

# **AN INVESTIGATION INTO THE DIFFUSION OF THE CRYPTOCURRENCY INNOVATION**

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## ABSTRACT

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<p><b>Abstract</b></p> <p>The information age has dawned upon us through the comprehensive and boundless adoption of the internet; E-banking and smart-phones thus, causing a reliance on online transaction systems reducing the need to handle tangible cash notes. The current monetary system is arguably on the cusp of an evolutionary moment through the adoption of virtualised currencies, this phenomenon potentially possesses the next metamorphic step in contemporary global economic money.</p>		
<p>Cryptocurrency is a radical new innovation, and has become a widely debated topic over the past few years despite this, the topic of the diffusion of innovation and the procedures which the phenomenon needs to overcome have had relatively small amounts of academic attention in comparison to other fields of research. Therefore, this study aims to identify how cryptocurrency is diffusing through the diffusion of innovation model with the intention of identifying the current location of diffusion; this in turn will create a more universalised understanding of the phenomenon in regards to other radical innovations.</p>		
<p>Due to the nature of the study, the conducted research utilised a qualitative method. Additionally, the focus on collecting data which will positively reflect an academic study with the purpose of uncovering information in alignment with the research questions of the study at hand lead to an 'interpretivist' methodology. Hence, 10 interviews were conducted of which the interviewees came from a range of different countries allowing the researcher to identify information rich data. This approach allowed for two pathways of research to occur. Firstly, the non/potential investors of which had basic cryptocurrency knowledge and secondly, current users/investors of which had an overall understanding of the cryptocurrency phenomenon. Furthermore, the primary data alongside the utilisation of secondary survey questions and the literature allowed for a wider understanding of the phenomenon.</p>		
<p>The results of the study unveiled a range of trends and developments in the diffusion process. Accordingly, these findings advance the understanding of the micro, macro and psychological factors which are present in the diffusion of the cryptocurrency innovation. Thereby, the research draws attention to how a range of barriers synergistically working together requires a synergistic strategic approach from governments and individuals to surpass the current diffusion position and progress further, in turn increasing the chances of mainstream adoption.</p>		
<p><b>Keywords</b> Cryptocurrency, Diffusion, Innovation</p>		
<p><b>Location</b> Jyväskylä University Library</p>		

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## 1 INTRODUCTION

The origins of trade have been the concern of economists and anthropologists in the past with the purpose of tracing back history to relate the present functions of trade to their primeval beginnings and to discover the basic characteristics of how economies fashioned wealth (Robbins, 1947; Syed et al, 2016)

We understand that the origins of trade started with a bartering system, as the ages advanced, shifts occurred through the adoption of a monetary arrangement which utilised the usage of coins; creating a fair trade universalised system. Eventually, the transformation of currency from coin to paper occurred through the enrichment of print technology and thus became the standard trade system of the contemporary era (Plumpe, 2016).

However, the information age has dawned upon us through the comprehensive and boundless adoption of the internet; E-banking and smart-phones thus, causing a reliance on online transaction systems reducing the need to handle tangible cash notes. The current monetary system is arguably on the cusp of an evolutionary moment through the adoption of virtualised currencies, this phenomenon potentially possesses the next metamorphic step in contemporary global economic money (Hurlburt & Bojanova, 2014). In this period of consistent innovation the nature of the internet has given birth to an unprecedented phenomenon in the form of deregulated digital currency; cryptocurrency (Hurlburt and Bojanova, 2014).

Cryptocurrencies are a form of digital money which are rapidly emerging as an open-source, programmable digital currency system (Hern, 2018). They are overcoming traditional roles of banking as this form of peer-to-peer financial networking is a trusted mode of interaction without the need for a third party arbitration or verification.

These cryptocurrencies have the power to make money programmable, which in turn could release huge amounts of economic potential, giving way to the trans-global, distributed, decentralised and innovative trade exchange; promoting global economy as such currencies have the capability to be used anytime and anywhere involving minimal transaction costs (Duivestein & Savalle, 2014).

However, these contemporary events have been over-shadowed by the growing interest in the stability and in turn safety of the largest and most used global currencies. With successive rounds of quantitative easing; monetary policy in which the central bank creates new money electronically, in the US in 2008 and 2014 have been met with strong opposition and critique as the GDP in those chosen countries (US) struggled to gain more than 2 percent thereby, the cause having an effect through growth of wealth disparity and the Federal Reserve's prediction coming up consistently short on its inflation goals (Cox, 2017).

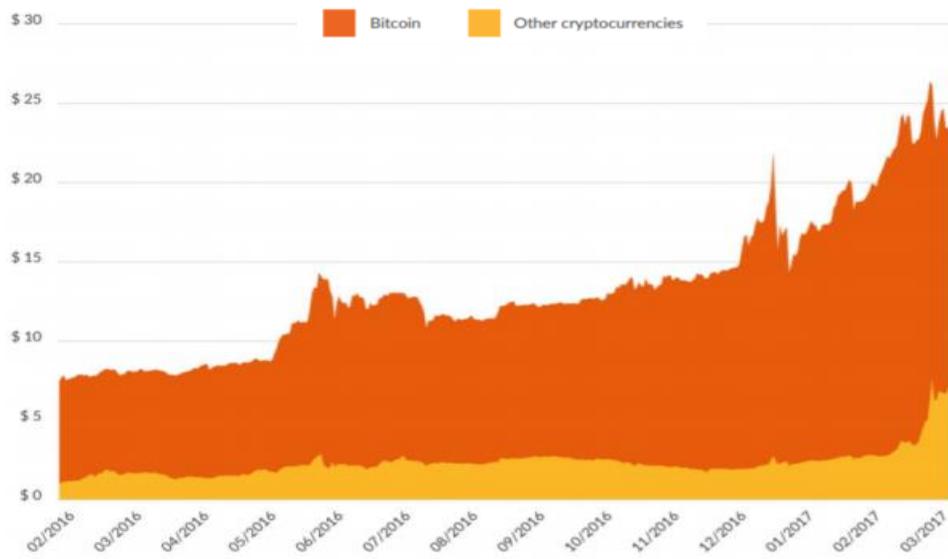
Accordingly, the failures of the Federal Reserve have caused many economists and politicians' to question whether or not the dollar will retain its value in the near and coming future. Equally, the same fears of instability are mirrored in Europe with the angst that the Euro may possess a similar fate. Admitting, bounteous amounts of people continue to put their trust into fiat currencies such as Euros and Dollars. However, there is a minority in this context which have turned to cryptocurrencies.

There are three major reasons why the topic of cryptocurrency is of significance. Firstly, the idea of "currency" is going through a radical psychological change; where fiat currencies presented to us by governments are being challenged by decentralised alternatives (Vigna and Casey, 2016; Heller, 2017). As a result of this advancement it could be argued that governments are in a position which they have never previously encountered; the rise of decentralised currencies (Gopalkrishnan and Hammond, 2015). The birth of currencies such as Bitcoin and Ethereum have disrupted the "governmental currency marketplace", fracturing the concept of currency, giving normal people the choice to confide in alternatives, potentially relinquishing the governmental dominance in this sector (Malekzadeh, 2015).

Secondly, we are currently in the digitalised era where more people, companies and governments are becoming dependent on digitalisation, this transformation has created a growing need for security and transparency (Turner et al, 2014). Block chain is essentially a giant globalised spread sheet that runs on millions of computers around the world. It's decentralised, distributed and open source, meaning that anyone can look at the coding; being able to see what is going on (Lee and Lee, 2017). It is a very pure form of peer to peer; not requiring powerful mediators to authenticate transactions (Frey et al, 2016 and Kiayias et al, 2017). Block chain, uses state of the art cryptography, with the ability to record every kind of information from marital records, medical records, land rights, financial services and currencies (Vukolic, 2015). Many argue that the implications for this technology are truly vast not just for financial applications but across society.

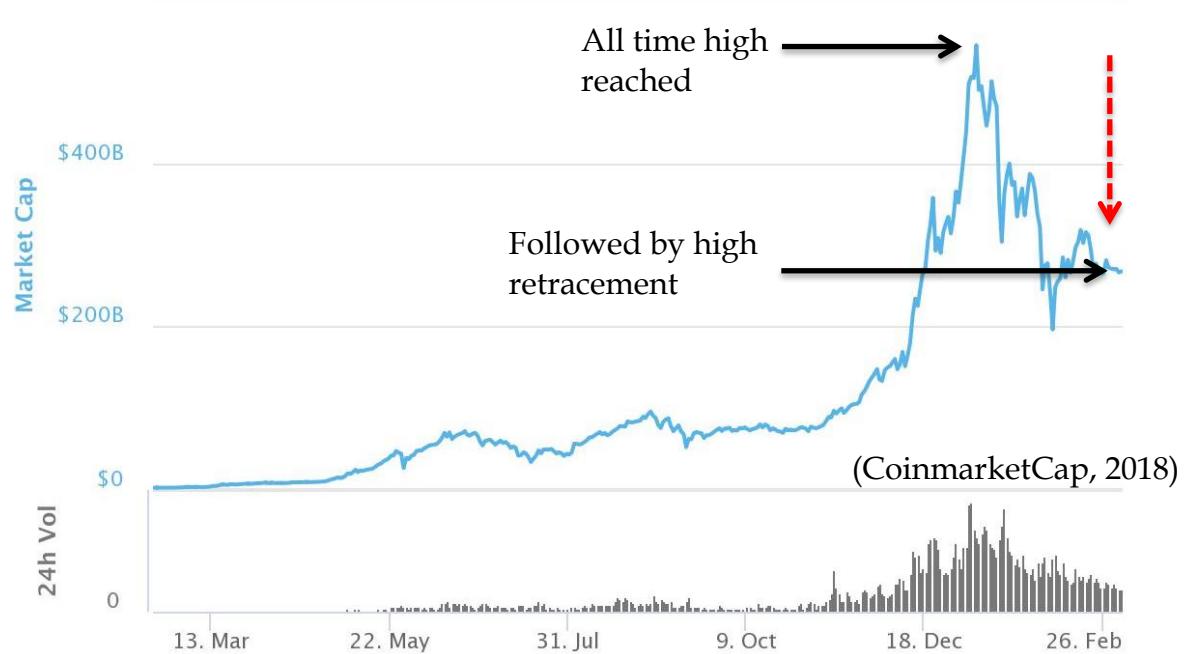
Thirdly, the incredible growth rate of cryptocurrency, especially over the past two years has shed light on the potential value that this medium of exchange can potentially bring to business and economies. It is important to note that the total crypto currency market capitalisation increased over 300% from February 2016 – March 2017 surpassing \$25 billion USD (see chart 1). However, from March 2017 – March 2018, the markets increased by a further 800%, reaching fluctuating heights of approximately 2200% growth before a retracement (see chart 2).

### Chart 1 - Bitcoin Dominance



(Hileman & Rauch, 2018)

### Chart 2 - Market capitalisation in Q1 2018



With such exponential growth it is unclear where this current technology is placed in terms of maturity and potential, therefore this will be explored further in this assignment.

There are three key reasons why the topic of the diffusion of cryptocurrency innovation is of interest. Firstly, the interest in this field stems from the authors passion of technological organisations and cryptocurrency, being a final year student and looking at potential options after graduating there is a hope that in the near future the writer will be working for a crypto currency company or potentially creating his own investment firm based on this phenomenon. Therefore, by obtaining a solid foundation of knowledge, this could help to gain a greater understanding of the mainstream reasons why people are currently not using cryptocurrency and why they would use it in the future thereby, potentially benefitting the author in achieving his ambition.

Secondly, the topic of cryptocurrency is an area the author is interested in understanding and learning more about because he is an investor in such technology therefore, acquiring knowledge on the current position of cryptocurrency in alignment with the diffusion of innovation model will allow for more accurate forecasting in terms of the market size.

Finally, during the initial research, it was clear that a lot of highly regarded academics such as Catalini and Tucker (2016) of which had focused on the diffusion of innovation and the role of early adopters from the perspective of Bitcoin alone. However, despite the importance of Bitcoin the growth in the industry suggests that the overall cryptocurrency phenomenon is undertaking a diverse expansion and thereby focusing on the phenomenon as a whole would allow for a greater understanding of the economic impact of the innovation from a globalised perspective.

## 1.1 AIM & RESEARCH QUESTIONS

### AIM:

*An Investigation into the Diffusion of the Cryptocurrency Innovation*

### RESEARCH QUESTIONS

*RQ1: What are the Nature and Benefits of Cryptocurrencies?*

*RQ2: What are the Barriers to the Expansion of Cryptocurrencies?*

*RQ3: What are the Potential Strategies for Overcoming Barriers to the Development of Cryptocurrencies?*

*RQ4: Does Cryptocurrency have a Future in the Global Economy?*

By exploring the nature and benefits of the cryptocurrency phenomenon from users and non/users perspectives alongside accredited literature, this research can illicit valuable information in understanding the barriers which prevent those from using and/or adopting with the possibility of unveiling potential strategies to overcome such barriers. An important point to comprehend is that this research has the primary function of identifying the process of the diffusion of innovation thereby, creating a universalised understanding of why the diffusion rate is in its current location based on a series of variables.

In order to achieve such an aim, the goal is to examine 10 individuals whom represent users and non-users thereby, the four research questions will act as a guideline with the purpose of uncovering detailed information which will help to discover a greater intrinsic understanding of why and where the current diffusion location is therefore, aiding in the process of understanding the future capabilities and usage in the global economic system.

