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Determinants of Cryptocurrency Adoption Behavior in Malaysia

(*Penentu kepada Tingkahlaku Penerimagunaan Kriptowang di Malaysia*)

Siew Chin Wong
Teoh Teng Tenk, Melissa
Yap Kiew Heong, Angeline
(Faculty of Business, Economics and Accounting and Economic, HELP University)
Zakiah Saleh
(Faculty of Business and Economics, University Malaya)

ABSTRACT

Cryptocurrency has proven to be an enabling force for financial service transformation. It allows users to perform transactions via blockchain technology that bypasses the involvement of conventional financial intermediaries. In local context, the acceptance of cryptocurrency is rather low as compared with other developed countries. The requirement of large consumer market base is the main challenges for cryptocurrency's adoption. Thus, the aim of this study is to determine the relationship between output quality, perceived accessibility, result demonstrability and perceived security and adoption behavior of cryptocurrency as an additional mode of internet/online transaction methods. The data was collected from a sample of 553 respondents from different age groups ranging from under 21 to over 60 years old. The PLS-SEM results demonstrated that there are significant positive relationships between output quality, result demonstrability and perceived security and the users' adoption behavior to use cryptocurrency. The paper provides an insight for explaining the adoption behavior of cryptocurrency. The findings are insightful to develop effective financial management mechanisms and interventions, which is important to enhance the confidence and understanding level toward the adoption of cryptocurrencies among existing and potential users.

Keywords: Cryptocurrency; output quality; perceived accessibility; result demonstrability; perceived security; adoption behavior

ABSTRAK

Kriptowang telah terbukti menjadi daya membolehkan transformasi perkhidmatan kewangan. Ia membolehkan pengguna melakukan transaksi melalui teknologi blok rantai yang memintas penglibatan pengantara kewangan konvensional. Dalam konteks tempatan, penerimaan kriptowang agak rendah berbanding dengan negara maju yang lain. Keperluan terhadap asas pasaran pengguna yang besar merupakan cabaran utama bagi penerimagunaan kriptowang. Tujuan kajian ini adalah untuk menentukan hubungan antara kualiti output, persepsi terhadap kebolehcapaian, keterlihatan hasil dan persepsi terhadap keselamatan dan tingkah laku penerimagunaan kriptowang sebagai kaedah tambahan bagi transaksi internet / dalam talian. Data telah dikumpulkan dari sampel yang terdiri daripada 553 orang responden dari pelbagai golongan umur dari umur 21 tahun ke bawah hingga umur 60 tahun ke atas. Hasil análisis PLS-SEM menunjukkan bahawa terdapat hubungan positif yang signifikan antara pemboleh ubah tak bersandar, iaitu, kualiti output, keterlihatan hasil dan persepsi terhadap keselamatan dengan pemboleh ubah bersandar (iaitu, tingkah laku penerimagunaan kriptowang). Kertas kajian ini memberikan pemahaman tentang tingkah laku penerimaan kriptowang. Hasil kajian ini adalah berguna untuk mengembangkan mekanisme dan intervensi pengurusan kewangan yang berkesan, yang mana adalah penting untuk meningkatkan tahap keyakinan dan pemahaman terhadap penerimagunaan kriptowang di kalangan pengguna yang sedia ada dan berpotensi.

Kata kunci: Kriptowang; kualiti output; persepsi terhadap kebolehcapaian; keterlihatan hasil; persepsi terhadap keselamatan; tingkah laku penerimagunaan kriptowang

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INTRODUCTION

The world we live in today is intensely set in and empowered by a web of information and financial technology. It is moving at a very quick pace and consumers need rapid transactions for instantaneous result. Technology

advancement in the modern day has encouraged individuals and organizations to incorporate a more convenient means to handle transactions. Among these are cashless transactions from emerging digital currencies.

The primary cryptocurrency known as Bitcoin was first introduced in 2008 by Satoshi Nakamoto, a pseudonym used by someone whose real identity is still unknown. Bitcoin uses the blockchain technology, a decentralized cash system without a central server, to conduct transactions. There are over 1,600 types of cryptocurrencies created and transacted on the internet. This suggests the idea that an unexpected market can emerge for cashless economy through use of cryptocurrency (Foley et al. 2018).

Cryptocurrency can be seen as a decentralized currency. One can say that it is not under the jurisdiction of any country, but acts as an internet currency, where it can be used for transactions around the world through the internet. The most prominent cryptocurrencies in the market are Ethereum, Bitcoin, Litecoin, Ripple, Zcash, Steller, Monero and Cardano which at present have become a hot phenomenon globally. Cryptocurrency offers a new payment alternative which exists in electronic form where transfers are made with the assistance of technology such as the internet, computers and smartphones. The innovation has changed the financial interests and payments preferences among consumers as well as introduced a new form of market competition in financial institutions. Amidst the various changes, a rising enthusiasm towards cryptocurrencies was created in the entire society among financial organizations, consumers, users, investors and regulators (Schaupp & Festa 2018). Towards the end of 2019, cryptocurrencies had a global market capitalization of about US$178 billion (according to data which tracks 6,412 coins). Bitcoin's market capitalization alone stood at US$120 billion (Noordin 2019). Undoubtedly, cryptocurrency has become increasingly popular in this advanced technological era. There is an increasing number of cryptocurrency users eager to purchase the currency for use in transactions through the block-chain system. Hence, it is pertinent to examine the potential factors that influence cryptocurrency adoption behaviour among existing and potential local users.

