. Validity was ensured through content and construct validity, with Cronbach's alpha results exceeding the recommended value of 0.70 for all constructs: green growth ($\alpha = 0.948$), fintech on green financing ($\alpha = 0.906$), fintech on green investment ($\alpha = 0.937$), fintech on blockchain ($\alpha = 0.959$), and fintech on cryptocurrency ($\alpha = 0.910$).

4. Research Results

Normality assessment of the study model:
Testing on the variable is important for research to determine the validity, normality, and suitability of the data variable. Hair *et al.* (2019) indicated that the skewness ranging from +1 to -1 is to be a significantly skewed distribution. As indicated by Menon (2024), values of -1 and -0.5 classified the data as negatively skewed, whereas values of 0.5 to 1, the data is positively skewed, which made the skewness moderate.

For kurtosis, the value range suggested is +2 to -1. Based on the data in the below table, this research indicates that all variables have a normal distribution.

Table 1. *Skewness and Kurtosis for Reliability Analysis.*

	N Statistic	Skewness Statistic	Kurtosis Statistic
Green Growth	247	-0.41	0.034
Fintech on Green Financing	247	-0.348	0.228
Fintech on Green Investment	247	-0.398	0.242
Fintech On Cryptocurrency	247	-0.284	-0.055

Source: *Own study.*

For the respondent’s demographic data, this research collects the data from SME’s decision-makers that involve the management line from the business. The demographic data involve the decision-maker’s level of position in SME’s business, gender, type of SME business, and also the size of employee in their organization.

Table 2 shows that most of the respondents are holding a position as senior executive in their organization with 36%, followed by executive level with 27% of

respondents. This analysis used 247 data points of respondents, of which 51% are male respondents and the rest of 49% are female respondents. Respondents' businesses vary in size, with the largest group having 201 to 250 employees (29.1%), followed by those with 101 to 150 employees (21.9%), 151 to 200 employees (20.2%), 1 to 50 employees (17.4%), and 51 to 100 employees (9.7%). This indicates a wide range of business sizes, with a notable concentration in larger SMEs.

Table 2. *Demographic Profile of Respondents of the Pilot Study (N=247)*

Variables	Coding	Frequency	%
Position in SMEs business	Chief Executive Officer	15	6.1
	Chief Financial Officer	6	2.4
	Chief Operation Officer	3	1.2
	Executive	68	27.5
	General Manager	60	24.3
	Senior Executive	89	36
Gender	Male	126	51
	Female	17	47.4
Type of SMEs business	Bumiputera	96	38.9
	Non Bumiputera	145	58.7
Number of employees in business	1 to 50 employees	43	17.4
	101 to 150 employees	54	21.9
	151 to 200 employees	50	20.2
	201 to 250 employees	72	29.1
	51 to 100 employees	24	9.7

Source: *Own study.*

Factor loadings quantify the strength of the relationship between variables and underlying factors, showing how well each variable is associated with a factor (Hair *et al.*, 2019). Meanwhile, cross loadings indicate that a variable significantly loads on more than one factor, which can complicate the interpretation of the factor structure and suggest a potential overlap between factors (Tabachnick and Fidell, 2019).

According to the Fornell and Larcker criterion, the factor loading for each construct should be greater than the loadings for all other constructs, with a recommended cut-off value of 0.70. Specifically, the square root of the Average Variance Extracted (AVE) for each latent construct exceeds its squared correlation with other constructs.

Standardized factor loadings should ideally be greater than 0.70 to demonstrate a strong association between the variables and the factors. Loadings below 0.40 may indicate weaker relationships and potential issues with construct validity (Larrivee and Hossler, 2021). Table 3 demonstrates that all five latent constructs meet the discriminant validity requirement.

Accordingly, the result comes out as all loadings are higher than 0.7, but there is one loading with the value of 0.705 and thus deleted. After deleting the loading, all remaining items are still resulting in a high loading above 0.7. Thus, the validity construct was confirmed.

Convergent validity is the extent to which a construct converges in order to account for the variance among its constituent parts. Using the Average Variance Extracted (AVE) measure, the convergence of each construct is evaluated. Hair *et al.* (2019) state that the AVE can only be found by squared the loading of each indicator on a build. An AVE of 0.5 or higher, which is regarded as good, indicates a construct that accounts for at least 50% of the item's variation.

Convergent validity is demonstrated when measures of the same construct from different sources or methods show strong correlations, confirming that they are assessing the same underlying concept (Cohen *et al.,* 2021). It is necessary to prove the convergent validity before building the discriminant validity. Every indicator needs to be distinct on a single construct. This is because research cannot claim that a construct is separate if the indicator is used to measure two different constructs. It is not required for a unidimensional latent construct to have a cross-loaded indication in order to have significance.

Composite reliability refers to the internal consistency of a construct as measured by multiple indicators. It assesses the extent to which a set of items consistently represents a single construct. Higher composite reliability values, typically above 0.70, suggest that the items collectively measure the construct well. Composite reliability measures the internal consistency of a construct, with values above 0.70 generally indicating acceptable reliability (Hair *et al.*, 2021).

