Bitcoin Adpotion in South Africa, an End User Perspective.

Dissertation presented to Department of Information Systems

In partial fulfilment of the degree:

Masters in Information Systems

Njinu Kimani

Internal Supervisor: Prof. Michael Kyobe

Declaration

1. I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.
2. I have used the APA convention for citation and referencing. Each contribution to, and quotation in, this literature review/report/project … from the work(s) of other people has been attributed and has been cited and referenced.
3. This literature review/report/project … is my own work.
4. I have not allowed, and I will not allow, anyone to copy my work with the intention of passing it off as his or her own work."
5 I acknowledge that copying someone else's assignment or literature review, or part of it, is wrong, and declare that this is my own work.

Signature: Signed by candidate

Njinu Kimani

Date: 14/10/2020

Abstract

The development of electronic money and virtual currencies has led to the growing presence of bitcoin and other blockchain based, decentralized cryptocurrencies). The most popular of these cryptocurrencies being Bitcoin, a globally traded cryptocurrency, evidence of which is prevalent in South Africa with the formation of Bitcoin exchanges such as Luno in 2012. The advancement of Bitcoin in South Africa presents a number of opportunities for a number of role players in the financial, technology, retail and service sectors. However successful, wide spread adoption may also be hampered by various actors such as governments, financial institutions, merchants and the behaviour of end users.

The usage of Bitcoin in developing countries for especially for international remittances and transfers has shown significant benefits such as lower transaction fees. The already prevalent use of mobile money in developing countries may aid Bitcoin's adoption. Mobile banking functions such as sending international remittances could easily be replaced by using a Bitcoin wallet, which offers much lower transaction costs than traditional banking services, especially when doing low value. It is believed that Bitcoin adoption and internet banking share parallels in that both involve the adoption of an innovating technology and both are susceptible to the effects of social phenomena and personal bias.

This study investigates the adoption of Bitcoin in South Africa, a developing African country, from an end user's perspective. Importance will be placed on identifying and assessing challenges that may inhibit the widespread adoption of Bitcoin amongst end users, as well as drivers that may promote Bitcoin's adoption in South Africa. A significant finding is that end users' adoption decisions towards Bitcoin were mainly driven by the users propensity to hoard bitcoin in order to make financial gains. In addition, result demonstrability was also shown to be a key driver influencing the end users adoption decision. A modified version of the innovation diffusion theory is suggested in the discussion based on the findings of this study.

Table of Contents

List of figures

List of tables

1. Introduction

This study investigates the adoption of Bitcoin in South Africa, a developing African nation, from an end user's perspective. Importance will be placed on identifying and assessing challenges that may inhibit the widespread adoption of Bitcoin amongst end users, as well as drivers that may promote Bitcoin's adoption in South Africa. In this section a brief background of the current situation is provided, research objectives listed and the problem statement being addressed by this research is also identified. Next definitions of important terms used in this research paper are provided followed by the problem statement being addressed in this study. Lastly the research objectives based on the problem statement is provided followed by a brief discussion about the importance of the research.

1.2. Background & Problem statement

The development of electronic money and virtual currencies has led to the growing presence of bitcoin and other blockchain based, decentralized cryptocurrencies (Chapelle, Panayi & Peters, 2015). The most popular of which being Bitcoin, a globally traded cryptocurrency, evidence of which is prevalent in South Africa with the formation of Bitcoin exchanges such as Luno in 2012. The advancement of Bitcoin in South Africa presents a number of opportunities for a number of role players in the financial, technology, retail and service sectors (Jonker, 2018). However successful, wide spread adoption may also be hampered by various actors such as governments, financial institutions, merchants and the behaviour of end users (Douget, 2014; Ammous, 2015). The adoption behaviour of a user to a new technology has been studied by various researchers and various theories have been developed attempting to model how a user approaches a novel technology and what drivers affect whether the user decides to adopt this technology. Bitcoin however cannot be viewed just as a technology but also a currency, thus the user's adoption behaviour regarding Bitcoin may differ from their adoption behaviour towards a more conventional technology (Jonker, 2018).

South Africa is classified as a developing country; however, the country has a very high mobile penetration rate and relatively high access to internet, both these factors suggest

that end users have access to basic Bitcoin services such as a bitcoin wallet. However research on Bitcoin adoption in South Africa specifically is still relatively scarce (Jonker, 2018; Mukoyama, 2003; Walton & Johnston, 2018).

The problem that this study seeks to uncover relates to the adoption behaviour of the end user when looking whether to adopt Bitcoin. Research by both Walton & Johnston (2018) and Spenkelink (2014) both explored Bitcoin perceptions of individuals in South Africa and Mwangi (2012) conducted similar research in Kenya. These papers are the most similar in scope and subject matter, seeking to understand how potential users view Bitcoin and what drives their adoption and continued use. This study will differ from current literature in the field in its approach and focus in that it will place importance on the direct financial incentive that Bitcoin offers and how this may affect the end user's adoption behaviour.

1.4. Definition of terms

Decentralized: A decentralized system is one where the key functionality is delegated away from a central authority in favor of a distributed approach and architecture, managed amongst many parties.

Distributed ledger technology: Distributed ledger technology is a decentralized database of assets that is managed by multiple parties in a network at the same time. A key differentiator when comparing digital ledger technology with traditional databases is that there is no central administration or data store as this functionality is delegated to the various parties in the network.

Blockchain: Blockchain is a system of recording transactions in an immutable way, achieved by duplicating a digital ledger of transactions across distributed network of computer systems. Each transaction is grouped with other transactions to form a block, and blocks are linked chronologically to form a chain. Blockchain differs from other digital ledger technologies as they use cryptographic functions to sign each transaction, making the whole database tamper proof and immutable.

Digital currency: A digital currency is a type of currency that are accessible only through digital or electronic form and not physical form. Digital currencies are intangible and can only be purchased and transacted with using digital wallets or computers to connect to the internet or other designated networks.

Cryptocurrency: A cryptocurrency is a digital currency that utilizes cryptography to securely store transaction data, making it nearly impossible to counterfeit or tamper. Many cryptocurrencies utilize a distributed ledger based on a blockchain technology allowing for a decentralized infrastructure and architecture.

Bitcoin: Bitcoin is a cryptocurrency created in January 2009, Bitcoin is not backed by any banks or governments nor is it traded as a commodity. No physical Bitcoins exist, but rather are created, distributed, traded, and stored by using a blockchain based distributed ledger. All transactions and balances are kept on a public, transparent ledger that is accessible by everyone on the Bitcoin network. As one of the first cryptocurrencies to be developed, Bitcoin is the most popular cryptocurrency however it has inspired numerous other alternative coins entering the cryptocurrency space.

Bitcoin services: Bitcoins services refer to value added services that allow users to purchase, transfer and spend their Bitcoin in the real world. Businesses such as bitcoin exchanges, Bitcoins ATM, and Bitcoin point of sale services and payment gateways.

Technology adoption: Technology adoption refers to the process of acceptance, integration and actual use of a novel technology in a society.

Diffusion: Diffusion is defined as the process whereby an innovation is communicated, through certain channels over time, among the members of a social system.

1.5. Research problem and objectives

In order to develop a model that accurately describes the end user's adoption decision, this study will attempt to complete the following research objectives:

1. To explore the current literature on end user Bitcoin adoption in South Africa.
2. To identify different theories, approaches and methodologies that are used to research Bitcoin adoption from an end user perspective.
3. To develop a robust theoretical framework based on current literature on the subject.
4. To develop an accurate conceptual model that evaluates Bitcoin end user adoption.

A research problem is a statement about a particular area of concern, a condition to be improved upon, a difficulty to be eliminated, or a troubling question that exists in scholarly literature; in theory, or in practice, this points to the need for meaningful understanding and deliberate investigation (Bryman, 2007). Research questions are defined as an answerable inquiry into a specific concern or issue and are often the initial steps in a research project.

The advantages of Bitcoin usage in developing countries has shown significant benefits such as lower transaction fees, as mentioned by Walton & Johnston (2018), Spenkelink (2014) and Mwangi (2012). Research conducted by Individuals in South Africa and in Kenya by Aker and Mbiti (2010) and a survey conducted by the GSM Association (2015) suggested that individuals in developing nations have access to the internet, mainly through their mobile phones. The adoption of mobile money services such as the case of Mpesa in Kenya, suggests that users in developing countries in Africa have access to information and are familiar with the concept of cellular banking.

Moreover Walton & Johnston (2018) suggest that parallels exist between the adoption process of internet and Bitcoin, both innovative technologies. This posits that Bitcoin may experience the same level of widespread growth and adoption in Africa as the internet, however in reality this is not currently the case (Walton & Johnston 2018; Jonker 2018).

The creation of a Bitcoin based currency BitPesa, mentioned by Mwangi (2012) further suggests that Bitcoin use is in fact emerging in Kenya, which may be the case in South Africa as well. Bitcoin has clear economic advantages and low technological barriers to gain entry, for the end user. Based on this a research problem identified is what other factors apart from access to the internet affect an end user's adoption decision regarding Bitcoin.

Based on the research problem, the following research questions were asked:

1. What are the drivers of Bitcoin adoption in South Africa, from an end user's perspective?
2. What are the inhibitors of Bitcoin adoption in South Africa, from an end user's perspective?

1.6. Importance of research

The purpose of this study is to expand on the existing research in the field of technology diffusion in developing nations. This research paper is to be completed as part of a master's dissertation which commenced in 2016. It is hoped that the findings from this investigation can be used to assess the readiness of end users regarding Bitcoin, and to identify the major factors affecting Bitcoin adoption, which may be relevant to policy makers and businesses in developing countries.

1.7. Dissertation Overview

This study will describe the methodology employed when researching the adoption of the most popular cryptocurrency, Bitcoin in South Africa, from an end user's perspective as well as highlighting the advantages and the challenges facing the use of the bitcoin cryptocurrency as an alternative transaction medium in South Africa and other developing nations. The rest of this study will be grouped in the following sections:

Chapter 2: The literature review section, this chapter goes in depth into cryptocurrencies and more specifically Bitcoin, how it works, how it integrates into society all the parties

involved in making this process possible. Similar South African research are reviewed in order to highlight important nuances and expose gaps in literature that are not discussed. Next, literature on technology adoption is explored in order to understand the underlying factors that influence end users to adopt Bitcoin. Theories on adoption are provided and broken down in order to find a good model to use in the research design section when investigating factors affecting an end user's adoption decision regarding Bitcoin.

Chapter 3: The research design section will explore the methodology that research will be conducted and the various philosophical approaches and considerations that were investigated. Important questions pertaining to why the research is being conducted are discussed before going into detail about the conceptual model. Research questions are listed and propositions related to these questions are provided and further mapped to the conceptual model, which is later translated into the research instrument employed in the later sections of the paper.

Chapter 4: The data analysis section provides background on the statistical methods that are applied to the data collected. Detailed results on the tests performed from the data collected is summarized and provided. The various propositions presented in the previous chapter are either rejected and accepted based on the results of the study.

Chapter 5: The findings sections highlight the key information from the data analysis section, then compares the information from the literature reviewed and the data analysed in this study in order evaluate whether they key findings from this study support prior research. Any discrepancies in research as well as any findings that do not support the conceptual model are discussed.

Chapter 6: The conclusion section summarizes all the key findings and ties them back to the conceptual model in order to evaluate its efficacy. Key discrepancies are explained and research limitations are highlighted in order to assist further research in this field.

2. Literature Review

The following literature review will first introduce cryptocurrencies and Bitcoin and second, it will look at technology adoption and the growth of similar mobile money services in South Africa and other developing nations in Africa. Lastly, conceptual models that may be used to explain an end users' adoption of decisions taken against disruptive innovations such as Bitcoin will be explored.

2.1. Cryptocurrencies

Cryptocurrencies started entering the market in the early 2000's and are best described as decentralized virtual currencies (Chapelle, Panayi & Peters, 2015). Simply put, cryptocurrencies are just computer protocols (Lim, 2015), that enable the internet to function and includes Transmission Control Protocol/Internet Protocol (TCP/IP) and Hyper Text Markup Language (HTML). What makes cryptocurrencies unique is that it makes use of cryptographic functions and a distributed database, to store value securely. This gives cryptocurrencies the potential to have a similar impact by revolutionizing the current electronic payments sector, across the globe, through a process called disruptive innovation (Lim, 2015).

Athey et.al (2017) introduces the theory of "money is memory" from macro-economics literature, which, if viewing Bitcoin as a purely digital recordkeeping device, posits that as technology lowers the costs of public record keeping devices, a digital ledger such as Bitcoin may emerge as an alternative to physical money. Most cash-based currencies in today's global economy are fiat currencies. Clegg (2014) claims that the only way for a fiat type currency to operate is if governments monopolize and centralize the issuance of the currency to an intermediary or to a central bank. Consequently, when the central bank increases the supply of the fiat currency, it causes inflation, thus central banks and governments are the only parties who control the value of the currency (Clegg, 2014).

Ally et.al (2015) defines a convertible digital currency as currencies that have an equivalent value in a fiat currency and thus, can be exchanged back-and-forth for real currency. Alternatively, a non-convertible currency are virtual currencies which often do

not have a link to the real-world economy Ally et.al (2015). Non-convertible digital currencies cannot be exchanged for a fiat currency, intended only to be used in its particular virtual domain, such as to buy virtual products in online role-playing games like World of Warcraft Gold Ally et.al (2015). Some non-convertible digital currencies can be purchased using a fiat currency at a specific exchange rate, but cannot be converted back into a fiat currency, for example Facebook credits Ally et.al (2015).

The centralization of power allows governments to make strategic economic decisions, which affect the whole nation. Fergusson (2010) criticized this approach and argued that, “Whatever the reason for a country’s deficit, it is alarming that some respected bankers and economists today … are still able to commend the printing press as a fail-safe, a last resort. A country’s budget can indeed be balanced in this way, but at the cost … of its citizens’ savings and pensions, their confidence, their trust, their morals and their morale” (Fergusson, 2010, pg. 8). In addition, Fergusson (2010) explains that the Austrian business cycle stated that the decision of expanding credit during an economic boom causes malinvestment, which involves the misallocation of resources within the capital structure. The supply of inexpensive credit by central banks causes distortions in market price signals, which lead to the propagation of a market correction or a “bust”. Clegg (2014) further states that distorted market prices show the historical weakness of centralized fiat currencies.

2.2. Blockchain Technology and Decentralization

The main drivers of cryptocurrency adoption include the independence of the currency from third party intrusion, which is a common trait of fiat currencies (Fergusson, 2010; Lim, 2015). Cryptocurrencies are not issued by a governing authority but are generated in the process of verifying transactions (Lim, 2015). Unlike centralized virtual currencies and electronic money systems, which are controlled by game developers or platform operators, cryptocurrencies do not typically operate in a centralized manner (Chapelle et. al., 2015; Stevens, 2017).

The lack of regulatory authorities governing cryptocurrencies is largely due to the decentralized nature of cryptocurrencies (Stevens, 2017). The most popular cryptocurrency Bitcoin was introduced in 2008 and is not geographically restricted to a region or to a country, nor is it backed by a particular government authority or by a public or private organization.

An important feature of cryptocurrencies is the flow of the currency directly between users of the platform, without going through a central authority (Chapelle et al., 2015; Stevens, 2017). This is mainly achieved through an electronic consensus mechanism, based on cryptographic algorithms, which allow transactions to be stored on a tamper proof distributed ledger of accounts, which is distributed to multiple parties on the network (Chapelle et. al., 2015). The verification of transactions without using traditional trusted third parties is achieved by utilizing blockchain technology. All users connected to the network spend computing power to effectively validate and timestamp payments in a process called mining (Ammous, 2013). Transactions are bundled into a block. All miners connected to the network then expend computing power attempting to solve a complex mathematical function, or proof of work, which is used to integrate the block into the blockchain (Chapelle et. al., 2015; Stevens, 2017).

Swan (2015) states that the blockchain has the capacity to drastically change various aspects of society and business operations. Swan (2015) explains that there have been four major paradigms in the IT field. First, the mainframe, the personal computer that made computing possible and accessible to the masses led to the ready uptake of the internet paradigm, which was followed by the mobile and the social networking paradigms, which is the most recent paradigm. Swan (2015) states that the current emerging paradigm is the increasing trend on interconnectedness, characterized by the seamless integration of different devices and platforms also referred to as the internet of things, which includes multidevice computing, sensors, smartphones and wearable technology.

Such a paradigm would require a middleware platform for handling transactions, which is where the blockchain comes in, by providing an economic layer that the web never had (Swan, 2015). The blockchain has the revolutionary potential equal to that of the internet

and has the ability to be deployed and adapted faster than the internet, given the current interconnectivity of the internet and cellular devices. The blockchain paradigm would offer a continuously connected, multidevice computing layer that allows for efficient, decentralized payments, micropayments, digital asset creation and transfers and smart contracts (Swan, 2015; Stevens, 2017).

The financial sector is setup to experience the largest disruptions, brought on by a rapid uptake of blockchain technology. Traditional banking practices can be made more robust, with the use of the blockchain, due to its tamper-proof cryptography-based architecture (Stevens, 2017) The introduction of blockchain based innovations such as micropayments allows for more efficient resource allocation and distribution, which cannot be realized with current transactional technologies (Swan, 2015).

2.3. Bitcoin

The most popular application that uses blockchain technology is the Bitcoin cryptocurrency (Hanley, 2014). Bitcoin is a crypto currency that was created in 2009 to facilitate electronic commerce (Douget, 2014). Ammous (2015) describes Bitcoin as a decentralized digital fiat currency that utilizes cryptography and a peer-to-peer network.

Ammous (2015) added that bitcoin is the first technology that facilitates instant payments across the globe, without the need for third parties or for intermediaries, making it an innovation with significant transformative potential for economies around the world. By utilizing the blockchain, Bitcoin provides several advantages over other electronic payment systems. Bitcoin allows transactions to occur without interference from governments and third parties, such as central banks, electronic payment processors and credit card companies (Douget, 2014; Stevens, 2017).

Ammous (2013) offers a different perspective on Bitcoin by describing it as the novel instance of electronic cash, he explains that like cash, Bitcoin payments are irreversible and do not require intermediation, which is a property of cash payments. However, unlike cash payments, bitcoin payments are not restricted by time and geographic location, as bitcoin payments can be conducted instantaneously across the world, through the internet (Ammous, 2013).