Earlier studies have related the behaviour or intention to adopt cryptocurrency to different cultural and national backgrounds; namely those in Norway, the United States, India, Netherlands, Poland and Thailand (Mikolajewicz-Wozniak & Scheibe 2015; Presthus & o'Malley 2017; Queiroz & Wamba 2018; Schaupp & Festa 2018). Such studies in the Malaysian context is however still insufficient, especially among existing and potential user perceptions towards the adoption behaviour of cryptocurrency. Previous studies have provided different explanatory frameworks of core variables associated with the theory of planned behaviour (TPB), technology acceptance model (TAM) and unified theory of acceptance and use of technology (UTAUT) in the context of adoption of cryptocurrency (Schaupp & Festa 2018; Queiroz & Wamba 2018). The divergence in utilization of underpinning theories provided inconsistent findings within these studies. Thus, the present paper aims to investigate the determinants of adoption behavior of cryptocurrency as an additional mode of internet/online transaction methods.

Findings from this study shall contribute towards the body of knowledge through closing the gap in the literature by focusing on the different unique contextual elements, namely output quality, perceived accessibility, perceived security and result demonstrability which are particularly associated with UTAUT dimensions. The investigation on these contextual factors sought to provide insights to the development of cryptocurrency industry, to ensure effective financial management mechanisms and development of interventions. This should potentially improve fraud prevention mechanisms such as laws for anti-money laundering, anti-terrorism financing, data privacy and security, to boost the attraction for cryptocurrency usage. Additionally, innovative systems need to be established to ensure output quality and result demonstrability are efficiently supported.

The remainder of this paper is organised as follows: The following section provides the literature review, methodology and data analysis. The discussion and implications of the study are then presented. The paper ends with a conclusion including limitations of the study as well as suggestions for future research.

LITERATURE REVIEW

UNDERPINNING THEORY: UTAUT MODEL

Reviews of the expanding literature on digital currency or e-payment have suggested that contextual elements (e.g., performance, efforts used, influence of others and infrastructure support) affect users' perception on adoption behavior. Notably, the UTAUT model (Venkatesh et al. 2003) lays out the groundwork for explaining how performance expectancy, effort expectancy, social influence and facilitating condition had significant influences on user intention to adopt technology. Given the growing empirical evidence supporting UTAUT in explaining technology acceptance and adoption behavior (Schaupp & Festa 2018; Queiroz & Wamba 2018), UTAUT dimensions should be considered when identifying the potential predictors of adoption behavior of cryptocurrency in the Malaysian perspectives.

The dependent variable of UTAUT model explains user behavior on the use of technologies to infer Behavioral Intention (BI) whilst the four independent variables are Performance Expectancy (PE), Effort Expectancy (EE), Social Factors (SF) and Facilitating Conditions (FC). PE is the perceived usefulness of

technology. It is the extent to which an individual considers that using technologies results in performance gain. EE is the ease in using technology. SF refers to the individual's perception on how important others would influence the adoption or usage of technologies. FC is the degree that the facilities and support of the technology is obtainable by the users (Venkatesh et al. 2003). In the present study, newly developed integrated contextual elements, associated with the UTAUT model, will enlarge the scope of technology adoption decision and offer useful insights for merchants and policy-makers to understand user behavior towards the adoption of local cryptocurrency.

Adoption Behavior Adoption behavior provides insights on how and why individuals embrace new invention and information technologies, subsequent to influencing the demonstration of particular types of user behavior (Davis 1989). Venkatesh et al. (2003) explained that consumers with intentions to use a particular type of technology exhibit higher actual usage rates than those consumers without such intention. A higher intention to adopt cryptocurrency improves the desires to use the application. Moreover, adoption behavior has been commonly used in information system to predict customer attitude towards e-commerce industry which involves online purchase and transaction. Similarly, the adoption behavior in this study can be applied on the decision to adopt use of cryptocurrency (Schaupp & Festa 2018). The utilization of cryptocurrency benefits users in speculative investment, medium of exchange and confidentiality protection. An anonymous transaction offers the greatest attraction to users in adopting cryptocurrency (Presthus & O'Malley 2017). The individual gains benefits from a faster payment for several reasons including the absence of expensive intermediaries in the trading transaction. Luno (2017) reveals that 48.8% of the Malaysian investors of Bitcoin viewed it as an investment tool (i.e., adoption behavior) owing to the high perceived trust towards this cryptocurrency. The COVID-19 pandemic accelerates the adoption of and investment in cryptocurrencies such as Bitcoin (Bejaoui et al. 2021). In this study, four important contextual factors, namely output quality, perceived accessibility, result demonstrability and perceived security were investigated to examine their predictability on the individual's adoption behavior of cryptocurrency.

Output Quality Output quality is regarded as an explanation on the impact of the user's cognitive instrumental processes on perceived utility (Gow et al. 2019; Koksal 2016; Yu 2012). Usability is the term strongly associated with PE in the UTAUT model. The good output quality of the cryptocurrency is conducted based on block chain technology. The decentralized base in transaction and data management technology provide sound and safe security, user anonymity and data integrity without engaging a third-party's control mechanism (Yli-Huumo et al. 2016), since the blockchain is a distributed ledger with permanent records comprising a decentralized database of computers belonging to a peer-to-peer network (P2P). Each computer in a distributed network maintains the same copy of the ledger to avoid hacking (Koibanx 2015).

The cryptocurrency being a decentralised payment system rather than a centralised one. It therefore be used for monetary transaction with good protective cache or depository of digital money without any service charges (Eswhari & Ahamed 2018). This perception provides more financial management freedom for investors which also effectively increase the transparency of consumer funds (Hydro 2019). The speed of transaction approximates a real-time assessment that takes ten minutes to process a block in the Bitcoin system, while other cryptocurrencies have shorter time spans (Gulled & Hossain 2018). In addition, the removal of third-party intermediaries through using the decentralized network enhances efficiency of the digital ecosystem, and fostering a faster, lower-cost transaction with lower security risks than the traditional centralized system approach (Zakaria et al. 2018). Cryptocurrency is traded freely in an unregulated market, which is not under the control of any government or financial institution. The adoption of cryptocurrency is influenced by the output quality in terms of the use of cryptocurrency for trading and payment transactions. (Abrahão et al. 2016; Silinskyte 2014; Slade et al. 2014). The hypothesis of output quality is thus established as follows:

H_1 There is positive effect of output quality on cryptocurrency adoption behavior.