In this study, smart-PLS has been chosen as the model estimation that measure the indicator of measurement model to form a composite variable. The composite variables are regarded as trustworthy substitutes for the conceptual variables under study because they are believed to be comprehensive representations of the constructs (Hair and Sarstedt, 2019).

Multitrait-multimethod (MTMM) matrices were employed to assess discriminant validity, a key empirical criterion whereas discriminant validity is essential for accurate measurement (Green *et al.* 2016). A decision rule was used to determine whether two scales have discriminant validity if the square factor correlation between them is less than the AVE for both.

Mcneish and Mcneish (2018) state that the definition of Cronbach's alpha, the commonly used objective reliability on the estimation, and the dependability of an instrument may be ascertained. Therefore, Cronbach's alpha and composite reliability are the two primary statistics used in the assessment of internal consistency and dependability. As indicated by Hair *et. al.* (2010), the interpretation

of Cronbach's alpha is complicated by disagreements about the acceptable range, with a commonly stated acceptable range of 0.70 or higher (Hair *et al.*, 2010).

The Cronbach's alpha for all structures exceeding the recommended value of .09 is displayed in Table 3 below. These results validate the reliability of internal consistency for every single concept. Because each variable met the threshold value, it was concluded that they all met the requirements for internal consistency, dependability, and the ability to explain the events.

In general, an econometric model is considered to have significant predictive power if its R^2 or modified R^2 is high. This general concept often gives the researcher some confidence that the explanatory factors in the model accurately predict the dependent variable (Hill, Griffiths and Lim, 2018).

R^2 determines the proportion of variance in the dependent variable explained by the independent variables, with higher values indicating a better model fit and greater explanatory power (Hair *et al.*, 2021).

This study come out with the structural model using the value of R^2 of 0.737 which indicate the fintech dimension of green financing, green investment, and cryptocurrency giving 73.7% of the variance in green growth sustainability, indicating R^2 is substantial.

For this study, two evaluations were conducted: the first involved analyzing the data without the moderator variable, while the second phase incorporated the blockchain Smart Contract as a moderator variable to assess its impact. After generate the structural model including the moderator, the outcome data showing the result of 74.4% which is greater than the R^2 excluding moderator which is 73.7%. This indicate that the data with moderator become more substantial than data without moderator.

The final stage in the PLS-SEM structural model involves testing the hypothesized relationships. For this, the researcher employed the PLS bootstrapping technique available in Smart PLS 4.0.

Figure 5 and Table 7 encompass the bootstrapping results, where the hypothesized relationships were tested. The above result and analysis indicate the direct relationship between independent variables as a direct association with positive effects, only H1, H2, and H4 was supported.

Meanwhile, the relationship between independent variable with moderator effect show H5, H6 and H7 was not supported. Not supported hypothesis because their p-values was greater than 0.05, as indicated in Table 3

Table 3. *Cross Loading*

Construct	Measurement	Item Used	Factor Loading
Fintech dimension on green financing	Green finance can provide impetus to fight the battle against pollution	FDF1	0.803
	Business should implement a rewarding system for the customers who carry out their transaction in an eco-friendly manner	FDF2	0.785
	With the accessibility and ease of use of fintech solutions specifically tailored for green financing	FDF3	0.815
	Fintech platforms have contributed to raising awareness about green financing options among consumers	FDF4	0.722
	Switch to a fintech platform that prioritizes green financing options over traditional banking services	FDF5	0.772
	Explore green financing options through fintech platforms due to the potential for higher returns on green investments	FDF6	0.763
Fintech dimension on green investment	Green investment can improve the wellbeing of the society around	FDI1	0.805
	Green investment can improve the profit of the company	FDI2	0.793
	Green investment promotes the implementation of carbon peaking	FDI3	0.777
	Green investment transforms to a better economy	FDI4	0.818
	Utilizing fintech solutions for green investment opportunities as a means to align your investments	FDI5	0.821
	Green investment initiatives facilitated by fintech platforms can contribute to the transformation of the economy towards sustainability	FDI6	0.836
Fintech dimension on cryptocurrency	Cryptocurrency allow business to do transaction worldwide easily.	FDC1	0.824
	Cryptocurrency can help to increase the business revenue as it attracts more customer due to the visibility of business in market.	FDC2	0.823
	Cryptocurrency increase the efficiency of the business as it provides a quick fund transfer.	FDC3	0.827
	Cryptocurrency make easier for business to sell to international client in a globalized marketplace.	FDC4	0.828
	Cryptocurrency offer lower transaction fees compared to the traditional payment methods such as credit card.	FDC5	0.807
	Cryptocurrency method such as central bank digital currencies provide a secure digital payment	FDC6	0.777
	Central bank digital makes it easier for people to participate in the digital economy.	FDC7	0.843
Fintech dimension on blockchain smart contracts	Is the perceived blockchain technology impacting the finance industry	FDB1	0.829
	Blockchain technology is well compatible with the work support information system that business currently uses	FDB2	0.856
	Blockchain technology help business to secure the information from hacking activity	FDB3	.818
	Blockchain technology help business to ensure the integrity and validity of the transactions	FDB4	0.846
	Blockchain distributed ledger is highly transparent as compared to a traditional ledger	FDB5	0.828
	The perceived blockchain technology in its transaction transparency impacting the finance industry	FDB6	0.830
	Adopting blockchain can increase the business efficiency as it increases the number of transactions that can be process within a specific timeframe	FDB7	0.867