The handling of payments by trusted third parties generates fees which are borne by the consumer. These fees are typically one to three percent of the purchase price when purchasing domestic products (Douget, 2014). Foreign purchases often require one currency to be converted into another currency, which generates additional fees. By bypassing the third parties, bitcoin eliminates these transaction costs and allows for smaller value payments which would be impractical in a typical payment gateway (Douget, 2014). Stevens (2017) and Athey, et. al., (2017) opposed Douget's (2014) view and cited that digital currencies such as Bitcoin are inherently exposed to exchange rate risks and their wide adoption may impair financial stability and monetary policy transmission. He added that this is because digital currencies are not governed by any sovereign currency but are rather denominated in their own units of value.

2.4. Bitcoin Stakeholder Landscape

Ally et.al (2015) describe the cryptocurrency stakeholder landscape as a supportive network of interconnected activities, institutions and technologies built around the global cryptocurrency market.

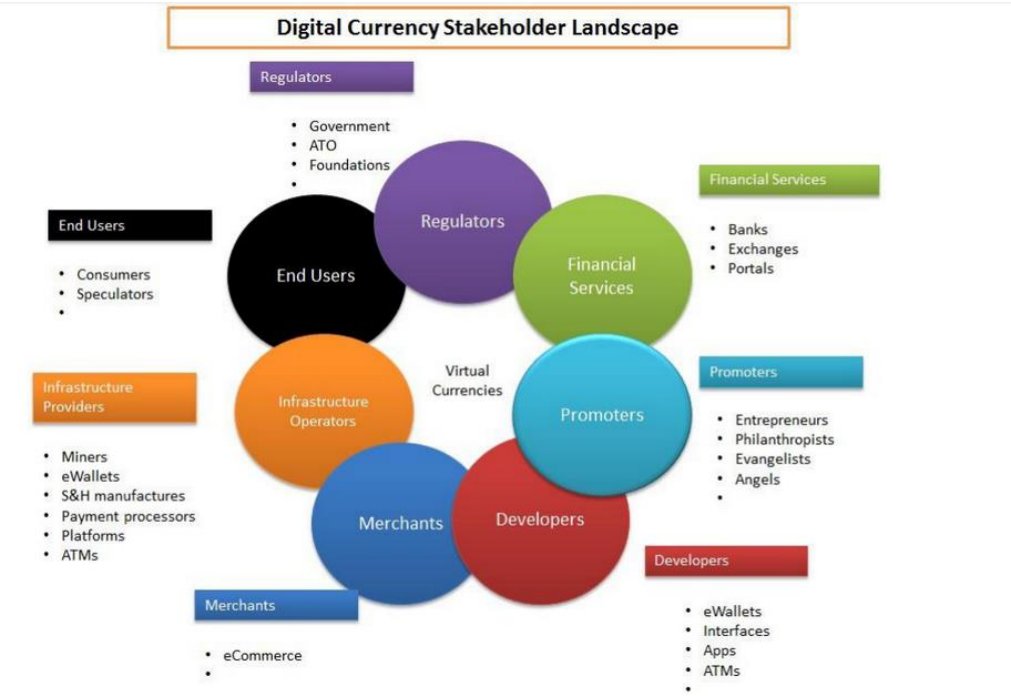

Figure 1: The bitcoin stake holder landscape Jonker (2018)

The Bitcoin stakeholder landscape consist of various parties who play different roles in the market (Figure 1). Firstly, regulators create and enforce laws which govern how Bitcoin is purchased, how it is taxed and how it can be exchanged. Regulators play an important role in promoting the use of Bitcoin by promoting market trust through the creation and enforcement of effective laws which protect the interest of all stakeholders involved (Ally et.al, 2015).

Financial services such as banks and cryptocurrency exchanges allow users to buy and exchange Bitcoin for other currencies, promoters such as investors and entrepreneurs create, market and promote new Bitcoin product offerings and services.

Jonker (2018) notes that the intermediaries that operate between retailers, their customers, and the providers of payment instruments play an important role, acting as facilitators of innovation and competition in the online retail payments market by lowering barriers to entry.

Developers are responsible for developing and extending various Bitcoin platforms such as apps, e-wallets, bitcoin atm's and cross platform interfaces. Merchants such as e-commerce stores, and brick and mortar businesses who provide goods and services to end customers in exchange for Bitcoin (Jonker, 2018). Infrastructure includes miners who secure transactions, payment processors, payment gateways and other platforms that interface with the Bitcoin chain in order to provide added functionality. Lastly the end user who either make purchases of goods and services with Bitcoin or speculators, who trade Bitcoin for profit on the open market (Jonker 2018). All these parties all benefit by the widespread adoption of Bitcoin and each party plays an important role in aiding this outcome(Jonker ,2018; Ally et.al, 2015).

2.5 Bitcoin merchants

Jonker (2018) researched the adoption of Bitcoin using a large sample of merchants who sell their products online and found that Bitcoin acceptance is currently very low with merchant adoption models showing adoption rates at two percent, however there is substantial interest amongst retailers to adopt cryptocurrencies in the near future. Further, Jonker (2018) found that the main factors affecting merchants to adopt Bitcoin are

consumer demand, net transactional benefits the merchants perceived adoption effort, and adoption intention.

Jonker (2018) compared cryptocurrency payment markets with 'traditional' two sided markets that currently exist in the retail payment system in order to provide insight into which factors drive merchant acceptance of cryptocurrency payments. Jonker (2018) explains that, generally, a two-sided market is characterized by having two demand sides, instead of one which means that the retail payment platform has to cater for. Only when both sides decide to adopt the platform, can it be sold, Jonker (2018) also notes that the platform governs the price of use that is paid by the two types of users.

2.5.1 Market externalities

Bitcoin may be viewed as a two-sided market, similar to current retail payments market as we discussed earlier, Bitcoin consists of a number of nodes offering users the ability to transfer funds between accounts Joker (2018). The transaction can only take happen if both the payer and recipient of funds have adopted Bitcoin (i.e. have a Bitcoin wallet) and have agreed to the particular transaction. If one party prefers a different cryptocurrency, then the transaction cannot take place, which is the same as a traditional two-sided market Joker (2018).

Net private transactional benefits refer to the difference between the benefits of Bitcoin in this case, less the transactional costs associated with the Bitcoin payment Jonker (2018). The decision of the merchant not choosing to adopt the platform may be due to the influence of net private transactional benefits or because of network externalities on either the merchant or Bitcoin end user (Stevens, 2017; Jonker, 2018).

Another important aspect of traditional two-sided markets is that network externalities acting on one side of the market, cause an increase in demand on the other side of the market Joker (2018). In our case, Bitcoin will seem more attractive to end users, as the number of retailers who accept Bitcoin increases, and vice versa, Bitcoin as a payment option will look more appealing to merchants as more end users chose adopt it (Ally et.al, 2015; Jonker 2018).

In general, payment providers attempt to offer platforms which waiver the transaction fees to the customer, offering retailers a zero-transaction fee or in some cases a negative fee encouraging end user uptake Jonker (2018). This is because retailer demand is assumed to be less price elastic than consumer demand meaning that a small change in the price of transaction fees causes a small change in demand from retailers when compared to customers. Jonker (2018) explains the rationale for payment platforms to price their payment platforms in this manner is to increase customer adoption levels in order to increase retailer adoption rate due to network externalities.

Another interesting point that Jonker (2018) highlights is that intermediaries such as non-bank payment service providers who offer payment platforms to retailers often charge transaction fees for processing other virtual card payments. However, unlike other current payment card networks, Bitcoin does not have a fixed transaction fee for payers or recipients of funds, however the users may voluntarily pay a higher mining fee in order to set an incentive for miners on the Bitcoin network to process their transaction as priority.

2.5.2. Merchant adoption across sectors

Jonker (2018) explains that early models on two sided markets assumed that retailers acted homogeneously and operated in a non-competitive market, in such a market, all retailers adopted the new payment method or did not (Jonker, 2018). However, in reality retailers and merchants act independently and each may perceive new payment instruments differently based on their perceptions, leading to different adoption rates of new platforms at different rates across sectors (Jonker, 2018). Importantly, merchants and retailers use different costing structures and the adoption of new payment instruments may impact their bottom line differently depending on sales volume and the size of the transaction (Stevens, 2017). Competition may also drive adoption decision by retailers, steep competition may cause retailers to accept a payment method in order to attract more customers, or to prevent the loss of current customers who use the payment method, even though the net transaction benefits are negative (Jonker, 2018; Stevens 2017). The effect of the current landscape is that in very competitive markets, debit card and credit card payment platforms may charge high fees to retailers, various

lawsuits and even price regulations have been the result of these high charges in various markets worldwide (Jonker, 2018).

Merchants also must consider another distinguishing feature of Bitcoin when compared to a traditional payment instrument, which is the exchange rate risk that Bitcoin carries. Jonker (2018) referenced a framework for analyzing the effective functioning of cryptocurrency markets, in particular the effect that cryptocurrencies have on the exchange rate. Their models found that investor demand (by means of speculation) , and consumer demand (by means of transactions) influence the development of the exchange rate of Bitcoin and other cryptocurrencies when compared to their local currency (Athey et al, 2017; Jonker, 2018).

The low adoption by retailers was found to be due to a lack of consumer demand, the long transfer times and increased transaction fees associated with current cryptocurrencies acts as barriers to consumer demand (Stevens, 2017; Jonker, 2018). This means that Bitcoin end users may choose other cheaper alternatives instead of Bitcoin for peer to peer payments. This trend makes it unlikely that online retailers will adopt and accept crypto currency payment instruments substantially in the near future (Jonker, 2018).

2.5. Bitcoin Offerings

2.5.1 Finance & Banking

Distributed ledger technology has the potential to improve security and efficiency of existing payment systems according to some observers. The key to the efficiency gains is the direct settlement mechanism that is built in distributed ledgers (Stevens, 2017). This mechanism has the potential to not only lower the settlement costs but also increase the speed of settlement when compared to traditional payment systems. The nature of distributed ledgers means that they are shared amongst the users, which makes them hard to corrupt, more so in cryptocurrencies which are signed and tamper proof (Stevens, 2017; Jonker, 2018; Ally et.al, 2015). Potential efficiency gains for the governing monetary policy that are offered by distributed ledgers may lead to an increase in trust in the monetary system (Stevens, 2017; Swan 2015). Trust is

considered an important cornerstone in fiduciary money systems, and this space offers opportunities for authorities such as central banks to permit interbank payments using distributed ledger technologies. However, the potential of distributed ledgers is not limited to interbank payments, but more interest is being placed on the possible issuance of digital bank notes or “central bank digital currency” offering central banks the opportunity to expand their roles by increasing access to their systems and their balance sheets (Stevens, 2017)

Blockchain technology can be leveraged to bring better efficiencies to the financial services sector with the potential of saving consumers billions of dollars annually (Ally et.al, 2015). The finance sector is set to experience the greatest disruptions brought about by Bitcoin, offering merchants and end users in the finance sector with unique payment options and has the potential to revolutionise and transform the global payments network (Stevens, 2017; Ally et.al, 2015). Such changes would include causing major financial institutions to retrofit their current technology and processes, update current fee structures and add new B2C and B2B transactional layers. Ally et.al (2015) adds that new specialists may have to be employed by big businesses in this sector in order to keep up to date and monitor regulatory issues.

Ally et.al (2015) states that digital currencies are not expected to have an impact on central bank policies, nor do they pose a significant risk to the monetary or financial stability risks to current banks and major financial institutions due to their size, however central banks, governments and other parties are watching the progression of this space with a keen interest (Stevens, 2017; Jonker, 2018) In the short term banks are not expected to suffer considerable losses caused by the introduction of Bitcoin, however as the bitcoin user base grows, the decrease that Bitcoin offers users especially when performing international transaction may cause banks and credit card processors to lower their transaction fees in order to remain competitive.

Bitcoin offers financial service providers a means to provide or extend financial services to unbanked individuals. Unbanked individuals are defined by Ally et.al (2015) as

individuals or businesses that do not operate in the formal financial system due to high bank charges and costs and due to the fact that no banks have operations in remote areas in which they may live. Novel Bitcoin based business models may be aimed to target the unbanked by decreasing the cost of simple transactions. A major driver for use of Bitcoin by the unbanked may lie in international remittances which are often expensive and subject to delays with Bitcoin offering international transfers for a fraction of a cent in some cases.

2.5.2 Payments & Retail

For Bitcoin users, there is an increasing number of intermediaries, providing value added services to users, businesses and other stake holders that facilitate customer participation in the Bitcoin ecosystem (Jonker, 2018). Services that intermediaries provide include Bitcoin wallets, currency exchanges, trading platforms, payment processing and Bitcoin ATMs Ally et.al (2015). Bitcoin presents opportunities for the retail sector by, firstly undercutting current credit card and debit card payment systems which are often relatively expensive while simultaneously improving security and privacy for end users. This efficiency gain would affect both online stores as well as point of sale systems in brick-and-mortar retailers and stores (Jonker, 2018).

In addition, the immutability of blockchain transactions which translates to irreversible payments entails a paradigm shift for online payment platforms and systems, shifting the balance in favor to those receiving the funds, often merchants (Ally et.al, 2015; Jonker, 2018). Guaranteed payments allows merchants to avoid the need to refund disputed transactions as well as offering protection from fraudulent transactions, improving security of personal data and fostering consumer trust on online platforms. New service and subscription models offer consumers and service providers new methods of transacting such as micropayments, a payment mechanism that allows for very low pricing of products and services (Ally et.al, 2015). Virtual content such as pages of a book can be billed for the equivalent of cents, which was never before possible due to the high transaction fees (Stevens, 2017; Jonker, 2018). Other notable

business models that are enabled or enhanced by the introduction of micropayments include tipping, pay-by-use and crowdfunding.

A side-effect of the decentralized infrastructure of Bitcoin is that it offers merchants involved in operations requiring the exchange of currencies a cheaper alternative to accepting foreign currencies (Jonker, 2018). Casinos have been noted as being especially interested in Bitcoin due to the ease of which international transaction can be processed, bypassing multiple currency conversions and banking restrictions currently imposed by banks and other governing authorities (Ally et.al, 2015). Tourism companies and airlines are examples of companies that may experiment with Bitcoin services to make it easier for international tourists to pay for goods and services while travelling abroad. B2B payments can also be enhanced by the introduction of Bitcoin allowing for an instant, safe means for businesses to transfer funds across borders, and may play a major role in aiding high export-driven economies through the reduction of international transactional fees, leading to a more competitive and robust sector in the long-term (Ally et.al, 2015).

2.4. Challenges to Bitcoin Adoption

The cryptocurrency market is characterized as a fragmented financial market with conflicting interests and a lack of targeted regulation (Fergusson, 2010; Douget, 2014). Metcalfe and Ramlogan (2008) pointed out that a fundamental factor that affects the widespread success or failure of an innovation is the degree of openness of the current market structure and culture, towards innovative challenges. However, users and merchants in developing nations may face additional challenges when considering their decision to adopt bitcoin. Some of these challenges are not specific to developing nations and include hoarding, accessibility, ease of use and a lack of targeted regulation.

2.4.1. Hoarding

Jonker (2018) cited a study which examined the adoption on Bitcoin within a small sample of 111 users and non-users across the world, using the UTAUT model. The results of the study found that the end users adoption intention is significantly influenced by the

respondent's expectations regarding the financial performance of Bitcoin and secondly, the amount of effort required to adopt the technology. Moreover, the end users actual Bitcoin usage depended on facilitating conditions such as retailer and merchant adoption of Bitcoin payment systems. Thus, hoarding can be considered as the act of holding Bitcoin with the expectation of future financial gains through the appreciation of the currency.

Barber et.al. (2012) presented hoarding as a moral hazard that is related to the bitcoin currency. Hoarding occurs when holders of the bitcoin currency choose to save and not spend their coins, due to their appreciation potential. As more and more users hoard their bitcoins, there are less transactions to verify and fewer fees for miners to collect. Barber et. al, (2012) explains that a major motivating factor influencing miner's decisions to verify transactions is the mining reward and as deflation occurs, miners may lose the incentive to persist with Bitcoin.

Athey et al (2017) highlights another important factor affected by widespread hoarding behavior. Athey, et. al. (2017) explains that if users value Bitcoins functional use as a means of transferring money then its future value may be tied to the future magnitude of that use. This suggests that users who buy Bitcoin without intending to use it as a means of payment would affect the value of the currency negatively, due to the decreased number of transactions occurring outside of Bitcoin exchanges.

A separate study by Shahzad Xiu, Wang and Shahbaz (2018) which explores the factors influencing Bitcoin adoption in China proposed that awareness and perceived trustworthiness are significant factors determining one's intention to use Bitcoin. Furthermore, perceived usefulness partially mediates the relationship between perceived ease of use and intention to use. This supports findings by Athey et. al. (2017) who suggested that end users perceived that the ease of use is linked to the intention and to the actual use of Bitcoin. Walton and Johnston (2018) found that perceived benefits, the user's attitude towards Bitcoin, the subjective norm, and perceived behavioral control affected the user's intentions to use Bitcoin in South Africa. Athey et. al, (2017), Barber et al, (2012), Shahzad et al., (2018) and Walton and Johnston (2018) highlighted that the user's intention to use Bitcoin plays a role that affects their adoption. Due to the financial

incentive that hoarding Bitcoin possesses, a user's adoption decision may not follow the traditional diffusion of innovations model and may adopt the product with no intent to use Bitcoin as a currency, but instead, merely as an investment instrument.

Jonker (2018) highlights another shortfall from hoarding, which is the lack of incentive that merchants and retailers would have to adopt Bitcoin payments if Bitcoin end users are not using Bitcoin for payments of goods and services. Jonker (2018) mentions that interestingly, in a study conducted amongst 108 Bitcoin accepting merchants, the share of Bitcoin in overall sales increases as Bitcoin awareness of customers increasing which suggests the existence of network externalities. This leads to what is quoted as the biggest barrier for cryptocurrency acceptance by merchants which seems to be a lack of consumer demand. The lack of demand brought about by hoarding makes it unlikely that the acceptance of Bitcoin by merchants will increase substantially, making it unlikely that Bitcoin or other cryptocurrencies will drastically transform existing retail payment systems.

2.6.2. Accessibility and ease of use

A practical study found that BitPesa, a Bitcoin based service reduced the cost of international fund transfers significantly, which supports Douget's (2014) findings. However, a major factor that limited the growth of the service was individual perceptions of the Bitcoin as a service and how it can practically benefit them (Athey et al, 2017; Mwangi, 2012).