Perceived Accessibility The concept of perceived accessibility refers to the ease of consumer usage of the technology as EE is highlighted in the UTAUT model (Venkatesh et al. 2003; 2012). Most studies found significant relationship between perceived accessibility and the adoption behaviour. (Abrahão et.al. 2016; Blinda et al. 2019; Koibanx 2015; Nseke 2018). Perceived accessibility was related to the ease of users in using blockchain technology in cryptocurrency transactions. Initially, users are required to send the transaction from their wallet to the other party, and the request is issued to a peer-to-peer computer networks as nodes. Subsequently, algorithms are used to verify the nodal network transaction and user status. Once verified, the transaction is merged with other transactions to start new data block for the ledger and this new block is permanently and unchangeably added to the existing blockchain following which the process of the transaction is successfully completed. Koibanx (2015) viewed that blockchain enables users to access and to track back from their historical records for every transaction made.

In a similar vein, perceived accessibility is closely associated with the ease of use which provides users with a platform on which to study the technology. It also allows users to access their system at any time and place via any digital tools and technologies that have an internet connection (Calheiros et al. 2011). In other words, useful technology should be able to facilitate users to initiate their learning process. Blinda et al. (2019) explained that successful technology no longer focuses on the functional aspect only but may also include the hedonic aspects (fun or pleasure derived from using a technology) that can be equally accessed effortlessly. On one of the latter aspects mentioned, the study should create an unobtrusive approach for users, where data would easily be available when needed due to high accessibility. The cryptocurrency developers or third-party participants are working hard to create new third-party interfaces meant to act as a behind-the-scenes payment network that is completely invisible to accelerate the adoption of the currency (Koibanx 2015). In this context, perceived accessibility of cryptocurrency system is an important feature to the users as they are more likely to adopt technologies that are easy to use and comprehend (Nseke 2018). Hence, perceived accessibility is viewed as one of the important contextual factors that influence user adoption behavior in the current study. The hypothesis of perceived accessibility is proposed below:

H_2 There is positive effect of perceived accessibility on cryptocurrency adoption behavior.

Perceived Security Perceived risk is the long-rooted central concept in explaining consumer behavior in the literature. It appears that hi-tech products represent specific technological risk (fear of technologically complicated innovations). The set of perceived risk components imply that user adoption behavior is influenced by potential obstacles (Liebermann & Stashevsky 2002, Henry et al. 2018Moore). It is a natural concept of perceived unreliability that may be negatively correlated with user adoption behavior. Typically, the risk refers to the combination of uncertainty and the severity of the consequences involved that influence the behavior intention in the use of cryptocurrency. Perceived risk is associated with facilitating conditions in the UTAUT model, whereby people believe that a mechanism exists to support user activities (Queiroz & Womba 2019). The perceived low risk of the system should develop a sense of trustworthiness towards its utilization for purposes of transactions. Its influence on the technology acceptance model is well demonstrated (Queiroz & Womba 2019).

Popović and Hocenski (2010) also showed that perceived security was ranked the first main matter for most of the users (technology-based services) when it concerns the adoption of hi-tech products or services. Second is the online transaction-aware risk (PRT) which refers to the transaction risk that users may face when revealing themselves to e-commerce while using e-wallet in dealings with cryptocurrency. Most users perceive that using cryptocurrency for online payments is a secured approach as they do not understand how the transaction is conducted. Notwithstanding, the privacy of cryptocurrency is protected by quasi-anonymity provided by private key-public key cryptography. The growing availability of information in a database connected to the internet may increase the potential for identity theft, hacker intrusion and large-scale data leakage problem (Popović & Hocenski 2010). Generally, hackers always attack user's online wallet service and transfer the secret key and funds from blockchain cryptocurrency accounts to their online wallet account (Zakaria et al. 2018). However, the Bitcoin operating software which tops the supply of the cryptocurrency at 21 million by 2041, has not been hacked in the past eight years. This apparent low risk faced by users would positively influence their willingness to adopt the cryptocurrency (Kuek 2019). Moreover, Kuek (2019) explained that the perceived risk is relatively low for cryptocurrency (i.e., Bitcoin) the traditional payment system. Bitcoin systems allow participants to transact and store Bitcoins independently without having to go through any intermediary. The decentralized system distributes money to each of the e-wallet users with minimum risk. Perceived risk is viewed as an important factor that influences user adoption behavior (Hong & Ismail 2021; Kuek 2019; Popović & Hocenski 2010; Queiroz & Womba 2019; and Zakaria et al. 2018). We thus propose the hypothesis of perceived security as follows:

H_3 There is positive effect of perceived security on cryptocurrency adoption behavior.

Result Demonstrability Moore and Benbasat (1991) explained that "result demonstrability" is part of the Innovations Diffusion Theory (IDT), which is one of the dimensions of social influence on the intension of consumers' behavior. Notably, the authors defined that result demonstrability is the extent of the noticeable and communicable results of using a particular technology product or service categorized under the cognitive instrumental processes. Nuriska et al. (2018), and Zhou et.al. (2010) further supported the significant relationship between result demonstrability and individual behavioral intention. Further, result demonstrability is achieved when the existing users of cryptocurrency express and share their pleasant experiences with the others i.e., potential users (Zhang et al. 2010), which is associated with the social factor in the UTAUT model.