## 1.2 BACKGROUND UNDERSTANDING OF CRYPTOCURRENCY

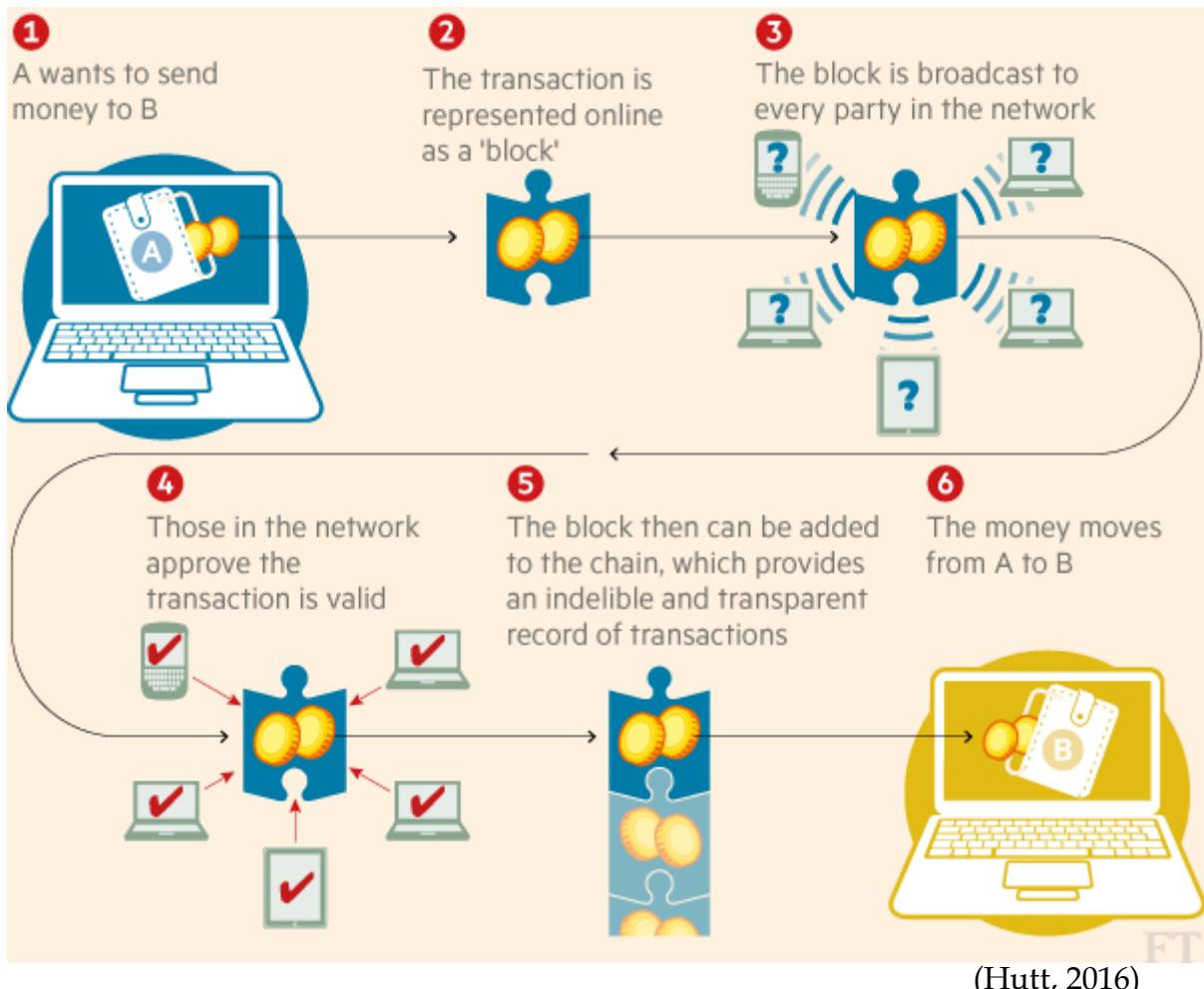
Preceding the historical financial crisis in 2008, due to the mortgage backed securities collapse, many people and companies lost large quantities of capital. However, in the year of 2008 an idea was presented from an unknown character by the name of Satoshi Nakamoto; that currency can be digitalised without centralised backed systems having power over those whom use their banks (Nakamoto, 2008).

The creator envisioned an idea where third party arbitration did not exist and thereby, would create a system where the money within such an arrangement could not be controlled nor manipulated in any circumstance and the name of the concept given at birth; Bitcoin.

The Bitcoin creation is arguably a revolution, providing a solution to the “double spending problem” (Nakamoto, 2008). This previous complication had formerly meant that online digitalised payments systems used by consumers required the participation of credit card processing organisations such as Visa or MasterCard (third party arbitration) to ensure that the money sent could not be spent twice with the intent of minimising fraud however, coming at a high financial cost to users. Nonetheless, In Nakamoto’s 2008 white paper he/she/it laid the plans for a potential solution to this issue through a protocol called the Block chain.

Block chain allows consumers and suppliers to connect directly, removing the need for a third party. Using cryptography; the science of coding and decoding exchanges so as to keep these monetary network secure, block chain provides a decentralised database, or more commonly known as a “digital ledger”, of transactions that everyone on the network can see (Dinh et al, 2017 and Katz et al, 1996). This network is essentially a chain of computers that must all approve an exchange before it can be verified and recorded, keeping the technology transparent and open for all to view (see image 1).

**Image 1 – How block chain works**



Moreover, author Alvin Lee Hong (2015) makes a powerful argument about Napster's influence on Bitcoin. Napster is the name given to free music-focused online services. It was founded as the one of the first peer-to-peer (P2P) file sharing sites that encouraged people to share digital audio files, such as; songs, and MP3 formatted music. However, the centralised infrastructure which was adopted by this company meant that all of their music and information files were stored in one location, causing the company to acquiesce to government regulation for copyright infringements.

On the other hand, Bitcoin which is at times referred to as the “Napster of Finance” has arguably learnt from the mistakes of its innovative predecessors issuing itself as a key proponent of decentralisation, which in turn poses a threat to the standard financial and payment sectors in modern society. Bitcoin and other cryptocurrencies alike possess disruptive attributes similar to the likes of BitTorrent and Napster whom had the nerve to threaten copyright and music industries (Hurlburt and Bojanova, 2014).

Currently, the general ambition for cryptocurrency has not yet accomplished the heights which are necessary for the phenomenon to become a far reaching success, its comparatively slow adoption rate has inferably been down to its negative relationship and connotations of theft and fraud, leaving a stigmatised persona around cryptocurrencies as a whole (Dupont, 2014). However, it is important to understand that all new technologies do not necessarily disrupt industries immediately; the curve of adoption goes through many obstacles before it reaches mainstream adoption, an example of such is none other than email.

E-mail, now considered an older technology but still used regularly faced similar challenges on its road to widespread diffusion; at birth the technology was used for approximately 15 years solely by engineers and scientific users, with the impression that it did not have the capability or need for mainstream usage. However, in the 1980s commercial usage became more apparent and in the 1990s widespread retail usage. In accordance with Paul (2018) CIO of Block Tower Capital suggests, that in order for a new technology to hop from hobbyist to commercialisation and then to average users requires three major factors, this will be addressed through the lens of e-mail adoption:

Firstly, the technology available has to be developed to a stage which is considered to be standardised and has the potential to bring value to an organisation or an individual user. Secondly, user interfaces (UI) had to be easy for non-engineers to use, ease of access and usage allows for mainstream adoption. Thirdly, the amount of users' needs to grow over time therefore, the more people that adopted email encouraged its growth and strength.

Similarly to e-mail, Bitcoin at birth was mainly used by engineers from 2009 – 2013. However, in 2013 Coinbase; an exchange organisation, made Bitcoin more accessible for those who were not as technological alliterate as engineers. Importantly, this process is arguably in alignment with what was previously stated by Paul (2018) however, this can be explained further in table 1.

**Table 1 – Hobbyist to Commercialisation steps**

<b>Steps</b>	<b>Bitcoin</b>
<b>Step 1</b>  (the technology available has to be developed to a stage which is considered to be standardised and has the potential to bring value to an organisation or an individual user).	2013/2014 early investors started to see the potential of Bitcoin and the market capitalisation started to increase in conjunction with the USD.
<b>Step 2</b>  (user interfaces (UI) had to be easy for non-engineers to use, ease of access and usage allows for mainstream adoption).	By 2017 Bitcoin is proven to be a stable protocol, with a range of user friendly interfaces and exchanges, including ATMs in larger cities.
<b>Step 3</b>  (The amount of users' needs to grow over time therefore, the more people that would adopt email encourages its growth and strength).	Garrick Hileman and Michel Rauchs study suggest around 45 million people are Bitcoin holders, representing 50% of the 1% global population of crypto holders.

(Hileman & Rauch, 2018)

Equivalent to email in the early 1990s, Bitcoin administers value today. The technology can transfer monetary value from one user to another, similar to fiat currency. Thereby, like email in 1994, it could be argued that crypto currency is a robust technology which is in the stages of becoming available for widespread usage. However, many authors believe that it is still early in terms of its adoption curve, leading us to ask; which factors influence the diffusion of the cryptocurrency innovation?

In order to answer this question concisely this study must go through a range of hurdles allowing for a divulge amount of information to be processed and extracted effectively. Therefore, conducive to meeting such demands this assignment will “jump through a series of hoops”:

### **1.3 Roadmap of the Study**

Firstly, the author will present the literature review in conjunction with the four main research questions of the study; this will include various critiques of current research with the intent of gathering a greater understanding of the current diffusion of crypto currency as a whole.

Secondly, in the chapter following, multiple theoretical frameworks will be displayed of which describe relevant theories to the innovation diffusion and adoption process, these models will be analysed and critiqued to determine their potential relationship with the diffusion of the crypto currency innovation.

Thirdly, the methodological approach will be presented, delving into the appropriateness of the study. Next, the findings; in this chapter the results of the qualitative interpretivist interviews will be presented in a way in which presents to the reader the most positive and negative trends associated with diffusion.

Finally, the conclusion of this study will present the reader with a capsule of the findings, critiques and concerns of the study with the main contribution focusing on answering the overall research question originally presented.

## 2 LITERATURE REVIEW

### 2.1 The Nature & Benefits of Cryptocurrencies

Cryptocurrency originally started as an anarchic computing subculture in which is arguably a cyber-spatial realisation of anarchism (Frisby, 2014). In 1992, Tim May, a computer scientist created a group of forward thinkers in which they discussed a new development called the internet. They discovered that beyond the realms of cash payments, no transaction that would take place could be private thereby; allowing governments, companies and other people to essentially track your behaviour.

However, some of the group members just wanted to find ways to protect their own privacy whereas, other members wanted the public to realise the potential power which the government would have over individuals. Arguably, their mistrust in the system originated from their experience when a member, Phil Zimmerman, a programmer, was under criminal investigation for creating privacy software called “Pretty Good Privacy” or PGP, which landed him in serious trouble with authorities of which argued he had violated the Arms Export Control Act, this started a movement in 1992 which would eventually become the origin of the cryptocurrency phenomenon (Frisby, 2014).

*“Just as a seemingly minor invention like barbed wire made possible the fencing-off of vast ranches and farms, thus altering forever the concepts of land and property rights in the frontier west, so too will the seemingly minor discovery out of an arcane branch of mathematics come to be the wire clippers which dismantle the barbed wire around intellectual property” – Timothy May 1992.*

Cryptocurrency is based on cryptography; cryptography's aim is to construct schemes or protocols that can accomplish certain tasks even in the presence of an adversary. A basic task in cryptography is to enable users to communicate securely over an insecure channel in a way that guarantees their safety (Coron, 2006). Thereby, in the case of cryptocurrencies it is used to ensure transactions are safe and secure for users, preventing users the same balance from being spent more than once, and to govern the supply of digital notes in circulation (William, 2016).

However, despite common belief Bitcoin was not the first cryptocurrency, commercially it all began in 1990 with DigiCash Inc ecash system. This currency was based on the paper created by its founders (Chaum, 1983 and Chaum et al, 1990). Payments were conducted offline and online adopting

cryptographical protocol which prevented double spending and applied a security layer through blind signatures for privacy purposes. Nonetheless, this ecash system was centralised unlike its successors and was available at various banks in the US and Finland. However, after the 1999 acquisition from InfoSpace, ecash faded into the background yet, over the following 20 years with many refinements including the application of the Blockchain first seen in the Bitcoin protocol and other advancements by various developers, it has evolved into the contemporary form of cryptocurrency.

Importantly, it is vital to address that cryptocurrency holds a similar yet different value base system to fiat currency; unlike fiat currencies, cryptocurrencies have a finite supply which means that currency cannot be manipulated and printed by a central bank to artificially boost an economy. However, cryptocurrencies have the same tendencies as fiat monies in terms of the fluctuation of pricing, value association and are used through a medium of exchange however; this exchange is purely intangible and exists on a different realm; the virtual world (Hauschildt, 2012). A key fundamental difference between standardised fiat monetary systems and cryptocurrencies is the utilisation of transparency which cryptocurrencies like Bitcoin provide proof of payment for all to see for every single transaction ever undertaken (Nakamoto, 2008).

Additionally, the largest cryptocurrencies by market capitalisation (Bitcoin and Ethereum) in the marketplace can be exchanged for significant world currencies. It is however, important to note that cryptocurrencies have no inherent value, their valuation is determined from the subjectivity which is given to them by a school of different factors including (table 2):

**Table 2 - Subjectivity of Cryptocurrency Value**

Factors	Explanation
Limited supply & demand	In cryptocurrency coins have a limited supply, if a currency has a high supply; usually the cost will be low. However, if a coin has a low supply, the cost tends to be higher.
Energy output (mining)	Mining (see page 71) uses a lot of energy in terms of computing power to facilitate transactions.
The utility and ease of use of the currency	In order for a currency to challenge fiat currencies they must present solutions to real world problems, one could be the costs incurred for overseas transactions.
Public perception of value	The value is created by demand and thereby public opinion impacts the price.
Bitcoin price	Bitcoin is the flagship of cryptocurrency and thereby

	tends to dictate the conditions of the marketplace (if Bitcoin goes down, everything tends to go down).
Media	Media have a large influence on the public perception and thereby impact the market (see pages 60-62)
Investors/ Investments	Investors share information about their investment strategies and thereby influence others
Scams	Due to the current situation of cryptocurrency being fairly deregulated, some organisations have displayed malice action through fraudulent schemes through ICOs (initial coin offerings)
Confidence in traditional systems	Governmental issues, bank problems have caused confidence to be shaken and some people are deciding to use cryptocurrency opposed to fiat
Legal and governmental issues	Governments imposing taxation laws and potential regulations, alongside regular governmental discussions about the future of this sector
Social Media	There are a lot of online characters whom have a large following and thereby an influential factor on the price fluctuations of certain currencies

(Shen, 2017)

However, despite many variables which have an influential factor on the market, the price of the most circulated currency; Bitcoin has multiplied almost 1 million times since 2010 (Shen, 2017). Thereby, displaying mesmerising growth with many authors claiming that this growth originates from the confused situation after the 2008 global economic crisis, where others sort refuge in a currency which could not be controlled by one entity.

Despite this, Bitcoin saw the most growth after the worst of the effects of the economic crisis had worn off and later again in 2017, highlighting one key point: cryptocurrencies satisfy a gap in the monetary market currently not met by existing monetary systems (Ahama and Varghese, 2013). Arguably, cryptocurrencies possess appealing characteristics currently not attributable to fiat monetary systems, confirmed by its rapid growth in recent years.