Dion (2013) added that mobile payment infrastructure is needed for easy point of sales for Bitcoin purchases, via mobile phones. Nawrot (2019) supported Dion's (2013) findings and stated that mainstream adoption may be negatively affected by the lack of accessibility to the end user; caused by the effort required to set-up a virtual wallet and purchase the crypto-currency. Nawrot (2019) proposed that consumer education focusing on the advantages of using Bitcoin and similar digital currencies is a possible method to combat this challenge. Jonker (2018) also supported this and stated that the biggest challenge to Bitcoin adoption seems to be the lack of consumer demand. Jonker (2018), explained that consumer demand, transactional benefits and perceived adoption efforts plays a role in consumer adoption intent and acceptance by retailers.

2.6.3. Market fluctuations

Some criticisms of private money include exchange rate fluctuations and associated inefficiencies that these fluctuations cause on the issuing bank/s, the potential loss of control of the money supply and uncertainty due to bank runs which occur when a large number of customers, in this case holders of private currency, decide to withdraw their deposits simultaneously (Athey et al, 2017).

Bitcoin is shielded from many of the issues facing private currencies such as bank runs and the administration involved with fractional reserve banking, however it does pose its own risks (Athey et al, 2017). One aspect of private currencies that is directly relevant to Bitcoin is the case when currency issuers can commit to the issuance of a private currency at a future date. The private currency in this case would have to be deflationary, requiring the issuer to buy the currency back over time. Bitcoin shares a parallel with such a scenario as the Bitcoin cryptocurrency has a pre-determined amount of units that will be issued, and are issued at a pre committed rate (Athey et al, 2017; Jonker 2018). However, it is not backed by an underlying asset but is rather has a fully fluctuating exchange rate, creating a substantial risk about its future value. The future value of Bitcoin may very well be linked to the magnitude of its use, if it is to have any functional use as a currency of means of money transfer. Currently Bitcoins value is based highly on speculation, which is similar with risky assets whose value changes over time as new information emerges, such scenarios have been shown to form speculative bubbles which may cause conflicting beliefs for investors which has already been shown to be the case with Bitcoins highly fluctuating value (Stevens 2017, Jonker 2018) . Athey et. al, (2017) supports this and states that cryptocurrencies have exhibited high volatility since their inception when compared to regular currencies. However, in the long term, these cryptocurrencies are expected to reach an equilibrium exchange rate at a point where investors would put a floor under the exchange rate.

2.6.4 Low Liquidity

Dion (2013) stated that there is a current lack of services, allowing users to quickly convert bitcoins into traditional FIAT currencies. Dion (2013) considers this a challenge that inhibits large scale bitcoin adoption, and makes liquidity a major cause of concern facing bitcoin exchanges

The low liquidity of the currency, in combination with some drastic market fluctuation of the bitcoin currency presents all bitcoin holders with a valid cause for concern. Nawrot (2019) expanded on this and explained that since Bitcoin is not backed by an underlying asset but instead has a highly fluctuating exchange rate, there is an inherent risk, based on its future value.

On June 2010, the bitcoin market lost thirty percent of its value in one day (Dion, 2013). When a major bitcoin exchange Mt. Gox was hacked, the bitcoin lost forty-four percent of its value in US Dollars (Dion, 2013). Not being able to quickly and easily exchange bitcoins for money in such scenarios presents a risk that bitcoin holders must bear (Nawrot, 2019).

Athey, et. al., (2017) raises an important consideration and explains that Bitcoin shares various factors with private currencies which are defined as units of value issue by a private company, corporation, or non profit organization to act as an alternative to a fiat currency which would have otherwise been used in that country (Athey, et. Al, 2017). Private currencies are not legal tender however they are usable within a network of operators or merchants, Athey et.al provides a few examples of private currencies, one of these include notes issued by private banks whose value is linked to a government backed FIAT currency such as BerkShares which are designed and issued for the Berkshire region of Massachusetts and are based on the US dollar, and the Ithaca Hour which is a form of local currency issued and used in the locality of Ithaca,New York, designed to encourage patronage of local businesses in Ithaca and surrounding communities and to prevent that money from leaving the local economy (Athey, et. Al, 2017). Another form of private currency are notes issued by banks where the value of the note floats, often there is an element of uncertainty related to the future value of such a

private currency and such a currency is often regulated by regulations requiring the issuing bank to hold local FIAT currency in reserves.

2.6.4. Regulation

Regulatory agencies create and enforce laws that protect consumers and promote economic stability. Targeted regulation allows both banks and other credit providers to provide mobile money services in a more sustainable way (GSM Association, 2015). This same effect may apply to Bitcoin services as well. Furthermore, if these agencies are slow to adopt and implement regulation surrounding innovative services, bitcoin may lose consumer trust and investor confidence (Nawrot, 2019).

Conflicts of interest amongst different stakeholders may arise. An example would be the government enforcing regulatory pressure on the use of bitcoin whilst businesses promote a decentralized database-based cryptocurrency (Spenkelink, 2014).

Another example of regulatory influence on Bitcoin would be China's decision to ban Bitcoin, which led to a six percent decline in Bitcoin prices. In this case, the outright ban of Bitcoin in a country directly affected the adoption of Bitcoin in the country, due to the restriction of Bitcoin trading websites, as well as prohibiting banks and other financial institutions from trading in Bitcoin. More recently certain Australian banks have disassociated themselves from Bitcoin services, and have gone as far as closing the accounts of cryptocurrency providers due their proposed level of risk to their business and their reputation Ally et.al (2015). Since crypto currency exchanges rely on the banks to change currencies in order to operate, this decision has a major effect of these businesses and add to the uncertain regulatory landscape which dissuades parties forming various parts of the Bitcoin ecosystem.

Lim (2015) explains that uncertain regulatory practices make it difficult for cryptocurrencies such as bitcoin to access investment capital and establish important networking relationships. End users may also be wary to adopt cryptocurrencies without the government backing such services (Shahzad et al., 2018). Lim (2015) stated that targeted regulation is used to ensure that products and services are controlled in order for the benefits of the innovation to be realized. Mukabi and Vu 's (2019) study also

cited government regulation as a deterrent to the successful adoption of Bitcoin services by retailers.

2.6.5. Technology in Developing Countries

The increased number of regulations targeting mobile money and financial services may decrease political pressure on firms, which was identified as a challenge by Metcalfe and Ramlogan (2008). Regulations favoring the development of the mobile money market offering may roll over into block chain-based cryptocurrencies, which represent a subset of the mobile money sector.

Literature on economic growth highlights the dependence of an economy's growth rate to its level of domestic technology, when compared to other economies (Borensztein et. al., 1998). Reinart (2004) expanded on this and stated that without appropriate technological capabilities, developing countries may continue to lag behind.

New information and communication technologies are recognized as an important source of economic development worldwide Lechman (2014). The widespread adoption of information technologies is causing significant changes in the economic performance of countries choosing to adopt systems that offer new unique ways of doing business and accessing information. The increase in information technology aids economic activities by decreasing barriers to entry, fostering market participation, especially so in labour markets of disadvantaged societal groups, and the development of new business models. These new business models may lead to greater investment capital coming into the country, and more competitively priced and better-quality goods and services. Lechman (2014) adds that least developed countries seek to benefit the most by an expansion of information technology through better infrastructure, free and more accessible education and healthcare system, and more effective and efficient governance.

The diffusion of technology is often cited as a distinguishing when comparing growth capacities between various countries, and growth rates in developing countries can, in part, be described as practicing a 'catch-up' process in the level of technology in the

global economy (Borensztein et. al., 1998, pg.1). Mukoyama (2003) also states that many researchers have found that technological progress is essential in the growth process of economies, further adding that recent studies focussed on international income variations suggest that a large part of income variation can explained by the differences in the level of technology employed in the country.

Mukoyama (2003) states that technological progress is the driver of growth in any country, in order to sustain the positive growth, effective research and development has to be considered. This can be aided by employing financial and other resources to develop relevant infrastructure and facilitate technological diffusion. However the research and development expenditure in developing African countries was less than 1 percent of total public expenditure in 2010. This may be due to the limitation of financial and other resources in African counties, Mukoyama (2003) continues and states that despite the efforts by some African leaders to mobilize resources towards research and development, these steps have yet to yield sufficient outcomes, especially when compared to economies such as China and India, supporting the view that countries that can promote effective knowledge and technologies experience economic progress compared to those which lag behind.

By leveraging a higher level of technology, developing countries seek to benefit from an increased level of education, foreign investment and GDP making the technological development process, a crucial as the diffusion process in the society in order to enhance human effort. (Reinart, 2004; Borensztein et. al., 1998).

The economic benefits of mobile banking services in Africa are already evident. An example would be the use of MPesa in Kenya. The economic survey found that Kenya, a developing African nation, had 43.0 million internet users in 2015 (sixty-nine percent of the population). Moreover, mobile phones were found to be the main access to internet with 19.9 million mobile internet users. MPesa is a banking service targeted at providing the large number of unbanked Kenyan's access to formal cellular banking services such as savings and withdrawals (Wanaina, 2015; Budree & Williams, 2013). In 2014, new regulations were implemented in Colombia, India, Kenya and Liberia (GSM Association,

2015). Currently there is targeted regulation in forty-seven out of the eighty-nine markets, where mobile money is available.

The already prevalent use of mobile money in developing countries may aid Bitcoin's adoption, as the end users are already accustomed to doing certain types of transactions online. Mobile banking functions such as sending international remittances could easily be replaced by using a Bitcoin wallet, which offers much lower transaction costs than traditional banking services, especially when doing low value transfers (Douget, 2014; Reinart, 2004). Walton & Johnston (2018) supports this and state that it is believed that Bitcoin adoption and internet banking share parallels in that both involve the adoption of an innovating technology and both are susceptible to the effects of social phenomena and personal bias.

2.5. The Diffusion of Innovations

The diffusion of technology is an important driver of economic development. Mukoyama, (2003) supports this by explaining that no new technologies have an economic impact until they become widespread in the economy.

Rogers (1962) defines diffusion as: "the process whereby an innovation is communicated through certain channels over time, among the members of a social system (Rogers, 1962, pg. 5). It is a special type of communication, in that the messages are concerned with new ideas". Lechman (2014) notes that the process is dependent on the functioning of a societal system, in which society's members individually make decisions regarding the adoption or rejection of using a given innovation. Lechman (2014) further adds that the Rogers' model of technology diffusion is widely applied in political sciences, economics, public health policies, history, and education.

Diffusion involves the communication and the exchange of information concerning new ideas (Rogers, 1962; van Vliet 2018). Communication is identified as a process, which involves the creation and the sharing of information with others in order to establish a consensus. Structure is defined as the pattern of arrangements of the units in a system.

This structure allows one to predict the behavior of the system with some degree of accuracy (Rogers, 1962; van Vliet, 2018).

The innovation decision theory is based on the diffusions of innovations theory and explains the adoption behavior of individuals to innovative technology through a sequence of stages.

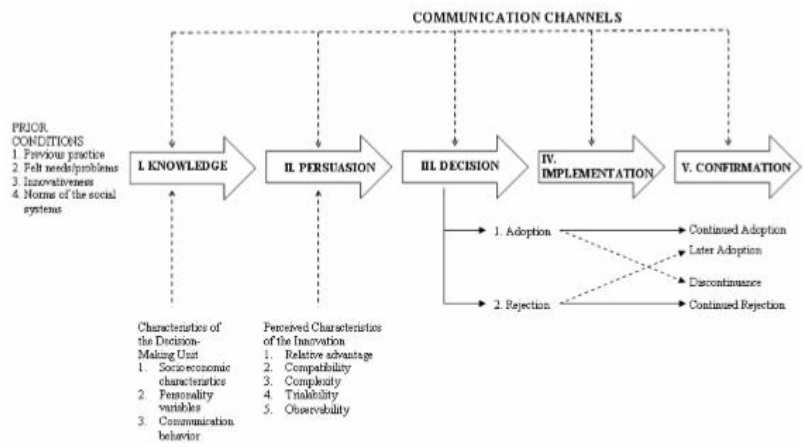

Figure 2 : Stages of the innovation decision process (Sahin, 2006, pg. 3)

The first stage, includes the user finding out about the innovation as a user cannot begin the adoption process without knowledge of the innovation, this is the first step of the innovation decision process. In this stage questions focused on “what?”, “how?”, and “why” are applied to the innovation as the individual attempts to understand the innovation and why it is relevant to them Sahin (2006).

The persuasion stage involves the user showing interest in the technology and actively seeking information such as features, costs and availability. During the stage of persuasion, the potential user considers adopting the innovation into his/her daily life (Sahin, 2006). The decision stage follows the persuasion stage, in the decision stage the potential user makes the decision to adopt or reject the innovation. The potential user identifies and weighs the benefits, costs and disadvantages of the innovation and

either adopts or rejects the innovation. The actual point when a user makes a decision has been mentioned as a difficult area of study in existing diffusion theories.

The implementation stage involves the user integrating the new innovation into his/her life, the process may be hindered by the user being slow to change previous habits and practices. Once the user adopts the innovation, they attempt to find information that supports their decision. Conflicting opinions on the innovation may cause discontinuance of the innovation, Sahin (2006) mentions that the users attitude plays an important role in the confirmation stage. (Sahin, 2006) mentions an additional stage which has been identified in similar literature, the stage of reinvention occurs when a user modifies his/her use of the adopted technology in order to further better suit his/her needs.

2.5.1. The Unified Theory of Acceptance and the Use of Technology model

The Unified Theory of Acceptance and the Use of Technology (UTAUT) is a combination of eight different theories, namely:

1) the Theory of Reasoned Action,
2) the Technology Acceptance Model,
3) the Motivational Model,
4) the TAM,
5) the TPB,
6) the Model of PC Utilization,
7) the Innovation Diffusion Theory, and
8) the Social Cognitive Theory (Hsieh, Hsu & Lee, 2011).

The UTAUT model provides a robust and tested method of the behavior of users, in relation to technology adoption and use (Hsieh et. al., 2011).

2.5.2. The theory of the rate of adoption models

The theory of the rate of adoption models proposes that the adoption of innovations in society is best represented as an s-curve on a graph. Time is an important factor in the

theory of the rate of adoption, as the communication of the perceived benefits of innovative ideas requires time to be accepted and adopted (Sahin, 2006).

Figure 3: Adopter Categorization on Basis of Innovativeness (Source: Sahin, 2006, pg. 19)

Figure 1 above shows the classification of individuals of a social system, based on innovativeness. The categories used are: innovators; early adopters; early majority; late majority and laggards. Innovators are individuals who are willing to experience new ideas and should be prepared to cope with a high level of uncertainty; innovators tend to have a high level of technical knowledge. Early adopters are more limited to the social boundaries than innovators; their adoption of innovation decreases uncertainty and motivates the diffusion process (Sahin, 2006). Mukoyama T, (2013) explains that the levels of skill of users is heterogenous, and high-skilled users adopt the technology early on the process.

The early and the late majority represent two thirds of all adopters of the innovation; the early majority are more skeptical than the early adopters are, and they motivate the late majority to adopt the innovation (Sahin, 2006). Laggards tend to live in a localized group comprising members from the same social system. The lack of awareness knowledge

leads laggards to wait until they know that the innovation works and is necessary, before adopting the new technology (Sahin, 2006).

Technology diffusion normally follows an S-shaped curve, this means that an innovation takes a long time to be widely adopted by society (Sahin, 2006). Various factors that can be attributed to this including a concept called social learning. Social learning is defined as the process by which an individual in a society acclimatized him/herself with a current technology by drawing from previous experiences, and experiences of other individuals who have the ame or similar technology (Sahin, 2006). The same type of diffusion occurs in companies who also first observe competitors and investigate their technological choices before implementing a wide stream technology change.

2.6. Diffusions of Innovation Theory

The diffusions of innovation theory, a subset of UTAUT is used to explain why, and at what rate, novel innovations spread through different cultures. Diffusion is defined as: “the process whereby an innovation is communicated, through certain channels over time, among the members of a social system” (Hsieh et al., 2011, pg. 126). It is important to note that the diffusions on the innovations model focuses on the perceptions of the end user, and not on other parties such as businesses and regulatory authorities. The innovation diffusion theory argues that potential users make decisions to adopt or to reject an innovation, based on beliefs that they form about the innovation (Hsieh et. al., 2011).

An innovation can be described as: “an idea, practice, or object that is perceived as new by an individual or by other units of adoption” (Rogers, 1962, pg. 15). Rogers (1962) explained that it is the perceived newness of the idea to an individual that determines whether it is considered as an innovation or not, and not the time that the idea was first used. Innovation Diffusion Theory (IDT) describes the following characteristics of innovations:

1) relative advantage,
2) compatibility,
3) complexity,
4) trialability, and

5) observability.

Relative advantage is described as: “the degree to which an innovation is considered as being better than the idea it replaced” (Hsieh et. al., 2011, pg. 4). Relative advantage has been found to be one of the best predictors of the successful adoption of innovation (Hsieh et. al., 2011; Mukabi and Vu, 2019). Compatibility refers to the degree to which an innovation is consistent with the potential end users’ needs, values and prior experiences. Complexity or ease of use refers to the end users’ perceived level of difficulty in understanding and using innovation (Hsieh et. al., 2011; Mukabi and Vu, 2019). A common feature of newly invented machines is that initially they are difficult to handle, requiring high levels of skill in the early stage of technology diffusion Mukoyama, T (2003). Ease of use is a construct introduced by Moore and Benbasat (1991) in order to test the ease of using a new innovation played an important part in the user’s adoption behaviour. A relevant finding by Mukoyama. T (2003) states that observations suggest that complexity decreased over time due to a change in the nature of the technology. Further explaining that as the technology matures, the technology becomes more user-friendly and reliable in a in order to attract more users.

Trialability refers to the degree to which innovations can be spontaneous, was a factor that affected an end user’s attitude towards modern innovations. Many authors, including Spenkelink (2014), and Mwangi (2012) cite voluntariness as a factor in their models.

The conceptual model proposed by Moore and Benbasat (1991) was based on the diffusion of innovations theory, and research instruments based on the model being proven to have acceptable levels of reliability. Moore and Benbasat (1991) mentioned that researchers wishing to use the research instrument would have to alter the questions, in order to make them more specific to the innovation in question.