The global use of social networks has enabled users to access cryptocurrency's information in a fast and easy manner, particularly with electronic word-of-mouth (eWOM) advertising and information shared in social media such as Facebook, Twitter, newsgroups, and other social networking sites. The trend of building crypto-

community in an advanced communication platform in social media is to enable individuals to express their own thoughts, and experiences and nurture more personal relationships, and facilitate knowledge exchange or information sharing on cryptocurrency in the online sphere (Cheung et al. 2008). Similarly et al. (2004) and Alalwan (2018) stressed that social media platforms are a two-way communication medium that provides their feedback and comments and also the motivation of consumers' intention in using cryptocurrency.

eWOM in social media is considered as an effective and efficient form of advertising since the users share their own experience and influence the purchase decisions with other users as compared to the traditional marketing (Larsen & Cashiola 2018). According to McMillen (2016), 74% of users agreed that the word-of-mouth is a key factor in affecting their decision to purchase cryptocurrencies, and as many as 92% believe and trust the recommendations from their friends which further facilitate them in dealing with cryptocurrencies as compared to other sources of advertising. Moreover, the success of word-of-mouth information shared in social networks is inseparable from the factor of trust. Individuals trust their acquaintances to provide them with recommendations as a reference to generate intent to use cryptocurrency, often more importantly than their trust in marketers, producers, or professional critics (Alalwan 2018; Larsen & Cashiola 2018). Thus, it is pertinent to identify the predictability of result demonstrability on behavioral intention to adopt cryptocurrency. In line with this the following hypothesis is proposed:

H_4 There is positive effect of result demonstrability on cryptocurrency adoption behavior.

METHODOLOGY

POPULATION AND SAMPLE

The sampling units were sourced from the public under different age groups ranging from below 21 years old to over 60 years old. The respondents comprised baby boomers, generation X, Y and Z from all over Malaysia. They represent the active users that conduct online transactions via different internet platforms. Baby boomers are included as this group is also contributing to consumer spending in the economy. The convenience sampling method (i.e., non-probability sampling) was used in this study where participants were identified in the most convenient way. The researchers personally reached out to respondents who fit the criteria of the study (i.e., active online users). In addition, the current study required at least 22 participants to obtain 80% statistical power, to detect at least a minimum of 50% of R^2 with 1% of probability error as suggested by PLS-SEM sample size requirement (Cohen 1992). Hence, a sample size of 553 was considered sufficient which represent about 70% response rate for the current study. The questionnaire included an informed consent form, which clarify that the survey is voluntary and no individual results would be made publicly available.

RESEARCH INSTRUMENTS

The five-point Likert scales of research instruments were adopted and adapted from previous studies. The five items comprising adoption behavior, output quality, perceived accessibility, result demonstrability and perceived security were adapted based on the work of Venkatesh et al.'s UTAUT model (2003). Table 1 summarizes the structure of the questionnaire. The values of 1= "strongly disagree" to 5= "strongly agree" were employed. The questionnaire is divided into six parts. The first part concerns respondents' profiles and preliminary view on cryptocurrencies. It also provides information on respondents' familiarity with cryptocurrencies. The second part indicates the respondents' adoption behavior intention of cryptocurrencies. The sample question of adoption behavior is "I will often use cryptocurrency in the future for either investment or online purchases". Thereafter, the third part solicits the output quality factor considered by the respondents. The sample question for output quality is "Cryptocurrency helps to save time". Part four indicates how the perceived accessibility is expected by the respondents towards the cryptocurrencies. The sample question is "I do not have difficulty in using cryptocurrency for either investment or online purchases". This is followed by Part five that requires the respondents to provide their viewpoints on perceived safety consideration. The sample questions of perceived security is "Cryptocurrency is compatible with other technologies I use", and Part six completes the questionnaire with the respondents' information on result demonstrability. The sample question is "Many of my friends are using cryptocurrency".

TABLE 1. Structure of measurement items

Construct	Item	
Adoption Behaviour	Q4.1	Strongly recommend to use
	Q4.2	Intended to use for investment or online purchases
	Q4.3	Given access, intend to use
	Q4.4	Given capital, will frequently use
Output	Q4.5	Increases productivity
Quality	Q4.6	Very convenient
	Q4.7	Save time
	Q4.8	Excellent usefulness
Perceived	Q4.9	Easy to learn
Accessibility	Q4.10	Simple
	Q4.11	No difficulty for investment or online purchases
	Q4.12	Extremely easy
Result	Q4.13	Friend's suggestions influence
Demonstrability	Q4.14	People important to me think
	Q4.15	Majority of my friends are using
	Q4.16	Impact on the acquaintance relationship
Perceived	Q4.17	Feel completely safe
Security	Q4.18	Not worried of loss
	Q4.19	Feel protected
	Q4.20	No unexpected problems

ANALYSIS TECHNIQUE

Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to analyse the data. Hair et al. (2003) emphasized that PLS-SEM is appropriate if the prediction is more important than parameter estimation. Specifically, this is the case of an incremental study which is initially based on a prior UTAUT model, but new measures and structural paths (i.e., independent variables of output quality, perceived accessibility, perceived security and result demonstrability) are then introduced into the model.

RESULTS

The present study involved 69.3% male and 30.7 % female respondents. About 15.2% of the respondents are below 21 years old; 32% are from the age group of 21 to 30; 24.4% are from 31-40 years old. About 8% of respondents are from 41 to 50 years old, and 20.4% above 50 years old (i.e., generation X and baby boomers). About 25.3% of the respondents obtained diploma qualification, 31.8% have a college degree and 9.1% have other qualifications.

In term of employment status, 55.7% of the respondents are employed, 15.9% are self-employed, and 28.4% are retired and unemployed. The current study revealed that 69.0% or 381 respondents have heard about cryptocurrency and 31% (172) did not. Out of the former 79% are slightly and somewhat familiar with cryptocurrency as compared to 16.9% who are moderately and extremely familiar.

ASSESSMENT OF MEASUREMENT MODEL

Convergent Validity Convergent validity involves the degree to which individual indicators reflect a construct convergent in comparison to indicators that measure other constructs (Hair et al. 2017). The factor loadings for all items are greater than the recommended value of 0.700 as indicated in Table 2 and Figure 1 (Hair et al. 2017). The composite reliability values of latent constructs are ranged from 0.850 to 0.918, which are greater than 0.700, thus indicating a latent variable can explain at least 50% of the indicator's variance (Hair et al. 2017). In Table 2, each construct accounts for at least 50% of the assigned indicators' variance (AVE $\geq$ 0.50) (Hair et al. 2017). Hence, the convergent validity requirement is met in the present study.