During cryptocurrencies relatively short current life span, the technology has been looked at sceptically, struggling to gain a solid reputation with the general populous (Rey, 2017). Arguably, this is due to the fact that the technology itself is new and is built on different technological architecture which is more complex than current means of payment. Despite the general public's unease for such an innovation it arguably has the potential to provide users with benefits.

Rey (2017) agrees with the previous contention, stating that cryptocurrencies are purposefully intended to be decentralised therefore; the protocol works on peer to peer transfers with no intermediary in the middle. By avoiding a middle man, cryptocurrency inherently avoids the current costly centralised system, where money is determined, regulated and controlled by a single entity such as the central bank or the government.

The decentralised systems possess many advantages; firstly, decentralised currencies are not controlled by governments and monetary policies therefore, they cannot be manipulated to a degree which could cause an economic disaster (Rey, 2017). Secondly, Pekanics (2016) adds that, decentralised networks are more likely to be open development platforms; this can be seen in social media sites such as Reddit which bears witness to developers adding tools, products and services on top of existing currencies to aid and boost the cryptocurrency economy (GSDR, 2011). However, Hauschmidt (2012) disputes that security is an indirect advantage of decentralisation as the way in which the Blockchain has been created facilitates security measures, which by today's technology makes it impossible to hack.

However, security on a personal level can be breached which presents problems such as loss of personal funds from a private ledger or an exchange where the money is being held. Nonetheless, Grinberg (2012) argues that even if a large amount of users' funds were stolen by hackers, it would not impact the overall system. 6 years after this statement was made a group of hackers tested Grinberg's statement by stealing approximately \$170 million dollars' worth of Nano (NANO) coins; 17 million units approximately 13% of the circulating supply. However, this activity impacted the price but not the currency itself, which remained un-breached and safe and recovered to the same price just 4 months later (Hatmaker, 2018).

Furthermore, Raymaekers (2015) displays that the protocol which cryptocurrencies are built on allows the transaction costs to be reduced as there is no need to go through an intermediary, cutting out the need for a middle man. Hayes (2016) agrees, arguing that cryptocurrencies can provide access to financial services to those whom do not have banks and those whom do have banking services focusing on the point that such technology allows for extremely low cost money transfers and remittances (Scott, 2016).

Nonetheless, Marian (2013), possesses an important statement about taxation; cryptocurrencies can be used for tax evasion and money laundering, further disputing that despite it being traditionally illegal wishing to evade tax and launder money can be done fairly easily and securely, and as cryptocurrencies

increase in popularity the impact will have greater levels of severity in terms of governments wanting to take action against the rise of the technology. However, it is important to note that this research was written in 2013, 5 years ago and today, the Inland Revenue Service has since determined that virtual currency is to be “treated as property for US federal tax purposes”; thereby any gains between the times cryptocurrency were bought and sold must be treated as capital gains (Klein, 2018).

Despite, the fact that the governments have placed charges on such, it is important to note that this provides recognition on a governmental level and potential governments may see the opportunities through cost reduction. In Plas-saras (2013) research he argues that with high incurring costs for just the United States central bank alone for the act of handling, processing currencies, accounting and security measures for storage of physical notes it costs approximately \$60 billion annually. Thereby, the cost reduction element not only has the potential to help individuals on a micro level but to help governments on a far wider macro scale.

On this note, the British government display evidence that there are more than 2.5 billion people of which do not have access to a financial system or a banking institution (Department for International Development, 2014). Darlington’s (2014) research agrees, arguing that the majority of these people are to be found in developing countries where corruption is ripe. However, Mims (2013) disagrees, disputing that the technological environment is changing especially in terms of the mobile phone infrastructure, making mobile banking a possibility with companies such as M-Pesa, processing 80 transactions a second for Kenyan mobile banking.

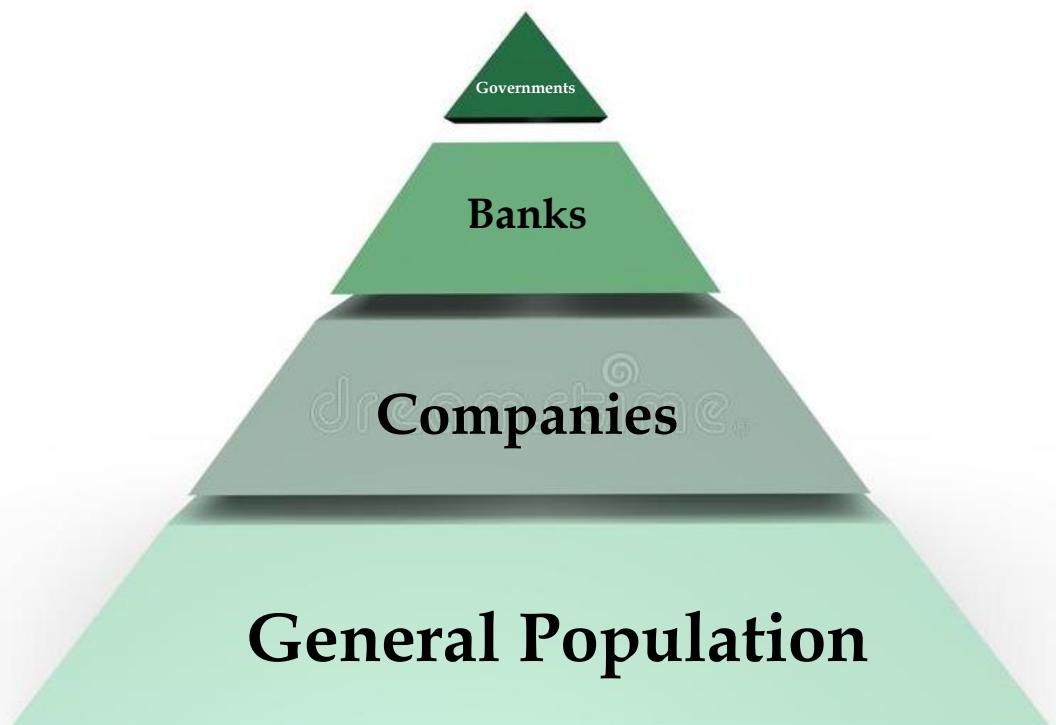
Despite this, over a billion people worldwide own a mobile device or smartphone and do not possess a bank account and thereby can only store finance in the form of cash (Department for International development, 2014). However, cryptocurrencies are accessible via smartphones, where users can set up wallets and interact with others instantly. Essentially currencies such as Bitcoin can allow those whom cannot undertake banking to instantly be able to trade locally and internationally, providing users with a safer, cheaper, faster and more private way of exchanging money than the leading African competitor M-Pesa (Hoyle, 2013).

## 2.2 Barriers to the Expansion of Cryptocurrencies

It could be argued that modern society has been constructed into four different layers; the first, the bottom layer of the society are the individual's and general populous. The second layer on top of the first are companies, a system created to innovate, create revenues expand and optimise efficiency and transaction costs. The third layer on top of the second would be banks, which handle money for corporations and individual people in a middleman gatekeeper position. Finally, the fourth layer is the government, which takes advantage of the banks' gatekeeper position to siphon off taxes from money flows in order to fund itself and governmental services (Crane, 2016 and Picciotto, 2017).

It is therefore important to note that, layer four; governments, completely depends on the previous three layers for its operations to work effectively (Falkvinge, 2017). However, what we see with innovations like Bitcoin, Ethereum and cryptocurrencies in general is they reduce the need to transact with banks, essentially cutting them out of the loop entirely, making them redundant. This resulting absence of anything where banks used to be creates an unfilled existence between the functional part of the economy, people and companies and governments who want funding.

**Image 2 – Layers of Society**

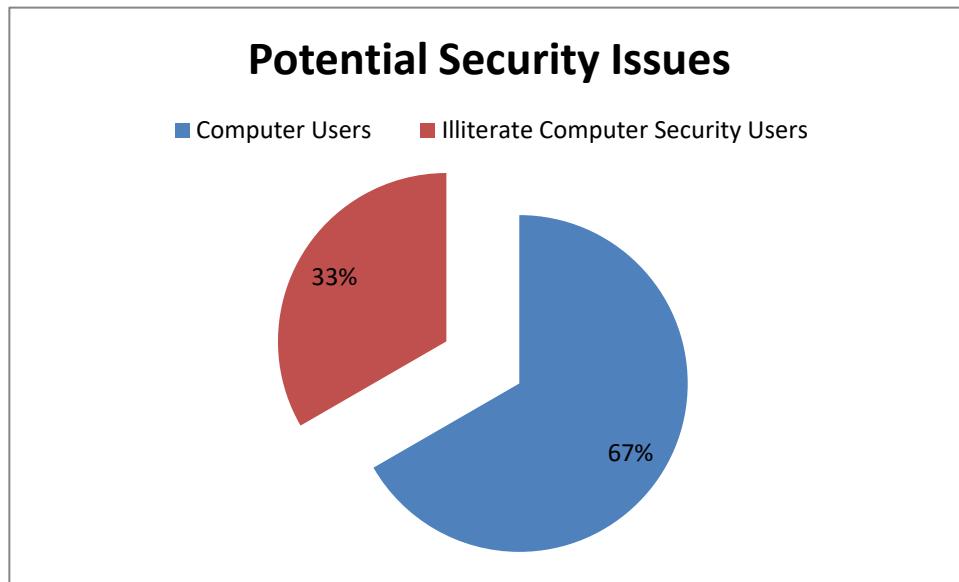


Therefore, it could be argued that the potential for this vacuum to occur could be a barrier in itself for cryptocurrency as a power shift of such magnitude has arguably never occurred in modern society thereby, future governments under a decentralised cryptocurrency economy may not be capable of organising economies, people and money in a centralised controlled manner to the degree in which they were used to.

However, US senator, Carper in early 2014 argued for the regulation of Bitcoin by the US treasury, stating that the technology should be given a chance to grow, aiding in the faster realisation of the positive side of cryptocurrency (Coindesk, 2014). Nonetheless, cryptocurrency arguably has a "dark side" which is exhibited in Kaspersky's (2014) research of which reveals that attacks related to cryptocurrencies have increased by 150%. Accordingly, these attacks were executed by hacking into Bitcoin users' wallets, executed by malware stored in downloadable content.

Barton (2010) research agrees with the previous contention, highlighting that there is a lack of network security knowledge from students; this research unveiled that only 67% of the people taking the security exam were able to pass a basic security test (Chart 3). On a macro scale, there are approximately 3 billion internet users globally, thereby, if the 33% of those whom failed were assumed to be the global average of those whom are security illiterate, it would mean that approximately 999 million people would be vulnerable to cyber-crime.

**Chart 3 – Potential Security Issues**



Building on the previous point, if Bitcoin or another cryptocurrency were to become a fundamental global currency with a much higher adoption rate than to-

day, hypothetically there would be around 1 billion potentially unaware targets. This assumption is based primarily on smaller studies however, it could be argued from a governmental stand point this would evoke a much higher level of cyber-crime and terrorism which the governments may not be able to control and therefore may want to control the potential outcomes now before it is too late. However, in a recent senate banking committee in early 2018, testimonies from the Chairman of the Commodity Futures Trading Commission (CFTC), Christopher Giancarlo and the Chairman of the Securities and Exchange Commission (SEC) Jay Clayton, of which understood and highlighted the potential problems with cryptocurrencies but, continued to cite that they need to be open minded in their approach:

*"We owe it to this new generation to respect their enthusiasm for virtual currencies, with a thoughtful and balance response, and not a dismissive one," - Christopher Giancarlo*

Alternatively J.P. Morgan CEO Jamie Dimon, dismissed digital currencies in late 2017, calling Bitcoin a fraud yet stating the technology it is built on; the Blockchain is a real technological advancement. Yet, Giancarlo disputed the previous citation in which he said that Bitcoin and Blockchain are not so easily separated, making note to that fact that there would be no ledger or Blockchain technology if Bitcoin was not founded (Shen, 2018).

It could therefore be argued that, there is a high level of uncertainty about cryptocurrency at the moment and this arguably has the power to shape the perception of this phenomenon. Enyi et al (2017) agrees, disputing that governments are currently unsure about the classification of cryptocurrencies, as some can be seen as securities and/or commodities, this lack of classification and ruling due to the complexity of cryptocurrencies as a whole means potentially that governments may have to reclassify cryptocurrencies in the future.

However, in the short term this arguably creates a negative stigma around cryptocurrency as when governments are unable to fully endorse a new technology it can have an influential factor on wider spread potential adoption. Whalen (2018) research agrees with the previous contention demon-

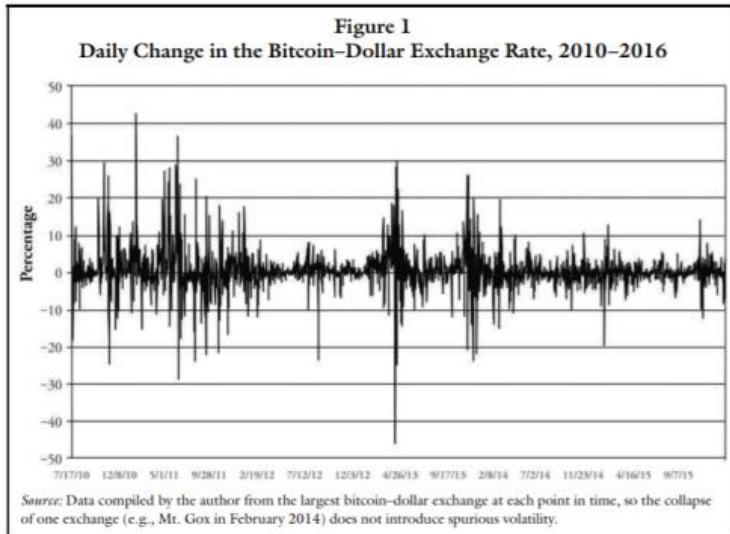
strating that technological policy can have an “endorsement effect” that legitimises and increases the salience of those areas. Thereby, the validation and enhanced attention towards that area provided by state or governmental policies can support the work of interested parties.

Nonetheless, The International Monetary Fund (IMF) responsible for overseeing the international monetary system and monitoring financial and economic policies, managing director Christina Lagarde argued that global usage of the IMFs in-house currency; the special drawing right (SDR) could be increased from the growth of digital currencies (Reuters, 2017). Therefore, the previous points raised in this study appear to show that the governments and organisations of which have influential powers have arguably started a shift of perception toward the acceptance of cryptocurrency. Schulze (2017) concurs, displaying evidence that the IMF have started to become more aware of the potential in terms of safety which cryptocurrencies and digitalised currencies hold in terms of benefitting those whom are prone to violence and theft in developing nations.

