Journal of Electronic Commerce in Organizations
Volume 21 • Issue 1

Can Cryptocurrency Be a Payment Method in a Developing Economy?
The Case of Bitcoin in South Africa

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ABSTRACT

This study sought to understand the factors driving the consumer adoption of a cryptocurrency, in particular Bitcoin, as an electronic payment (e-payment) system for electronic commerce (e-commerce) transactions within a developing economy such as South Africa. The advent of e-commerce has led to increased online transactions facilitated by e-payment systems, which can fall prey to opportunistic hackers. Cryptocurrencies have been pegged as a solution to this security issue. However, little is currently known around consumer propensity to use a cryptocurrency as an e-payment option, particularly within a developing economy. The investigated factors that could influence user adoption were based on literature and tested on a South African representative sample of 814 respondents. Of the factors identified from literature, the study found that "perceived usefulness and perceived ease of use," "self-efficacy," "awareness," "trust," and "security" have the most significant influence on South African consumers adopting a cryptocurrency as an e-payment system.

KEYWORDS

Bitcoin, Consumer Adoption, Cryptocurrency, Digital Divide, eCommerce, ePayment, ICT4D, Technology Economics

INTRODUCTION

In an e-commerce environment, money exchanges for goods or services in electronic format are referred to as e-payments. Electronic payments have become fundamental in e-commerce and the absence of an efficient system to handle them could deter its overall successful adoption (Liébana-Cabanillas, Muñoz-Leiva, & Sánchez-Fernández, 2018; Özkan, Bindusara, & Hackney, 2010). Electronic payments are facilitated by e-payment systems, mechanisms used by individuals and organisations as a secure and convenient way of making payments over the internet (Slozko & Pelo, 2015). As with

DOI: 10.4018/JECO.320223
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any transaction-based activity, the issues surrounding reliable and secure money exchange between individuals or groups still remains of the utmost importance (Abrazhevich, 2004; Conti, Kumar, & Lal, 2018). Blockchain technology has been identified as a key innovation instrumental to overcoming these issues by enabling the use of digital currencies, or cryptocurrency, of which Bitcoin was the first and remains one of the most popular (Dodd, 2018; Dourado & Brito, 2014; John, O'Hara, & Saleh, 2022). This is due to cryptocurrency being an information system that is a form of electronic cash supported by intangible mathematical and cryptographic constructs, unlike traditional currency which is supported by tangible precious metals, specifically gold and silver (Morris, 2015).

A key factor in determining the success or failure of any information system such as a cryptocurrency is user acceptance (Davis, 1989). Without this, no technology can successfully be present in the business environment it was intended to operate in, and e-payment systems are no exception (Abrazhevich, 2004). Current cryptocurrency studies have thus far mainly addressed the Bitcoin tax implications in South Africa (Berger & Van Der Berg, 2016; Wicht & Fritz, 2016), adoption from a venture capital investment perspective (Walton & Johnston, 2018) and the use of a Bitcoin framework as an alternative payment system on low-end cellular devices for individuals in rural areas (Dlamini, Scott, & Krishnan Nair, 2016). Public uptake of cryptocurrency generally in most developing economies including South Africa has also been highlighted as disappointingly slow (Gogo, 2019).

This study is focused on identifying those influencing factors that impact user intention to adopt a cryptocurrency, in this case Bitcoin, as an e-payment system. This is done by investigating the research question: What are the factors that influence a user's intention to adopt a cryptocurrency, such as Bitcoin, for e-payment? In order to address the research question, a conceptual model was developed based on a literature review conducted, and an online questionnaire was administered to gather data to analyse the relationships among the factors identified through the literature review as being relevant to user adoption of Bitcoin.

BACKGROUND

In the last two decades e-payment systems have garnered substantial focus from both researchers and systems specialists owing to their crucial role played in facilitating e-commerce (Kabir, Saidin, & Ahmi, 2015). There are four main types of e-payment systems, namely electronic cash, online credit card payments, electronic checks and smaller payments. All of these offer different pros and cons impacting both merchants and consumers in different business environments (Yu, Hsi, & Kuo, 2002).

Electronic payment systems can be classified into distinct categories, namely electronic currency systems (token based) and credit/debit systems (account based) (Abrazhevich, 2001). Payments made in electronic currency systems mimic payments made using conventional cash in that users exchange tokens which represent specific values, just as people normally exchange bank notes. From an electronic payments perspective, credit card systems are where "money is represented by numbers in bank accounts and these numbers are transferred between parties in an electronic manner over computer networks" (Abrazhevich, 2001, p. 82). Due to increased efforts in shifting the global economy from a 'cash-based' to a 'cash-less' economy, there have been great strides taken in innovations regarding electronic currency systems (Wonglimpiyarat, 2016).

Cryptocurrency popularity has been on the rise in recent years due to its core characteristics of decentralization and anonymity within its peer-to-peer protocols (Morris, 2015). Despite the rise and fall of competitors, Bitcoin remains currently the most reputable, widely known and used cryptocurrency in the world (D'Alfonso, Langer, & Vandelis, 2016; Heid, 2009; John, O'Hara, & Saleh, 2022). It operates on an unparalleled level of transparency, in which all transactions are traceable, public and permanent (Nigam, 2016). However, to date, Bitcoin has been used predominantly as a speculative investment tool rather than a trading base, with the perspective that if it is adopted more widely it will cause a major upset to current markets and monetary policies (Baur, Hong, & Lee, 2018).

Few studies have been conducted around the use of blockchain for e-payments within an African or Global South contexts. One such study by Dwivedi, Alabdooli & Dwivedi (2021) investigating the impact of FinTech on the competitiveness in the United Arab Emirates (UAE). The study found that the adoption of FinTech could have a significant influence on the competitiveness with the existing banking industry Dwivedi, P., Alabdooli, J. I., & Dwivedi, R. (2021). Related to this in the Global South is the issue of financial inclusion, where financial inclusion was found to be successful only with government support and motivation for FinTech solutions such as e-payments (Dwivedi, Alrasheedi, Dwivedi, & Starešinić, 2022; Chopra, Dwivedi, & Sherry, 2013).

Given the aforementioned points, Bitcoin has been viewed as highly adoptable in markets that lack financial infrastructure but have access to mobile data, as well as in markets that experience hyperinflation and need mechanisms to allow for accumulation and exchange of currencies. In addition, Bitcoin also offers the advantages of Payment Freedom, Low Transaction Fees and Minimal Merchant Risk and Customer Risk (Nigam, 2016). However, a gap in current literature exists around the usage of cryptocurrency, and in particular Bitcoin, as an e-payment method in an African country such as South Africa.