Discriminant Validity Discriminant validity refers to the extent to which the indicators are differentiated across the constructs and are truly distinct from other constructs. The correlations between the measures of potential overlapping is identified (Hair et al. 2017). Fornell and Lacker's (1981) criteria indicated that a latent variable should better explain the variance on its own indicators than the variance of the latent variables. The adequate discriminant validity is met when the correlations for each construct are less than the square root of AVE

for indicators that measure the particular construct (Table 3). Meanwhile, the alternative approach to assess discriminant validity is through the Heterotrait–Monotrait (HTMT) ratio correlations. HTMT refers to the ratio of correlations within the constructs to correlations between them. In the present study, the HTMT of correlation value is lower than the threshold value of 0.90 (Gold et al. 2001). In addition, since neither of the bootstrap confidence intervals include the value 1, it is concluded that the measurement model demonstrates adequate discriminant validity in this study (Table 4) (Hair et al. 2017).

Common Method Bias and Lateral Collinearity Assessment The consistent partial least square (PLS) Algorithm, with factor weighting scheme and 300 maximum iterations, was used to examine the existence of common method bias issue. In Table 5, the VIF values of all the relevant constructs are less than 3.3, which indicate that the structural model is free from common method bias (Diamantopoulous & Siguaw 2006; Kock 2015).

TABLE 2. Result of measurement model

Construct	Item	Loading	AVE	CR
Adoption Behaviour	Q4.1	0.805	0.742	0.884
	Q4.2	0.846		
	Q4.3	0.882		
	Q4.4	0.916		
Output	Q4.5	0.906	0.802	0.918
Quality	Q4.6	0.917		
	Q4.7	0.902		
	Q4.8	0.881		
Perceived	Q4.9	0.899	0.762	0.896
Accessibility	Q4.10	0.917		
	Q4.11	0.899		
	Q4.12	0.904		
Result	Q4.13	0.754	0.713	0.864
Demonstrability	Q4.14	0.890		
	Q4.15	0.837		
	Q4.16	0.889		
Perceived	Q4.17	0.859	0.691	0.850
Security	Q4.18	0.873		
	Q4.19	0.827		
	Q4.20	0.763		

TABLE 3. Discriminant validity

	Adoption behaviour	Perceived Accessibility	Output Quality	Result Demonstrability	Perceivec Security
Adoption behaviour	**0.861**				
Perceived Accessibility	0.387	**0.873**			
Output Quality	0.724	0.497	**0.896**		
Result Demonstrability	0.670	0.487	0.719	**0.844**	
Perceived Security	0.733	0.449	0.686	0.743	**0.831**

Note: Diagonals represent the square root of the AVE, while the off-diagonals represent the correlations

TABLE 4. HTMT criterion

	Adoption behaviour	Perceived Accessibility	Perceived Security	Output Quality	Result Demonstrability
Adoption behaviour					
Perceived Accessibility	0.387				
	CI.90 (0.289,0.562)				
Perceived Security	0.836	0.449			
	CI.90 (0.766,0.887)	CI.90(0.341, 0.663)			
Output Quality	0.724	0.497	0.686		
	CI.90 (0.711, 0.850)	CI.90(0.382,0.686)	CI.90(0.654, 0.841)		
Result Demonstrability	0.670	0.487	0.862	0.719	
	CI.90 (0.663, 0.832)	CI.90(0.387,0.695)	CI.90(0.776, 0.913)	CI.90(0.707,0.867)	

TABLE 5. Lateral collinearity assessment

Construct	Adoption Behaviour (VIF)
Adoption Behaviour	
Output Quality	3.026
Perceived Security	2.986
Perceived Accessibility	2.560
Result Demonstrability	2.903

ASSESSMENT OF STRUCTURAL MODEL

The results of the PLS output are shown in Table 6. The R^2 value (0.635) showed that 63.5% of the variance in behavior intention to adopt cryptocurrency can be explained by independent variables. In Table 5 and Figure 1, the findings reveal that the influence of the output quality ($\beta = 0.387$, $p < 0.01$), perceived security ($\beta = 0.403$, $p < 0.01$) and result demonstrability ($\beta = 0.112$, $p < 0.01$) are positively related to behavior intention in adopting cryptocurrency. Thus, H_1, H_3 and H_4 are supported, while H_2 ($\beta = -0.040$, $p > 0.05$) rejected in the present study. An in-depth study highlighted that perceived security, output quality and facilitating conditions were the three key determinants of behavior intention to adopt cryptocurrency.

Effect size (f^2) illustrates the strength of the relationships investigated between independent and dependent variables which are included in Table 5. The results show that there are medium effect size for both perceived security ($f^2 = 0.177$) and output quality ($f^2 = 0.169$) on behavior intention but a relatively small effect size for result demonstrability ($f^2 = 0.112$). The effect size of both perceived security and output quality are higher than result demonstrability. Hence, the influence of perceived security and output quality factors are more important than result demonstrability factor in explaining the behavior intention to adopt cryptocurrency.

Predictive relevance (Q^2) is accessed via blindfolding procedures. A Q^2 value greater than 0 shows that the independent variables have predictive relevance for the dependent variable under investigation (Hair et al. 2017). In this study, the Q^2 ($0.510 > 0$) of behavior intention to adopt cryptocurrency, shows that the predictive relevance requirement is met. Table 5 also shows the different q^2 values, namely output quality ($q^2 = 0.237$), perceived security ($q^2 = 0.035$), result demonstrability ($q^2 = 0.016$) and perceived accessibility ($q^2 = 0.006$). The finding shows that output quality has moderate effect on behavior intention to adopt cryptocurrency. However, there is weak effect size of perceived security on behavior intentions.