Source: *Own study.*

Table 4. *Results of Convergent Validity.*

Construct reliability and validity – Overview.	**Cronbach's alpha**	**Composite reliability**	**Average variance extracted (AVE)**
FINTECH DIMENSION GREEN FINANCING	0.868	0870	0.604
FINTECH DIMENSION GREEN INVESTMENT	0.894	0.896	0.654
FINTECH DIMENSION CRYPTOCURRENCY	0.918	0.921	0.670
FINTECH DIMENSION BLOCKCHAIN SMART CONTRACTS	0.930	0.931	0.704

Source: *Own study.*

Table 5. *Discriminant Validity- Square Root of AVE*

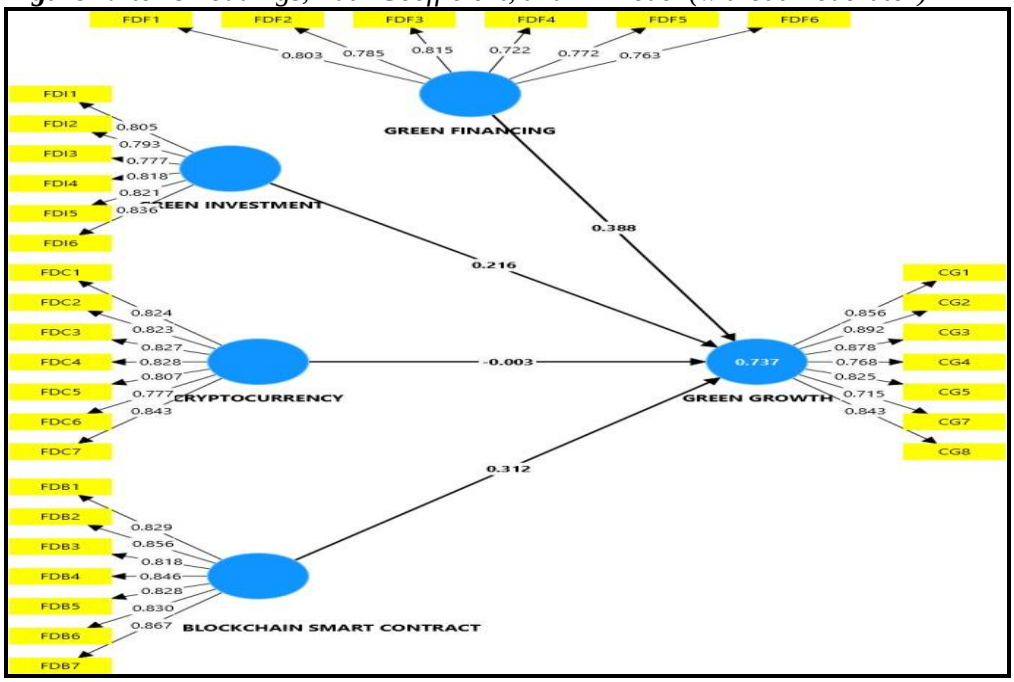
Discriminant Validity – Heterotrait-monotrait ratio (HTMT) - Matrix	**BLOCKCHAIN SMART CONTRACTS**	**CRYPTOCURRENCY**	**GREEN FINANCING**	**GREEN GROWTH**	**GREEN INVESMTMENT**
BLOCKCHAIN SMART CONTRACTS	0.839				
CRYPTOCURRENCY	0.774	0.819			
GREEN FINANCING	0.805	0.685	0.777		
GREEN GROWTH	0.792	0.652	0.825	0.827	
GREEN INVESTMENT	0.791	0.686	0.872	0.798	0.809