From a geographic perspective, Bitcoin can be used for cross border payments without the need to worry about additional currency conversion and foreign transaction fees. Although not all credit card providers charge foreign transaction fees, it has the potential to inflate the cost of electronic purchases between merchants and customers located in different countries. Currency conversion fees are the result of what is known as Cardholder Preferred Currency (CPC) or Dynamic Currency Conversion (DCC) (Issa, 2016). DCC allows the holder of the credit card to pay for goods and services worldwide with their local currency and offers the merchant the opportunity to charge a mark-up on the exchange rate used on currency conversions, which directly adds additional cost to the initial transaction (Feinstein, 2014).

From a political perspective, it has been documented that governments have used their local fiat currencies as tools to manipulate economies to control monetary policy and to gain political advantage. None of these activities are perceived as justifiable in the best interests of their citizens (Staiger & Sykes, 2010). Countries globally using the American US Dollar and the Euro, have also been observed to indulge in such activities (Staiger & Sykes, 2010). Bitcoin offers a currency that avoids concentrations of power that could lead to a single person, organisation or government taking control of the system and abusing it as highlighted above, due to one of its key innovative strategies, namely being decentralised in nature (Böhme, Christin, Edelman, & Moore, 2015).

An increase in interest in the usage and adoption of Bitcoin in South Africa has been observed due to its many advantages over cash, such as speed and security from fraud (Edmunds, 2017). A growing interest in the use of Bitcoin can be confirmed by the increased volume of trade in the last few years (Blenkinsop, 2019). General cryptocurrency adoption in South Africa is driven in large part by attitude and perceived behavioural control (Mazambani & Mutambara, 2019). Only two fully licensed Bitcoin exchanges in South Africa have been in existence since 2013, namely Internet Currency Evolution Cubed (Pty) LTD (ICE3X) and Luno (Bitcoin, n.d.). Bitcoin exchanges offer individuals and organisations the ability to buy Bitcoin in exchange for their local currency (Bitcoin, n.d.). Luno had gone even further in the promotion of Bitcoin as an e-payment system by partnering with one of South Africa's local payment gateways, Payfast, in order to allow sellers to accept Bitcoin payments but were unable to sustain the offering (Payfast, 2019).

Theoretical and Conceptual Frameworks

Several theoretical models that seek to explain user acceptance of information systems exist with roots in a combination of information systems theory, psychology and sociology (Doleck, Bazelais, & John Lemay, 2017). As is well known, the Technology Acceptance Model (TAM) remains the most widely used model in information systems research, particularly when investigating technology adoption in developing economies (Kwon & Chidambaram, 2000; Davis, 1989).

This study extends on the two main factors being the main influencers of user acceptance of technology in the TAM model as identified by (Davis, 1989). TAM concentrates on predicting the acceptance of information systems' and diagnosing design issues prior to users experiencing them (Dillon & Morris, 1996). TAM posits that user acceptance of technology can be determined using two factors, namely Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) (Kwon & Chidambaram, 2000). PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989, p. 320). PEOU is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). Both TAM factors are perceptions that the user has that are grounded in specific beliefs about the system (Dillon & Morris, 1996). According to the TAM model, PU and PEOU significantly impact the users' attitude towards using the information system. This can be defined as user perception of the favourableness or unfavourableness toward the system (Dillon & Morris, 1996). Behavioural intention to use the system is a combination of attitude towards the system and perceived usefulness, which eventually determines the actual usage.

However, due to the infancy of the adoption of cryptocurrency as an e-Payment method in the research domain, a number of other factors were also selected from studies conducted in multiple domains relating to technology adoption, such as the adoption of internet banking, e-payment systems and e-commerce. These include:

- Self-efficacy

Dory et al. (2009) define self-efficacy as an individual's belief in their own capability to accomplish a given task. This belief in oneself stems from four different sources, namely: performance accomplishments (whether successful or not), vicarious experience (observing peers performing the same or similar activity), verbal persuasion (being led verbally into believing that one can successfully carry out the activity) and, finally, physiological arousal (brought about by emotions such as anxiety or stress) (Bandura, 1977).

Numerous studies have been carried out that examine the relationship between computer systems' use and self-efficacy (Kwon & Chidambaram, 2000; Al-Somali, Gholami, & Clegg, 2009; BitcoinZAR, n.d.; Teoh, Chong, Lin, & Chua, 2013). Many have found that self-efficacy and PEOU (a factor used extensively in technology adoption study that stems from the TAM model developed by Kwon & Chidambaram (2000), are closely related.

From the context of using Bitcoin as an e-payment method, self-efficacy becomes a multi-faceted entity as one needs to have confidence in the ability to, first of all, acquire Bitcoin and then follow the payment instructions to the letter, as a payment made into the wrong account is irreversible. Therefore, the confidence in one's ability to make a payment correctly using Bitcoin can be considered as an important factor in the adoption intent of Bitcoin as an e-payment method.

- Awareness

While majority of Bitcoin related transactions in South Africa center around investment, a number of organisations have indicated interest in offering a cryptocurrency payment method as it offers benefits such as no chargebacks and it is cheaper than accepting credit card payments (Vissor, 2016). Awareness was also found to have a significant impact on both PU and PEOU in the acceptance of mobile banking in Yemen (Mutahar, Daud, Ramayah, Isaac & Aldholay, 2018).

- Trust

Along with security, trust ranks as a highly researched factor in studies regarding e-commerce adoption and e-payment systems. This may be due to the fact that trust is perceived as a defining element in most socio-economic interactions where uncertainty is present (Pavlou, 2003). The uncertainty stems from the fact that the internet has no direct human control over individual transactions due to it being an open network, combined with the fact that the technical infrastructure that has been built to support e-commerce and e-payment systems is prone to security attacks (Kim, Tao, & Shin, 2010). Although many definitions exist within the context of e-commerce and e-payment, for the purpose of this particular study, trust is given "as the consumer's confidence that their money and personal information will not be used against their personal interest" (Özkan, Bindusara, & Hackney, 2010, p. 309).