TABLE 6. Summary of structural model

Hypothesis	Relationships	Std Beta	Std. Error	t-value	Decision	R^2	f^2	Q^2	q^2
H_1	Output Quality →Adoption Behaviour	0.387	0.059	5.907**	Supported	0.635	0.169	0.510	0.23
H_2	Perceived accessibility → Adoption Behaviour	-0.040	0.064	0.152	Rejected		0.003		0.00
H_3	Perceived Security → Adoption Behaviour	0.403	0.057	7.192**	Supported		0.177		0.03
H_4	Result Demonstrability →Adoption Behaviour	0.112	0.065	1.752*	Supported		0.112		0.01

Note: **p<0.01, *p<0.05,

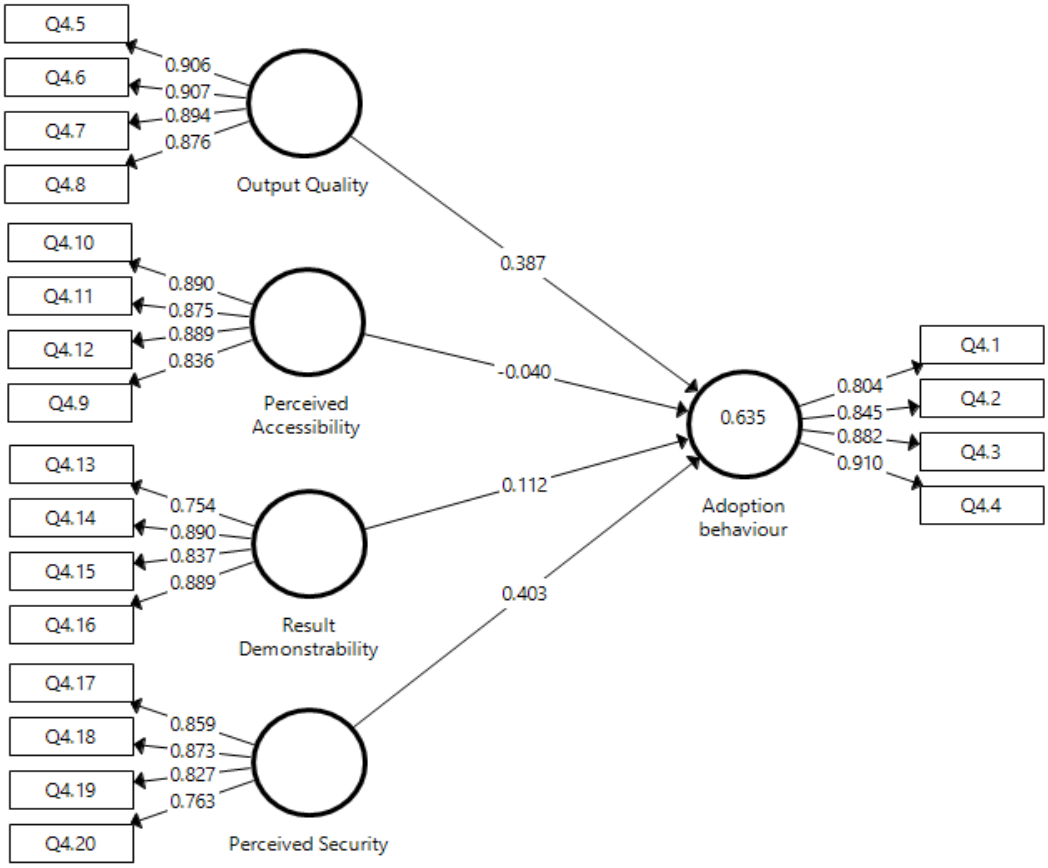

FIGURE 1. Structural model

IMPORTANCE AND PERFORMANCE MATRIX (IPMA)

Importance and Performance Matrix (IPMA) extends the standard PLS-SEM results reporting of path coefficient estimates and other parameters by including a procedure that considers the average values of the latent variable scores. The reason is to identify the predecessor constructs that have a relatively high importance for predicting the target constructs, but may also have relatively low performance, so that improvements can be implemented on those important constructs (Hair et al. 2017). IPMA aims to facilitate identification of important attributes or constructs which is underperformed or overperformed. The importance measure represents the vertical axis, and the performance measure constitutes the horizontal axis of a two-dimensional graphs. The mean importance value (i.e., vertical line) and the mean performance value (i.e., horizontal line) divides the importance and performance map into four areas with importance and performance values below and above the average (Hair et al. 2017).

The importance-performance results (Table 7 and figure 2) show that all the constructs have low performance with the average value of 26.807. On the other hand, in both output quality and perceived security, with a total effect of 0.428 and 0.413 respectively, the constructs' importance are particularly high (upper right area) in comparison with results for demonstrability and perceived accessibility. Generally, when analyzing the importance-performance map, constructs in the lower right area represent the greatest opportunity to achieve improvement, followed by the upper right, lower left, and, finally the upper left areas. The IPMA provides guidance for the prioritization of managerial or policy activities of high importance, that require performance improvement (Hair et al. 2017). Hence, when policy makers and relevant businessmen aim at increasing the performance of cryptocurrency adoption in the local context, their priority should be to improve the performance of aspects captured by output quality and perceived security, as these have great (above average) importance, but relatively low in performance (close to mean value of horizontal line). The aspects related to result demonstrability and perceived accessibility are ranked in the subsequent priority.