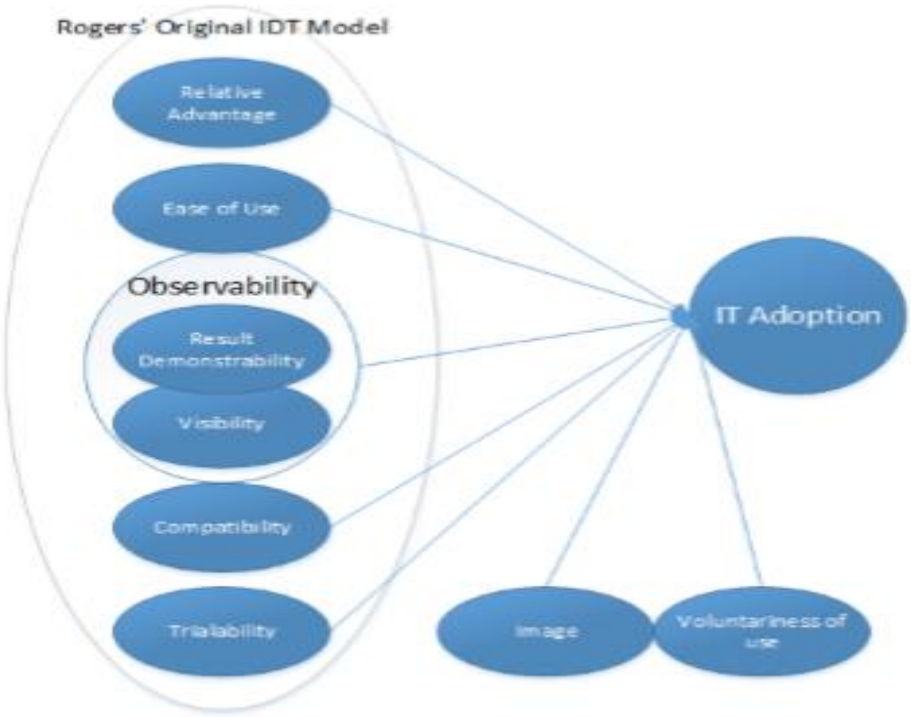

Figure 4: Innovation Diffusion Theory Adaptation by Moore and Benbasat (1991)

2.7. Summary of literature review

The adoption of Bitcoin as an alternative currency offers individuals in developing countries many economic advantages, mostly linked to the elimination of fees associated with credit card and forex transactions.

Some of the literature reviewed attempted to provide a broad view of Bitcoin while others investigated the adoption of Bitcoin or similar technologies in developing countries. A gap identified in literature was identified, as few papers investigated Bitcoin adoption from an end-user perspective, especially in developing countries. Mwangi (2012) looked at a similar study in Kenya and both Walton and Johnston (2018) and Spenkelink (2014) conducted similar studies in South Africa. However, all of these studies considered hoarding in their conceptual models.

It has been shown that the adoption of innovative technology such as mobile banking by a developing nation may lead to an increase in the growth of that economy and in turn may lead to a higher standard of living (Borensztein et. al., 1998). Cryptocurrencies utilize

the internet in order to function, which suggests that their large-scale adoption may be viable in developing nations such as South Africa, that exhibit high levels of mobile phone penetration and mobile internet usage (GSM Association, 2015). Moreover, the prevalence of mobile banking services may be a proxy for the readiness of the population to adopt Bitcoin services (Metcalfe and Ramlogan, 2008).

The Bitcoin stakeholder landscape consist of various parties who play different roles in the market. All these parties all benefit by the widespread adoption of Bitcoin and each party plays an important role in aiding this outcome (Jonker 2018; Athey et.al, 2017). Bitcoin may be viewed as a two-sided market, similar to current retail payments market as a transaction can only take happen if both the payer and recipient of funds have adopted Bitcoin (i.e. have a Bitcoin wallet) and have agreed to the particular transaction. An important aspect of traditional two-sided markets is that network externalities acting on one side of the market, cause an increase in demand on the other side of the market Joker (2018). The low adoption by retailers was found to be due to a lack of consumer demand, the long transfer times and increased transaction fees associated with current cryptocurrencies acts as barriers to consumer demand (Stevens, 2017; Jonker, 2018).

The large-scale adoption of bitcoin also presents various challenges to market participants, such as the threat of a deflationary spiral, the prohibited use of the currency, coupled with uncertain regulations and the high market price fluctuations that Bitcoin has experienced in recent times (Barber et al., 2012). These challenges, in combination with various network externalities that are required to ensure successful Bitcoin adoption, were identified as potential inhibitors of bitcoin adoption in developing countries (Barber et. al., 2012). Mobile phones have become more than a personal communications device, with the introduction of mobile internet and the development of mobile phone-based services such as mobile banking (Swan, 2015).

An increase in legislation targeting mobile money may suggest that governments in the mentioned developing African countries anticipate the widespread use of virtual and cryptocurrencies (Budree and Williams, 2013; GSM Association, 2015). Such government actions would encourage the use of bitcoin and other cryptocurrencies, as

the lack of clear regulations was considered an important problem facing the widespread adoption of a cryptocurrency in countries (Budree and Williams, 2013).

Various theories attempt to model the adoption behavior and the perspective that end users have toward a technological development. The diffusion of the innovation theory is a robust and tested model that is used to model potential users' decisions to either accept or reject an innovation, in order to explain how, why and at what rate new ideas spread through a population.

The diffusions of the innovation theory is well suited for this research paper, as the constructs that it follows pursues a positivist epistemology and are quantifiable through the use of a research instrument that suits the nature of this research paper. Another compatible model is the UTAUT model, which has been cited as having a: "Very high explanatory power, r^2 = 0.77" (Spenkelink, 2014, pg. 22). Spenkelink (2014) also criticized the UTAUT model for being too complex to model the adoption of innovative technology, such as cryptocurrencies.

2.8. Conceptual Model

The data requirements needed to conduct this study include journal articles, which are used to provide background information and insight on conceptual models and highlights relevant findings. The diffusion of the innovation's theory is the base of various other conceptual models and theories that describe the adoption of an innovation through society. Hsieh et. al., (2011) stated that the innovation diffusion theory argues that: "potential users make decisions to adopt or reject an innovation, based on beliefs that they hold about the innovation."

Other models such as the theory of the rate of adoption and the innovation decision process are closely linked to the diffusion of the innovation theory, and can be easily applied when describing the findings, so as to further understand the current situation of Bitcoin adoption in Africa. Thus, the diffusion of the innovation theory model is an ideal model on which to base the conceptual model of this study and this was why it was chosen as a backbone when designing the research instrument.

Spenkelink (2014) chose to use this model rather than the UTAUT model, as the UTAUT model was overly complex, given the research questions. Research conducted by Mwangi (2012) did not reference the use of a specific conceptual model; however, analyzing Mwangi's (2012) research instrument implies that he based it on the diffusion of the innovation theory model, as Mwangi (2012) tests almost all the constructs referenced in the diffusion of the innovation theory.

The conceptual model used in this study (Figure 7) included voluntariness as a construct, in order to further test the respondent's propensity to adopt Bitcoin and to further validate or disprove findings by Moore and Benbasat (1991). Moore and Benbasat (1991) attempted to develop a research instrument that would measure the various perceptions that individuals have when adopting information technology. The research instrument used by Moore and Benbasat (1991) was based on the diffusion of the innovation theory and was proven to have acceptable levels of reliability. Moore and Benbasat (1991) mentioned that researchers wishing to use the research instrument would have to alter the questions, in order to make them more specific to the innovation in question. The conceptual model differs from Moore and Benbesat's (1991) model and Roger's (1962) original diffusion of the innovation model, as the model being tested in this study includes hoarding as a construct.

Hoarding has not been tested as a construct in any of the theoretical models cited in this study and is a novel concept. Barber et. al., (2012) suggested that hoarding would affect an end users adoption decisions by incentivizing the user to purchase and to store Bitcoin as an investment instrument, as opposed to purchasing it, due to the advantages that arise from its utilization as a tradable currency. Athey et al, (2017), Barber et al, (2012), Shahzad et al., (2018) and Walton and Johnston's (2018) findings all identified the user's intention as an important factor affecting their adoption decision. Barber et. al's (2012) findings will be approved or disapproved, based on findings relating to the end user's response, to this construct.

The second difference between the current conceptual model and Moore and Benbesat's (1991) conceptual model used in this study includes gender as a construct. Gender was not found to be a significant factor affecting an end user's adoption decision of innovative

technology, in any of the studies cited, which utilized the diffusion of innovation theory. This suggests that gender is not a significant factor affecting an end user's Bitcoin adoption decision.

Moreover Spenkelink (2014) and Mwangi (2012) both stated that gender did not affect an end user's adoption decision, regarding Bitcoin. However, due to the addition of hoarding as a construct to the model, gender may be a significant factor affecting an end user's adoption decision, by influencing an end user's propensity to hoard. It is because of the possibility of this mechanism that we included gender as a construct in the conceptual model used in this study. The findings by Spenkelink (2014) and Mwangi (2012) will be approved or disapproved by testing gender as a construct, in the conceptual model. The conceptual model represented below, is an adaptation of Moore and Benbasat's (1991) model, which is based on Rogers (1962) diffusion of the innovation theory, with hoarding added as a construct. The conceptual model was used as a lens through which we can visualize a South African end user's perspective of Bitcoin. Based on the conceptual model, the following propositions was drawn, in order to test each construct.

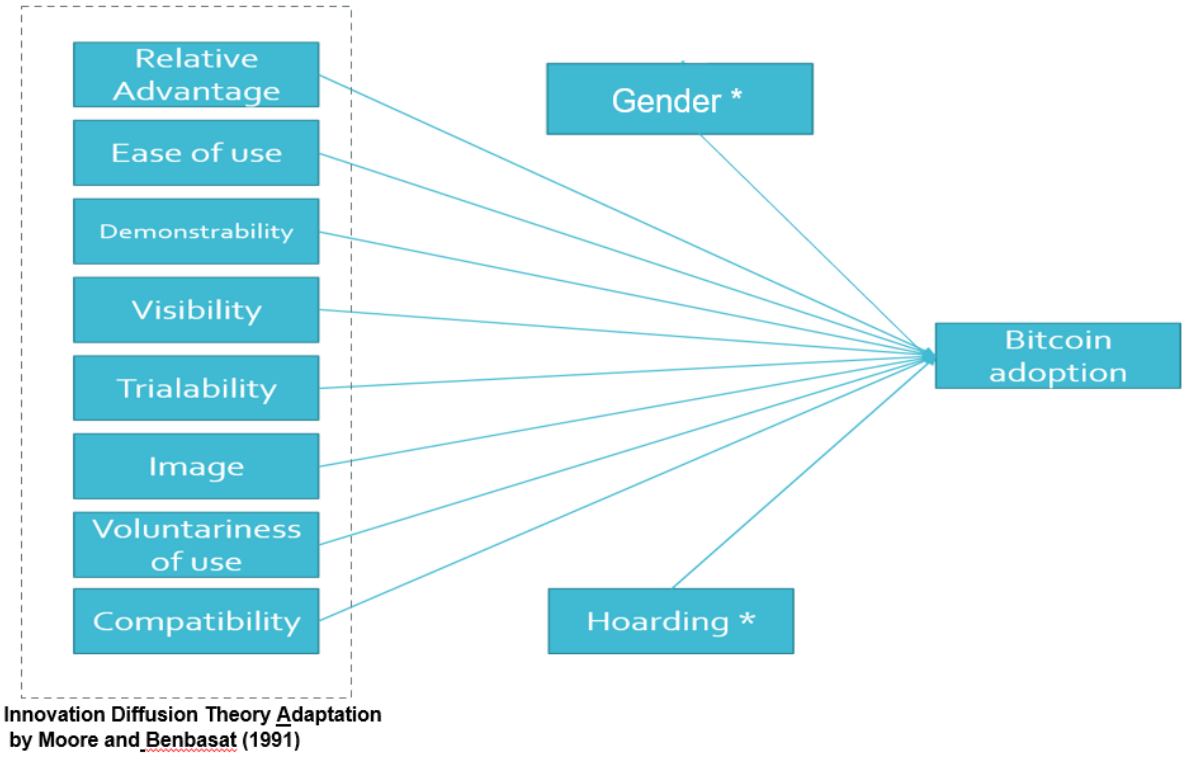

Figure 7: Bitcoin Adoption Conceptual Model

2.9. Propositions

Walton and Johnston's (2018) recommend clearly stating propositions prior to the data analysis section of this study. The research propositions below were derived from the literature review and conceptual model sections above.

The first proposition (P1) relates to gender and was tested to validate or to disprove the findings presented by Spenkelink (2014) and Mwangi (2012), who both stated that it is not a significant factor that affects a user's adoption decision regarding cryptocurrencies. The next eight propositions (P2 – P8) relate to factors that affect an individual's adoption decision identified in Rogers (1962) original innovation diffusion theory model.

The ninth proposition (P9): relates to an end user's voluntariness of use, which is proposed by Moore and Benbasat (1991), and cited by other researchers thereafter, as a factor in the innovation diffusion theory model. The tenth proposition (p11) relates to the user's propensity to hoard Bitcoin and is influenced by the market volatility of the Bitcoin currency. This proposition is tested in order to gauge whether the users decisions are based on the inherent advantages of Bitcoin as a technology, or are they mainly determined by the financial gain that is offered by hoarding the Bitcoin currency during the Bitcoin bubble.

P1: Gender is not a statistically significant factor affecting a student's adoption decision regarding Bitcoin.

P2: There is no statistical correlation between a respondent's adoption decision and the perceived relative advantage of Bitcoin.

P3: There is no statistical correlation between a respondent's adoption decision and Bitcoins perceived ease of use.

P4: There is no statistical correlation between a respondent's adoption decision and Bitcoins visibility in their social setting.

P5: There is no statistical correlation between a respondent's adoption decision and Bitcoin's demonstrable result.

P6: There is no statistical correlation between a respondent's adoption decision and Bitcoins observability.

P7: There is no statistical correlation between a respondent's adoption decision and their perception of Bitcoins image.

P8: There is no statistical correlation between a respondent's adoption decision and their perceived compatibility with Bitcoin services.

P9 There is no statistical correlation between a respondent's Bitcoin adoption decision and Bitcoins perceived voluntariness of use.

P10: There is no statistical correlation between a respondent's adoption decision and people's propensity to hoard Bitcoin

3. Research Design

This research design section will describe the manner in which the study was conducted, by discussing the research methods employed during the study. First, the limitations of the research and the time frame of the research study are provided, thereafter the research instrument design is discussed. Demographics of the study are provided next, followed by a brief overview of the data analysis techniques and tests that were used. Finally, the research hypotheses are listed, together with their respective statistical tests.

3.1 Research Strategy and Approach

Research strategy is defined by Saunders (2003) as a general plan that helps the researcher with answering research questions in a systemic way. The research strategy employed in this research paper included reviewing the literature on similar research, in order to understand the research problem and to get background on the various elements of the study. Case studies such as the adoption of Bitcoin in Indonesia, as a mainstream currency and the creation and the adoption of BitPesa in Kenya were reviewed, in order

to identify any parallels that may be used to investigate Bitcoin adoption in South Africa specifically.

A survey will be conducted, and the results will be analyzed so as to fulfil the aims for this study. A similar research strategy was employed by Mwangi (2012), whose research paper investigated the adoption of BitPesa in Kenya and by Spenkelink (2014), who investigated the adoption of cryptocurrencies such as Bitcoin in South Africa. Out of all the literature reviewed, the two research papers mentioned above have the greatest similarity to this research paper, and have similar research aims and objectives. This supports the decision to use the research strategy described above as it has been tested and shown to be effective.

A combination of an exploratory and descriptive approach to research will be used in the context of this research paper. The fundamental nature of an exploratory approach often disproves the perceived problem or hypothesis (Pearson, 2007). Researchers using an exploratory approach do not usually draw definitive conclusions, but they do suggest possible cause-effect relationships behind their findings, which is well suited for the research method employed in this study. An exploratory approach is suited for research paper, as it focuses on gaining insight and becoming familiar with an unclear phenomenon (i.e. factors affecting Bitcoin adoption in Africa). An exploratory approach was chosen in studies by Mwangi (2012) and Spenkelink (2014), as the relationships governing bitcoin adoption in Africa are still largely unclear.

A descriptive research methodology attempts to explain and provide details on a topic, by analyzing additional information. This study aims to identify and describe novel concepts and factors, regarding the adoption of technology within a society, in order to fill in gaps in the current literature regarding Bitcoin adoption. By explaining how different variables affect an end user’s decision to adopt Bitcoin, this research paper will attempt to elaborate on, and test the models mentioned in current literature.

3.2. Philosophy

The research philosophy relates to the nature and development of knowledge and consists of important assumptions about the way in which the world is viewed by the researcher (Saunders et al. 2012). In order to answer the research questions, a research philosophy must be selected and used throughout the study. Saunders et al. (2012) suggests that the chosen research philosophy influences the way researcher goes about answering the research questions and affects the research method employed in the study.

There are two main branches of philosophy namely: Ontology and epistemology, ontology looks at the nature of existence and what governs reality and different aspects of social structures. Ontological questions are often concerned with what is possible to know about the world, Al-Saadi (2014) views ontology as the assumptions we make about reality and what exists, or the nature of the world and what we can know about it.

The concept of ontology can be broken down into two main standpoints, subjectivism and objectivism. Subjectivism dictates that reality is a social phenomenon are created by the human mind and is thus always changing based on an individual's prior experiences (Saunders et al, 2012; Al-Saadi ,2014) A researcher employing a subjective stance should be actively involved in the social phenomenon in order to derive meaningful, context-specific information that can be used in the study (Al-Saadi ,2014; Maxwell, 2010). Alternatively, objectivism dictates that one constant, unchanging reality exists and can be observed, measured and explored objectively. Researchers employing an objectivistic stance would remain independent of the study, using measurements and methods such as hypothesis testing to derive knowledge about the relationships between different social structures and actors (Pearson, 2007; Al-Saadi ,2014).

Epistemology is concerned with what constitutes acceptable knowledge in a field of study and underlies how a research investigation is investigated. Al-Saadi (2014) explains that epistemology involves understanding the underlying nature of knowledge, its scope and legitimacy. Epistemology focusses on knowledge creation, and uses different approaches to learn and know about a social reality, it is a method of observing the world and making sense of it (Pearson, 2007; Saunders et al, 2012). Different epistemological assumptions affect how a researcher goes about uncovering knowledge about a social setting. If the researcher's perspective on knowledge is that it is objective in nature, the researcher would assume an observer role and use methods of natural science such as hypothesis testing. Alternatively, if knowledge is considered subjective then the researcher would not use natural science methods but seek to gain greater involvement with their subjects and research setting through more contextual research methods (Saunders et al, 2012; Al-Saadi 2014).