Research has pointed out the importance of consumer trust in both e-payment and e-commerce systems. For instance, in a study done by Kniberg (2002) to uncover the reasons why an Australian e-payment system failed, they identified the lack of trust consumers had in the e-payment system as a hindering factor in its adoption. To further emphasize this, a survey conducted by Abrazhevich (2004) exposed how consumers were not willing to use an e-payment system that they deemed as untrustworthy. Literature thus confirms that it is difficult for an e-payment system to gain extensive adoption and use without consumer trust (Kim, Tao, & Shin, 2010).

- Security

Security is, by far, one of the main researched areas in the study of payment systems (Abrazhevich, 2004). People fear transacting and paying online because the possibility that their personal information may be stolen and used for criminal/fraudulent activity scares them (Özkan et al., 2010). In a study done by Lim & Kurnia (2007) in an effort to discover the reasons why an Australian based e-payment system failed in its attempt to be widely adopted, it was discovered that the lack of security in the system affected its acceptability among consumers.

From an e-payment systems perspective, security is seen as the perceptions around payment means, procedures and programs driven to guarantee the secure storage and transmission of information (Teoh et al., 2013). From a technical perspective, the key areas that ensure integrity, confidentiality, non-recognition of relationships and authentication, for example by whom the payment was made, are of the greatest importance with regards to e-payment system adoption (Flavián & Guinalíu, 2006).

From a technical perspective, Bitcoin uses what is known as a cryptographic proof system in order to verify and process transactions between users (Nakamoto, 2008). Cryptography provides transaction security within the system (McDougall, 2014). The cryptographic proof system works in such a manner that it is impossible to get any personal details of those transacting on the system; thus, protecting sellers and buyers from fraud (Nakamoto, 2008).

- Regulation

The rapid growth of cryptocurrencies on a global scale has given rise to a regulatory quagmire for governmental financial regulators worldwide (Petzer, 2017). This has left the regulatory environment regarding Bitcoin uncertain in many countries (McDougall, 2014). Consumers need well established regulation in order to protect them, due to the price volatility and security concerns surrounding Bitcoin (Federal Reserve Bank of America, 2017). In general, consumers need to trust the systems they use, and many have revealed their distrust for Bitcoin. This is due to a lack of regulation, resulting in insufficient consumer protection, as demonstrated by the fall of MtGox (McDougall, 2014). In addition, thereto and more recently, Bithumb, the world's fourth largest cryptocurrency exchange which consisted of 20% of all ether trades and approximately 10% of all Bitcoin trades, was hacked, losing approximately 3% of its users more than 10 million Won worth of Bitcoins (Khandelwal, 2017).

Due to more advanced cryptocurrency regulation in South Korea, the government could formally start looking into the incident after more than 100 Bithumb users filed complaints with the National Police Agency's cybercrime unit.

Although the government of South Africa has been criticised for being among the slowest of the advanced economies to develop a juridical apparatus for cryptocurrencies, it is not completely ignorant of the potential disruptive capabilities thereof (Haig, 2017). In December of 2014, the South African Reserve Bank (SARB) released a position paper on cryptocurrencies. In the paper the SARB highlighted the risks it had identified with the cryptocurrency landscape, such as money laundering, risk to consumers and the financing of terrorism (South African Reserve Bank, 2014). The SARB proceeded by stating that, even though they had identified these potential risks, it was not going take any responsibility in relation to the acquisition, trading or the use of a cryptocurrency. They thus cemented the fact that the use of cryptocurrency was at the consumer's own risk. More recently, however, the SARB has been seen to be taking significant steps toward solidifying a regulatory framework for Bitcoin and other cryptocurrencies. The SARB is yet to develop case studies to improve the regulation (Haig, 2017).

- Social Influence

According to White, Smith, Terry, Greenslade, & McKimmie (2009), individuals are influenced by their social environment, and can be represented by subjective norms, or the perceptions of pressure from others on actions. Subjective norm is one of the three main determinants of intention of use part of the theoretical framework of the Theory of Reasoned Action (Kwon & Chidambaram, 2000). This social factor can be described as "social pressure to perform or not to perform the behaviour" (Kwon & Chidambaram, 2000, p. 188]. The fact that users' use of a system can be influenced by other's perceptions is highlighted by subjective norms (Doleck et al., 2017).

From the results of four longitudinal studies that included subjective norms as a factor in the Technology Acceptance Model 2 (TAM2), Venkatesh & Davis (2000) agree on the key role that social influence plays in the determining of the acceptance of information technology by users.

- Perceived Risk

Perceived risk is defined as being "a consumer's subjective belief of suffering a loss in pursuit of a desired outcome" (Pavlou, 2003, p. 109). These subjective beliefs are created by limited access to information regarding the true mechanics behind transacting online (Bensaou & Venkatraman, 1996).

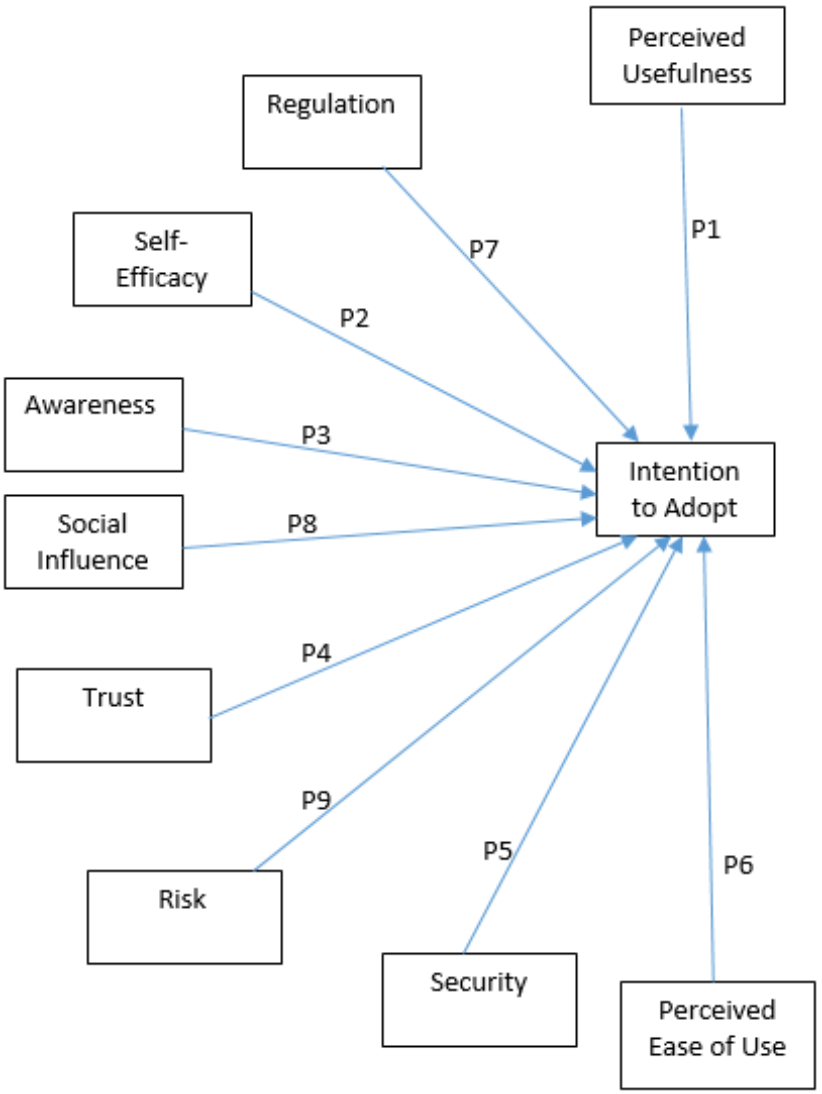
The sometimes unfriendly and detached nature of the internet, as well as the uncertainty associated with the use of open source transactions infrastructure, has made perceived risk an unavoidable element within all e-commerce activities (Pavlou, 2003). This risk is fuelled mainly by two forms of uncertainty: behavioural and environmental doubt (Bensaou & Venkatraman, 1996).