TABLE 7. IPMA result

Construct	Importance (Total Effect)	Performance (Index Value)
Result Demonstrability	0.109	22.547
Output Quality	0.428	30.162
Perceived Accessibility	-0.058	28.249
Perceived Security	0.413	26.273

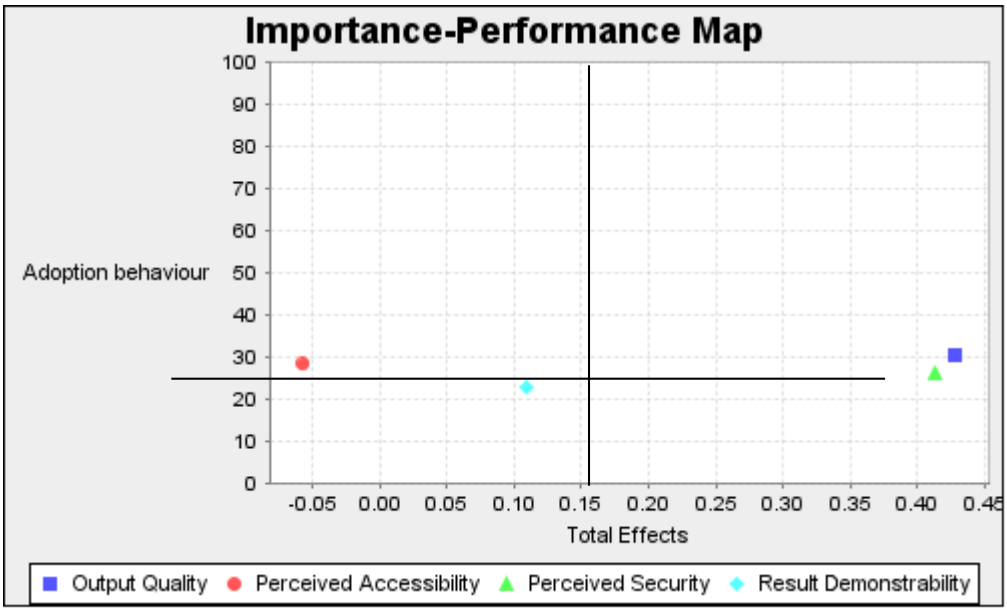

FIGURE2. Adjusted IPMA of adoption behavior

DISCUSSION

The present study explains that there is a significant positive relationship between the output quality and the adoption behavior of cryptocurrency among current and potential users in the Malaysian perspectives. This is consistent with the studies conducted by Silinskyte (2014), Shahzad et al. (2018) and Hydro (2019). Generally, the motivation of adoption behavior among the existing and potential users is aimed to enhance the efficiency in payment, trading and investment transactions, and in value storing with a safer, more transparent, traceable and efficient digital operation process. The quality performance involves the possibility to move and provide evidence of ownership of cryptocurrency without an intermediary, by means of the blockchain. The security risks associated with the traditional centralized system approach will be mitigated by having faster and lower-cost transaction activities (Zakaria et al. 2018).

In contemporary trends, consumers prefer a cashless economy through digital currency, wherein its transaction is equipped with the features of digital wallets. The reasons for this include preference for a faster and easier payment system and dissatisfaction with fiat money, in particular the need to eliminate the use of expensive intermediaries (Yussof & Al-Harthy 2018). Bitcoin is transferred by using the crypto-wallet that takes the shortest time compared to traditional cash and credit card payments (Rahim & Chung 2019). Hence, excellent output quality of cryptocurrency is pertinent in influencing user adoption behavior to meet the investment and transaction objectives.

Similarly, result demonstrability postulates significant influences on public cryptocurrency adoption behaviour. This study appears to support Hennig-Thurau et al. (2004) and Alalwan (2018)'s view that consumers that engaged in eWOM communication on the web-based consumers' opinion platforms have positively affected their adoption decisions. In particular, the social media platforms are a two-way communication that provides comments that affect consumers' intention to use digital currency. By exploring the process of recommendation and act on this information, the cryptocurrency agents or miners demonstrate that word-of-mouth marketing can become an integral part of business strategy.

Velázquez, Blusco and Saura (2015) explained that individuals always seek information from others (i.e., the social circle) at the pre-purchase stage. Thus, eWOM has become popular in accelerating commercial efforts which enable potential users to have better understanding on the advantages of cryptocurrency adoption. In this context, result demonstrability through social media is viewed as an important factor in public cryptocurrency adoption behaviour.

Our findings reaffirm perceived security is an important predictor of adoption behaviour for cryptocurrency which is in line with the past studies of Popović and Hocenski (2010) and Zakaria et al. (2018). The results similarly emphasised that sound security features of the transaction system include personal data protection, elusive features of blockchain, decentralised control and autonomy of sought that enhances individuals' trustiness and positive purchase experiences of cryptocurrency (Hong & Ismail 2021; Yussof & A-Harthy 2018). Kuek (2019) stressed that launching an attack and destroying the full blockchain with today's technology is impossible as the hacking process is expensive. The present study also sought to provide insight to government authorities and businessmen the necessity to develop effective protection strategies and regulatory frameworks against the risk of fraudulent transactions and data privacy issues (Kuek 2019).

However, the empirical results demonstrated that perceived accessibility does not affect adoption behaviour. The non-significant findings are inconsistent with those of previous studies by Koibanx (2015) and Alalwan et al. (2017). According to Ismail (2019), most of the consumers understand that a new hi-tech product approximately needs a ten-year cycle before it becomes a mainstream product. The development and integration of the new transaction system may require security and audit reviews by respective departments throughout the early and immature stage, which is also applied to cryptocurrency. The review process will limit the accessibility of the users to the transaction system. Hence, there is high level of tolerance and concession among the public towards the limited access and inconvenience of cryptocurrency usage in Malaysia.

THEORETICAL IMPLICATIONS

The current research applies the UTAUT Model as the theoretical mechanism to further investigate the potential factors of cryptocurrency adoption behaviour among existing and potential users. The study extends and operationalizes the existing conceptual knowledge, especially in determining the possible influences of contextual elements which are associated with the UTAUT Model especially in the local context.