This research paper is exploring the adoption of a technology is society, the concept of technology adoption forms a well-researched field of study with validated adoption models (Al-Saadi ,2014). These models are tested objectively through various data collection and analysis methods. It is for this reason that the researcher has assumed an objective stance which would allow this research paper to follow closely with studies looking at the adoption of other technologies Pearson, 2007). Objective studies often entail that the researcher looks at independent and dependent causal relationships and how these affect social actors/ structures, this is well suited for this research paper which essentially aims to highlight dependent and causal relationships between different constructs affecting a user's perception and thus their adoption decision (Pearson, 2007; Saunders et al, 2012).

The onotology and epistemology of a study are closely linked, a positivist epistemology focuses on formulating information based on observable phenomena (Pearson, 2007). Positivism focuses on objectivity and evidence and dictates that the social reality is unnafected by the researcher. A positivistic approach employs methods that allow for precise, direct ovservations such as data collections, modelling and interpretation. Lasty

a positivist approach holds that the truth is constant and always objective, thus the interpretation of results and test should also be objective with the researcher distancing themselves from the impact of their findings(Pearson, 2007; Maxwell, 2010).

In contrast, a realist evaluation focuses on developing information by investigating and describing the various perceptions that individuals have of certain phoenomena (Pearson, 2007; Saunders et al, 2012). The realist approach is well suited for research that is concerned with describing an individual's personal perceptions of reality, in relation to specific subject matter (Maxwell, 2010). A qualitative approach to data collection and analysis is normally used when employing a realistic approach to theory (Maxwell, 2010; Saunders et al, 2012).

This research paper is attempting to uncover the drivers behind the adoption behavious of social actors (Bitcoin users) acting in a social setting. Schmitz (2013) explains that a positivist approach would suit exploratory research which involves observing phoenomena and attempting to explain the observations using existing theory.

The adoption of Bitcoin has been studied objectively by various researchers noted in this research paper and can be viewed as a real-world phenomenom that we can study and draw knowledge from. Various authors such as Darlington (2014), Tsanidis et.al (2015), Spenkelink (2014) and Wanaina (2015) have investigated cryptocurrency adoption in various contexts and countries, their findings may be relevant when investigating bitcoin adoption in an African context. Findings from similar case studies will be considered in conjunction with various theories on technology adoption in order to identify important factors that affect bitcoin adoption in a developing economy. Other relevant literature such as studies conducted by Borensztein et.al (1998), Gikandi and Boor (2010) and Mariani (2014) have investigated the opportunities that large scale bitcoin adoption present to developing economies. Their findings will be considered and evaluated as they may highlight important factors that drive bitcoin adoption in the developing economies.

A positivist approach is suitable, as it affirms the separation between the researcher and the sample, in order to eliminate bias (Maxwell, 2010). A positivist epistemology will be

employed in this research paper, as it best suits the purpose of the research and the nature of this study.

Furthermore, relationships and causality are best identified and described when dopting a positivist stance. a positivist approach involves generating a hypothesis, testing, and proving or refuting it (Pearson, 2007). The adoption behaviour of a user may be affected by different drivers and how these factors relate to the user, these relationships can be uncovered by assuming a positivist stace. It is for this reason that this study will be employing an anonymous survey as a research instrument as it can be effeciently distributed and critisized objectively. Spenkelink (2014) and Mwangi (2012) employed a positivist philosophy in similar papers and hypothesis testing was used by other less similar studies, futher justifying the decision to follow a positivist approach.

3.3. Approach to Theory and Data

A deductive approach is based on drawing conclusions from one or more premises (Pearson, 2007). A deductive approach to theory as described by Schmitz (2013) as an approach to research that is concerned with developing hypotheses based on existing theory, and then designing a research strategy to test the hypotheses. Figure 3 shows the steps used when conducting research using a deductive approach, the first step involves developing hypotheses using findings and conclusions drawn from relevant literature. The next step involves collecting and analyzing data by implementing a relevant methodology in order to approve or disprove the hypotheses formulated in step 1 (Schmitz, 2013).

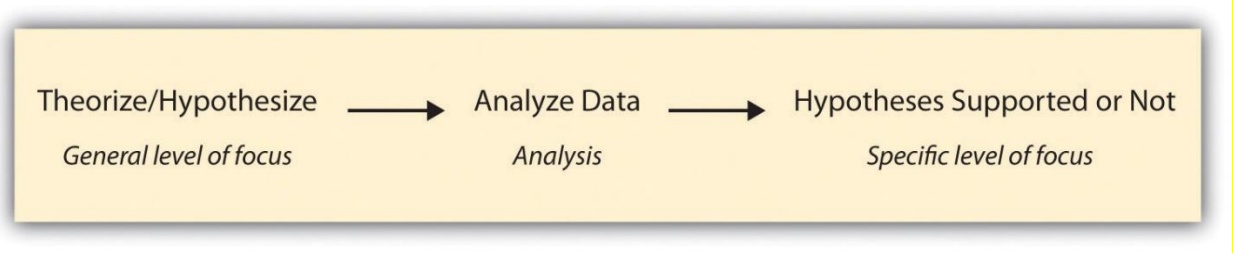

Figure 5: Deductive research approach (Schmitz, 2013, pg.16)

In contrast, inductive reasoning is based on drawing predictions from specific observations (Pearson, 2007). A deductive approach to theory was applied in the literature review section of this study as well as research on bitcoin adoption in Africa is still novel and fragmented, leading researchers to differ in respect of its objectives and its purposes (Mwangi, 2012). This approach was also adopted because of the small number of reliable and tested theories in this field, in order to draw general conclusions on certain factors relating to Bitcoin adoption in Africa (Mwangi, 2012). If this research were to be conducted using an inductive approach, the literature review would focus mainly on interviews and the personal perceptions of individuals in developing African nations. However, most of the research available shares similar research objectives and thus does not favor an inductive approach to theory, as researchers employ a quantitative approach towards research (Spenkelink, 2014; Mwangi, 2012).

A quantitative approach to data collection involves gathering empirical data, in order to answer the research questions (Pearson, 2007). A quantitative approach favors the positivist philosophy, as both concepts represent the traditional scientific method of hypothesis testing. Therefore, a quantitative approach to data collection was applied to this study. In contrast, a qualitative approach would focus on describing and understanding phenomena by analyzing and making sense of unstructured data (Pearson, 2007).

2.10. Research Limitations

South Africa has the largest gross domestic product (GDP) per capita in the African continent (GSM Association, 2013). The nation also leads in terms of mobile service subscribers with a 65.7 percent subscriber penetration rate.

The 3G internet access protocol has a 39.3 percent penetration among South African users; much higher than that of Kenya at 14.2 percent which was second in terms of 3G penetration in 2013 (GSM Association, 2013). The high levels of mobile phone penetration and internet use in South Africa suggests that the individuals in the sample

have been exposed to mobile banking services which is advantageous to this study, as it provides a larger pool from which to draw information.

A limitation with this approach may be that the findings may not be generalizable to the rest of Africa, especially in nations where the mobile phone and the internet adoption rates are lower than those in South Africa and Kenya.

2.11. Research Timeframe

A cross sectional research timeframe was used for this study. This type of timeframe means that the information regarding the study group's adoption of Bitcoin can be recorded at one time, without manipulating the study environment.

The main justification behind using a cross sectional study is the time constraints surrounding this study, and the purpose of this study which is to complete a master's dissertation in a year. In contrast, a longitudinal study would involve conducting several observations on the same subjects over a period of time (Institute for Work and Health Toronto, 2015). A longitudinal study may provide insightful information on developmental changes in the target population's adoption levels. The findings of this study could be used later in other research investigating Bitcoin adoption in South Africa, which follows a longitudinal time frame.

This survey was conducted during a high growth period for Bitcoin during the latter part of 2017. Bitcoin prices increased dramatically throughout the year from $900 to nearly $20 000, with the most dramatic rises happening towards the end of the year.

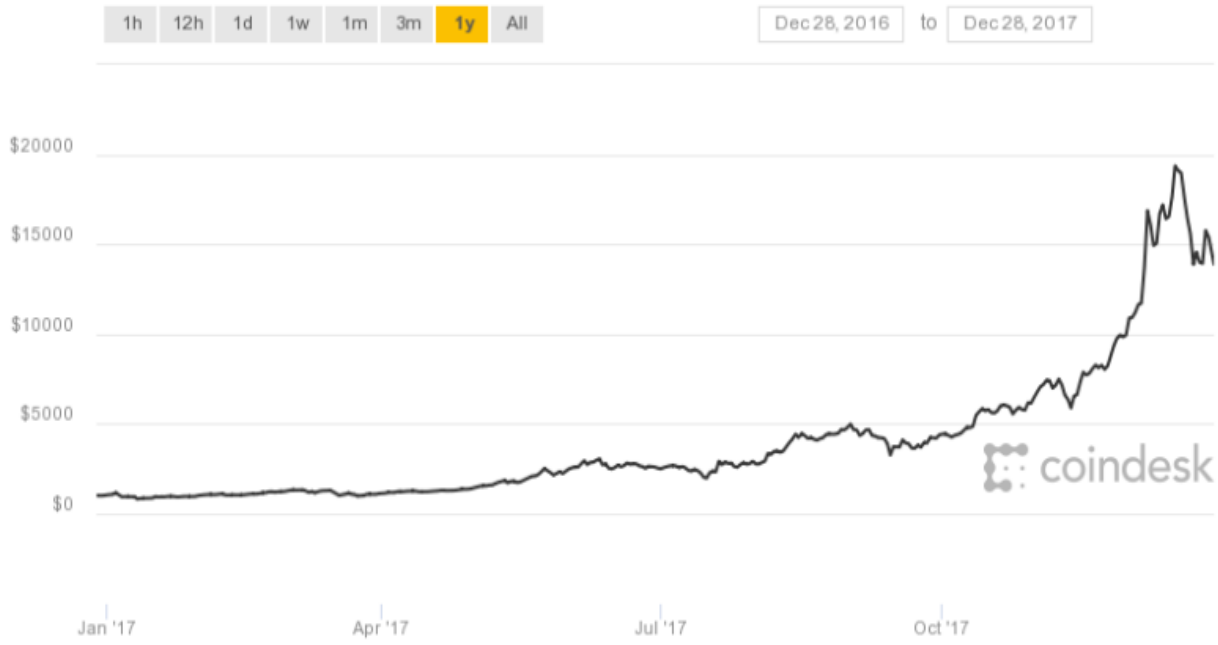

Figure 6: Bitcoin Prices January 2017 – December 2017 (Higgins, 2017)

Bitcoin received a large amount of press coverage during this time, and Bitcoin exchanges received increased revenues due to the high public demand. Investment by investors and speculators in Bitcoin increased dramatically during this time, with investors entering the market to use Bitcoin solely as an investment instrument. This user behavior is what will be considered as hoarding in this study. This classification is important, as the data suggests that more and more people are entering the Bitcoin market during this time, with the intent not to use Bitcoin services but to hold Bitcoin in their digital wallets, expecting a return in the near future.

2.12. Instrument Design

When developing the questionnaire, a number of research instruments and conceptual models were considered. Since Spenkelink's (2014) and Mwangi's (2012) research problems and objectives were similar to the ones stated in this study, the research instruments used by these authors were considered appropriate.

The eight factors in Moore and Benbasat's (1991) diffusion of the innovation model was represented in the conceptual model as a construct. Each of those constructs was tested

as a section on the research instrument, comprising four to five questions relating to the construct and how it affects the respondent's perception of Bitcoin and consequently, their adoption decision. Questions relating to a respondent's hoarding behavior was used to gauge a user's propensity to hoard, which is a factor of the conceptual model developed in this study. Compatibility, a factor in Rogers' (1962) innovation diffusion theory, may be used as a proxy for hoarding. A low compatibility score and positive adoption decision may indicate that the end user bought Bitcoin, even though they did not intend to use it regularly.

Each respondent's date of birth was collected, in order to avoid duplication and in attempting to ensure that each response is valid. Data was collected, using an online questionnaire created using Qualtrics software and was distributed by means of an online link. Each respondent was asked whether they had purchased Bitcoin. The answer to this question served as a proxy to identify a positive or a negative adoption decision, when examining the data, according to gender.

Responses relating to all the constructs of the conceptual model except gender were captured using a five-point Likert scale, which is an established method of scaling responses used in survey research (Pearson, 2007). The questions were phrased so that a high or a low response on the scale would indicate a positive or a negative factor that affected the respondent's adoption decision, and a zero response would indicate that the item being ranked had no effect on a user's perception or adoption decision.

2.13. Study Demographic

The online questionnaire was distributed in October 2017, as this was when most university courses commenced. Eighty-three respondents replied in a survey conducted during 20 October 2017 and 21 November 2017. However, nineteen of the responses were incomplete and could not be used in the data analysis. The sample comprised eighteen females and forty-six males. Thus, the sample in the study comprised eighty-three South African university students and young professionals. The size of this sample is greater than or equal to the size of the sample used in similar research that were conducted by Spenkelink (2014) and Mwangi (2012). The fairly large sample size is

robust and can be used to run normality tests, which is important, and will be discussed in the data analysis section.

This representation assumes the fact that the respondents are university students and young professionals in South Africa who were active end users of electronic money systems, prior to the commencement of the study. The theory of the rate of adoption (Sahin, 2006) was considered when selecting the target population and the sample. The model describes the adoption of innovaton over time, as an s-curve on a graph. The theory dictates that individuals were classified as innovators and early adopters, and the early majority were the first to adopt innovation.

Multiple research has shown that older individuals falling into the generation age group of forty-eight or older, are not avid adopters of new technology (Bianchi and Phillips, 2005). Other research such as the papers written by Kumar and Lim (2008) and May and Hearn (2005) identified age is as a factor influencing an individual's mobile service preference. Based on the theory of the rate of adoption by Sahin (2006), it was decided that the sample should represent the early adopters of innovative products among the financially active individuals in South Africa, and possibly other developing African countries.

In order to best answer the research questions, set out in this study, it was decided that it would be advantageous to sample individuals who are in the process of adopting Bitcoin or at least know about Bitcoin. Since the younger generations have been shown to be early adopters of new technology, the study sample comprised South African students studying at the University of Cape Town.

The ages of the population ranged from the oldest members of the generation z bracket (nineteen years) and the oldest members of generation y (thirty-four years). The age of each individual was noted in the survey questionnaire, which allowed for discrimination between each generational age group.

2.14. Ethics

The nature of this investigation required the respondents to answer sensitive questions, relating to their perceptions of financial services. It was important that the identity and the responses of the respondents were kept anonymous. The ethics approval committee of the university of Cape Town (UCT) would review the ethics surrounding the research investigation. The ethics approval form detailed all the ethic procedures that would be implemented while carrying out the investigation.

3. Data Analysis

The data analysis section describes the statistical tests undertaken for the purpose of drawing results from the data collected, using the research instrument described in Chapter 3. First, a short description of the tests conducted is provided. Thereafter the hypotheses identified in Chapter 3 were tested, in order to answer the research questions for this study and to validate or to disprove our conceptual model.

Data analysis refers to the process of converting data into useful information in order to answer a research question or proposition (Pearson, 2007). The data analysis procedures employed in this study will involve formulating statistical p and t tests which are used to evaluate the readiness of Bitcoin adoption in different individuals.

Pearson's (2007) correlation test will be used to analyze the underlying relationships between certain elements and the individual's adoption decision. In order to comprehensively analyze the research questions and to provide insight on the findings relating to the propositions, the data underwent a process of statistical testing, categorization, aggregation and tabulation. Various reports are then generated from this information. It is important that the data transformation and the analysis procedures used in the study are valid, reliable and transparent. For this reason, unit tests are performed on the data to ensure the integrity of the data during the transformation process.

3.4. Reliability Test

Table 1: Results of Cronbach Alpha Test

The Cronbach alpha test measures the internal consistency of a research instrument in order to validate and verify the integrity of the data collected from the respondents. The response variable for the Cronbach Alpha test is the alpha coefficient, a result greater than 0.7 indicates good internal consistency. An alpha co-efficient of less than 0.5 indicates an unreliable instrument. This study utilized the test to test the reliability of each construct in the IDT model, as well as the questions relating to Bitcoin as an investment. A Cronbach alpha test was carried out and the alpha co-efficient was recorded as 0.88, this represents a high internal consistency of the research instrument and indicates a reliable research instrument.

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.880	.878	64

3.5. Normality Test

In order to run all inferential statistics or parametric tests, a sample must fit a normal distribution. A Shapiro Wilkes test for normality was used, to assess the extent to which the different constructs were normal. The Shapiro Wilkes test was used instead of the Kolmogorov-Smirnov test, as the total sample size did not exceed 2000 members (Pearson, 2007). The null and the alternate hypotheses for the Shapiro Wilkes test are stated below:

H0: The competency scores are normally distributed.

H1: The competency scores are not normally distributed.

The null hypothesis for this test is that the data is normally distributed. The Prob < W value listed in the output is the p-value. The response variable for a Shapiro Wilkes test

is the p-value, and the chosen alpha level is 0.05. Thus, if the p-value is less than 0.05, then the null hypothesis that the data is normally distributed is rejected. If the p-value is greater than 0.05, then the null hypothesis is not rejected (Pearson, 2007).

Table 2: Summary of Shapiro Wilk test for all constructs

Construct	Shapiro Wilk (W)	P value
Relative Advantage	0.934	0.002
Result Demonstrability	0.939	0.004
Ease of use	0.979	0.330
Visibility	0.821	0.044
Trialability	0.954	0.018
Image	0.964	0.057
Voluntariness of use	0,936	0,002
Compatibility	0.968	0.097
Hoarding	0.993	0.981

Ease of use, Image, compatibility, and hoarding were all found to be normal and had response variables higher than 0.05, meaning that there was no statistical difference between the scores relating to these constructs. Normal was set at a ninety-five percent confidence level. The other six factors had response variables below the desired confidence level and are analyzed in more detail below.