Source: *Own study.*

5. Discussion

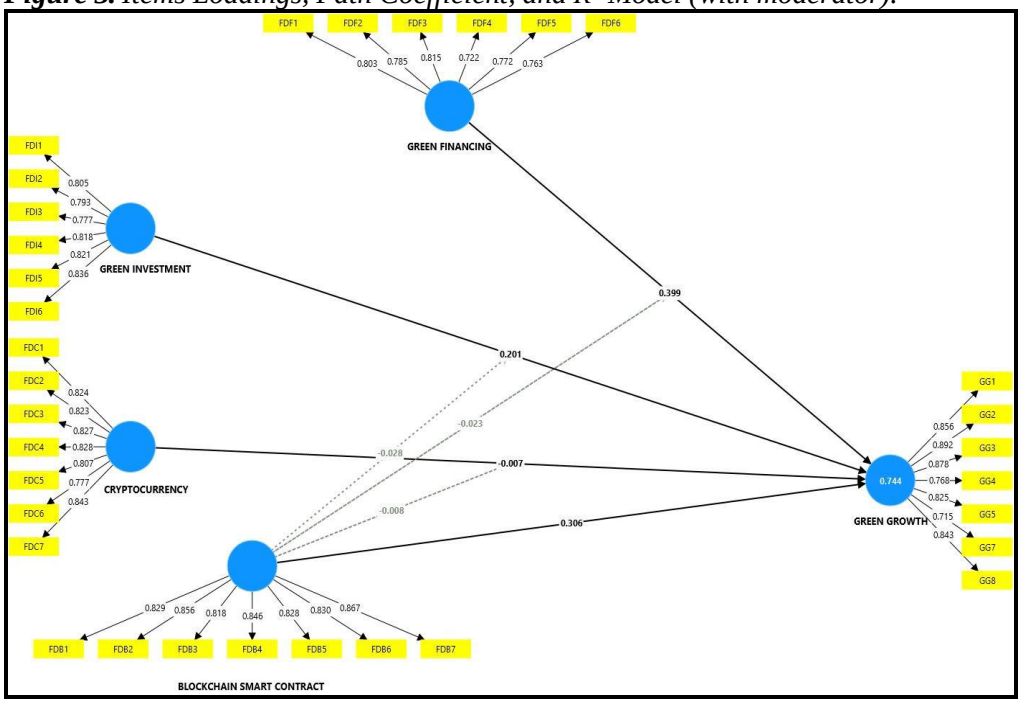
This study investigated the relationship between fintech innovation and green growth sustainability moderated by blockchain smart contracts among small and medium-sized enterprises in Selangor Malaysia. The results show that blockchain, cryptocurrency, green investment, and green finance are examples of fintech technologies that have a beneficial effect on green growth. By increasing these financial instruments' efficiency, smart contracting encourages sustainability. Green financing is a major factor in the green growth of SMEs; this is consistent with studies by Du *et al.* (2024) that indicate digital inclusive finance platforms facilitate green initiatives among Chinese SMEs.

Figure 2. *Items Loadings, Path Coefficient, and R² Model (without moderator)*



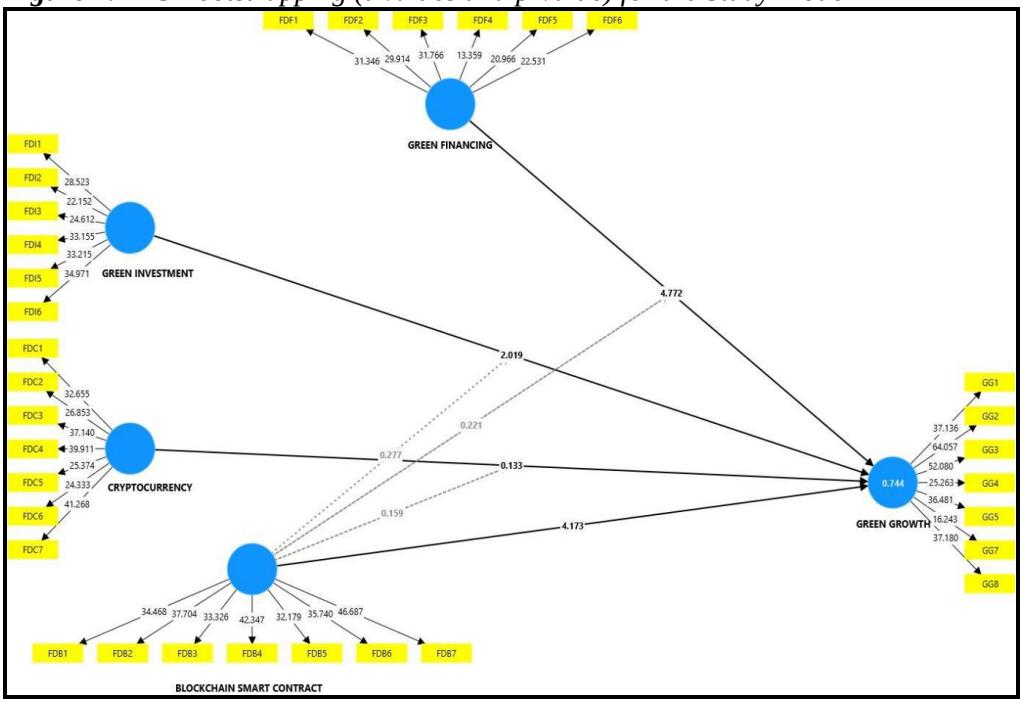
Source: *Created by the authors.*

Figure 3. *Items Loadings, Path Coefficient, and R² Model (with moderator).*



Source: *Created by the authors.*

Figure 4. *PLS Bootstrapping (t-values and p-value) for the Study Model*



Source: *Created by the authors.*

Table 6. *Results of Hypothesis Testing*

Hypothesis	Relationship	T-Value	P-Value	Decision
H1	SMEs in Selangor identified fintech dimension of green financing have significant effect on Green Growth	4.772	0.000	Supported
H2	SMEs in Selangor identified fintech dimension of green investment have significant effect on Green Growth	2.019	0.044	Supported
H3	SMEs in Selangor identified fintech dimension of cryptocurrency have significant effect on Green Growth	0.133	0.894	Not Supported
H4	SMEs in Selangor identified fintech dimension of blockchain smart contract have significant effect on Green Growth	4.173	0.000	Supported
H5	Blockchain Smart Contract has significant moderating effect on fintech dimension of Green Financing for SMEs in Selangor towards the Green Growth.	0.221	0.825	Not Supported
H6	Blockchain Smart Contract has significant moderating effect on fintech dimension of Green Investment for SMEs in Selangor towards the Green Growth.	0.277	0.782	Not Supported