PRACTICAL IMPLICATIONS

The present study helps regulators to understand the perceptions of cryptocurrency users in Malaysia. The government should focus on designing, implementing and enforcing an ideal regulatory framework to protect the users and enhance investors' confidence in cryptocurrency activities, especially in addressing perceived security issues. Prospective cryptocurrency users are extremely concerned with the security risk and cybercrimes, due to its uninsured nature and the threats from inadvertent collapse of the cryptocurrency system. The Malaysia law on cryptocurrencies that came into effect in January 2019 stipulated that the operating of any digital assets exchange platform must gain approval from the Securities Commission. However, cryptocurrency exchanges will still be the most targeted cyber-attack areas. One of the primary causes of potential hacking is the negligence of the exchange operators to observe and oblige the security standard. Government regulations need to address the risks on this aspect. The Security Commission should establish regulatory framework on cyber risk management in relation to cryptocurrency capital market which include steps to prevent, reduce and manage the activities. Regulations on ICO, anti-money laundering, anti-terrorism financing laws, data privacy and security laws enhance users' protection and hence boost their intention in cryptocurrency usage (Yussof & Al-Harthy 2018).

The present findings indicate that perceived security is an important predictor of users' cryptocurrency adoption behaviour. Related laws should be enacted to protect the users in terms of holding of cryptocurrency as medium of transactions, value storage and investment purposes which are the primary concerns of output quality among users. In addition, rules and regulations to ensure protection from technical errors or human errors that arise from online transactions is significant to all the users. Notably, Bank Negara Malaysia should consider issuing a government backed digital coin since global central bankers have already ventured into the idea of a central bank for digital currencies (CBDCs) (Roubini 2018). The use of fiat cash is diminishing and has nearly disappeared in countries such as Sweden and China. If a CBDC were to be officially approved, cryptocurrency, which is not scalable, cheap, secured or decentralized, would immediately replace fiat currency. Enthusiasts would argue for the anonymous attributes of cryptocurrency. But, similar to private bank transactions, CBDC transactions can also be made anonymous. When necessary, CBDC transactions are only identifiable to law-enforcement authorities or regulators as already conventionally applied by private banks. In due time, a narrower CBDC-based banking system could ensure a better and more stable financial system to users and bankers. Subsequently, the risk of investing in cryptocurrency would be substantially reduced with the support of the government (Roubini 2018).

The present study also highlights output quality and result demonstrability have significant impact on the adoption behavior. Initial Exchange Offerings (IEO) may emphasize the attributes of cryptocurrency such as speed, liquidity or value storing to secure a new coin launching success. In terms of convenience and innovation, cryptocurrency or e-money providers could explore the possibility of holding central bank reserves, as per conventional banks, to the extent that they meet certain criteria and that they agree to be monitored (Roubini 2018). Meanwhile, to deal with investors' concern on the output quality associated with cryptocurrency, IEOs should focus on ensuring that they are able to provide investors with a stable and secure exchange platform. This would include maintenance of a robust firewall system and network with consistent updates and stringent security protocols that aim to hinder hacking activities and unwanted technical errors to boost user adoption (Kuek 2019).

It is important for technology corporations to develop cryptocurrency along with their portfolio of related technology innovations such as quantum computing, cloud computing, internet of things, analytics and artificial intelligence to provide the most secured system for facilitating multi-step transactions (Woodside et al. 2017). It will facilitate transactions to reduce settlement time from days to minutes, and to manage their flow of payments more closely through the cross-industry consortia. Corporations including retailers, financial institutions and logistic providers can work closely together to apply this technology to radically change their ecosystems through open platforms. Moreover, female clients, who are the major spenders on households goods and services, should give be given extra incentives (such as rewards or bonus points) to encourage them in using cryptocurrency transactions, since they are always looking for new technologies that can facilitate their activities with least spending effort.

CONCLUSION

There is increasing popularity and novelty of cryptocurrency technology in conducting online transaction activities. Nonetheless, the local empirical evidence on the adoption behavior of cryptocurrencies is still inadequate. The aim of the present research is to determine the perceptions of Malaysians towards cryptocurrency usage. Factors such as output quality, result demonstrability and perceived security are viewed as potential predictors of the individual's adoption behavior on the use of cryptocurrency. Robust regulatory framework is important to protect the integrity of the operation mechanism of cryptocurrency to enhance the perceived security among the public towards the currency. In addition, well-established innovative systems instituted by market participants, to ensure output quality and result demonstrability, are equally important to the continued growth of cryptocurrency as a popular medium of transaction.

Some limitations are however apparent in the present study. Firstly, the implementation of cross-sectional design of the study could be improved by applying longitudinal approach in a more desirable and consistent manner, especially in determining the pattern of adoption behaviour among users. Secondly, the age span among users sampled is 21-60 years. This large age band would inherently contain wide variation in terms of consumption and adoption behaviour among respondents. Thus, it is suggested that a quota sampling method be applied within different generations to yield statistically more significant research findings. Third, the current study did not examine the interaction effect between the demographic variables and the research constructs. It is suggested that future studies include interactions, such as between gender differences and education levels, to determine their effect on adoption behaviour of cryptocurrencies in the Malaysian perspectives.

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Wong Siew Chin (corresponding author)
Faculty of Business, Economics and Accounting
HELP University
50490 Kuala Lumpur, MALAYSIA.
E-Mail: sc.wong@help.edu.my

Teoh Teng Tenk, Melissa
Faculty of Business, Economics and Accounting
HELP University
50490 Kuala Lumpur, MALAYSIA.
E-Mail: melissateoh@help.edu.my

Yap Kiew Heong, Angeline
Faculty of Business, Economics and Accounting
HELP University
50490 Kuala Lumpur, MALAYSIA.
E-Mail: angeline.yap@help.edu.my

Zakiah Saleh
Faculty of Business and Economics
University Malaya
Jalan Universiti
50603 Kuala Lumpur, MALAYSIA.
E-Mail: zakiahs@um.edu.my