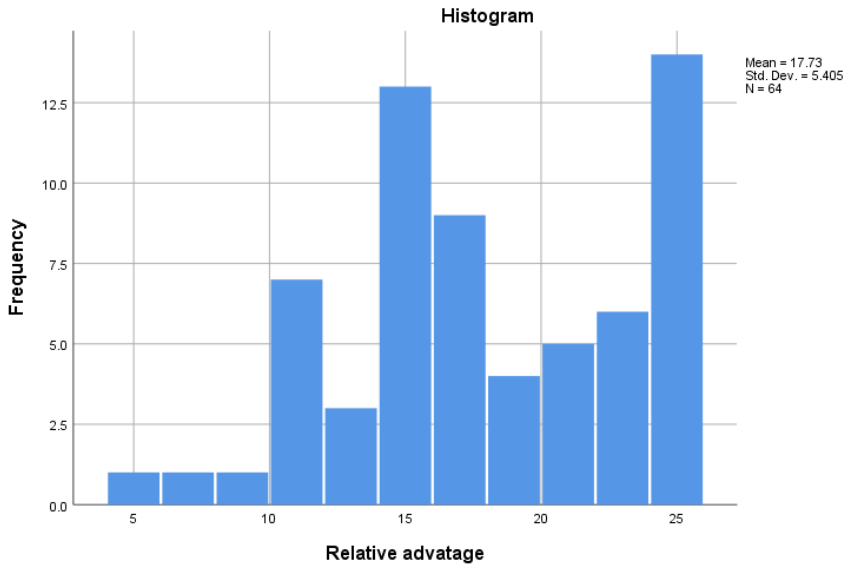

Figure 8: Histogram Plot of Relative Advantage Scores (n = 64)

Figure 5 above shows the distribution of the scores relating to relative advantage. The distribution of the data indicates that it is skewed right. A normality test determines that the responses relating to relative advantage had a normal distribution. The p value of 0.002 means that the null hypothesis is rejected and that the results are in fact not normal.

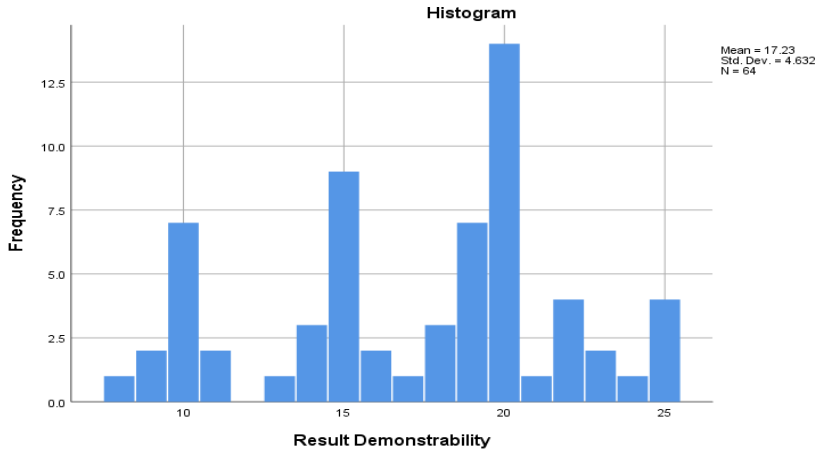

Figure 9: Histogram Plot of Result Demonstrability Scores (n = 64)

Figure 6 above illustrates the distribution of scores relating to the result demonstrability of Bitcoin. The data does not match a normal distribution and is skewed left. This was confirmed with a normality test, which had a response variable (p) of 0.004, which is

statistically significant, meaning that we reject the null hypothesis that the data is normally distributed.

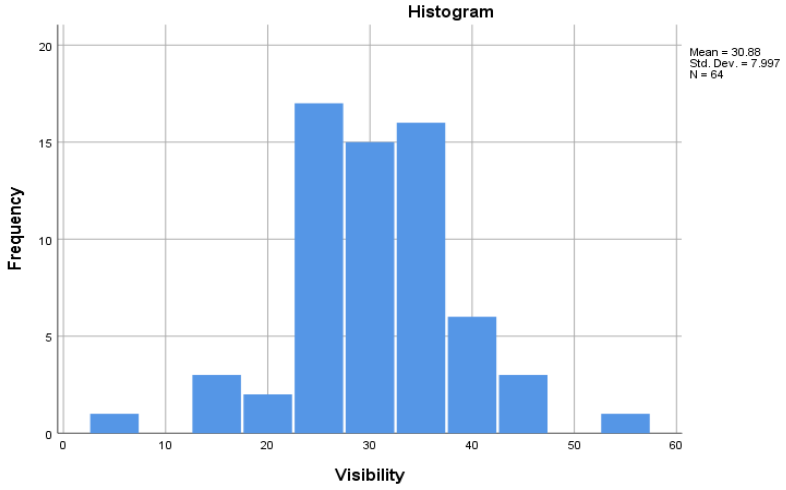

Figure 10: Histogram Plot of Visibility Scores (n = 64)

The results of a normality test showed that the distribution of visibility scores was not normal and had a response value (p) of 0.044, which is below the desired confidence level of ninety-five percent.

However, the response value is only 0.006 below the accepted p value of 0.05, this means that we can consider the scores relating to Bitcoin visibility normal at a ninety-four percent confidence interval.

Figure 7 above shows the distribution of scores relating to the respondent's visibility of Bitcoin as a factor affecting their adoption decision. The distribution is not skewed and is approaching a normal distribution, which supports the results of the normality test. Visibility will be considered normal for this study, due to the small difference (0.006) in confidence levels.

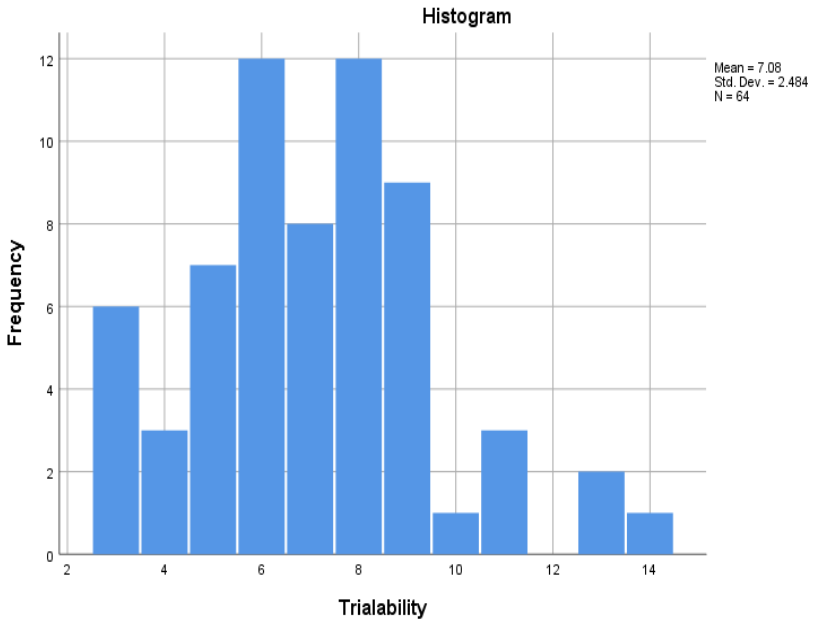

Figure 11: Histogram Plot of Trialability Scores (n = 64)

The trialability scores were aggregated and they were run through a normality test which concluded that the scores were not normally distributed with a response variable (p) of 0.018 which is significantly lower than the standard accepted confidence level of ninety-five percent. Figure 8 above illustrates the spread of scores and shows that the data is skewed to the right.

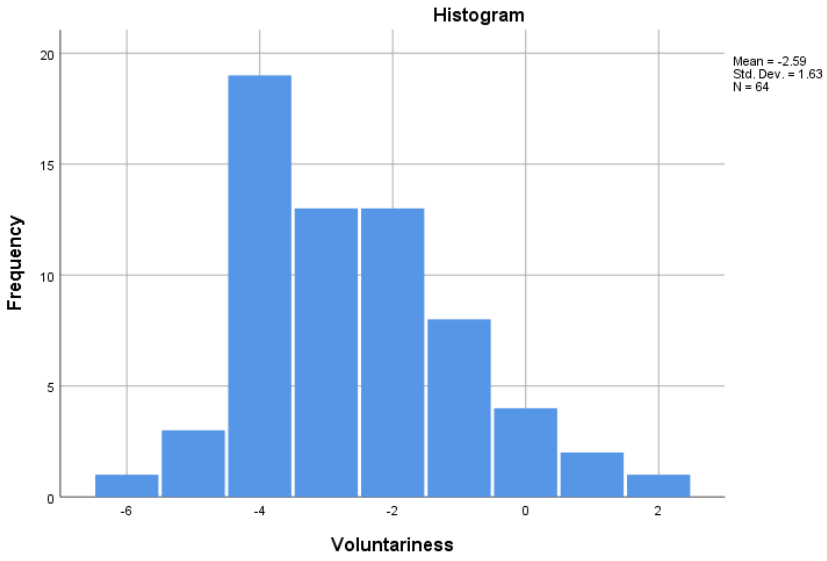

Figure 12: Histogram Plot of Voluntariness Scores (n = 64)

Respondents' scores relating to voluntariness of use were tested for normality and were found not to be normal (p=0.002), Figure 9 above shows the spread of the scores relating to this construct and shows a clear skew to the right. Non-parametric tests were used to test the constructs that did not follow normal distribution.

3.6. Difference of Means Test

The Mann-Whitney U test is a non-parametric test that determines whether two samples are from populations with similar distributions. Gender was tested, using a Mann-Whitney test as opposed to a correlation test, due to the fact that the Boolean value is not suitable for a Spearman correlation test.

The Mann-Whitney test was chosen to test whether gender played a significant factor in the end users adoption decision, as a normality test showed that the scores relating to gender were not normally distributed but were skewed heavily as the sample size that comprised twenty females and forty-four males. The null hypothesis and the alternative hypothesis for the test are given below.

- **H (null):** There will be no statistically significant differences between the adoption decision of genders.
- **H (alt):** There will be statistically significant differences between the adoption decision, of genders.

In order to further investigate the role that gender plays, the following hypothesis were also tested.

- **H (null):** There will be no statistically significant differences between the risk profiles of genders.
- **H1 (alt):** There will be a statistically significant difference between the risk profiles of genders.

The results of the Mann-Whitney test are detailed below. Gender was not found to be a significant factor affecting the respondent's decision to buy Bitcoin (p=0.788). Gender was also not a significant determinant of the risk profile of the sample (p=0.722)

Table 3: Results of Mann-Whitney U tests

Test Description	Mann-Whitney U	P value	Significant
Gender vs buy bitcoin	396	0.788	No
Gender vs risk averse	391	0,722	No

3.7. Correlation Test

Correlation tests are used to measure the (1) strength of association between two variables and (2) the direction of the relationship. The correlation co-efficient of a correlation test ranges between 1- and +1. A value close to 0 represents a strong weak relationship while a value closer to -1 or +1 represents a negative or a positive correlation, respectively (Leard Statistics, 2018). A Pearson's correlation test is a technique used when investigating the relationship between two quantitative variables. The Pearson's correlation test works by plotting a line of best fit between the two variables (Leard Statistics, 2018; Pearson, 2007). The response variable for the Pearson's correlation test is the correlation co-efficient (r), which indicates how far the data points are from the line of best fit. A high correlation coefficient value demonstrates that a strong, positive correlation exists between two variables (Leard Statistics, 2018; Pearson, 2007).

Pearson's correlation tests were conducted in order to test whether each of the constructs with normal distributions had a positive correlation with the respondent's adoption decision of Bitcoin. The user's adoption decision was a nominal value, indicating their propensity towards a positive Bitcoin adoption decision.

Table 4: Results of Pearson's and Spearman Correlation Tests

Construct	Type of test	Correlation co-efficient	Significant at 0.05 interval	Significant at 0.01 interval
Relative Advantage	Spearman	0.652	Yes	Yes
Demonstrability	Spearman	0.868	Yes	Yes
Ease of use	Pearson	0.677	Yes	Yes
Visibility	Spearman	0.784	Yes	Yes
Trialability	Spearman	0.317	Yes	No
Image	Pearson	0.200	No	No
Voluntariness of use	Spearman	0.784	Yes	Yes
Compatibility	Pearson	0.680	Yes	Yes
Hoarding	Pearson	0.915	Yes	Yes

4. Findings

4.1. Gender

Spenkelink, (2014) and Mwangi, (2012) the authors of a similar research both stated that gender was not a significant factor affecting an end user's Bitcoin adoption decision. Although gender was not included as part of the conceptual model, its effect on the respondent's Bitcoin adoption decision was explored, to validate or to disprove findings by similar research.

Results of a Mann-Whitney U test (Table 3) found that gender was not a significant factor when considering an end user's Bitcoin adoption decision. A similar test was run, and it was found that gender was not a significant determinant of an end user's risk profile. Further analysis found on the sample revealed that 28.5 percent of the female sample had bought Bitcoin whereas 57.1 percent of the male sample had bought Bitcoin before.

This finding may suggest that factor/s other than risk aversion may affect male and female buyers' decisions differently, when considering whether to buy Bitcoin. However, the findings by Spenkelink, (2014) and Mwangi (2012) are validated by this study and even though a large discrepancy exists between the two genders' Bitcoin adoption decisions, the variability is not statistically significant enough to warrant rejecting the hypothesis (H0) and find that:

Gender is not a statistically significant factor affecting a respondent's adoption decisions regarding Bitcoin.

4.2. Relative Advantage

The results of the normality test showed that the scores relating to relative advantage were not normal, meaning that a Spearman correlation test should be used in order to determine whether relative advantage plays a significant role in determining whether an end user adopts Bitcoin.

The value of the correlation co-efficient was 0.652, significant at a ninety-nine percent confidence interval. The results of the Pearson's correlation test showed that relative advantage had a significant statistical correlation with an end user's adoption decision. The high correlation between relative advantage and an individual's propensity to adopt Bitcoin means that we must reject our hypothesis (H1) and find that:

There is a strong positive statistical correlation between a respondent's adoption decision and their perceived relative advantage of Bitcoin.

This finding supports research by Mukabi and Vu (2019) where the authors found relative advantage to be a highly significant factor affecting the retail adoption of Bitcoin. Mukabi and Vu (2019) explained that this is because retailers and end users strive for greater efficiency, lower costs and borderless restrictions for remittances.

Another possible explanation for this may be the rapid increase in Bitcoin's value at around the time when the survey was carried out (Higgins, 2017). The increase in media coverage on Bitcoin when the survey took place, may have caused the respondent to perceive Bitcoin as having a relative advantage. The high perception of Bitcoin's relative

advantage however, may not be due solely to its utility as a more efficient means of transferring funds, but may also be due to its high returns on investments at around the time of the study, as described by Barber et. al., (2012), Shahzad et. al., (2018) and Jonker (2018).

4.3. Ease of Use

The scores relating to the ease of use had a normal distribution, with a corresponding response variable (p) of 0.329 at a ninety-five percent confidence interval, indicating that the scores relating to this factor were normal. A Pearson's correlation test was run, and the ease of use was found to have a statistically significant correlation with a user's adoption decision towards Bitcoin. The correlation coefficient had a value of 0.677, which signifies a strong, positive correlation with the end user's Bitcoin adoption decision. The strong positive correlation between the ease of use and the respondent's propensity to adopt Bitcoin means that we have to reject our hypothesis (H2) and find that:

There is a strong positive statistical correlation between a respondent's adoption decision and their perceived ease of use regarding Bitcoin.

One may interpret this finding to mean that individuals classify the services or the software used to acquire and transfer Bitcoin as user friendly and easier to use than expected. This supports findings by Jonker (2018) that individuals classify the services or the software used to acquire and transfer Bitcoin as user friendly and thus easy to use. If this is the case, then the ease of use may relate to interactions between Bitcoin exchanges in South Africa. An example of such an exchange is Luno, which was at the time the largest Bitcoin exchange in South Africa that offered a mobile application and a wallet to South African smartphone users (Francois, 2017).

A limitation that this finding does not highlight is the end user's intent of use. This classification is important as it affects the end user's perceived ease of use. Athey et al, (2017) explained that an end user with an intention to use Bitcoin as a means of payment may find this hard to do, whereas an end user who views Bitcoin as an investment does not have much interaction with Bitcoin payment services, and thus only deals with Bitcoin exchanges such as Luno.

4.4. Observability

Observability comprises two sub-constructs, namely result demonstrability and visibility. Scores relating to the two constructs were tested for normality separately, and both samples were found to be non-parametric. A Pearson's correlation test showed that both visibility and result demonstrability had significant, positive correlation with an end user's adoption decision. Visibility had a correlation co-efficient of 0.784 and the result demonstrability had a correlation co-efficient of 0.868. From the results of the two tests, we reject the two null hypotheses (H3 and H4) and find that:

There is a strong, positive statistical correlation between a respondent's adoption decision and Bitcoins' visibility in their social setting.

There is a strong, positive statistical correlation between a respondent's adoption decision and Bitcoins result demonstrability.

The two strong, positive correlations may suggest that the questions were indeed testing the same construct (observability), which validates our model and Roger's IDT theory. This finding goes against findings by Mukabi and Vu (2019), where the authors cited observability as having no direct correlation with the retailer's adoption decision; thus implying that the end users struggle to see the direct benefit of adopting Bitcoin services.

A possible interpretation of this result could be that the visible monetary advantages offered by Bitcoin, not as a technology, but as an investment instrument increased the end user's propensity to adopt Bitcoin technology. As mentioned before, Bitcoin's high volatility and ever-increasing growth rate was a popular social topic at the time when the respondents undertook the survey. This high coverage due to media or word of mouth may explain the strong, positive correlation observed between observability and the respondents' buying decisions which were not considered by Mukabi and Vu (2019).

4.5. Trialability

Scores relating to an end user's perception of their ability to try out Bitcoin before purchase, were tested and shown as not following a normal distribution. This meant that the sample was suitable for a Spearson's correlation test to check whether Bitcoins triability affected their propensity to adopt Bitcoin.

The results from the correlation test showed that trialability did not have a statistically significant correlation with an end user's adoption decision, regarding Bitcoin. The insignificant relationship was represented by a correlation coefficient of 0.317, which is statistically insignificant at a ninety-five percent confidence interval but is not statistically significant at a ninety-nine percent confidence interval. Even though the correlation co-efficient is relatively weak, compared with other constructs, and is statistically insignificant at a ninety-nine percent confidence interval, it is significant at a ninety-five percent confidence interval, thus we reject our null hypothesis (H5) and find that:

There is a weak but significant, positive statistical correlation between a respondent's adoption decision and Bitcoins observability.

The relatively weak correlation between the triability factor and an end user's propensity to adopt Bitcoin may be somewhat expected, as the nature of Bitcoin as a currency does not allow for trialability. Apart from mock trading accounts aimed at cryptocurrency investors, there are few methods available for testing Bitcoin when going through the adoption process. The high price and the demand for Bitcoin means that few vendors are willing to give out free Bitcoins (satoshi's) to users, as part of a trial (Higgins, 2017). Mukabi and Vu (2019) supported this finding, and they also found that trialability did not play a significant role affecting the adoption of Bitcoin by retailers.