H7	Blockchain Smart Contract has significant moderating effect on fintech dimension of Cryptocurrency for SMEs in Selangor towards the Green Growth.	0.159	0.874	Not Supported

Source: *Created by the authors.*

Additionally, in the context of Pakistan and the BRIC nations, Shaikh et al. (2024) and Mirza *et al.* (2022) have also emphasized the same favorable impacts on SMEs, highlighting the potential of green finance in improving environmental performance and alleviating financial risks. The findings support the original study question and show how fintech may improve sustainable management in small and medium-sized enterprises.

The results also demonstrated that green investment had a favorable and significant effect on the green growth of SMEs; these findings bolster the claims made by Ozbugday *et al.* (2020), Sun *et al.* (2022), and Horbach (2018) that resource efficiency improvements and green investment policies improve SMEs' performance and foster sustainable growth.

As the result is the Cronbach's alpha, it confirms internal consistency reliability for all concepts, with Cronbach's alpha values above.09, indicating all variables meet specified standards for internal consistency and explanation capacity.

Table 7. *Reliability Analysis*

The study variables	No. of items	Cronbach's Alpha
Green Growth	8	.928
Fintech on Green Financing	6	.868
Fintech on Green Investment	6	.894
Fintech on Cryptocurrency	7	.918
Blockchain Smart Contract	7	.930

Source: *Created by the authors.*

Hence, the study's conclusions support the hypothesis regarding the relationship between fintech innovation and sustainable green growth among small and medium-sized enterprises in Selangor, Selangor, Malaysia, as moderated by blockchain smart contracts. In order to comprehend the linkages that impact the purpose of contributing to green growth, the discussion of the moderating role of blockchain smart contracts is also expanded in this part.

H_1: There is a positive significant relationship between the fintech factor of green financing and the green growth of SMEs in Selangor, Malaysia.

In the model that the present study proposes, the fintech dimension of green financing conjectured is to positively affect green growth. However, conferring on

the parameter estimation of the results, the above hypothesis was statistically significant (H1: PCBCWI; t = 4.772, p = 0.00), which means that this hypothesis is supported, insinuating that there is a positive and significant relationship between the fintech factor of green investment and the green growth of SME in Selangor, Malaysia. Malaysia.

The link between fintech in green financing and the green growth of SMEs in Selangor, Malaysia, supports the research hypothesis. The results show that green investments positively impact green development, influenced by financial management practices and the role of digital and green financial literacy. Bumiputera entrepreneurs with digital and financial skills are more likely to adopt i-Fintech and support sustainable business practices. This research offers useful insights for researchers, regulators, entrepreneurs, and i-Fintech service providers.

Mirza *et al.* (2023) support the idea that fintech is crucial for advancing green finance and boosting profitability. By using artificial intelligence, blockchain, and data analytics, fintech helps businesses reduce their environmental impact and attract sustainable investments, which in turn enhances bank profitability and supports loans for eco-friendly projects. Green finance involves offering financial services that consider environmental impact when assessing loan eligibility and risk and promoting investments in low-carbon initiatives and sustainable innovations.

Nenavath and Mishra (2023) highlight that fintech uniquely supports green economy development by improving credit knowledge, reducing financial barriers, and speeding up ecosystem growth. Wang *et al.* (2022) found that green financing enhances the environmental performance of SMEs in developing countries and fosters green innovation in the long term.

However, Hsu *et al.* (2021) reported mixed results, with some firms benefiting from green financing for environmental improvements while others find it costly in the short term. The effect of green financing on growth varies based on market conditions and government support.

H_2: There is a positive significant relationship between the fintech factor of green investment and the green growth of SMEs in Selangor, Malaysia.

The results of Hypothesis H_2 revealed that the proposed relationship between There is a positive and significant relationship between fintech factors of green investment and green growth of SME in Selangor, Malaysia. shows a positive relationship (t = 2.019, p = 0.044), and hence indicates the statistical significance of the factor.

The fintech aspect of green investment greatly boosts the green growth of SMEs in Selangor, Malaysia. It promotes sustainability by encouraging circular economy practices, increasing funding for environmental projects, cutting carbon emissions, and supporting innovative green solutions. Green investments also drive fintech

adoption, which enhances organizational sustainability. This leads to more engagement, increased investment in technology, and wider access to fintech solutions for businesses and individuals.