Behavioural uncertainty is associated with the opportunistic nature of human beings. Web-retailers may take advantage of customers through tactics such as false advertising, demonstration of false identity, leaking of private information and warranty denunciations (Pavlou, 2003). These forms of risk that could arise from behavioural uncertainty are economic risk (monetary loss), personal risk (obtaining unsafe products) and privacy risk (disclosing private information to criminal entities) (Pavlou, 2003).

Environmental uncertainty speaks to the internet's unpredictable nature; an element that is outside the control of web-retailers (Pavlou, 2003). Although web-retailers can, to a certain degree, take measures to ensure transaction security by using Secure Socket Layer (SSL) protocols for data transmission, implementing firewalls and using encryption, the likelihood of malicious third-parties that could compromise the transaction process putting both retailer and consumer at risk remains.

Consumers may also fear the risk of using secure e-payment systems if they do not understand the underlying security technology and measures that have been implemented as this information is not

Figure 1.
Research Model



always readily available (Abrazhevich, 2004). Due to the complicated nature of Bitcoin transactions, this could lead to consumers fearing the use of Bitcoin.

Research done by Jarvenpaa, Tractinsky, & Vitale (2000) on the impact of perceived risk on consumer decision-making when using online transaction systems revealed that individuals are less motivated to adopt new payment methods when they perceive that the risk of adopting them is greater than when using existing methods.

Figure 1 shows the conceptual research model proposed to investigate user cryptocurrency adoption intention, such as Bitcoin, as an e-payment system, taking into account PU and PEOU (from TAM), together with regulation, self-efficacy, awareness, social influence, risk, trust and security.

The propositions posed by the conceptual model are listed in Table 1 below

Table 1.
List of Propositions

Proposition 1: Perceived usefulness has an influence on the intention to adopt Bitcoin as an epayment system
Proposition 2: Self efficacy has an influence on the intention to adopt Bitcoin as an epayment system
Proposition 3: Awareness has an influence on the intention to adopt Bitcoin as an epayment
Proposition 4: Trust has an influence on the intention to adopt Bitcoin as an epayment
Proposition 5: Security has an influence on the intention to adopt Bitcoin as an epayment system
Proposition 6: Perceived Ease of Use has an influence on the intention to adopt Bitcoin as an epayment system
Proposition 7: Regulation has an influence on the intention to adopt Bitcoin as an epayment system
Proposition 8: Social Influence has an influence on the intention to adopt Bitcoin as an epayment system
Proposition 9: Risk has an influence on the intention to adopt Bitcoin as an epayment system

RESEARCH METHOD

Research Design

This research is empirical in nature and uses numerical data gathered directly from a sample in South Africa using a questionnaire to collect numerical primary data that did not previously exist. Empirical research is defined as experimentation based on observed and measured phenomena which derives knowledge from actual experience rather than merely from theory or belief (Cahoy, 2019).

Survey studies are those that are quantitative in nature and that seek to provide a broad overview of a representative sample of a larger population (Babbie, 2001). Given that the main objective of the study was the identification of possible influencing factors that could impact consumer Bitcoin adoption intention as an e-payment system by the development and testing of a conceptual model with the identified factors, the survey strategy was seen as the most appropriate to use.

Instrument Development

In order to develop the survey used to gather data, the first step was to develop a conceptual model showing the identified factors as the most relevant with regards to the intent to adopt Bitcoin as an e-payment system. This was done due to the infancy of the research domain, leaving very little literature to base the survey on, unless the model was developed first. This strategy has previously been employed by many researchers, for example, Al-Somali et al. (2009) in a study done to identify factors encouraging customer adoption of Saudi Arabian online banking; Özkan et al. (2010) to identify factors influencing adoption of an e-payment system; and by Pavlou (2003) to integrate the TAM model with trust and risk, in order to assess the significance of trust and risk in technology adoption. Once the model was developed, key questions identified from literature were developed to probe each factor identified.

Data Sources and Sampling

The study targeted respondents from all walks of life, including those who have purchased online from any e-commerce websites, as well as those who have not but may do so in the future. Respondents targeted also did not need pre-existing knowledge on cryptocurrency or own any specific cryptocurrency such as Bitcoin.

The survey was distributed by a number of channels; firstly, through social media platforms such as LinkedIn and Facebook. Secondly, the survey was distributed to individuals via company-wide e-mails within 4 different organisations based in Cape Town South Africa, namely DataOrbis, Singular Systems, PayFast and Luno. Lastly, the survey was handed to a postgraduate class at a major South

African university for distribution to their professional and social connections. This effort yielded 827 responses. The data was then cleaned by removing those respondents who do not reside in South Africa, as well as those who had declined to answer the question on whether they are residing in South Africa. That reduced the number of usable responses to 814.

Sample size was key for this study in particular, as structural equation modelling was employed. Sample size can impact a number of aspects of the analysis, including model fit, parameter estimates and statistical power (Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014). A commonly used heuristic identifies the minimum sample size as above or equal to 10 per estimated factor (Hair et al., 2014). Given that there were 9 factors identified, the minimum sample size would thus have to be 90.