4.6. Image

The extent to which Bitcoin services enhance an end user's image within their social circle was graphed and shown to have a normal distribution; the response variable (p) had a value of 0.057, which makes it a suitable sample on which to perform a Pearson correlation test.

The correlation test yielded a response variable (r) of 0.200, representing a statistically insignificant correlation between the perceived, positive image that Bitcoin holds and the end users' adoption decisions regarding it. The lack of a significant correlation between Image and the end users' propensity to adopt Bitcoin means that we accept the null hypothesis (H6) and find that:

There is no statistical correlation between a respondent's adoption decision and their perception of Bitcoins' image.

The lack of a correlation between the end users' image may be due to the market perception of Bitcoin, which was highly volatile at the time of the study. Another interpretation of the result may be that Bitcoin is not used to purchasing goods and services and therefore cannot be used as a proxy, to enhance the end users', image due to its limited real-world application. The lack of a significant correlation between Image and the end user's propensity to adopt Bitcoin means that we accept the hypothesis (H6).

4.7. Voluntariness of Use

Scores relating to the respondents' perception of Bitcoin use as voluntary do not follow a normal distribution. A normality test was run and a response variable (p) of 0.002 was found. A correlation test showed that voluntariness had a positive correlation with an end user's adoption decision; represented by a strong positive correlation with the responding variable, having a value of 0.784. This strong, and positive correlation may suggest that end users who adopted bitcoin did so intentionally. Thus, we reject the null hypothesis (H7) and conclude that:

There is a strong, positive statistical correlation between a respondent's Bitcoin adoption decision and Bitcoins perceived voluntariness of use.

This finding suggests that an end user's adoption decisions were not due to external factors such as merchants offering bitcoin as a payment or because of peer influences in the end user's social circle. This finding also correlates with the interpretation that the end users who adopted Bitcoin intended to use it as an investment instrument, as opposed to a currency used to purchase goods and services.

4.8. Compatibility

Scores relating to respondents' compatibility with Bitcoin services were tested, in order to investigate whether it affected their propensity to adopt Bitcoin and their adoption decisions. Firstly, a normality test was run on the results which had a response variable (p) of 0.680, which represents a normal sample.

A Pearson correlation test highlighted a significant positive correlation between compatibility, and an end user's adoption decisions. A response variable (r) of 0.680 shows a strong positive correlation between the two variables. The positive correlation means that we reject our null hypothesis (H8) and find that:

There is a strong, positive statistical correlation between a respondent's adoption decision and their compatibility with Bitcoin services.

The positive value of the responding variable suggests that individuals who consider Bitcoin compatible with their lifestyles are more likely to purchase Bitcoin. Considering the findings relating to the use of bitcoin as an investment instrument, the strong positive correlation between the compatibility with Bitcoin and lifestyles may also reflect how compatible respondents are to using such instruments, to attain financial gains in the long or the short term. Only thirty-six6 percent of the sample performed international fund transfers fairly regularly, which may suggest that the respondents who bought Bitcoin were not doing so to use it as a medium of exchange, but rather to utilize it as an investment.

4.9. Hoarding

Scores relating to the respondents' propensity to hoard Bitcoin as opposed to using it as a currency were tested and found to be normal, with a response variable of 0.981. A Pearson correlation test was used to identify whether the hoarding incentive affected the respondent's adoption decision. The results of the Pearson correlation revealed a correlation co-efficient of 0.915, which is relatively high when compared to the other constructs tested. Thus, we reject our hypothesis (H9) and find that:

There is a very strong, positive statistical correlation between a respondent's adoption decision and their propensity to hoard Bitcoin.

The strong, positive correlation may indicate that hoarding was in fact the largest factor affecting a respondents Bitcoin adoption decision. This finding is not surprising, due to the state of Bitcoin at the time that the study was conducted. The finding validates our conceptual model and may suggest that the end users of Bitcoin have an inherent hoarding incentive, which would strongly affect their adoption decision relating to Bitcoin and possibly other cryptocurrencies.

4.10. Summary of findings

The first construct relative advantage was shown to have a positive correlation with the end user's adoption decision, validating the Rogers diffusions of innovation theory and the adapted conceptual model used in this research paper. Relative advantage was cited by Moore and Benbasat's (1991) as being a significant determinant affecting the adoption decision of users when looking to adopt technologies similar to Bitcoin. The strength of the correlation was significant (0.652), however relative to the other factors relative advantage had a relatively weak which may indicate that it was the main determinant influencing and end user's adoption decision relating to Bitcoin. However, as noted before it is also possible that the end user may be referring to Bitcoins financial performance as an investment instrument rather than an innovative technology as described by Moore and Benbasat's (1991) adaption of Rogers (1963) theory of diffusion of innovations.

The second construct in our adapted model was ease of use, the ease of which a user can interact with Bitcoin services and attain Bitcoin was shown to be a high contributor to a user's propensity to adopt Bitcoin. The strength of the correlation relating to ease of use was significant at 0.677 which is relatively weak compared to other significant factors suggesting that it was not the main determinant acting on the end user's adoption decision regarding Bitcoin. This finding may suggest that services such as Bitcoin wallets and Bitcoin trading platforms are widely marketable and easily accessible.

An important finding considered in conjunction with ease of use is that voluntariness of use was also seen to have a high, positive correlation. Although these two findings may not necessarily suggest that Bitcoin services have become prevalent enough that merchants and other social pressures are pushing the end user to pay for goods and services with the currency but rather that services such as Bitcoin exchanges This finding may also suggest that the end user have themselves observed the benefits of Bitcoin through word of mouth, mainstream media or similar mediums. As discussed, the high level of media attention during the time of this study which may have skewed this result. The correlation strength was relatively medium in strength with the response variable measuring 0.784. This suggests that it was not the main determinant of a user's propensity to adopt Bitcoin. The perceived benefits may again have been interpreted differently than they would have been for an innovative technology that was not tied to a currency and consequently does not offer the end user a financial incentive through hoarding.

Observability had a strong positive correlation with a user's propensity to adopt Bitcoin. Recall, observability is made up on two constructs, result demonstrability, and visibility and refers to the degree to which the benefits of innovations are made visible to other people. The positive correlation suggests users were motivated to adopt Bitcoin because of the positive benefits that the they believed they will be able to show to other people. Result demonstrability was shown to have a significant effect on a user's adoption decision, with a correlation value of 0.863 which is relatively high compared to other factors.

This finding also supports both Moore and Benbasat's (1991) and Rogers (1963) original model of diffusions of innovations theory. Visibility was shown to also have a significant effect on the user's adoption decision, with a correlation value of 0.784. Looking at these two factors together, Bitcoins levels of observability seems to have been high, however Bitcoin's observability may be related to coverage of Bitcoin's performance and volatility and not necessarily the observability of Bitcoin as a means to transact and send money. The strength of the correlation was not as strong as result

demonstrability and neither factor was found to be the main determinant of a user's propensity to adopt Bitcoin.

Trialability was found to have the weakest correlation (0.317) relative to all the other significant constructs in the model. The fact that trialability was significant may indicate that users were able to gain Bitcoin on a trial basis but the likelihood that users were able to attain free Bitcoin is low, the result therefore may relate to Bitcoin services and online wallets that facilitate Bitcoin transactions. The trialability of Bitcoin and other cryptocurrencies may be expected to be relatively low influencers on end users mainly due to the fact that cryptocurrencies act as currencies and opportunities to attain free currency on a trial basis without having to put any considerable effort such as mining are not popular. The significant relationship however does support findings by Moore and Benbasat's (1991) and Rogers (1963) original model of diffusions of innovations theory.

Image was the only construct that was found not to have a significant relationship with the respondent's propensity to adopt Bitcoin with a correlation value of (0.20). The interpretation of this finding may indicate that the respondent's use of Bitcoin may not add to his/her image in their respective social circle. This finding is somewhat counter intuitive given that result demonstrability was shown to have a strong positive correlation (0.868) and may be explained as there is no real way to show the ownership and use of Bitcoin apart from word of mouth. This finding validates both Moore and Benbasat's (1991) and Rogers (1963) original model of diffusions of innovations theory on which the conceptual model used in this study was based.

Compatibility was shown to have a significant relationship with the respondent's propensity to adopt Bitcoin. The strength of this correlation (0.680) was relatively low which indicates that it was not the main determinant influencing the end user's adoption decision. Moore and Benbasat's (1991) and Rogers (1963) original model of diffusions of innovations theory also cited compatibility as a significant factor affecting an individual's adoption decision.

Hoarding, had the highest effect on a user's behavior to adopt Bitcoin (0.915), end users with a high propensity to hoard Bitcoin, were the same users with a high propensity to adopt Bitcoin. This finding contradicts the finding above which suggested that users who adopted Bitcoin felt that Bitcoin and Bitcoin services were compatible with their lifestyle. However Only 36% of the sample performed international fund transfers fairly regularly and no major online South African retailers accept Bitcoin payment, suggesting that end users were in fact saying that using applications and bitcoin services that are used to attain and hoard Bitcoin were compatible with their lifestyles. The hoarding concept was not present on Moore and Benbasat's (1991) adaption of Rogers (1963) theory of the diffusions of innovations. The very strong correlation suggests that this concept is in fact the main determinant governing a user's adoption decision and validates the model used in this research paper. This finding may also indicate that Moore and Benbasat's (1991) model may not sufficiently model all the governing relationships affecting a user's adoption decision when specifically looking at cryptocurrencies.

Below is the consolidated research model with all the statistically significant constructs with their respective correlations with the resulting variable being the end user's adoption decision. Moore and Benbesat (1991) adaptation of Rogers original innovation diffusion theory is illustrated, which excludes the hoarding construct which was introduced in this research paper and the image construct which was shown to be statistically insignificant.

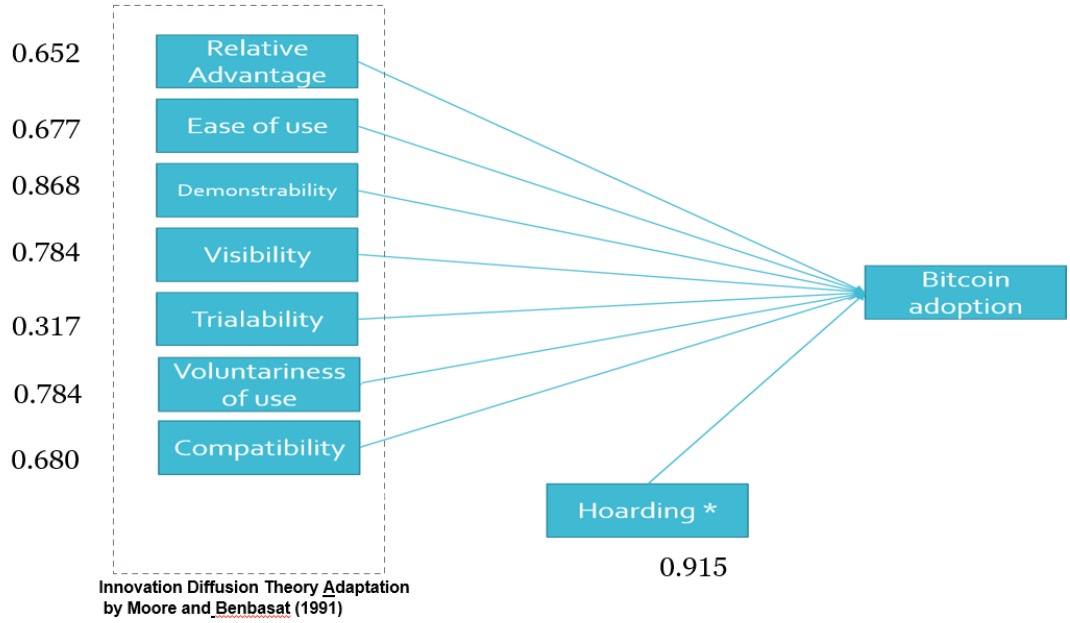

Figure 13: Revised Bitcoin Adoption Conceptual Model

5. Discussion

An end user propensity to hoard was a behaviour found to be a significant factor affecting the user's adoption decision in this study. This finding corresponds to similar findings cited by Jonker (2018) studies who found that results indicated that owners of cryptocurrencies do not generally use them for online payments, and that the user's adoption intention is significantly influenced by the respondent's expectations regarding the financial performance of the cryptocurrency. Recall that Jonker also found that the end users actual Bitcoin usage depended on facilitating conditions such as retailer and merchant adoption of Bitcoin payment systems. This finding may be relevant as major merchants and online retailers in South Africa may not accept Bitcoin as a payment which would have the effect of stunting consumer adoption through the effect of network externalities.

Spenkelink (2014), Walton and Johnston (2018) and Mwangi (2012) who carried out similar studies did not mention the effect that hoarding behaviour may play in the end users adoption decision. Walton and Johnston (2018) did find that perceived benefit indirectly affected the user's intention to use Bitcoin by influencing the attitudes of potential users and that Bitcoins market volatility and performance was often mentioned by respondents taking part in their study. Bitcoins market volatility was later formally identified as a key risk factor and was found to be the most cited reason that South Africans may not adopt Bitcoin Walton and Johnston (2018). This may suggest that users were well aware of Bitcoin as an investment instrument and were perceiving Bitcoin as an investment rather than a method of payment or money transfer, however, the behavioral intention of the end users adopting Bitcoin and how hoarding may affect this intention was not mentioned by Walton and Johnston (2018).

Result demonstrability was also shown to have a very strong positive correlation with the end user's adoption decision regarding Bitcoin, second only to the user's propensity to hoard Bitcoin. Considering the timeframe and financial gains Bitcoin was offering during the time that this research was conducted, the findings may hint that the respondents may have associated result demonstrability with Bitcoin's ability to provide users with positive returns when utilizing it as an investment instrument. Taking these two findings about hoarding and result demonstrability into consideration, one may posit that the main drivers of a user's Bitcoin adoption decision are driven by Bitcoins financial performance and ability for it to provide returns and not necessarily its practical usefulness as a means of transacting and transferring funds. This would support findings by Jonker (2018) and Ally et.al (2015).

Ease of use was found to have a high, positive correlation with the user's adoption decision, Walton and Johnston (2018) findings did not correspond with this finding and cited that the complexity of the user experience are barriers which negatively affect an end user's decision to adopt Bitcoin, especially with older members of the sample study. Walton and Johnston (2018) stated that Bitcoin was viewed as difficult to use and complex to setup, mentioning that tools and interfaces that act to reduce complexity of the user experience that the end users have with Bitcoin services were cited as important enablers

of wider levels of Bitcoin adoption by Walton and Johnston (2018). The discrepancy of the two findings may be due the different sample of users that answered the respective questionnaires, as mentioned, the respondents to this study had a high knowledge of Bitcoin and a significant amount had already adopted Bitcoin, the sample in Walton and Johnston's (2018) study was cited as being individuals in South Africa who are familiar with Bitcoin, however the adoption rate of the sample was not formally provided. The different theoretical models and interpretations of them may also have played a role in the variation of the findings when relating to ease of use.

Relative advantage was found to be a significant factor in this research paper however it was not cited by similar research done by Walton and Johnston's (2018), Mwangi (2012) and Spenkelink (2014), this can be explained as these studies did not use the same conceptual model used in this study and did not factor in nor consider relative advantage as a factor affecting the respondents in their studies adoption behaviour. None the less other studies which have used the diffusions of innovations theory found relative advantage to be a significant determinant of a user's adoption decision which is supported by findings of this study.

Compatibility had a relatively weak but significant correlation with the respondents Bitcoin adoption decision. Interpreting this finding may posit that users find Bitcoin as a transaction medium that falls in line with the respondent's lifestyle through the use of services such as international remittances, Bitcoin payments and micropayments, however it is important to indicate that this may not be the case as findings suggest that most respondents would not spend their Bitcoin on products and services. Thus, the compatibility construct may not accurately describe Bitcoin's compatibility with the respondent's lifestyle in terms of payments but rather in terms of an investment instrument such as a trading platform for forex and other commodities. The relatively weak correlation may correlate with findings by Jonker (2018) who stated that there is currently a low demand from consumers to spend their Bitcoin on products and services, which consequently leads to low demand for suppliers to adopt Bitcoin payment systems.

6. Conclusion

In this section, we will discuss the findings while building on our conceptual model derived from Moore and Benbasat's (1991) adaption of Rogers (1962) diffusions of innovations theory. The conclusions drawn are deduced by interpreting the findings through the end user's perspective lens and taking into consideration the various challenges that affect the end users' adoption decision and results cited by similar research. Lastly recommendations for future research in this area are provided given the findings, limitations and challenges encountered during this study.

6.1. Final Conclusion

The advent of Bitcoin and other cryptocurrencies in 2009 has created opportunities for developing countries such as South Africa to benefit through efficiency gains brought about by the use of Blockchain technology. Various stakeholders across industries stand to benefit from the widespread use of Bitcoin through the creation new innovative products, decrease in transaction fees, and enhancement of existing payment systems. Cheaper transaction fees on international payments and remittances, the ability to process micropayments and increased transparency if transactions are some of the proposed benefits of Bitcoin use when compared to traditional payment and financial transaction systems. The main objective of this study was to identify significant factors that affect end user's adoption decision when considering whether to adopt Bitcoin and further create a model that accurately evaluates how these factors may affect the end user's adoption decision.

The literature reviewed looked at studies from different disciplines in order to understand the impact, challenges and factors influencing Bitcoin's mainstream adoption in a developing country such as South Africa. While conducting the literature review, various gaps in literature were identified regarding which factors affect end user's decision to adopt Bitcoin. Relevant theories were discussed in the process of formulating the conceptual model and gaps found in literature were then explored by

applying Moore and Benbasat's (1991) adaption of Rogers (1963) theory of diffusions of innovation using Bitcoin as the use case.

Data was collected using a survey which was conducted with 69 recipients, thereafter various statistical tests were performed in order to test whether the constructs in the conceptual model were in fact significant factors affecting an end user's adoption decision. The most notable finding was that users were primarily driven to adopt Bitcoin due to their propensity to hoarding Bitcoin for future returns. This is not unexpected as no major merchants accepted payment in Bitcoin around the time of the survey, and a large majority of the sample did not engage in international fund transfers which are the only alternatives to hoarding that the user could engage in.