It is however, important to note the limitations of the IMF, as Bitcoin could essentially be used to launch a speculative attack on fiat currencies, with the potential to cause economic instability (Plassaras, 2013). Nevertheless, the argument posed by Luther (2013) of which global economic instability is a necessity for Bitcoin to gain greater levels of acceptance could remain a growing possibility. Arguably, to counter such instability the IMF would have to acquire some kind of control by buying as much Bitcoin as possible to maintain economic stability.

Furthermore, the proponents of the market’s volatility have also suggested instability however, to determine relativity in terms of instability we must look at fiat currencies. The USD – Bitcoin exchange has reached heights of 50% in either direction, and the currency regularly fluctuates plus and minus 10% daily/weekly. Conversely, the USD – EUR rate over the same period of time has never exceeded 2.5% in fluctuation in either direction. It could thereby be thought that this is not a basic problem in terms of scale which can be expected to be reduced as the volume of transactions increase, with the exception of its extreme fluctuations during its time below 1 dollar per Bitcoin as seen in the chart 4.

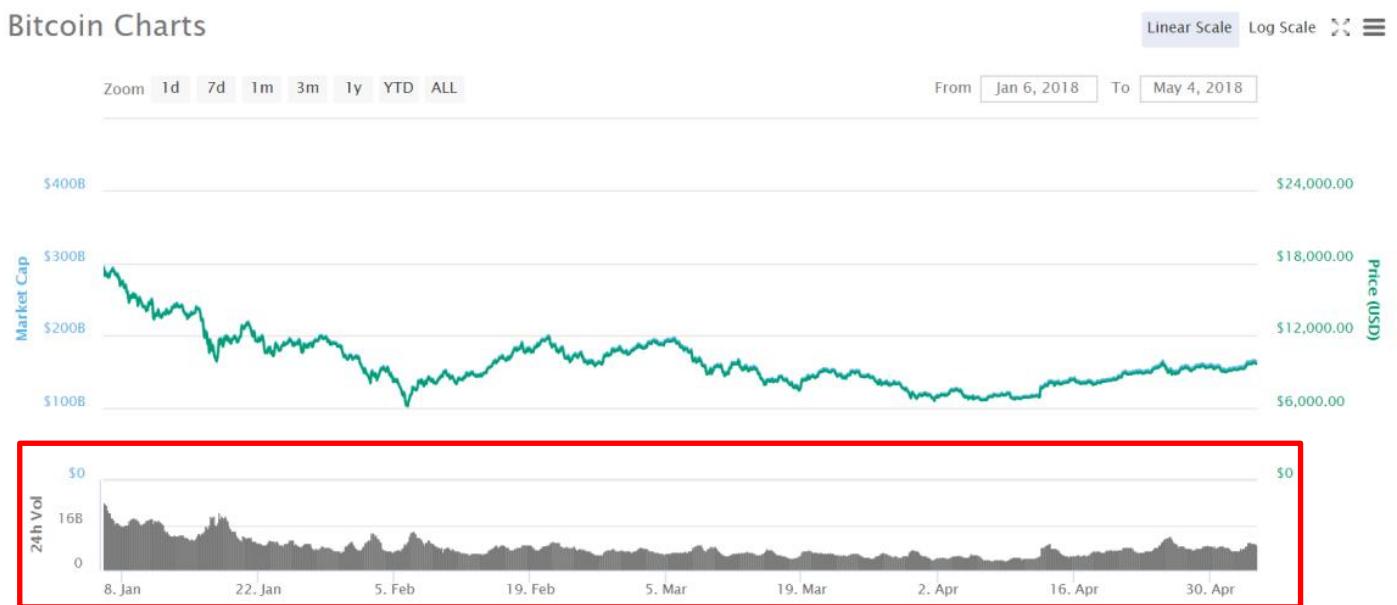
### Chart 4 – Change in Bitcoin to USD exchange rate



(Harwick, 2016)

Certainly, there is no shortage of disagreement within Harwick (2016) research which claims that there is no notable correlation between volatility, price or volume of transactions after surpassing \$10 and even past \$1,000, the same phenomenon continues to be exhibited today as seen in chart 5 below, suggesting that the previous research is yet to be out-dated concluding that the volatility of the marketplace is something which cannot be effectively understood or predicted.

### Chart 5 – Bitcoin Volume



(Coinmarketcap, 2018)

This point is further extenuated by the fluctuation of the top ten cryptocurrencies by market capitalisation, as seen in table 3 and 4; Bitcoin and Ethereum are the only two currencies of which have maintained their position however, The DAO which previously had a market capitalisation of over \$150 million now ceases to exist.

**Table 3 – 4<sup>th</sup> June 2016, Cryptocurrency Market Capitalisation**

▲ #	Name	Symbol	Market Cap	Price	Circulating Supply	Volume (24h)
1	Bitcoin	BTC	\$9,023,523,867	\$577.65	15,621,101	\$90,712,737
2	Ethereum	ETH	\$1,106,186,856	\$13.71	80,711,726	\$15,266,623
3	Litecoin	LTC	\$221,930,594	\$4.82	46,082,333	\$2,277,706
4	Ripple	XRP	\$202,242,593	\$0.005800	34,868,679,462 *	\$724,945
5	The DAO	DAO	\$150,814,757	\$0.128596	1,172,775,159 *	\$1,441,351
6	Dash	DASH	\$51,622,441	\$7.95		
7	Lisk	LSK	\$44,996,341	\$0.449963		
8	MaidSafeCoin	MAID	\$27,756,673	\$0.061334		
9	Dogecoin	DOGE	\$24,687,729	\$0.000236		
10	DigixDAO	DGD	\$20,071,643	\$10.04		

(Coinmarketcap, 2018)

From 2016 – 2018, Bitcoin market cap has grown approximately 1800%, the prices in general have increased massively and volatility has been shown in the sense that a lot of the larger currencies in 2016 either do not exist or have reduced in size of their relative market capitalisation

**Table 4 – 4<sup>th</sup> June 2018, Cryptocurrency Market Capitalis.**

▲ #	Name	Symbol	Market Cap	Price	Circulating Supply	Volume (24h)
1	Bitcoin	BTC	\$164,456,995,453	\$9,665.37	17,015,075	\$9,094,930,000
2	Ethereum	ETH	\$77,228,136,718	\$778.29	99,227,842	\$3,792,720,000
3	Ripple	XRP	\$35,087,500,684	\$0.895586	39,178,259,468 *	\$1,051,550,000
4	Bitcoin Cash	BCH	\$25,742,630,317	\$1,504.58	17,109,513	\$1,024,270,000
5	Cardano	ADA	\$9,446,761,494	\$0.364359	25,927,070,538 *	\$196,957,000
6	Litecoin	LTC	\$9,194,850,500	\$163.09	56,379,688	\$560,491,000
7	Stellar	XLM	\$7,980,353,746	\$0.429699	18,571,962,573 *	\$63,924,700
8	IOTA	MIOTA	\$6,707,423,502	\$2.41	2,779,530,283 *	\$169,243,000
9	NEO	NEO	\$5,424,295,500	\$83.45	65,000,000 *	\$176,223,000
10	Dash	DASH	\$3,894,943,954	\$483.71	8,052,263	\$149,927,000

Thereby, it could be contended that from a trading or investment perspective this volatility resembles past events such as the dotcom bubble, where in the late 1990s the market was arguably driven by market overconfidence and pure speculation, where it did not matter if the start-up companies were not generating any form of revenue. Arguably, the same “hype” can be seen in the cryptocurrency market which creates a “herding effect” (Wermers, 1999) this investment behaviour can create large rallies or selloffs based on little or no evidence of an event occurring, this was exhibited in Q4 of 2017 when Bitcoin grew from \$4,000 to almost \$20,000 and then dropped in Q1 2018 to almost \$6,000.

Additionally, Mesis and Zapranis (2014) research of the Athens stock exchange from 1995 – 2010 confirmed that there is a linear effect in terms of herding on all volatility measures considered thereby, concluding that stocks exhibiting a higher degree of herding or anti-herding will present higher levels of volatility, thereby herding itself can be seen as an additional risk factor (Staff, 2018). Despite the fact that cryptocurrencies are not seen as stocks it is important to understand that the general populous has a tendency to refer to cryptocurrencies as if they were and therefore general knowledge of the financial crisis and volatility is something which has disputably created a somewhat psychological barrier which needs to be broken down in order for wide spread adoption to occur.

### **2.3 Strategies for Overcoming the Barriers to the Expansion of Cryptocurrencies**

It is important to comprehend that barriers similar to the likes of which cryptocurrency is currently facing have appeared in society through a different form of currency, that of fiat, the solution to such an issue came in the form of monetary transitions. Nonetheless, it is vital to consider the fact that these monetary changes occurred under the supervision of governmental support and/or the existence of hyperinflation (William, 2016).

Selgin (1994) and Lotz and Rocheteau (2002) studies agree with William (2016) research of which argues that most new fiat currencies which have been put forward into motion over the period of the past 50 years have overcome potential barriers with governmental backing. Indeed, such currencies include the Somaliland shilling in late-1994 and the South Sudanese pound in mid-2011. It can be seen from Williams’s analysis that both of these new monetary systems share a range of similarities in terms of their reason for being introduced. Firstly, these currencies were both introduced by new governments after a civil war. Secondly, both currencies directly replaced existing money through govern-

ment organised fixed exchange rates. Thirdly, during the time since these currencies were endorsed and introduced by governments, both of these currencies have received positive adoption rates and have become widespread in their chosen countries.

Therefore, noting the compelling nature of such results it could be disputed that the prosperity of such money and other government issued currency changes such as the Euro replacing mainland European currencies such as French Francs are consistent with literature from multiple studies inquiring in the same matter. Equally, Hogan and Luther (2014), Li and Wright (1998) and Aiyagari and Wallace (1997) research conveys that a government has the power to influence the form of currency if it is committed to make large consistent transactions. Additionally, Goldberg (2012) and Ritter (1995) concur, with their research concluding that the same issue is in occurrence in terms of governmental tax collection and governments' having the power to limit the supply of money thereby determining which money is being used by controlling the in/outflow.

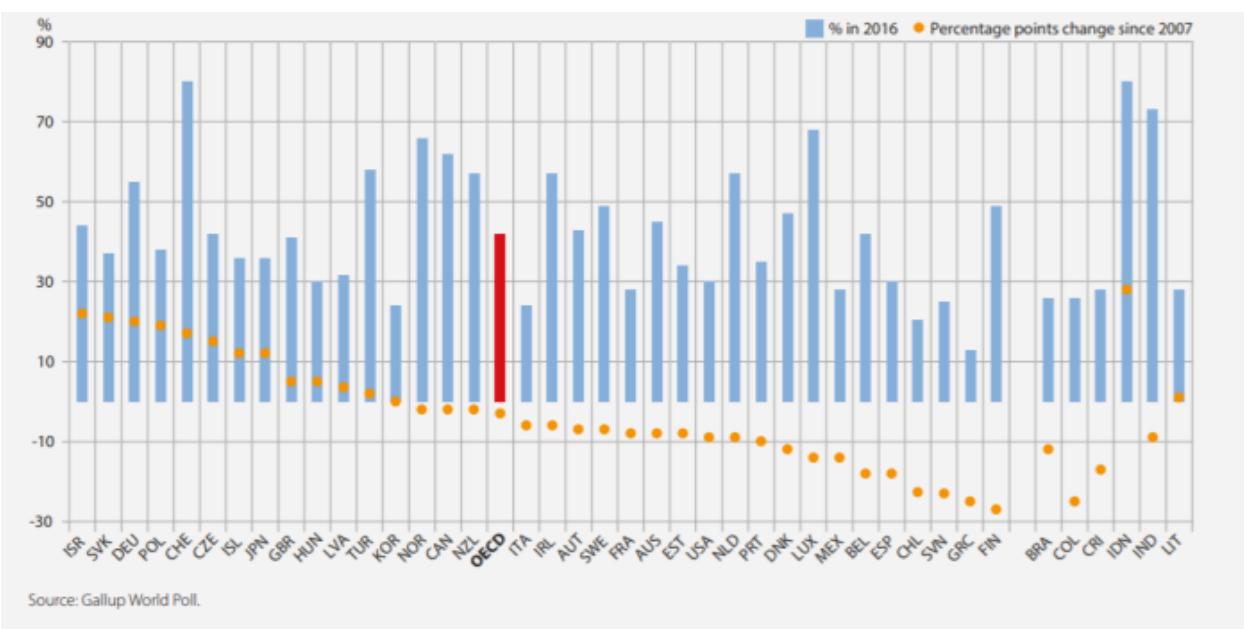
It could be argued that this power structure in the form of government has a large influential factor, Whalen (2018) research agrees with the previous contention demonstrating that technological policy can have an "endorsement effect" that legitimises and increases the salience of those areas. Thereby, the validation and enhanced attention towards that area provided by state or governmental policies can support the work of interested parties.

Noting the compelling nature of such evidence, it is still important to understand and recognise that current cryptocurrencies are forms of money which cannot be essentially dictated to by a centralised system such as the government. However, from the research obtained from Whalen (2018) study it is clear that the governmental endorsements alongside the introduction of a new currency have enabled these new forms of money to become widely adopted within given countries.

Nonetheless, it is important to note that there is another fundamental factor which does not include governmental endorsement which has caused people to find and seek a more reliant system; this has come in the form of hyperinflation. Resulting in unofficial dollarization, this is an act of when members of a given country decide to switch to the USD as a more reliable alternative to their own currency without governmental permission. During the years from 1984 - 1986 and 1988 - 1990 Bolivians and Peruvians took the choice of currency into their own hands and would use the USD due to the extreme inflation rates which caused their own currencies to deflate on a macro level (William, 2016).

However, one could argue that the “network effect”; a phenomenon where the more people of which participate in an event/service increases the value of that particular element plays a considerable role in terms of creating a strategy to overcome barriers to the cryptocurrency innovation (Uzzi, 1996). If we look at Westernised banking, it is clear that the current system is effective despite its flaws and this can be seen in the fact that there are billions of people which continue to trust their money with banks and governments (see chart 6) thereby increasing the uncertainty around a switch to cryptocurrency as less people utilise this service (Luther, 2014).