This study employed a form of probability sampling known as simple random sampling. In random sampling, cases are selected at random until the sample size is reached. In this study, this was not followed stringently. Due to the distribution method of the survey, however, the probability of it being answered was equal amongst all (Saunders, M., Lewis, P., & Thornhill, 2015).

Data Gathering

This study employed an online survey via surveymonkey.com to gather the necessary data. Online surveys allow for the elimination of a number of costly aspects such as paper, postage, manual data entry and reduce the amount of time required to create them, while making it easier to send out reminders to respondents, conduct follow-ups and import data into programmes used for data analysis (Dillman, 2011). The survey was comprised mainly of close ended questions, which are often preferred for survey studies as they tend to garner higher response rates as users do not have to type out responses to questions. Furthermore, answers from close-ended questions can easily be analysed employing both descriptive and inferential statistics, which is usually the goal with survey data (Farrell, 2016).

The first part of the survey was mainly comprised of general demographic descriptive questions, such as age, gender, race, highest educational qualification and ownership of Bitcoin or other cryptocurrencies. Once the descriptive aspect was covered, the survey moved onto key questions regarding Bitcoin and e-payment system adoption. Key questions were presented with a five-point Likert Scale answer rating, with responses that ranged from ‘Strongly Disagree’ to ‘Strongly Agree’. This allows the generation of numerical data to be analysed and used both descriptive and inferential techniques. This particular data gathering method was utilized in similar studies (Dehbini, Birjandi, & Birjandi, 2015; Kim et al., 2010; Özkan et al., 2010; Teoh et al., 2013) which investigated factors affecting the adoption of e-payment systems.

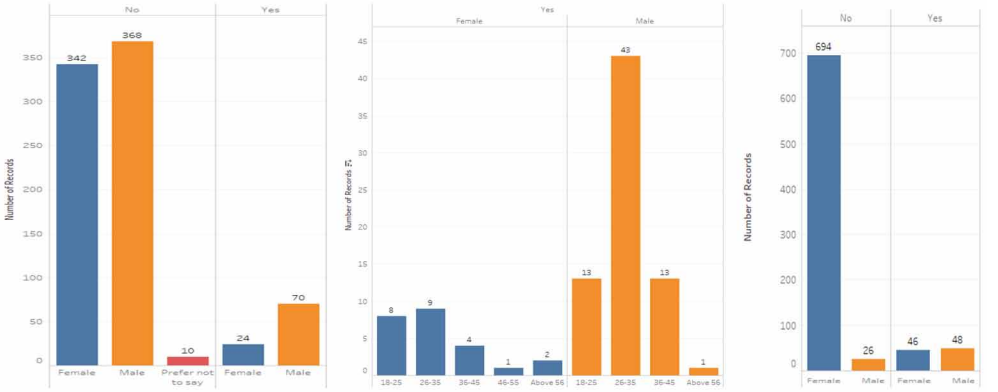
DATA ANALYSIS

Descriptive Statistics

Descriptive statistical and data analytical techniques were used in order to effectively analyse the data received from the online survey. The sample saw a skew towards male respondents who made up 53.81% of the total respondents, while females made up 44.96% of the population, which is in line with population statistics in South Africa, and those who preferred not to state their gender made up the remaining 1.23%. The largest age group that provided the most respondents was that of 26-35; of which males made up 57.74%, while females made up 40.16%, and those who preferred not to state their gender made up the remaining 2.10%. The sample tended to be well educated, with a large number of respondents (35.87%) in possession of a Bachelor’s degree; 20.64% in possession of diplomas; 16.83% in possession of High School completion certification; 4.18% in possession of a Master’s degree; 0.25% in possession of a Doctorate and 2.21% in possession of either an industry or a job specific qualifications

In line with current literature, the prevalence of Bitcoin or other cryptocurrency owners is low in developing countries such as South Africa. Figure 2 shows that 88.45% of respondents do not own

Figure 2.
Bitcoin Ownership



Bitcoin while only 11.55% do. In addition, younger users who have disposable income and are seen to be more tech-savvy, specifically within the age group of 26-35, and had a higher representation (55.31%) of Bitcoin owners than any other age groups. It was also found that a larger number of male respondents owned Bitcoin than female. The study found that a larger number of respondents (51.1%) who are aware of cryptocurrencies and own Bitcoin also tended to own other cryptocurrencies, while 48.9% did not. Of the number of respondents who did not own Bitcoin, only 3.61% owned other cryptocurrencies.

Data Analysis Technique: Factor Analysis & Partial Least Squares Structural Equation Modelling (PLS-SEM)

In order to assess the strength (model fit) of the research model developed and to ultimately answer the main research question of the likelihood of adoption of Bitcoin as an e-payment system, partial least squares (PLS) structural equation modelling (SEM) was used. SEM was chosen as an appropriate method due to its ability to assess the extent of latent variables (unobserved variables), while also assessing relationships between them (Hair et al., 2014). PLS "is a second-generation multivariate technique that helps in construct testing of the psychometric properties of the scales used to estimate the parameters of a structural model, i.e., the strength and direction of the relationships among the model variables" (Al-Somali et al., 2009).

SEM consist of two parts, namely the 'measurement model' and 'structural model'. The measurement model of SEM "depicts the pattern between observed variables and latent variables in the hypothesized model" (Schreiber, Nora, Stage, Barlow, & King, 2006, p.325). The value of the measurement model lies is in its ability to test the reliability and validity of the model to estimate the best indicators of latent variables (Schreiber et al., 2006). This is beneficial to the model development phase as it will indicate which latent variables must either be added or removed prior to testing the structural model.

Measurement Model

According to Fronell (1982), the best way to determine the impact of the latent variables to be used while testing the proposed model is to estimate the internal consistency, together with the convergent and discriminant validity of the instrument.