Mo *et al.'s* 2022 study found that green investment contributes to green growth in China, India, and Russia, with R&D and internet users encouraging this growth in heavily polluted Asian countries. Financial depth can help reduce risks related to climate change and environmental issues, fostering green growth.

Shamsi, Mariam, and Nobanee (2021) argue that green investments enhance sustainability and improve organizational performance by integrating sustainable practices. These practices include green technologies, financial products, eco-friendly buildings, efficient supply chains, smart systems, and energy-saving measures, all contributing to reduced carbon emissions and increased carbon resilience.

Pizzi *et al.* (2021) found that green investments via ICT platforms improve environmental sustainability in SMEs, with fintech significantly aiding their shift to a circular economy model.

However, Chien *et al.* (2021) reported that green investments did not yield the expected environmental benefits for SMEs in the UAE, noting only a small increase in green technology adoption. The effectiveness of green investments varies greatly depending on the specific context.

H_3: There is a positive significant relationship between the fintech factor of cryptocurrency and the green growth of SMEs in Selangor, Malaysia.

The research hypothesized H3 SME's in Selangor identified fintech dimensions of cryptocurrency have no significant effect on green growth. The result of the findings revealed that the proposed relationship between fintech dimension of cryptocurrency and significant effect on green growth shows a negative relationship ($t = 0.133$, $p = 0.894$), and hence, the hypothesis was not supported. It implies that the SME's in Selangor's identified fintech dimension of cryptocurrency does not influence the effect on green growth.

FinTech tools in finance, such as digital money, cryptocurrencies, crowdfunding, and blockchain, have changed the financial industry by decentralizing and speeding up transactions. Bitcoin, the first cryptocurrency, dominates the market and is produced through energy-intensive mining.

Green cryptocurrencies, which are meant to be environmentally friendly, do not offer protection against market fluctuations. During financial instability, it's better to focus on green bonds and gold for safety, as green cryptocurrencies have limited risk-reducing benefits.

A study by Corbet and Yarovaya (2020) found that the environmental effect of cryptocurrencies is mainly negative due to high energy consumption in mining processes. The rise of blockchain technology and cryptocurrencies could result in increased carbon emissions, posing a problem to green growth initiatives.

However, a 2024 study by Oriekhoe *et al.* suggests that blockchain could improve transparency and reliability of green supply chains, positively affecting the environment. This aligns with the objectives of the green growth framework, despite the primary environmental impact of cryptocurrencies.

H_4: There is a significant positive relationship between the fintech factor of blockchain smart contracts and the green growth of SME in Selangor, Malaysia.

In this section, demonstrate the finding for the research objective, hypnotizing H4: There is a significant positive relationship between the fintech factor of blockchain smart contracts and the green growth of SME in Selangor, Malaysia. The result of the investigation supported the hypothesis, revealing that the proposed relationship between the fintech dimension of blockchain smart contracts and green growth shows a positive relationship ($t = 4.173$, $p = 0.000$).

The use of blockchain smart contracts in the fintech sector supports the idea that they help green growth for SMEs in Selangor, Malaysia. Smart contracts are valued for their security, lower transaction costs, and reliable, direct transactions. They are well-suited for blockchain because they are unchangeable and traceable. Platforms like Ethereum and Hyperledger use these contracts. Research shows that blockchain technology improves environmental compliance, which boosts green growth and makes operations more cost-efficient.

Teoh *et al.* (2021) argue that blockchain smart contracts have a major impact on green growth by ensuring data is anonymous, distributed, time-stamped, secure, and programmable. Malaysian SMEs can use this technology in areas like Islamic banking, data storage, remittance, and traceability.

The report highlights six blockchain projects that could benefit Malaysian SMEs. Smart contracts, known for their security, low transaction costs, and traceability, are efficient to develop, cheap to maintain, and accurate in execution. Saberi et al. (2019) support this view, noting that blockchain technology boosts operational efficiency and green growth by improving environmental compliance.

Sapra *et al.* (2019) point out some downsides to using blockchain for environmental sustainability, such as its high energy consumption. They stress the need for industries to address the challenge of improving profits while dealing with significant energy use and carbon emissions from non-renewable energy sources. In summary, although blockchain technology can positively influence green growth, it's important to weigh both its benefits and drawbacks.

5.1 Discussion of Hypothesis Testing for Moderating Variables

H5: There is positive moderating significance of blockchain smart contracts on the relationship between green financing and green growth of SME in Selangor, Malaysia.

The result of the analysis indicates an insignificant relationship between green financing and green growth intention when it is moderated by a blockchain smart contract with t = 0.221, p-value = 0.825, and since t-statistics is lower than 1.96 and p-value higher than 0.05, thus indicating the hypothesis being rejected. The result of this finding specifies that SMEs in Selangor do not have the intention to contribute to green growth when its fintech dimension of green financing is met through the implementation of blockchain smart contracts.