**Chart 6 - Confidence change in National Governments**



(OECD, 2018)

However, one could argue that money itself was once created and thereby may have been considered with the network effect to be an incompetent solution despite the possibility that it provided a more universalised fair system. Plassaras (2013) research supports the influential factors upheld by the network effect claiming that the more people using the prevailing monetary system the more uncertainty there will be around cryptocurrencies.

To support such a claim, it is arguably important to look back in history at a similar event where a powerful currency was replaced by another. This can be seen in the research paper; network effects in currency internationalisation (He and Yu, 2016) of which their research focuses on the dominance of the USD in the foreign exchange markets, arguably the USD reflects a very

strong network effect internationally. However, it is vital to note that this was not always the case, as a slow moving process occurred which witnessed a change in dominance from the Great British Pound (GBP) to the US dollar in the early twentieth century.

Therefore, the lesson that can be extracted from the previous study is that the main problem is time itself, in terms of general widespread acceptance. Currently, Bitcoin has not reached the heights which some believe it can achieve and therefore, current network effects may have the power to prevent further acceptance. Accordingly, the fundamental issue with replacing an existing currency requires widespread co-ordination to thereby advance past the network effects which are influential however, it could be argued that the cost of such co-ordination will become higher as the amount of early adopters reaches its saturation point (William, 2016).

Importantly, one issue must be addressed and that is the previous authors have had a tendency to focus on cryptocurrencies as a replacement mechanism. However, cryptocurrencies overall purpose is not exactly clear and may be envisioned as an alternative which coincides with such governmental fiat currencies. Nobel prize winning economist Joseph Stiglitz raises a point of contention which opposes the Euro currency arguing, that the EU did not take into consideration the inherent diversity, disputing that an assumption was made that a highly diverse region could be managed by the same macroeconomic standards and thereby proposed that the currency be divided into two categories; a strong euro for northern economies and a weaker euro for southern economies (Stiglitz, 2016 and Stiglitz and Heymann, 2014).

Arguably, if Joseph Stiglitz ideology came to fruition alongside the alternative adoption of cryptocurrencies, then we would have a range of different national currencies which would hypothetically facilitate and consider inherent diversity thereby, cryptocurrencies could be used effectively as a means of cross border transactions, allowing businesses and consumers to reap the advantages of an organised friendly digitalised currency, individuals of certain countries would diversify their own portfolios with the option of shifting to a digitalised currency when travelling abroad.

Economists today agree, arguing that a European wide digitalised currency would provide great benefits (Bordo and Levin, 2017). Fioramonti (2017) research concurs, disputing that such a currency would complement national currencies rather than substituting them, it could be argued that forcing a currency upon a new nation, group of countries or even the world will re-

quire a great deal of financing and will encounter resilience thereby, previous authors of which assume that cryptocurrency has the sole purpose of overtaking and controlling may be incorrect and may have created assumptions based on historical events such as the USD surpassing the GBP as the globally backed currency.

Accordingly, the Euro was a replacement currency for over 19 different existing currencies. The currency was not designed to act as an alternative just a replacement and thereby would incur large costs. To facilitate such change organised procedures would need to be emplaced in order for such a currency to take root into the economy. This can be seen in the following report by Eesti Pank (2010) of which formulated a design through their banking system to reveal the euro within Estonia; this change was coordinated into three steps:

Firstly, banks distributed euro coins and cash notes to institutions, guaranteeing rapid distribution. Secondly, a set duration of time was created where retailers had to display prices in Kroons and in Euros, converting the prices at an official exchange rate. Finally, the governments aided the private sector by rounding down state costs, taxes and environmental fees to help the taxpayers.

What is conclusive from the previous paragraph is the fact that if a currency is hoping to replace another it requires organisation from a range of different benefactors. However putting forward an alternative may arguably bypass such resistance, by having two currencies present in an ecosystem; one governmental and the other, digital this will provide the same convenience as the current system yet will administer the advantage of securing flexibility for national governments to deal with structural differences and changes in the global economic system, this would thereby create a harmonious relationship, such a system could thereby be built into the frameworks of institutions whereas, an outright acquisition of monetary integration would require high amounts of policy reforms (Fioramonti, 2017).

This type of harmonious relationship is currently being exhibited in China through a cryptocurrency called Walton Chain. Walton chain is already contracted by a range of governmental organisations to offer Internet of things (IoT) Blockchain solution to their cities and industrial zones, providing “smart city solutions” (Velden, 2018).

Additionally, as of January 2018 Walton chain announced that it is working with China mobile; government owned and the world's largest mobile phone operator by market capitalisation, this further indicates China's strong intent in becoming one of the world's largest national influencers in the cryptocurrency marketplace (Krishnan, 2018).

If we refer back to the barriers of cryptocurrency, the previous research in this section referred to the layers of society impeding the diffusion of cryptocurrency focusing on the power which governments have over the current system. However, if governments are starting to understand that cryptocurrencies are not detrimental to their own fiat money and can be used to further aid economic growth then there is potential that this in itself could entail a band wagon effect with other parts of the societal pyramid following suit.

Furthermore, this phenomenon could arguably be presently occurring as Amazon, a US company has announced through Amazon Web Services (AWS) of which is responsible for handling data management, server solution and cloud storage are introducing AWS Blockchain templates for Ethereum. Therefore, Amazon is allowing their current users to integrate with the Ethereum Blockchain (Amazon, 2018). It could be disputed that if companies with hundreds of billions of revenue such as Amazon are willing to adopt Blockchain systems then other organisations may pursue a similar path.

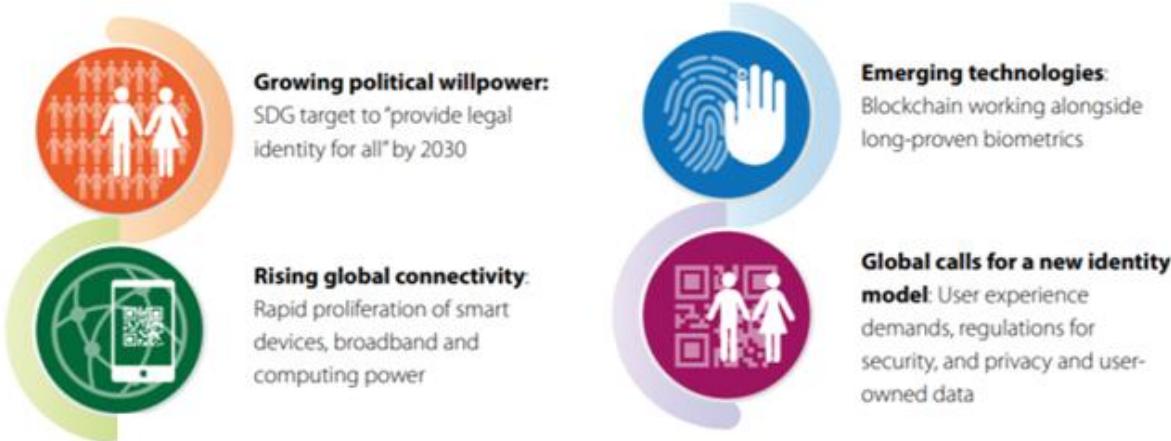
The strategy which is disputably being formulated by American firms and the Chinese government to become a leader in the acceptance of cryptocurrency may in itself provide a strategy for overcoming the barriers to such diffusion problems through its governmental policies to accept new currencies. Therefore, further adoption of such innovations from other governments will allow more organisations and governmental departments to seek potential usage of similar technology.

Consequently, ID2020 which stands for; "The Innovative Blockchain Identity Project" is a global initiative and a public/private partnership between the United Nations agencies alongside private sector companies such as Accenture, Microsoft and the Rockefeller Foundation. The aim of this initiative is to make an impact on the 1.1 billion people of which do not have official identities, access to education, healthcare, banking, voting and housing.

This United Nations foundation was created on the belief that the present convergence of trends such as Blockchain technology will provide opportunities to provide universal identities. The programme is being executed through the alliance of all of the companies of which are involved in the

ID2020, they seek to introduce a universal system by 2030 (seen in image 3). However, their short term goals are to experiment and test different technology solutions and partner governments and organisations for early implementation (OECD, 2018).

### Image 3 - ID2020 Goals



(OECD, 2018)

It could be argued that the ID2020 with the involvement of multinational enterprises, governmental and non-governmental institutions working in collaboration is acting as a prototype to discover potentially untapped innovative solutions to current technological, governmental and institutional issues which are occurring today. This in itself could help governments and such to see the potential innovative capabilities of such technologies and begin to aid in the regulation process. Arguably, this would further aid diffusion as the amount of manipulation and fraudulent activity which has been circulated around cryptocurrencies has prevented larger organisations from stepping into the industry.

Popper (2018) agrees, citing that the chief executive of NASDAQ; the second largest exchange in the world by market capitalisation, Adena Friedman, proposed in Q2 of 2018 that the organisation would be keen on creating a virtualised exchange if regulatory issues can be sorted out. However, it could be argued that the governmental barriers which once stood firmly are starting to transform under the weight of such interest relinquishing certain barriers, where once original scepticism stood is now being replaced with a curiosity to come forward, explore and experiment with such technology.

This can be witnessed with Intercontinental Exchange's effort to make Bitcoin available to a greater plethora of people and firms. Importantly, this company operates 23 regulated exchange marketplaces including the largest in the world; The New York Stock Exchange (NYSE). However, there are already smaller

companies working on such projects which are acting as pilot programmes for larger organisations which have higher levels of governmental influence (Popper, 2018). This disputably entails that one of the biggest barriers to cryptocurrency, which is the institution itself is starting to explore the possibilities of the technology.

*"I've been amazed that the strongest believers in cryptocurrency often start out the most skeptical. It's a healthy skepticism. But at some point the perception shifts, and for many institutions – I think we're finally there." - Paul Chou (Popper, 2018).*

## 2.4 The Future of Cryptocurrencies in the Global Economy

In the course of the twentieth century European and US government/s facilitated a crucial act in cultivating and spreading innovation, this focus on innovation often came under the strain of war. Nonetheless, during this period in time government organisations developed basic infrastructural technologies, which would eventually evolve over time to become the internet, medicinal advances and space travel. However, a change occurred at the end of the twentieth century which saw Ronald Reagan and Margaret Thatcher, turn their attention away from innovative governmental policies to focus on a market of liberalisation. This change in approach from both countries leaders suggested a more minimalist governmental role should be undertaken (World Government Summit, 2018).

However, over the past ten years there has been an increasing development in the understanding that governments play a key role in the ability to enable and spread innovation at a faster pace than just the private sector alone. Accordingly, governments comprehend that innovation is intertwined with technological advancement and industrial innovation. The previous sentiment expressed, embodies the non-orthodox views of Mazzucato (2018) and Pilling (2018) which have disputed that governments play an intrinsic role in driving industrial and economic change, their research displays that China is evident of such remarks, as many of its most promising sectors of technology from cryptocurrency to artificial intelligence have been the benefactors from state inclusion.

Arguably, with governments such as the Chinese endorsing cryptocurrencies to create smart cities, could this itself be a catalyst for the diffusion of innovation, in the sense that if one country starts to economically progress at a faster pace, then others may look to follow. Undoubtedly, the previous statement lies in

agreement with the UK government review of government's science and innovation policies titled "The Race to the Top". Accordingly, Turnsville (2007) research concurs disputing that at no time since the industrial revolution has the restructuring of the global economy been so apparent, with countries such as China seeking to upgrade their industries.

Turnsville (2007) proposes that around 30 years ago it would have been impossible to imagine the United Kingdom as a global leader of science and innovation in relation to the world economy. Further postulating that, failure to be successful in the new global economy, will be through ignorance of the challenge or the solution opposed to the resources to commit to such pursuit of "the race to the top".

However, it is important to note that this idea of a "race to the top" is not the mission of a single country but the mission of many, this in turn may have an influential factor in the development of cryptocurrency. In late 2011 US foreign policy coined a term "America's Pacific Century" then-Secretary Hillary Clinton cited that, "harnessing Asia's growth and dynamism is central to American economic and strategic interests" (Reynolds, 2015; Clinton, 2011).

However, what can be extracted from both parties is that economic interests are fundamental drivers for both China and the US nonetheless, where researchers and politicians dispute aspects of mutual beneficial policies between such nations, it could be argued that such authors are potentially ignoring the competitive element (Ikenberry, 2009; Clinton, 2011 and Bergsten, 2008). Thereby leading to a potential power struggle in relation to emerging markets and technological dominance, of which could project one country whilst adversely impacting the other, thereby intensifying competition as economic growth starts to slow down.

Accordingly, as the global economic super powers; United States and China begin to reach their maximum output this will present a large problem for both countries and potentially the global economy. There are two fundamental reasons for such:

Firstly, both countries share capitalist ideologies and the purpose of a capitalist economy is to have consistent growth in order to maintain viability in the global economy, therefore as both countries GDP outputs are squeezed and are nearing a saturation point if they do not find a solution, restructuring may need to occur which will present many problems within a single country which may need to be solved by means of universalised payment schemes (Tawney, 2017

and Levi-Faur, 2017). Secondly, in order to counter the first problem a search for new markets and regions with high growth rates need to be identified in order for either country to maintain its capitalistic ideologies.

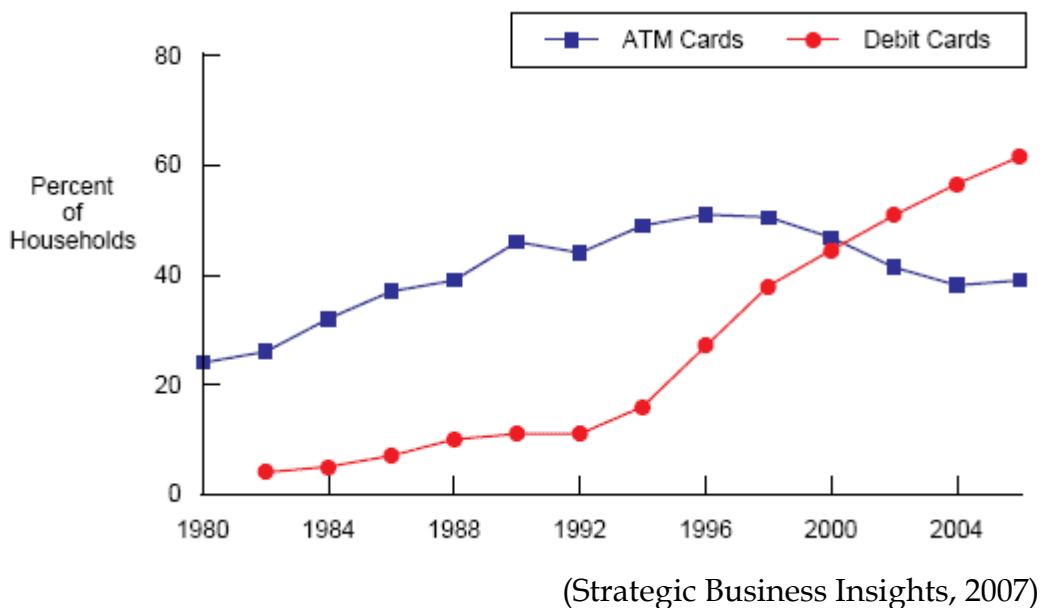
It could therefore be disputed that cryptocurrencies are an ever present solution to the possible issues which larger GDP governments are currently facing; the endorsement effects seen by the Chinese government alongside a change in governmental perception may create some form of economic race to become a leading facilitator for cryptocurrency. However, whilst this race is being undertaken cryptocurrencies potential also lies outside of a governmental battle for supremacy.