The reliabilities of latent variables were measured via factor loadings. Factor loadings are recommended to exceed a minimum threshold of 0.70 (Chin, 1998). However, some consider a value above or equal to 0.50 to suffice (Hulland, 1999). Results in Table 2 show that the latent variables Social Influence, Risk and Regulation all had items that loaded to values less than 0.7 and 0.5 respectively; thereby diminishing their overall strength within the model. Composite reliability was also reported

Table 2.
Factor loadings, internal consistency reliability and convergent reliability

Construct	Items	Loading	Composite Reliability	Average Variance Extracted (AVE)
Awareness (AW)	AW1	0,866	0,906	0,763
	AW2	0,904		
	AW3	0,850		
PEOU	PEOU1	0,860	0,906	0,763
	PEOU2	0,889		
	PEOU3	0,871		
PU	PU1	0,886	0,916	0,785
	PU2	0,878		
	PU3	0,894		
Regulation (RG)	RG1	0,825	0,452	0,487
	RG2	0,455		
	RG3	0,757		
Risk (RK)	RK1	0,955	0,110	0,345
	RK2	0,139		
	RK3	-0,324		
Security (S)	S1	0,872	0,894	0,738
	S2	0,800		
	S3	0,902		
Self-Efficacy (SE)	SE1	0,759	0,855	0,664
	SE2	0,877		
	SE3	0,804		
Social Influence (SI)	SI1	0,838	0,691	0,464
	SI2	0,269		
	SI3	0,786		
Trust (T)	T1	0,899	0,926	0,807
	T2	0,930		
	T3	0,865		
Intent to Adopt (I)	I1	0,899	0,938	0,835
	I2	0,931		
	I3	0,863		

to further test reliability. Straub et al. (2004) suggest that the recommended threshold for composite reliability should be 0.70 and above. Results in Table 1 show that the latent variables Social Influence, Risk and Regulation had composite reliabilities less than the recommended threshold.

The Average Variance Extracted (AVE) was also reported in order to assess convergent validity. It is suggested that the recommended threshold for AVE should be 0.50 and above (Fornell & Larcker, 1981). Results in Table 1 show that the latent variables Social Influence, Risk and Regulation had composite reliabilities less than the recommended threshold.

The Standardized Root Mean Square Residual (SRMR) was calculated in order to test the overall goodness of fit of the model, or how well the model fits the set of observations made. SRMR is an absolute measure of fit; therefore, a value of 0 indicates perfect fit. Generally, a value of less than 0.08 indicates a good fit (Hu & Bentler, 1999). The model had a SRMR value of 0.072 which sits below the recommended threshold. To increase the accuracy of the model, however, Social Influence, Risk and Regulation were removed from the proposed model. Table 3 displays the results of removing the mentioned variables and re-running the PLS algorithm again.

As shown in Table 3, once the latent variables Social Influence, Risk and Regulation were removed all reliability measures were comfortably above the recommended threshold of 0.70, an adequate

Table 3.
Revised Factor loadings, internal consistency reliability and convergent reliability

Construct	Items	Loading	Composite Reliability	Average Variance Extracted (AVE)
Awareness (AW)	AW1	0,862	0,905	0,761
	AW2	0,903		
	AW3	0,852		
PEOU	PEOU1	0,858	0,905	0,761
	PEOU2	0,888		
	PEOU3	0,872		
PU	PU1	0,886	0,916	0,784
	PU2	0,877		
	PU3	0,894		
Security (S)	S1	0,872	0,895	0,741
	S2	0,803		
	S3	0,904		
Self-Efficacy (SE)	SE1	0,756	0,854	0.662
	SE2	0,879		
	SE3	0,802		
Trust (T)	T1	0,900	0926	0.806
	T2	0,931		
	T3	0,862		
Intent to Adopt (I)	I1	0,888	0,939	0,836
	I2	0,910		
	I3	0,945		

indication of internal consistency of the model. The SRMR goodness of model fit indicator, after the latent variables Social Influence, Risk and Regulation had been removed, improved to a value of 0.056.

The Fornell-Lacker criterion approach was used to assess discriminant validity. The Fornell-Lacker criterion approach postulates that in order to assess discriminant validity, the square roots of the Average Variance Extended for two latent variables must exceed the correlations between the two variables (Fornell & Larcker, 1981). It can be seen from Table 4 that the Fornell-Lacker criterion was met as all diagonal values (square root AVEs in bold) are larger than the off-diagonal values in the corresponding rows and columns; this indicates adequate discriminant validity.

Structural Model

After ensuring that the measurement model had satisfactory convergent and discriminant validity for the constructs, the structural model was tested to assess whether each research proposition stated was either supported or rejected. Values used in this examination, namely path coefficients (β), path significance (t-statistic) and the coefficient of determination (R-squared) were obtained by running both the PLS calculation as well as the bootstrapping technique using SMART PLS 3. Results of the PLS algorithm are illustrated in Figure 3 and the bootstrapping results are illustrated in Figure 4.

The coefficient of determination (R-squared) is a calculation that is used to determine a model's predictive accuracy/power (Hair et al., 2014). This value ranges from 0 to 1, with 1 representing complete predictive accuracy. Due to the fact that the R-squared value is used in a number of disciplines, scholars have developed a 'rule of thumb' regarding what is an acceptable R-squared value, with 0.75, 0.50 and 0.25 representing substantial, moderate and weak respectively (Hair et al., 2014). Path coefficients (β) are estimates produced after running the PLS algorithm that determine the strength of construct relationships (Schreiber et al., 2006). Path coefficient values range from -1 to +1, with coefficients tending towards +1 representing a strong positive relationship and coefficients closer to -1 representing a strong negative relationship (Hair et al., 2014).

The bootstrapping technique was used to assess the significance of path coefficients between constructs. Using a two-tailed t-test with a significance level of 0.05, the path coefficient is considered significant if the t-value is greater than 1.96 (Davis, 1989)(table 5).

DISCUSSION OF FINDINGS

The continuous evolution of e-commerce business models and transactional relationships has facilitated a need for newer, more effective methods of exchanging money electronically. As more e-payment systems are created and offered as an alternative means of payment by merchants to customers, it is essential to identify those factors that may influence user intention to adopt and system usage.