Using blockchain smart contracts for green financing does not greatly boost green growth because of potential inefficiencies and scalability issues. Scalability is a major problem in blockchain networks, leading to low efficiency, high transaction fees, and high energy use. This energy consumption also raises concerns for green financing, as it can contribute to climate change.

Khan *et al.* (2021) identify scalability as a major problem. Green financing systems often struggle with low efficiency and limited capacity, causing high transaction fees and large energy use. Finextra (2023) adds that blockchain networks can have scalability issues if they can't manage a high volume of transactions, leading to slower processing and higher costs. Croman *et al.* (2016) note that many blockchain networks face risks of centralization and fail to achieve effective scalability.

De Vries (2018) highlights that blockchain is known for its high energy consumption. This raises concerns about the energy use of blockchain smart contract technology (Truby, 2018). Beck *et al.* (2018) explain that these environmental and sustainability issues are slowing down the adoption of blockchain. The high energy use, mainly from mining transactions and creating new blocks, leads to significant greenhouse gas emissions, which contribute to climate change (Clarke, 2023).

H6: There is positive moderating significance of blockchain smart contracts on the relationship between green investment and green growth of SME in Selangor, Malaysia.

The result of the analysis indicates an insignificant relationship between green investment and green growth intention when it is moderated by a blockchain smart contract with t = 0.277, p-value = 0.782, and since t-statistics is lower than 1.96 and p-value higher than 0.05, thus indicating the hypothesis being rejected.

The fintech aspect of green investment using blockchain smart contracts has had a had a limited impact on green growth so far. This technology is still developing, and

regulations are evolving. Effective regulation is essential to ensure that blockchain smart contracts truly support green investments and sustainability. Without proper regulation, there is a risk of greenwashing, where investments are falsely marketed as environmentally friendly. Regulations can help set standards and verification processes to ensure that green investments are genuine, protect stakeholders, and build trust in green blockchain projects.

Many countries do not have strict penalties for false environmental claims, allowing businesses to misrepresent their environmental efforts with little risk. In the UK, the Competition and Markets Authority (CMA) has introduced the Green Claims Code to ensure businesses provide complete and accurate information about their green credentials (Authority, 2021). However, Chu (2024) points out that enforcing this code is still difficult, and making sure businesses are truthful about their environmental claims remains a challenge.

Fraga-Lamas and Fernández-Caramés (2020) suggest that blockchain can address the issue of greenwashing by meeting four key sustainability criteria: security, accountability, transparency, and traceability. Wang *et al.* (2019) provide an overview of how blockchain practices and policies impact various sectors, while Zhao *et al.* (2016) recommend integrating blockchain into the finance industry to drive business innovation. Simons and Simons (2022) describe blockchain as a form of decentralized finance that represents a new financial paradigm, enabling the creation of a more transparent, open, and permissionless financial system.

H7: There is positive moderating significance of blockchain smart contracts on the relationship between cryptocurrency and green growth of SME in Selangor, Malaysia.

The result of the analysis indicates an insignificant relationship between cryptocurrency and green growth intention when it is moderated by a blockchain smart contract with t = 0.159, p-value = 0.874, and since t-statistics is lower than 1.96 and p-value higher than 0.05, thus indicating the hypothesis being rejected.

The implementation of cryptocurrency through smart contracts using blockchain technology has proven to be insignificant in contributing to green growth due to the uncertain status of cryptocurrencies. In Islamic finance and jurisprudence, there is considerable debate and differing opinions on the permissibility of cryptocurrencies, with perspectives varying based on interpretations of Islamic principles and their application to contemporary financial innovations.

The volatile nature of cryptocurrency further complicates its acceptance, as it presents different implications for users. Additionally, several countries have banned their citizens from engaging with cryptocurrency, leading some respondents to reject its use in their operations.

Cryptocurrency use with smart contracts on blockchain has been criticized for its limited impact on green growth due to its uncertain status (Bakar *et al.*, 2017). In Islamic finance, debates about whether cryptocurrencies are allowed depend on interpretations of Islamic principles and their fit with modern financial practices.

Cryptocurrencies are also used in illegal activities like money laundering and drug trafficking, raising government concerns. Their uncertain status in Islamic finance creates challenges, as they don't align with traditional monetary systems (Bakar, Rosbi, & Uzaki, 2017). Additionally, the volatility of Bitcoin transactions raises concerns about its effects on the real economy and consumer protection (Antonakakis et al., 2019).

Islamic scholars, such as Sheikh Imran Hussain, have clarified that valid money must meet intrinsic value requirements, while others argue that digital currencies need a monetary commodity with a measure of worth to be accepted in the Islamic banking sector. Despite these concerns, some Islamic scholars, such as Sheikh Dr. Adnan Al-Zahrani and Mufti Abdul Qadir Barakatullah, support the use of cryptocurrency as an effective tool in developing Islamic finance.

The Shariah Review Bureau also found that cryptocurrency adheres to other criteria, such as maal (property), manfa'ah (usufruct), haqq (right), and dayn (responsibility). In conclusion, the implementation of cryptocurrency through blockchain smart contract technology has been criticized for its insignificance in promoting green growth in the Islamic world. (Oziev and Yandiev, 2017).