Subsequently, Nian et al (2015) research postulates that there is a clear similarity between the growth of the internet and the growth of cryptocurrency. Despite this, it is important to understand that innovations present themselves in different formats, the internet presented a platform to radically disrupt commerce and cryptocurrency provides a stage to disrupt finance. Furthermore, Nian argues that this is one of the first times in human history where technology is trying to change the fundamental system of finance, which has the potential to see future beings using digitalised versions of banks, which are unknown to the likes of today's banking system.

However, one could argue that the previous statement is partially incorrect as prior to cryptocurrency, Visa credit cards were a disruptive product which stimulated great change in the psychology of users and in the way in which the system operates. Visa started in 1958 after the Bank of America launched their first consumer credit card programme. The company then went international in 1974, expanding into debit cards in 1975. In 2018 Visa operates in more than 200 countries with products and services available on every modern device (Visa, 2018).

Despite its operational size in 2018, it is important to understand that it took Visa 16 years for their organisation to become internationalised and a further 30 years before reaching 60% adoption in the United States (see chart 7). However, cryptocurrency as a digitalised currency was born globalised with the capability to be transferred internationally, therefore it could be disputed that such currency has the capability to quickly overcome barriers which Visa encountered and thereby be utilised in sectors where cards and cash cannot enter - the internet realm.

**Chart 7 – Adoption Speed of Credit and Debit cards**



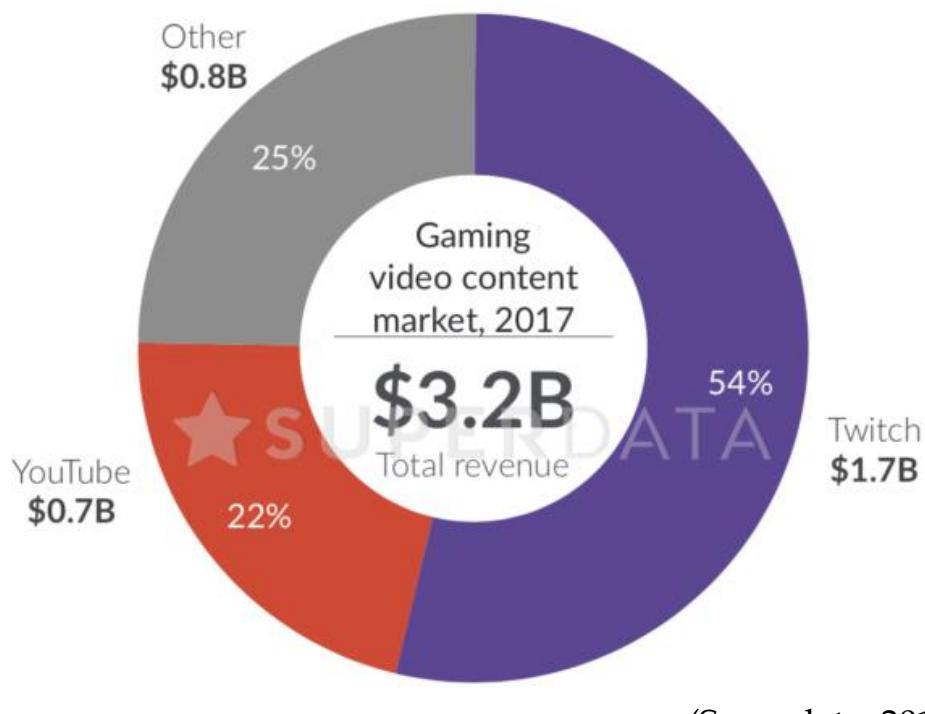
Subsequently, there are still many areas which remain untapped from an economic standpoint therefore, it could be disputed that the future of cryptocurrency in the global economy has the unique ability to tap into some of those potential pathways:

Firstly, it is important to note that virtualised currency may be seen as a new form of money in society but in the gaming community virtualised money has been conceptualised and effectively used for over a decade. Wolfson (2018) research argues that gamers in particular understand cryptocurrency because virtual money has been a part of gaming for such a long time, adding that there is a \$100 million dollar marketplace for in house World of Warcraft digital gold. This currency allows users to buy in game assets however, it's important to understand that it takes users a large sum of time to obtain such in game gold therefore, gamers commonly purchase the virtual coins with USD or other fiat currencies.

Building on the previous point, it could be argued that virtualised currencies and cryptocurrencies go hand in hand and this will provide a strong economic pathway for cryptocurrencies to adhere towards. This is primarily due to the fact that the gaming industry is growing rapidly, with new segments such as Esports, gaming video content and virtual reality have led to a dynamic marketplace with revenues exceeding \$108 billion (Superdata, 2018).

SuperData (2018) a company which have proprietary data partnerships and collect gaming information, their data displays evidence that Twitch; the gaming streaming service captures 54% of all gaming video content revenue by attracting a high spending audience. The users of the Twitch service regularly support their favourite content creators through subscriptions and donations and have far surpassed YouTube, displaying a shift in the media industry towards a surge in gaming (Chart 8).

**Chart 8 – Gaming Industry Video Content**

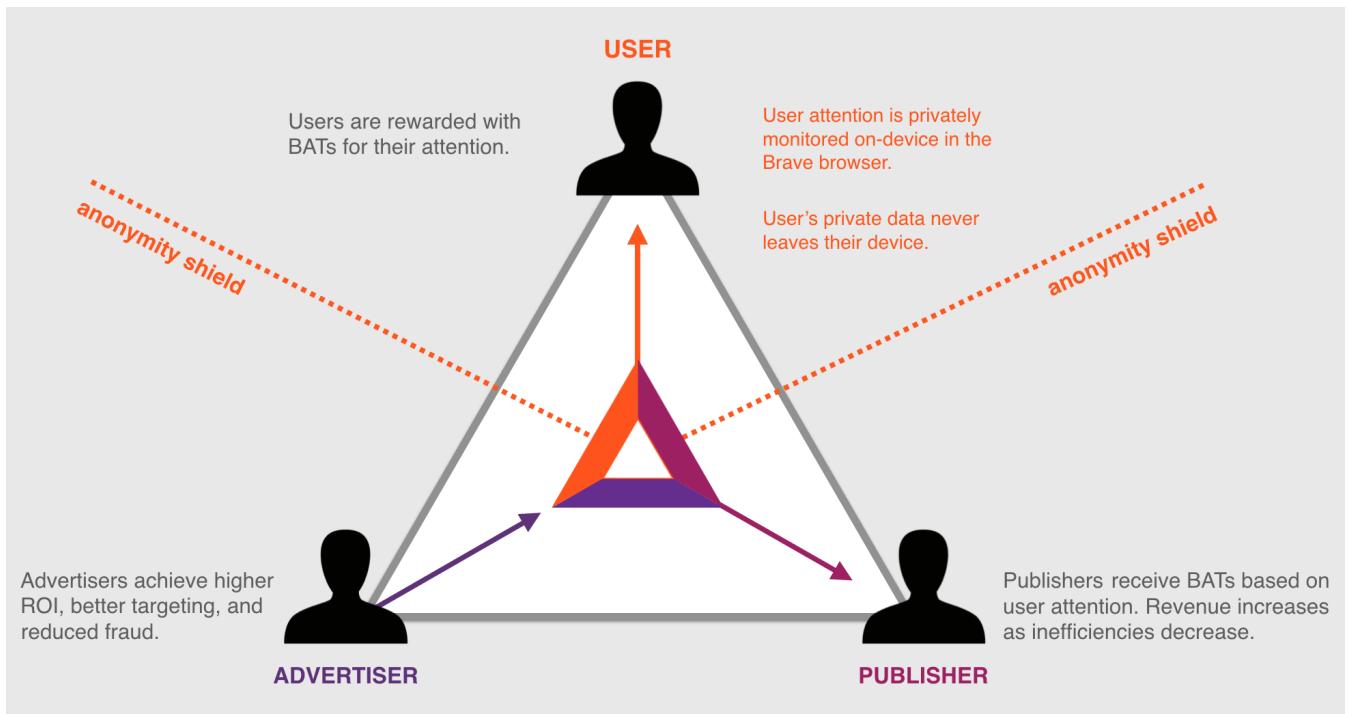


However, it is important to understand that gaming is not only intertwined with the internet itself but cryptocurrency as well and this triad of innovations has the capability to potentially shape the future economy towards one which represents the Internet of Things (IOT). The IoT is a concept of connecting any device to the internet, allowing devices to communicate with one another, with the purpose of potentially making living easier through technology (Greengard, 2015). Forbes Technology Council (2018) interviews from leaders in cryptocurrency and IoT concur, pointing out that theoretically cryptocurrency is the type of system which has the capacity to power the IoT, one interviewer gives the example of Bitcoin and Blockchain consumer devices being utilised for when your car needs oil, it will purchase it when needed, when your fridge identifies its low on milk, it automatically puts milk in your basket for your next pur-

chase, and your washing machine having the capability of buying more detergent when necessary (Dixon, J cited in Forbes technology Council, 2018).

However, Rajan (2016) enhances the previous debate by postulating that the IoT will drive such micro transactions, imposing the idea that cryptocurrencies will feature heavily in such transactions due to their ability to effectively interchange with services on micro and macro level. Menezes (2018) article agrees, it would appear that cryptocurrencies, gaming, and internet applications are starting to work in synergy to provide a greater benefit to their users. An example of such can be witnessed from an internet browsing company called Brave Browser, which includes a system called “Brave Payments” which is a built in method for supporting content creators through a cryptocurrency called Basic Attention Token (BAT), this is integrated into their browser; therefore members of the audience can use their cryptocurrency to support their favourite creators on YouTube and Twitch, in turn creating a synergistic relationship (see image 2)

**Image 2 – Basic Attention Token (BAT) ability**



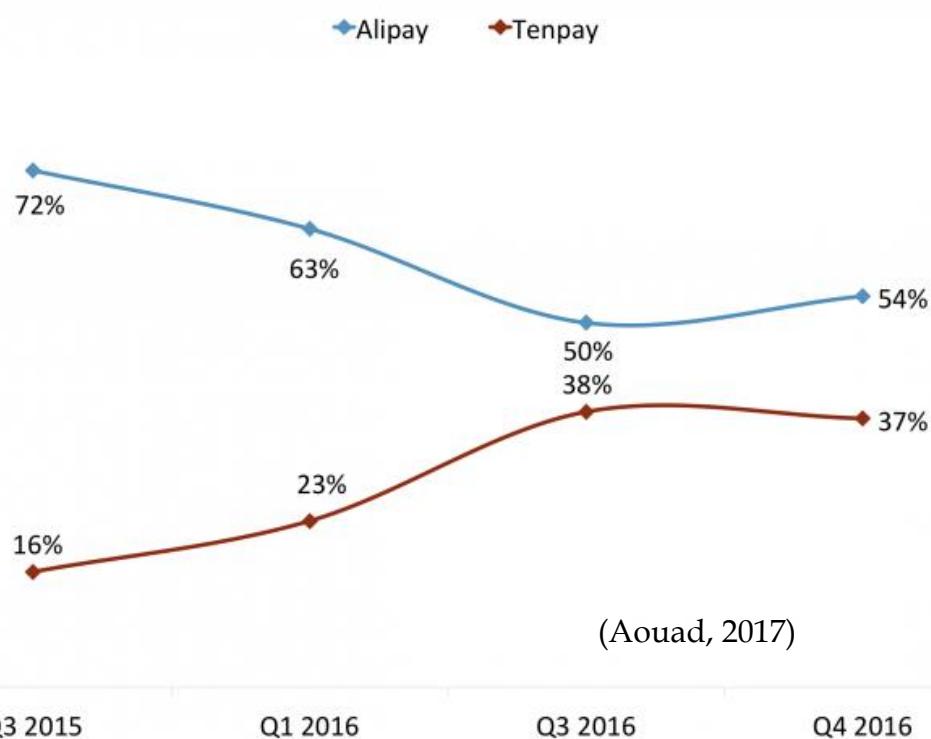
(Basicattentiontoken, 2018)

However, building on the previous points, it is important to acknowledge that the internet is the cause of the effectual impact on money transaction methods in the last decade. This consequence of innovation has created a surge in financial technology companies coming to fruition, allowing a range of alternative payment systems to challenge traditional payment methods (Foster et al, 1999; Bourgeois, 2010 and Olsen, 2013).

Koley (2014) research disagrees with the previous contention, reporting that the MasterCard and Visa are still experiencing high annual levels of growth of around 10% each in 2014. Similarly in 2017, MasterCard's revenue increased a further 20% from the previous year, with Visa increasing by exactly the same amount and forecasting to double their revenue by 2021 (Trefis, 2018; MasterCard, 2018).

Importantly, Aouad (2017) research disproves the previous contention by facilitating evidence which shows that despite high growth rates in traditional systems as previously stated, the growth rates from "FinTech" companies such as Union Pay have growth rates of at least 100% higher, with companies such as AliPay and TenPay completely dominating the Chinese marketplace (as seen in chart 9). Similarly, an identical trend appears to be occurring in both the Far East and in the West with companies such as PayPal becoming a major player in online payments, alongside Google and Apple which offer payment solutions which have been quickly adopted internationally since their introduction (Gonggrijp et al, 2013; Conrad, 2007; Pogue, 2015 and Dempsey, 2015).

**Chart 9 - Market Share of Chinese mobile payment services**



Arguably, the current growth in this market and the forecasted compound annual growth of 80% between 2015 and 2020, suggests that consumer behaviour is being altered through the adoption of viable alternatives to credit and debit cards. Nonetheless, despite such change and in such short time, it is important to note that these payment systems are still connected to regular bank accounts and a traditional notion of money (Baur et al, 2015).