Table 4.
Discriminant Validity

	Awareness	Intent to Adopt	Perceived Ease of Use	Perceived Usefulness	Security	Self-Efficacy	Trust
Awareness	**0.873**						
Intent to Adopt	0.412	**0.915**					
PEOU	0.438	0.621	**0.873**				
PU	0.313	0.552	0.545	**0.886**			
Security	0.452	0.608	0.672	0.501	**0.861**		
Self-Efficacy	0.384	0.559	0.631	0.589	0.583	**0.814**	
Trust	0.506	0.578	0.616	0.486	0.777	0.562	**0.898**

Table 5.
Summary of values used to assess the structural model

No	Path Analysis	Path Coefficient	t-Value	p-Value	Supported?
P1	**PU→I**	0.203	4.686	0.000	Yes
P2	**SE→I**	0.103	2.267	0.024	Yes
P3	**AW→I**	0.076	2.158	0.031	Yes
P4	**T→I**	0.103	2.202	0.028	Yes
P5	**S→I**	0.177	3.363	0.001	Yes
P6	**PEOU→I**	0.230	4.903	0.000	Yes
P7	**RG→I**	*Removed due to reliability constraints*			
P8	**SI→I**	*Removed due to reliability constraints*			
P9	**R→I**	*Removed due to reliability constraints*			

Figure 3.
PLS-SEM Results

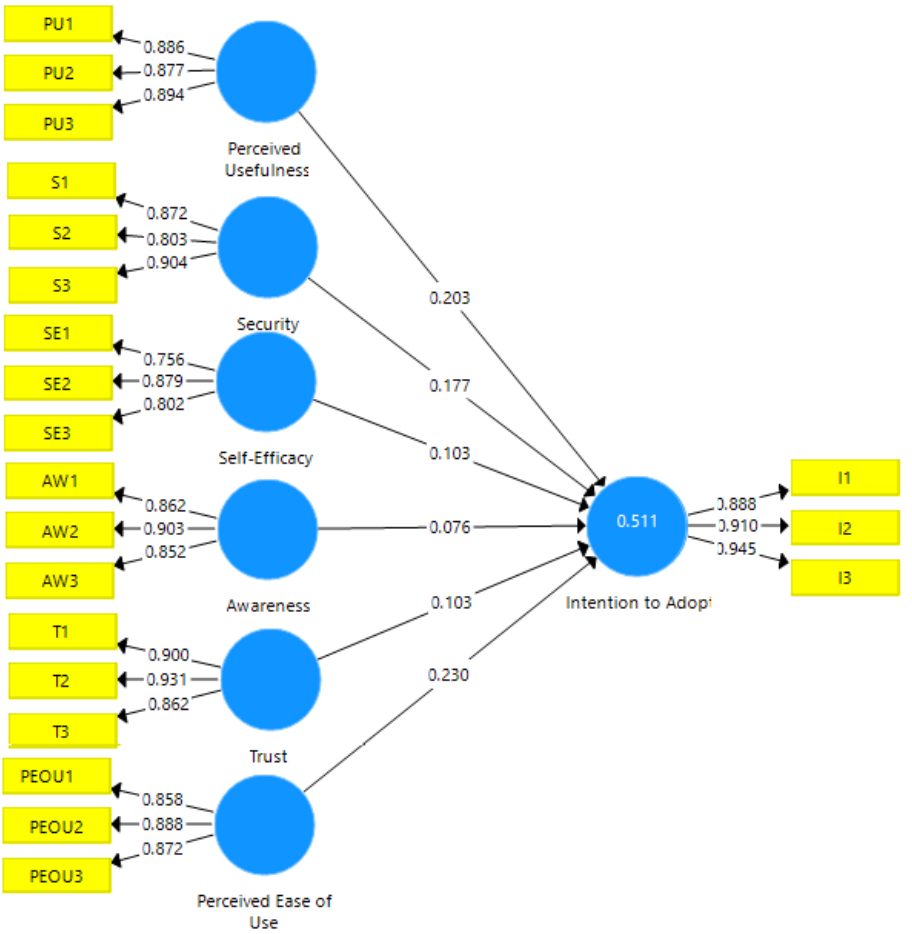
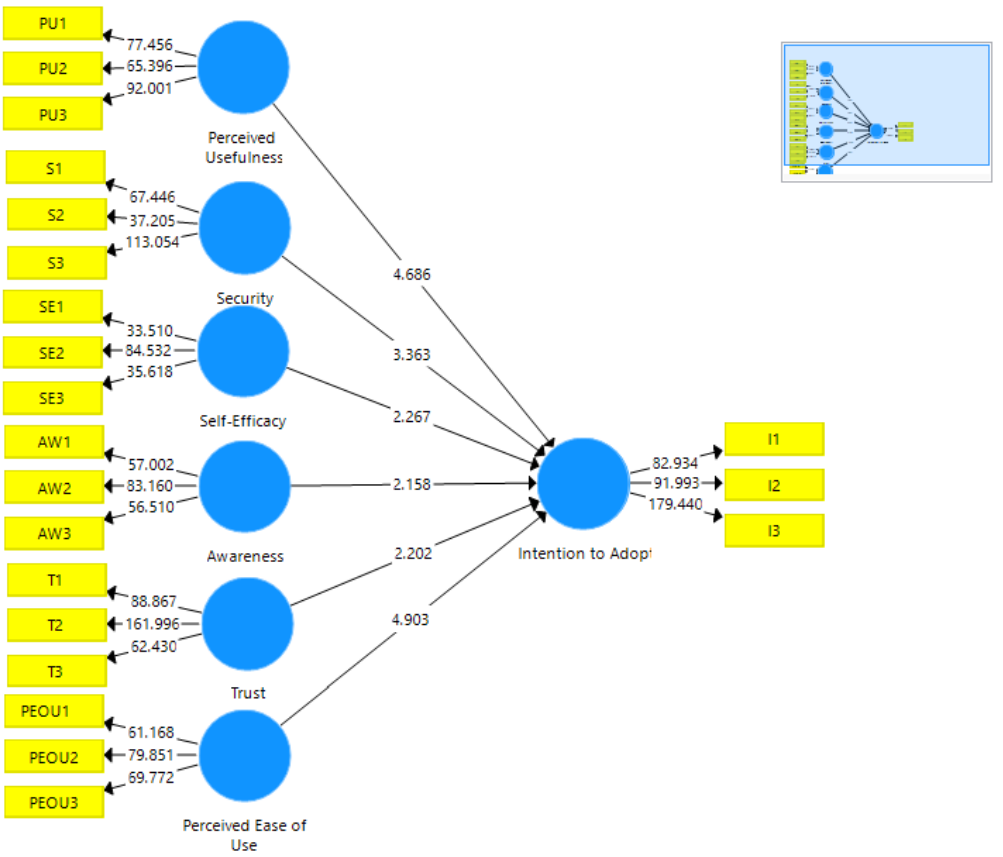


Figure 4.
Bootstrapping Results



This study identifies several significant factors that could influence user adoption intention of cryptocurrency such as Bitcoin as an alternative e-payment system. These factors include Perceived Usefulness (PU), Perceived Ease of Use (PEOU), security, self-efficacy, awareness, trust, social influence, risk and regulation.