5.2 Implications of the Research

The study explores the impact of fintech innovation on green growth among SMEs in Selangor, focusing on the role of blockchain smart contract technology in adopting the green growth sustainability. The research reveals a significant relationship between green financing, green investment, and blockchain, highlighting the importance of technology adoption in SMEs' green growth strategies.

However, the adoption of blockchain smart contracts as a moderator for the fintech dimension does not significantly contribute to green growth sustainability, as it consumes and destroys natural habitats due to digital money laundering practices.

The practical implications of the research are useful for SMEs, fintech developers, and investors, as they can leverage green financing and green investment platforms to improve their green growth strategies. However, compliance with sustainability standards and efficiency cannot be enhanced with the adoption of blockchain smart contracts as a moderator for the fintech dimension. Regulatory policy implications are also highlighted, highlighting the need for effective elements of regulatory policies to encourage the use of fintech solutions in green development.

The study proposes enhancing the implementation of blockchain smart contracts to support green growth sustainability, but acknowledges the need for robust regulation to address issues with transparency, security, validity, and efficiency.

5.3 Limitations and Future Research

This research study focuses on the application of financial technology in the SMEs sector, specifically in green financing, green investment, cryptocurrency, and smart contract blockchain. The methodology limitations include insufficient sample size for statistical measurement, time constraints on the questionnaires understandability, and a lack of confidence in the reliability of the data.

The study was distributed among 300 questionnaires, but only 247 respondents participated, which did not adequately represent the larger population of SMEs players in Selangor. Time constraints also contributed to the study's limitations, as the questionnaire was distributed online, making it difficult to confirm the accuracy of the data.

Applicability limitations in the research refer to constraints that restrict the generalizability or relevance of research findings beyond specific conditions or contexts. The scope of the study is limited to green financing, green investment, cryptocurrency, and smart contract blockchain, and there is a lack of empirical evidence for the study and interpretation of information.

As financial technology is not widely used in the SMEs field, there is a limitation of empirical evidence to the study and interpretation of information. This makes it difficult to gather observable data and establish a repeatable process to produce verifiable results.

Future research should address limitations in current studies to improve understanding and contribute to the development of knowledge in the field of financial technology's impact on green growth in SME players. Adequate sample size is crucial for data collection and validation, ensuring an error-free dataset for future studies.

Focusing on the moderating impact of blockchain smart contract implementation in SME practice is recommended, as many small-sized businesses still use traditional methods. Exposure to financial technology is also needed for practitioners and policymakers to adapt and leverage advancements effectively. Future research should encourage SME players to implement fintech.

5.4 Contribution

This study explores the relationship between fintech innovation and green growth sustainability, particularly in small and medium-sized enterprises (SMEs) in

Selangor, Malaysia. The research identifies a gap of knowledge in the fintech field, which hinders SMEs players from adopting technology in their operations. The proposed framework integrates two theoretical approaches: research-based view theory and an extended version of the technology acceptance model theory.

The findings show a strong direct relationship between green financing and green investment, but the moderating effect of blockchain smart contracts has an insignificant impact on green sustainability. The adoption of blockchain smart contracts is perceived as disruptive within the fintech dimension, suggesting that while green financing and investment are directly beneficial for sustainability, the integration of blockchain smart contracts does not significantly enhance the positive impact on green sustainability goals.

The practical contribution of this research covers financial technology tools in SMEs business operations that have effects on green growth and the moderating effect of blockchain smart contracts. The Malaysia Fintech Hub provides resources and support to fintech enterprises, helping SMEs gain return on investment and contribute to a green economy.

Regulatory policy contributions involve striking a balance between enabling innovation, managing risks, and ensuring financial stability and consumer protection. Regulators should work with fintech firms to develop regulatory frameworks that support financial inclusion and address concerns around data privacy, cybersecurity, and anti-money laundering. In conclusion, this study contributes to understanding the relationship between fintech innovation, green growth, and green investment in SME operations.

6. Conclusions

The study of the relationship between fintech innovation moderated by blockchain smart contracts indicates the complex relationship with the green growth sustainability of SMEs in Selangor, Malaysia. The result highlights the issue and obstacle in the adoption of fintech into SMEs business operations. The demographic data that was collected from respondents gives a valuable insight into the fintech adoption in effect to overcome the green growth sustainability issue.

Regarding fintech innovation, research highlights the importance for small and medium-sized enterprises (SMEs) to orchestrate and strategize a cohesive set of commitments. This involves implementing designs that leverage their fundamental strengths to achieve a competitive edge. The study portrays innovation as essential for SMEs to reinvent, restructure, and actualize their potential, enabling them to sustain their competitiveness in a volatile marketplace.

The research indicates that SMEs should cultivate and organize their resources to boost innovation capabilities. This can be achieved by recruiting technically skilled

employees or establishing training programs that stimulate staff creativity and innovative thinking. A precise comprehension of the specific characteristics of innovations will enable companies to effectively prioritize their market, production, and technology strategies toward having a green sustainability.

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