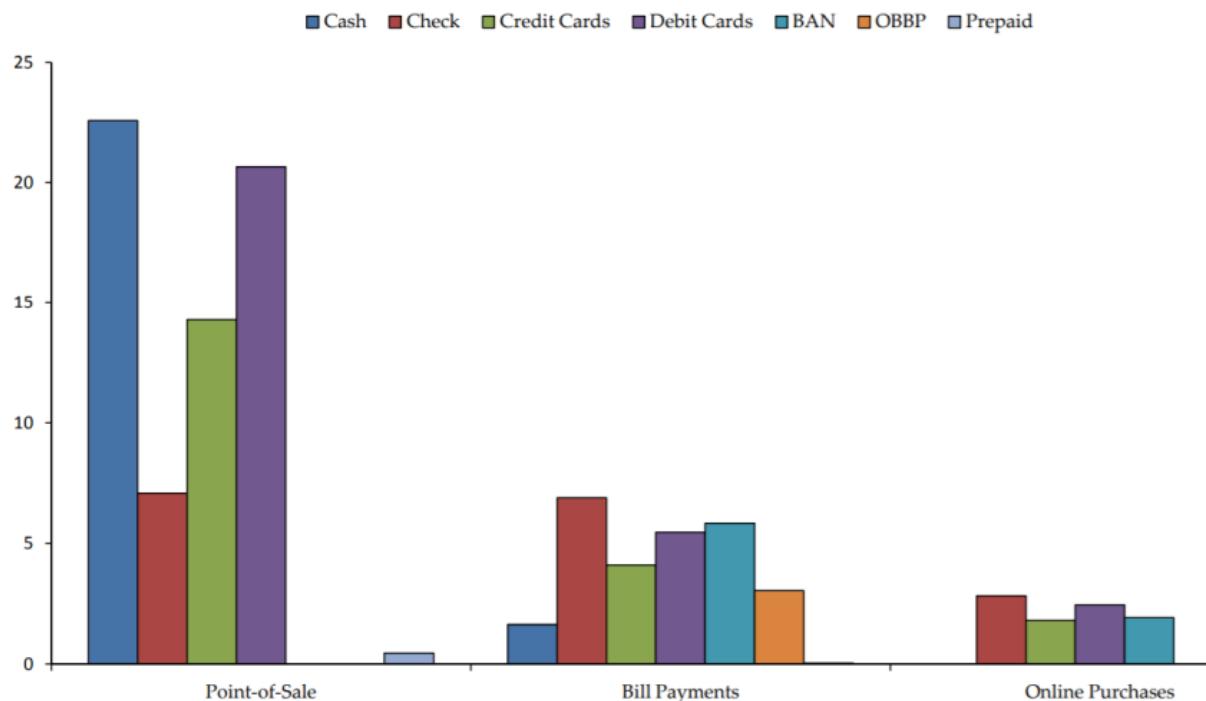
Nian et al (2015) concurs, pointing out those payment systems such as credit cards and PayPal will for a period of time in the future remain the most popular online payment method. Pointing out however, that issues with credit cards such as having to type out numbers, details, security information where met with resistance at first yet, over a period of time became more tolerated as the system advanced and allowed for easier user interaction.

However, Papilloud and Haesler (2014) interviews with business merchants counteracts Nian's point; displaying an eagerness to adopt cryptocurrency however, as a collective, an understanding was found from the interviews which affirms that widespread adoption in terms of timing cannot be judged effectively as there are so many variables to consider. Regardless of such, a wide majority of the interviewees mentioned the power of cryptocurrency in alliance with the Blockchain, being under the impression that it has the potential to be far reaching and disruptive on a micro and macroeconomic level.

Luther (2016) acknowledges the preceding argument, building on the macroeconomics element, he disputes that the most feasible environment for cryptocurrencies to achieve wide spread acceptance would be to enter the regions where fiat currency is ill-managed thereby, in such a scenario the advantages may be much greater than in countries where the banking system is satisfactory, justifying the cost and necessary organisation required for switching to a digital currency.

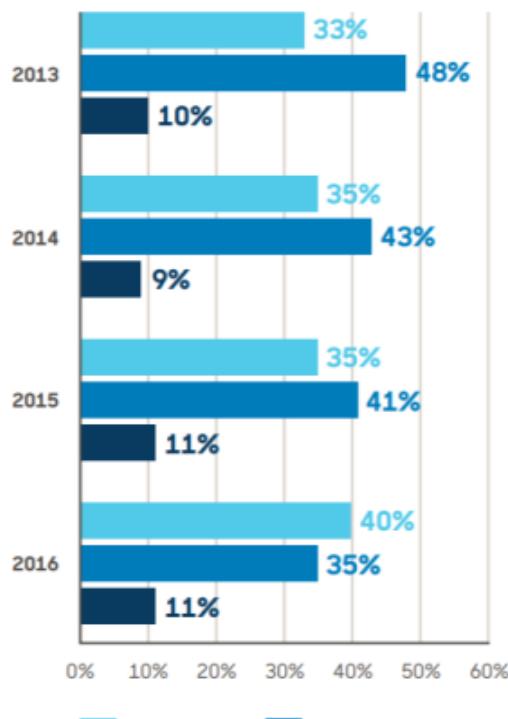
However, in order to understand the potential future of cryptocurrencies, it is important to understand current consumer behaviour. Schuh and Stavins (2011) report uncovered that debit and credit cards account for almost 40% of Point of sale transactions (chart 10). It could be argued however, that these statistics may be out-dated. Tsys (2016) research paper of the U.S. consumer payment study disproves the previous statistics, certifying that credit and debit cards have become even more dominant at 75% of the market in terms of most preferred payment type (chart 11)

**Chart 10 – Share of monthly payments by transaction type**



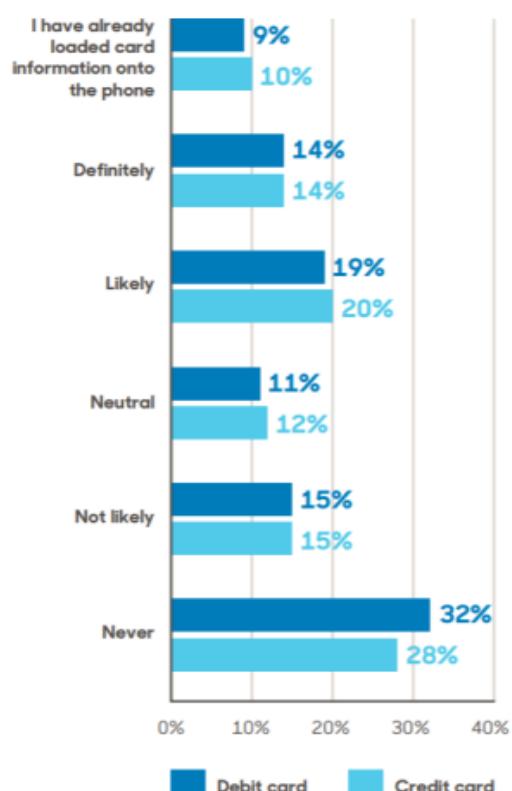
(Schuh and Stavins, 2011)

**Chart 11 – Preferred payment type**



(Tysy, 2017)

**Chart 12 – Likelihood of loading a credit/debit card into a mobile phone or “wallet”**



However, cryptocurrency companies are starting to develop an alternative to a debit card, instead of the card being linked to a bank it will be connected to a digital wallet. Nonetheless, it is vital to comprehend that government regulations and price volatility are still concerning elements in this stage of the innovation essentially impacting the potential adoption and diffusion rate due to current consumer behaviour focusing on security, ease of use, control and the neglect to change from tradition means as seen in chart 12 With 47% and 43% of debit and credit card users respectively, either “Not likely” or “Never” willing to utilise debit/credit cards into their smartphone or mobile wallet. Therefore, as the technology progresses it could be argued that a linear relationship will occur with the amount of improvements and the adoption rate thereby having the potential to help bridge the gap between fiat and cryptocurrency (Tsys, 2017).

Although cryptocurrency presents many negative connotations, it arguably still remains an innovative force in modernised currency which has the capability to bring vast economic change to countries which suffer from corrupt governmental regimes and banking systems. This ability to offer new alternatives for people of which live in countries with poor economic states will arguably help to transform their financial environment, giving people the ability to securely manage their own finances without being reliant on an entity which they cannot trust (Darlington, 2014).

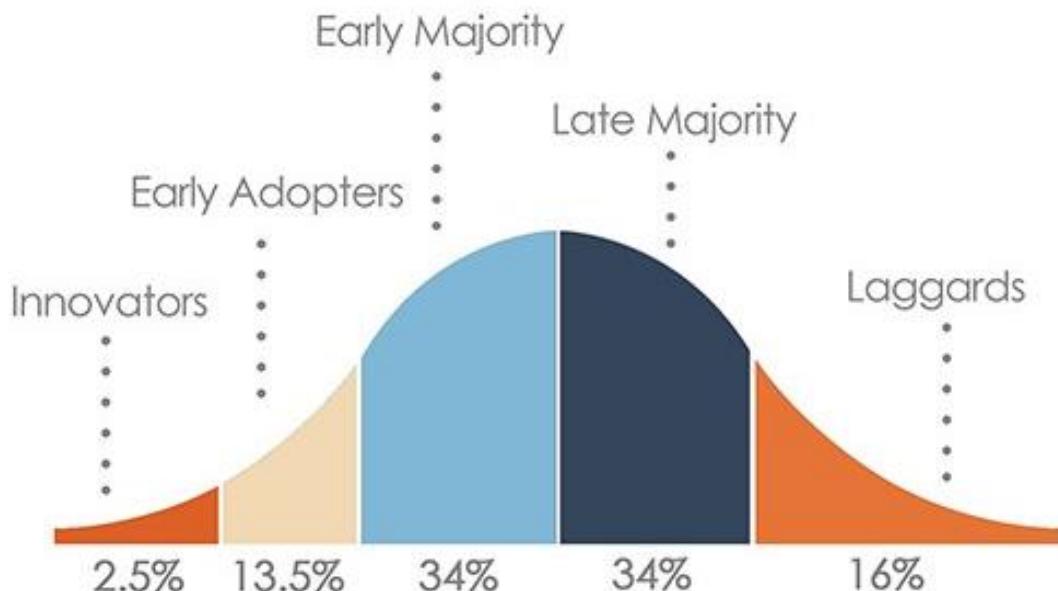
It is important however to note that there is a major focus on Bitcoin being the “world currency” however, even if Bitcoin does not achieve its mission there are many up and coming currencies which may have the capacity to be far more advanced entering the financial system which may provide users with much easier user ability, access and ease of use helping to bridge the transition from fiat to cryptocurrency.

## 2.5 THEORETICAL FRAMEWORKS

### 2.5.1 Diffusion of Innovation Model

The Diffusion of Innovation Model and theoretical framework was first hypothesised by Everett Rogers in 1962 (Mustonen-Ollila and Lyytinen, 2003; Luu, 2018). This theory conveys how an idea, product or behaviour builds momentum in society through 5 key behavioural divisions within a population (Image 4, displays a visual version):

**Image 4 – The Diffusion of Innovation Model**



Firstly, it starts slowly with the “innovators”, representing 2.5% of the population, this group is primarily characterised by their eagerness to take risks which others avoid. Therefore, this group tend to have higher propensity for risk taking surrounding a new innovation.

Secondly, “Early Adopters”; 13.5% of the chosen population, this group plays a slightly different role to the previous in the sense that, this population tend to have leadership roles within the overall social system which the innovation is currently diffusing through. The leadership in this case can be seen through ad-

vice distribution about the innovation and because of their individual status within society their attitudes in regards to the innovation has an authoritative and positive role on others which in turn reduces uncertainty amongst the people.

Thirdly, the main bulk of adoption falls under the headings of early majority (34%) and later majority (34%). The innovation tends to gain traction and spreads aggressively to the early majority; this particular group are more calculated in their decision to adopt an innovation, however, being slightly more wary of the risks. Nonetheless, they are encapsulated in important and significant networks that have an influential factor on the further diffusion of an innovation. Alternatively, the later majority usually wait for others to adopt first, they are not willing to commit due to sceptical and cautious thought, usually this group are pressured by economic change or peer pressure.

Finally, laggards, this group represent 16% of a given population; they are the most sceptical and slowest to adopt newer technology. Usually, they are bound by traditional methods and have a conservative mind set. In Rogers (2003) paper he spoke about the fact that laggard's social encounters tend to be with others whom share similar traits therefore, a lack of leadership and ambition is prevalent in their social circles meaning they are not aware of the same innovation revolutions which previous groups are exposed to.

At this stage, the diffusion of innovation has reached its end and thereby, a new norm, behaviour or product has reached a level of dominance within its society. This model of adoption has arguably been visible throughout the ages, from the rise and fall of Nokia, the abolishment of the prohibition and the ascent of Apple Computers and the iPhone (Dearing, 2009). However, there are alternative models which theorise the diffusion of innovation in a slightly different manner, and this will be explored in the following section.

## 2.5.2 Technology Acceptance Model

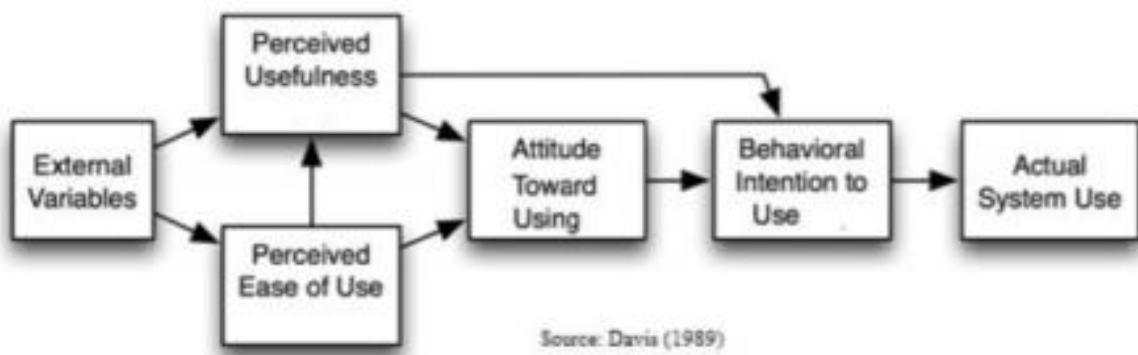
The Technology Acceptance Model (TAM), is an academic theory which displays how users come to accept and begin to use a certain technology (Tanhini et al, 2017). There are two key factors which influence how and when they will use the technology which will be explained below (for model see figure 1):

Firstly, perceived usefulness (PU); the degree to which a person believes that using a particular system or technology would enhance his/her performance (Davis, 1989). Research conveys that the author originally constructed the theory in reference with general practice within firms looking at periods of increasing performance which is usually rewarded with bonuses or an increase in salary.