Eight of the nine constructs (Relative Advantage, Demonstrability, Ease of Use, Visibility, Trialability, Voluntariness of Use, Compatibility, Hoarding) forming the theoretical model for this study were shown to have a significant, positive correlation with the respondent's propensity to adopt Bitcoin (Table 4). This finding suggests that the conceptual model formulated in this study as well as Moore and Benbasat's (1991) adaptation of the original Innovation Diffusion Theory is indeed valid in explaining an end user's adoption decision when referring to Bitcoin. The introduction and validation of the hoarding construct may suggest that further research studying cryptocurrencies or other technologies which currencies should include hoarding as a positive driver of user adoption of said technology. Further research would have to be carried out to determine why image, did not have a significant relationship with the user's adoption decision when adopting Bitcoin as found in this study.

An increase in regulation has been cited by various authors, this may aid the widespread acceptance of Bitcoin by merchants may offset the hoarding behavior by enticing customers to spend their Bitcoin. However, since merchant behavior is largely driven by consumer demand, and consumers do not seem to be using their Bitcoins for payments, merchant adoption may be slow in the near future (Jonker, 2018).

Considering the Bitcoin stakeholder landscape, the slow uptake of Bitcoin by merchants and the lack of end users looking to spend their Bitcoin may translate to fewer promoters, developers and infrastructure operators in the Bitcoin market in South Africa.

The low prevalence of these parties within the Bitcoin landscape may lead to fewer product and service offerings that utilize Bitcoin technology such as micropayments and instant international transfers entering the market in the short term (Jonker, 2018).

6.2. Limitations & Recommendations

The data collected was taken during a time of high media coverage on Bitcoin which may have favored the hoarding behavior in users and caused unexpected results due to the end users' perceptions of Bitcoin as a currency rather than a novel technology.

A possible improvement for future studies looking to expand on this research would be to differentiate between Bitcoin services that are used to trade Bitcoin, transfer Bitcoin and spend Bitcoin. This would allow for a better understanding of the user's intention when adopting Bitcoin and further investigate how the user's intention may change depending on their compatibility and intention of use as noted by Moore and Benbasat (1991).

The fact that responses did not follow the theoretical model and underlying diffusions of innovation framework may be due to the fact that Bitcoin is not only a technology but also a currency, which has other driving factors that were well defined and considered in the scope of this study but may have been collectively interpreted as the hoarding construct, acting as a catch-all variable. The hoarding construct may be broken down to identify various other relationships that were not considered in the context of this study. Further research may look to uncover these correlations and assess the strength of the correlations with regard to by Moore and Benbasat (1991) and Rogers (1962)'s models on the diffusions of innovations. This would also aid in investigating the network externalities as mentioned by Jonker (2018) and how these may affect long term consumer and merchant adoption of Bitcoin and Bitcoin payment systems respectively.

References

1. Ally, M; Gardiner, M; Lane, M. (2015). The Potential Impact of Digital Currencies on the Australian Economy. Australasian Conference on Information Systems. 1 (1), 1-24.

2. Al-Saadi, H. (2014). Demystifying Ontology and Epistemology in research methods. University of Sheffield School of Education . 1 (1), 1-7

3. Ammous, S. (2013). Economics beyond Financial Intermediation. Available: http://www.capitalism.columbia.edu/. Last accessed 28 April 2016.

4. Ammous, S. (2015). Economics beyond Financial Intermediation: Digital Currencies' Possibilities for Growth, Poverty Alleviation, and International Development. The Journal of Private Enterprise. 30 (3), pg. 19-50.

5. Aker, J. and Mbiti, I. (2010). Mobile Phones and Economic Development in Africa. Center of Global Development. 1 (1), pg. 1-23.

6. Athey, S; Parashkevov, I; Sarukkai, S; Xia, J. (2017). Bitcoin Pricing, Adoption, and Usage: Theory and Evidence. Stanford Insitute of Economic Policy Research. 17 (14), pg. 1-6.

7. Barber, S., Boyen, X., Shi, E. and Uzun, E. (2012). Bitter to Better - How to make bitcoin a better currency. Lecture Notes in Computer Science. 11 (7397), pg. 399-414.

8. Bianchi, A. and Phillips, J. (2005). Psychological Predictors of Problem Mobile Phone Us. Cyberpsychology and Behavior (8)1, 39-50.

9. Borensztein, E., Gregorio, J. and Lee, J.W. (1998). How does foreign direct investment affect economic 1growth. Journal of International Economics. 45 (1), pg. 115-135.

10. Bryman, A. (2007). "The Research Question in Social Research: What is its Role?" International Journal of Social Research Methodology 10 (2007): pg. 5-20.

11. Budree, A. and Williams, K. (2013). Factors Influencing the Uptake of Mobile Banking in Developing Countries: A Case Study of M-Pesa in South Africa . Proceedings of 22nd International Business Research Conference, pg. 1-10.

12. Chapelle, A., Panayi, E., Peters, G. (2015). Trends in crypto-currencies and blockchain technologies: A monetary theory and regulation perspective. Available: http://arxiv.org/pdf/1508.04364.pdf. Last accessed 17th July 2015.

13. Clegg, A. (2014). Could Bitcoin Be A Financial Solution For Developing Economie. Available: http://www.cs.bham.ac.uk/~rjh/courses/ResearchTopicsInHCI/2013-14/Papers/Alastair.pdf. Last accessed 28 April 2016.

14. Dion, D. (2013). I'll Gladly Trade You Two Bits on Tuesday for a Byte Today: Bitcoin, Regulating Fraud in the E-Conomy of Hacker-Cash.University of Illinois Journal of Law, Technology & Policy. 2013 (165), pg. 168-198.

15. Douget, J. (2014). The Nature of the Form: Legal and Regulatory Issues Surrounding the Bitcoin Digital Currency System. Louisiana Law Review. 73 (4), pg. 1120-1144.

16. Fergusson, A. (2010). When Money Dies: The Nightmare of Deficit Spending, Devaluation, and Hyperinflation in Weimar Germany. London: Public Affrairs Books. pg. 34-44.

17. Francois, A. (2017). How to use Luno bitcoin exchange to buy bitcoin in South Africa. Available: https://www.bitcoinzar.co.za/how-to-buy-bitcoin-luno-exchange/. Last accessed 23th Jan 2019.

18. GSM Association. (2013). Sub-Saharan Africa Mobile Economy 2013. New York: GSM Association (12) 1 pg. 18-19.

19. GSM Association. (2015). The Mobile Economy 2015. Available: http://gsmamobileeconomy.com/GSMA_Global_Mobile_Economy_Report_2015.pdf. Last accessed 28 April 2016.

20. Institute for Work & Health Toronto. (2015). Cross-sectional vs. longitudinal studies. At work. 81 (1), pg. 2-8.

21. Kumar, A. and Lim, H. (2008). Age differences in mobile service perceptions: comparison of Generation Y and baby boomer. Journal of Services Marketing, pg. 568-577.

22. Hanley, B. (2014). The False Premises and Promises of Bitcoin . Available: http://www.academia.edu/9877338/The_False_Premises_and_Promises_of_Bitcoin._In_arXiv.org. Last accessed 28 April 2016.

23. Higgins, S. (2017). From $900 to $20,000: Bitcoin's Historic 2017 Price Run Revisited. Available : https://www.coindesk.com/900-20000-bitcoins-historic-2017-price-run-revisited. Last accessed 19th Jan 2019.

24. Hsieh, Y., Hsu, C.' Lee, Y. (2011). International Forum of Educational Technology & Society. Journal of Educational Technology & Society. 14 (4), pg. 124-137.

25. Hxt. (2014). South Africas Mobile Penetration Rate is 133%. Available: http://www.htxt.co.za/2014/10/23/south-africas-mobile-penetration-is-133/. Last accessed 28 April 2016.

26. Jonker, N. (2018). What drives bitcoin adoption by retailers? De Nederlandsche Bank EuroSysteem. 585 (1), pg. 21-25.

27. Lechman, E. (2014). ICT Diffusion Economic development in Developing countries: Empirical Evidence for 46 Developing Countries. In: Kaur, H; Tao, X ICTs and the Millennium Development Goals - A United Nations Perspective . Southern Queensland : Springer Verlag. 19-38.

28. Leard Statistics. (2018). Pearson's Product-Moment Correlation using SPSS Statistics. Available: https://statistics.laerd.com/spss-tutorials/pearsons-product-moment-correlation-using-spss-statistics.php. Last accessed 15th Jan 2019.

29. Lim, J. (2015). A Facilitative Model for Cryptocurrency Regulation in Singapore. In: Chuen, L Handbook of digital currency, bitcoin, innovation, financial instruments and big data. Singapore: Elsevier. pg. 361-379.

30. Maxwell, J.A. (2010). What Is Realism, and Why Should Qualitative Researchers Care? In J.A. Maxwell: A Realist Approach for Qualitative Research. George Mason University: Sage, pg. 3-13.

31. May, H. and Hearn, G. (2005). The mobile phone as media. *International Journal of Cultural Studies* (8) 2, pg. 195-211.

32. Metcalfe, S. Ramlogan, R. (2008). Innovation systems and the competitive process in developing economies. The Quarterly Review of Economics and Finance. 48 (1), pg. 433-446.

33. Moore,G. and Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. Information Systems Research. 2 (3), pg. 192-222.

34. Mukabi, B., Vu, N. (2019). Cryptocurrency as a Payment Method in the Retail Industry. Telematics and Informatics. 1 (1), pg. 1-22.

35. Mukoyama, T (2003). A Theory of Technology Diffusion. EconWPA. 1 (1), 1-14.

36. Mwangi, N. (2012). Adoption Of Bitcoin In Kenya, A Case Study Of Bitpesa. Available: http://erepository.uonbi.ac.ke/handle/11295/74669. Last accessed 18th July 2016.

37. Nawrot, O. (2019). Accepting Blockchain Tech to Increase Bitcoin Acceptance. Economic Crime Forensics Capstones. 37 (1), p25-33.

38. Osabuohien ,E; Efobi, U. (2012). Technology Diffusion and Economic Progress in Africa: Challenges and Opportunities. In: Ekekwe, N; Islam, N Disruptive Technologies, Innovation and Global Redesign: Emerging Implications . Nigeria: ICG Global. 425-460.

39. Reinart, E. (2004). Technical change and the dynamics of income inequality. In: Reinert , E Globalization, Economic Development and Inequality An Alternative Perspective. Massachusetts: Edward Elgar Publishing Limited pg. 217-223.

40. Pearson. (2007). Understanding research philosophies and approaches. Retrieved May 9, 2014, from Pearson Education: http://wps.pearsoned.co.uk/ema_uk_he_saunders_resmethbus_4/51/13274/3398341.cw/

41. Rogers, E. (1962). Elements of diffusion. In: Rogers, E Diffusion of Innovations. London: Macmillan Publishers. pg 1-34.

42. Sahin, I. (2006) 'Detailed review of Rogers' Diffusion of Innovations Theory and Educational Technology-related studies based on Rogers' Theory, The Turkish Online Journal of Educational Technology, vol. 5(2), pp. 14-23.

43. Saunders, M. (2003). Research methods for business students, 5/e. Pearson Education India (1)1. Pg. 14-29.

44. Saunders, M; Lewis, P; Thornhill, A (2012). Understanding research philosophies and approaches. In: Research Methods for Business Studies (5th edition). London: FT Prentice Hall . 106.

45. Shahzad, F., Xiu, G., Wang, J. & Shahbaz, M. (2018). An empirical investigation on the adoption of cryptocurrencies among the people of mainland China. Technology in Society. 55 (1), pg. 33-40.

46. Spenkelink, H. (2014). The adoption process of cryptocurrencies. Identifying factors that influence the adoption of cryptocurrencies from a multiple stakeholder perspective. Available: http://essay.utwente.nl/65677/. Last accessed 14 April 2017.

47. Stevens, A. (2017), Digital currencies: Threats and opportunities for monetary policy, NBB Economic Review, Chapter 5, June 2017

48. Swan, M. (2015). Blockchain 3: Effeciency and coordination. In: McGovern,T Blockchain, blueprint for a new economy. United States of America: O'Reilly Media, Inc. pg 25-48.

49. Van Vliet, B. (2018). An Alternative Model of Metcalfe's Law for Valuing Bitcoin. Economics Letters, Forthcoming. Available SSRN: https://ssrn.com/abstract=3087398 or http://dx.doi.org/10.2139/ssrn.3087398. Last accessed 15 April 2020.

50. Wanaina, E. (2015). Mobile Data Propels Kenya's Internet Penetration to 69% of the Population. Available: http://www.techweez.com/2015/09/18/kenya-internet-penetration/. Last accessed 28 April 2016.

51. Walton, A. & Johnston, K. (2018). Exploring perceptions of Bitcoin adoption: The South African Virtual Community Perspective. Interdisciplinary Journal of Information, Knowledge & Management. 13 (4), pg. 165-182.

Appendix

Appendix A: Research Instrument

Construct	No.	Question	Answer				
	1	I have prior knowledge on Bitcoin	Yes				No
	2	I perform international fund transfers regularly	Yes				No
	3	Gender	Male				Female
	4	Age					
			Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
Voluntariness							
	5	I am expected to use Bitcoin for purchases					
	6	The use of Bitcoin is voluntary					
	7	Merchants do not expect me to use Bitcoin for purchases					
	8	Although it might be helpful, using Bitcoin for purchases is not compulsory					
Relative Advantage							
	9	Using Bitcoin enables me to transfer funds more efficiently					
	10	Using Bitcoin enables me to transfer funds more conveniently than other methods					
	11	Using Bitcoin enables me to					

		transfer funds more cheaply
	12	The disadvantages of using Bitcoin far outweigh the advantages
	13	Overall, using Bitcoin would improve my standard of living
Compatibility		
	14	Using Bitcoin is compatible with the way I usually transfer funds
	15	Using Bitcoin is completely compatible with my lifestyle
	16	Using Bitcoin fits in well with the way that I like to make payments
	17	Starting to use Bitcoin was simple and easy
Image		
	18	Using Bitcoin enhances my image within my peer group
	19	People who use Bitcoin services generally have a higher social status than those who don’t
	20	Using Bitcoin is a status symbol amongst my peer group
Ease of use		
	21	I believe that Bitcoin services are easy to use

	22	Using Bitcoin services requires a lot of mental effort
	23	Using Bitcoin services is normally frustrating
	24	Using bitcoin services is clear and understandable
	25	Learning how to use Bitcoin services was easy for me
Result Demonstrability		
	26	I would have no difficulty telling others about the results of using Bitcoin
	27	I believe I could communicate the consequences of using Bitcoin to others
	28	The results of using Bitcoin services were apparent to me
	29	I would have difficulty explaining why using Bitcoin services may or may not be beneficial
Visibility		
	30	I haven't seen what other people use Bitcoin services for
	31	In my social setting, the use of Bitcoin services is evident

	32	I have seen other people using Bitcoin services
	33	Bitcoin services are NOT very visible in my social setting
Trialability		
	34	I have had a great deal of opportunity to try other Bitcoin-like payment services
	35	I am able to try Bitcoin services before signing up
	36	I am able to try Bitcoin services for a trial period before choosing to continue
External Factors		
	37	I have easy access to the internet
	38	I am comfortable with making transactions online
	39	I trust that transactions that occur on Bitcoin and other cryptocurrencies are protected by the law
	40	I believe that I can get legal restitution should anything occur while transacting with Bitcoin and other cryptocurrencies
	41	I believe that Bitcoin is well regulated
	42	I believe that Bitcoin services

are backed by a
higher authority
like the
government

Ethics

SA 100 Form

	**RESEARCH ACCESS TO STUDENTS**	**DSA 100 (c)**

NOTES

1. This form must be FULLY completed by applicants who want to access UCT students for the purpose of research.
2. Please return the completed application form together with your research proposal. to: Moonira.Khan@uct.ac.za; or deliver to: Attention: Executive Director, Department of Student Affairs, North Lane, Steve Biko Students' Union, Room 7.22, Upper Campus, UCT.
3. The turnaround time for a reply is approximately 10 working days.
4. NB: It is the responsibility of the researcher/s to apply for ethical clearance and access to staff and/or students, respectively to (a) Faculty's 'Ethics in Research Committee' (EiRC), and (b) to the Executive Director, HR to access staff for research purposes and (c) Executive Director, Student Affairs to access students for research purposes.
5. For noting, a requirement of UCT (according to Senate policy) is that items (1) and (4) apply, even if prior clearance has been obtained by the researcher/s from any other institution.

SECTION A: RESEARCH APPLICANT/S DETAILS

Position	Staff / Student No	Title and Name	Contact Details (Email / Cell / land line)
A.1 Student Number	Kmnnji001	Mr Njinu Kimani	Kmnnji001@myuct.ac.za
A.2 Academic / PASS Staff No.			
A.3 Visiting Researcher ID No.			
A.4 University / Institution where employed / or a registered student	UCT	Address if not UCT: 1D Donne Street Observatory	
A.5 Faculty/Department/School	Commerce		
A.6 APPLICANTS DETAILS If different from above	**Title and Name**	**Tel.**	**Email**

SECTION B: RESEARCHER/S SUPERVISOR/S DETAILS

Position	Title and Name	Tel.	Email
B.1 Supervisor	Michael Kyobe		Michae.Kyobe@uct.ac.za

B.2 Co-Supervisor/s (a) (b)			

SECTION C: APPLICANT'S RESEARCH STUDY FIELD AND APPROVAL STATUS

C.1 Degree (if a student)	Master's in information systems
C.2 Research Project Title	Bitcoin adoption in South Africa, an end user perspective.
C.3 Research Proposal	Attached: Yes [v] No [ ]
C.4 Target Population	**UCT students aged 19 – 35**
C.5 Lead Researcher Details	If different from applicant:
C6. Will use research assistant/s	Yes [ ] No [n]
C.7 Research Methodology and Informed Consent:	A quantitative approach, A self-reporting questionnaire will be created, A positivist epistemology will be employed. See attached research design for more details.
C.8 Ethics Clearance Status	Approved by the EiRC: Yes [ ] No [n] If yes, attach copy and state the date and ref. no of EiRC approval. If awaiting response, provide the date of application. If no, indicate when an application will be made.

SECTION D: APPLICANT/S APPROVAL STATUS FOR ACCESS TO STUDENTS FOR RESEARCH PURPOSE
(*To be completed by the ED, DSA or Nominee)*

APPROVAL STATUS	**Approved / Not Approved**	**Applicant/s Ref. No.:**	**Comments:**	
	Yes [ ] No [n]		*Research may only be undertaken after ethics approval has been obtained from the relevant UCT's EiRC.*	
APPROVED BY:	**Designation**	**Name**	**Signature**	**Date**
	Executive Director Department of Student Affairs			