According to the two-tailed t-test that was conducted at a significance level of 0.05, both constructs from the original TAM model, .i.e. PU and PEOU, scored t-values of 4.686 and 4.903 respectively therefore supporting propositions 1 and 6. These findings are aligned with a number of studies that have been done in different technology adoption studies that highlight the significance of PU and PEOU with regards to intention to adopt technology (Al-Somali et al., 2009; Chin, 1998; Davis, 1989b; Dehbini et al., 2015; Park, 2009). The results from the current study also showed that according to the two-tailed t-test conducted at a significance level of 0.05, self-efficacy, awareness, trust and security, scored 2.267, 2.158, 2.202 and 2.267 respectively, therefore supporting propositions 2,3,4 and 5.

From the initial analysis of the measurement model, proposition 7, i.e. Regulation has an influence on the user' intention to adopt Bitcoin as an e-payment system, was removed due to reliability constraints. In 2014, the South African Reserve Bank (SARB) released a position paper on virtual currencies/cryptocurrencies. In this paper, SARB clearly stated that it does not view Bitcoin as legal tender therefore it is not a currency and shall be treated as an asset (South African Reserve Bank, 2014). That said, the South African Revenue Service (SARS) has specified that transactions or

speculation in Bitcoin are subject to South African tax law and are to be taxed respectively (Hulland, 1999). Depending on how an individual uses Bitcoin, different tax laws will apply. If Bitcoin is held as an investment, capital gains tax (CGT) may be applicable at the time of disposal of the Bitcoin. If Bitcoin is used as a trading instrument, i.e. an individual actively buys and sells Bitcoin in order to make a profit, they may be liable to pay income tax. Those who earn Bitcoin for goods and services rendered are also liable for income tax. With regards to using Bitcoin as a payment method, there is no current regulation that either incentivizes or disincentives an individual for paying using Bitcoin, since the SARB does not view it as legal tender.

From the initial analysis of the measurement, proposition 8, i.e. Social Influence has an influence on the adoption intention of Bitcoin as an e-payment system, was removed due to reliability constraints. Given the rising interest in cryptocurrency and Bitcoin specifically, Luno, one of South Africa's most established cryptocurrency exchanges, conducted research in order to determine how South Africans view Bitcoin and what they would do with it. When questioned about the practical reasons for buying Bitcoin, the results worth mentioning are, 39.6% stated that they bought Bitcoin as an investment vehicle, 14.3% stated that they bought Bitcoin for trading activities and 12.9% stated that they bought Bitcoin as a means to make payments (Edmunds, 2017). Cumulatively, 53.9% (39.6% + 14.3%) of the respondent population were using Bitcoin as a potential income generating tool. This statistic leads one to the conclusion that amongst social groups, individuals are discussing, propagating and influencing each other to use Bitcoin to earn income, through investment or trading activities rather than using it as a means of payment.

From the initial analysis of the measurement model, proposition 9, i.e. Risk has an influence on the adoption intention of Bitcoin as an e-payment system, was removed due to reliability constraints. The results of the study demonstrated no tangible relationship between risk and the intention to adopt Bitcoin as an e-payment system. Literature currently available posits risk as one of the most significant factors regarding the adoption of e-payment systems and will need to be tested further in future studies.

In a study done by Lu, Hsu, & Hsu (2005), perceived risk was found to be an important element in the adoption intention of e-payment systems, but no direct link was found to the intention to adopt within a Bitcoin context. According to Nakhumwa, (2013), perceived risk associated with e-payment systems stems from a heavy financial services reliance on IT infrastructure, which has led to attacks by hackers using packet and address spoofing, sweepers, stealth diagnosis and backdoors. These attacks, if successfully implemented could lead to catastrophic fraud incidents for customers, of which mitigation is often costly and time consuming. However, with Bitcoin, such attacks are mitigated. Firstly, no personal information is transmitted when transactions are being made as only Bitcoin addresses are used to identify the parties transacting. Secondly, the use of cryptography provides unrivalled transaction security (McDougall, 2014). Therefore, from an e-payment perspective, it is understandable why users are not concerned about risk when using the Bitcoin system to transact.

CONCLUSION AND RECOMMENDED FUTURE STUDIES

The emergence of financial technology within developing markets is associated with developmental benefits (Marszk et al., 2019). In light of this, this study is key in that it allows for a better understanding of factors influencing the adoption of a cryptocurrency for trading purposes within a developing economy. This understanding can lead to better industry and public sector interventions in line with the main factors identified. The study is also instrumental in the field of developmental and behavioural economics by adding to the body of knowledge around the determinants of the adoption of cryptocurrency for trading in a developing economy, which in turn informs policymakers and electronic commerce practitioners (Mazambani & Mutambara, 2019).

The hypothesized model, using the factors identified from literature and assessing their impact on the intention to adopt, explained about 51.1% of the variance of whether or not a user intended to adopt Bitcoin as an example of a cryptocurrency e-payment system. Of the nine factors identified,

perceived usefulness (PU), perceived ease of use (PEOU), security, trust, awareness and self-efficacy were proven to significantly influence a users' intention to adopt Bitcoin as an e-payment system.

Consumers in developing economies are idiosyncratically different to those of more developed economies, and do not always behave in line with mainstream anticipated financial innovations. The key to incorporating the factors identified above is to inculcate a culture of allowing financial technology interventions such as a cryptocurrency like Bitcoin as an e-payment system to be nuanced to the market in which it is being rolled out and communicated accordingly (Mazambani & Mutambara, 2019).

This study was however limited by the lack of previous research studies specific to cryptocurrency usage in an African context, as well as time constraints during the data analysis phase. The study was also restricted geographically to South Africa and focused on South African citizens.

The academic implications of this study address a gap in current literature around the use of a cryptocurrency, in this case specifically Bitcoin, as an e-payment method within a South African context. This also assists business decision-makers within the country to make decisions around the roll-out of crypto-currency payment methods in the country.

Future studies can build on findings by expanding the sample to other developing economies. In addition, studies could focus on extending the model using the factors identified in this research and including other factors regarding e-payment system adoption. Demographic variables in literature have also been found to influence user adoption of e-payment systems, therefore future work would be prudent to incorporate these for analysis. Additionally, the study was carried out in a modern setting, what would be of interest is to carry out a comparative study using data gathered from a rural community to investigate if a cryptocurrency such as Bitcoin would be of value in that context.

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