This in turn, led businesses and individuals to obtain a positive attitude towards such systems or technologies resulting in enhanced performance. Therefore, when a user believes such an arrangement has a positive impact on performance, the system is thought to have a high perceived usefulness by that individual.

Secondly, perceived Ease of Use (PEU) is hereby defined by Davis (1989) as “the degree to which a person believes that using the system will be free of effort”. Thereby, individuals have the capability of directing their efforts towards certain goals and as effort is an immeasurable phenomenon, individuals tend to use their energy and time efficiently or in conjunction with what they want to do, which aligns with Davis (1989) claim that users of such technologies are more likely to accept a system with a higher perceived ease of use over one with a lower perceived ease of use, as it will be much more efficient and less time consuming for them.

**Figure 1 – TAM Process**



In Davis (1989) paper he cites a range of authors of which have critiqued his work and have equally understood that PEU and PU are arguably technological acceptance indicators which allow new innovations to be studied effectively. Bandura (1982) concurs, stating that, although both indicators have different precursors, these variables need to be examined together when trying to conduct a study about behavioural usage (Davis, 1989).

However, it is important to take into consideration the originality and thereby the purpose of such study. At TAMs inception its original usage was aimed toward computer adoption. Nonetheless, alternative researchers saw the models potential value in understanding the diffusion of other technologies and thereby set out to apply TAM to numerous other advancements (Lee, Kozar & Larsen, 2003).

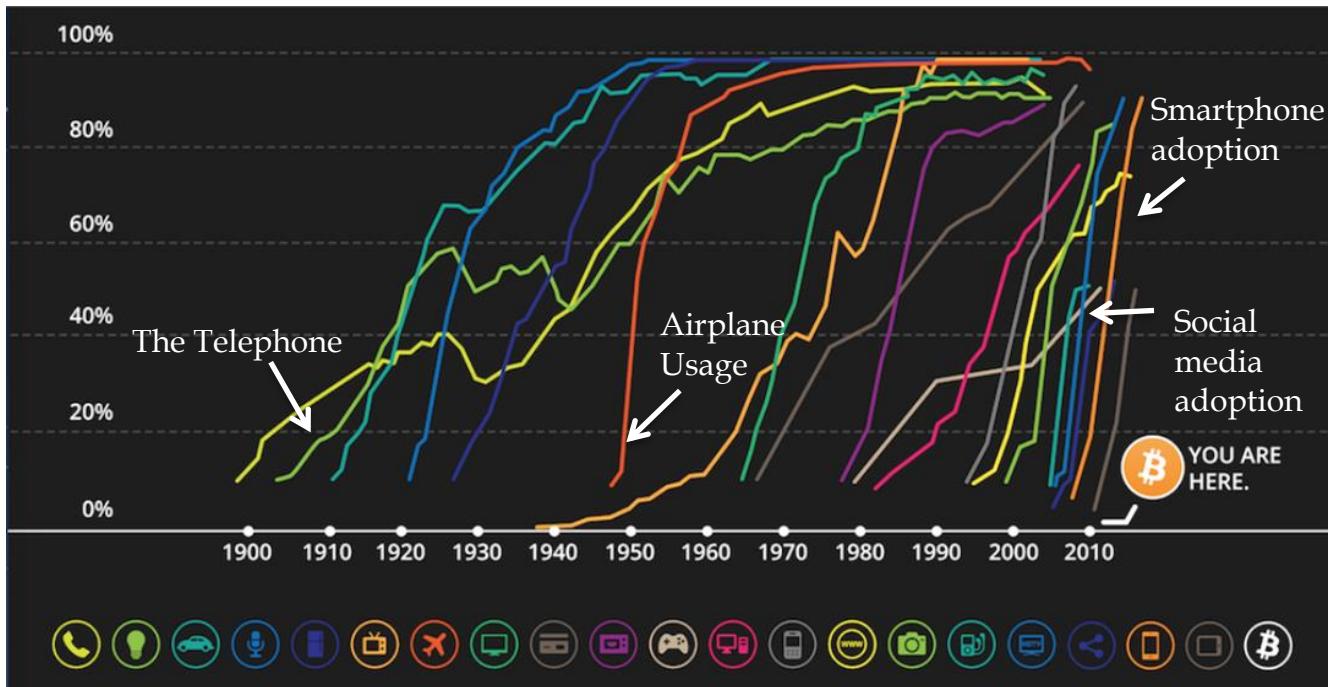
The TAM model has been adopted for the observation of a range of different technologies such as e-mail and social media (Raunier, 2014). In accordance with its wide usability Lee et al (2010) maintains the summation that its consistency and validity in explaining adoption is apparent. Venkatesh and Davis (2010) research agrees, laying claim that in the past 10 years the technology acceptance model has developed into a model which has established itself as being a powerful indicator and judge for identifying and additionally predicting user acceptance, displaying consistent results which reflect accurate data in regards to usage intent.

However, it is important to note that cryptocurrency is a radical innovation, one in which prompts significant development and thereby exhibits an architecture of change, a standard innovation is perceived as something which improves an existing technology whereas a radical innovation redefines what is existing (Kasmire et al, 2012).

Therefore, this relatively new technology has the power to potentially alter the way in which humans see and adhere to their own perspective of what value is. This is arguably a psychological shift, to administer a change in your own thought process toward something new or different to what is the current norm. Arguably, innovations as such have always been apparent in society and at first have been met with high levels of scepticism for example the telephone, the airplane, mobile phones and even social media (Caspers and Van Waarden, 2005)

However, when observing such radical innovations which have occurred in the past 100 years, we discover that the speed of diffusion is becoming more rapid. Looking at chart 13 below, we can identify a common trend which is occurring with radical innovations:

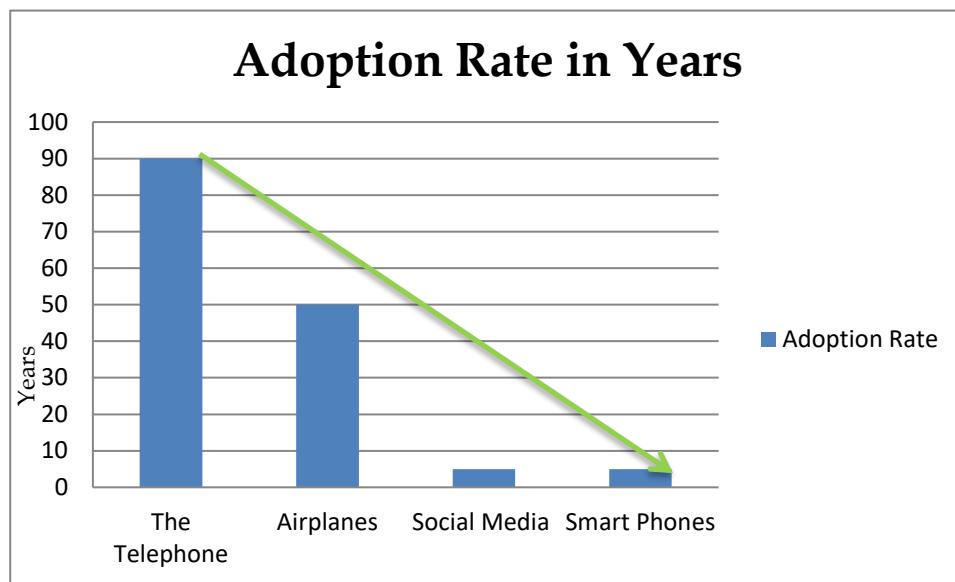
**Chart 13 - Technology adoption rate in the US**



(Cox and Alm, 2008)

Firstly, the chart shows that it took approximately 90 years from 1900 – 1990 for the telephone to reach an adoption rate of 90% in the US. Secondly, however we see that the adoption of a similar radical innovation in this case, commercial flight adoption took approximately 20 years from 1950 - 1970 for this technological advancement to become main-stream; 450% faster. Thirdly, Social media; the diffusion rate is even faster, taking approximately 5 years from 2005 – 2010, 400% faster than the previous, and finally, smartphone adoption displaying an almost identical time frame in terms of hitting the 90% adoption rate. Therefore, from the first innovation explained to the last, the difference in adoption rate in the 110 year period was 1800% in terms of speed of adoption, displaying significant growth as synthesised in the bar chart on the following page.

**Chart 14 – Adoption Speed Increase**



*(Decline in the time for a technology to diffuse through the S-Curve)*

Importantly, what is prevalent about chart 13 is the trajectory of the adoptions. Looking at the telephone, this innovation arguably follows a distinct S curve pattern yet as we get closer to the 21<sup>st</sup> century it is clear that the latest innovations being social media and smart phones do not follow this structure they are more so concerned with an “A curve” in the sense that they rise quickly like the left incline in the letter “A”, leading us to question the current validity of such a model in this contemporary innovative era.

However, the previous contention may be incorrect and it is the speed of which a technology diffuses is becoming much faster thereby, the S curve is not as apparent when plotted on a chart. It is important to note that there are many variables to consider and not all can be measured for example the modern emphasis on technology may have larger implications, more people may be “innovators” or “early adopters” than 100 years ago due to the ability to find valuable information online arguably, this may equate toward faster adoption and diffusion rates.

Many authors including those whom made the Organisation for Economic co-operation and development (OECD) report of which represents 35 nations, claims that the accelerating pace of innovation and diffusion of such is driven by globalisation and the speed of communication (Planes-Satorra and Paunov,

2017). Therefore, we could argue that the make-up of innovation itself is changing and it is important to consider the validity of such models of which were created before such fast paced innovations were prevalent in society.

Thereby, to understand this phenomenon more effectively a comparison will be made between cryptocurrency and another radical innovation which has had a dramatic diffusion; social media, in this case specifically looking at Twitter with the purpose of identifying whether or not such models can still be administered and used effectively in the modern era.

## **2.6 ARE RADICAL TECHNOLOGICAL INNOVATIONS IN ALIGNMENT WITH THE DIFFUSION OF INNOVATION MODELS?**

Two of the models which will be analysed to see whether or not they are in alignment with modern radical innovations are the DOI and TAM models. Therefore, in order to get a comprehensive understanding of the potential coherence of such models two paths must be crossed which will be explained further in the following section:

Firstly, an understanding of each model must be obtained and compared; once this is achieved a greater understanding will be exhibited leading us to the second point; using the knowledge acquired from the first section, radical technological innovations will be put through the DOI model with the purpose of identifying whether or not this particular system is still viable in the modern era or whether it needs to be updated.

### **2.6.1 Pathway 1 – Understanding the models**

It is important to note that the DOI models relative advantage section is comparable to perceived usefulness (PU). Additionally the complexity component is equivalent to that of perceived ease of use (PEU) (Hong, 2015). However, despite TAM's similarities, Carter and Belanger (2005) report argues that this particular model is not applicable to a wide range of technologies, therefore posing as a potential problem in terms of being a limiting factor to researchers whom use this model solely on its own.

Therefore, in order to negate this issue researchers have come to the conclusion that in order to obtain a greater understanding, combining multiple theories will further enhance the strength of the research which will be acquired for an innovation (Lee et al, 2011 and Oliveira and Martins, 2011).

However, many authors disagree with Carter and Belanger (2005) arguments stating that The DOI and TAM are models which have been used to try to understand and analyse a range of different technological innovations such as social media, the telephone and medicinal innovation (Robertson, 1967; Van den Bulte and Lilien, 2001 and Sanson-Fisher, 2004), individually they have been used to effectively communicate the way in which technologies diffuse.

Thereby, if we were to put the models under a microscope and examine them, it would be clear that the theories attached to the diffusion of innovation process present to the user a broad matrix, as one could argue that there may be many different factors to contemplate between the diffusion of a medical innovation in comparison to a social media innovation, such as laws, regulations, approval, training and examining. Therefore, leading us to believe that there is openness with such models which could arguably lead to variations in terms of interpretation.

Additionally, there is a level of interpretive flexibility in terms of the innovation process for example; the importance of an individual innovation significantly changes from one situation in time to another (Karsten, 1995 and Orlikowshu and Gash, 1993). Thus, organisations, individuals and industries will have a different opinion and foresight on the construct of the diffusion of innovation. Moreover, culture, governmental and economic structuring are elements which impose influential characteristics which appoint and determine constructs which people hereby follow.

Consequently, the following was drawn from Lyytinen and Damsgaard (2001) study of the relevance of diffusion of innovation models. Their research uncovered that the ideas about the diffusion of innovation heavily varied in different areas of innovation thereby, affecting the adoption process. It could therefore be contended that the theoretical frameworks apparent tend to lack a lot of elements, this could arguably be because the authors of which created these models shaped them from their own perspective, countries and cultures therefore, the same model may not be viable in another scenario.

Hong (2015) research agrees with the previous contention stating that, both of the previous models are seen as being limited by other theories. Firstly, Social

Shaping Theory (SST), this academic model creates the argument that the emergence of new technological innovation is a social process and people are the catalysts and thereby quintessential elements in leveraging innovation. Therefore, this approach disputes against intrinsic characteristics inherent in technologies determining their effect and use (Hynes and Richardson, 2009).

Secondly, Gartner Hype Cycle Model (GHC) adds another thought process to technological life cycle models by characterising the typical progression of an emerging technology from user and media overenthusiasm through a period of disillusionment to an eventual understanding of the technology's relevance and role in a particular market or area (Linden and Fenn, 2003).

Furthermore, it could be contended that TAM and the DOI model do not take into consideration other elements which models such as SST and GHC are able to, therefore this leads us to question the validity of certain models, this is primarily down to the fact that each model is based on something different and that basis is a belief from an individual or group of individuals.

Nonetheless, it is crucial to understand that beliefs are shaped by cultural, personal and professional experiences (Zelizer, 2010) and each individual in this world has different experiences thereby, having different beliefs, meaning that the psychological element of these models is very much apparent yet not displayed in a way which makes the models 100% reliable (Stroope, 2011). Lyytinen and Damsgaard (2001) research agrees; arguing that elements of the DOI and TAM are unable to address these issues and thereby focus more so on less complex psychological issues displaying minimal interest in the larger picture in terms of social outcomes.

However, SST is arguably more concerned with the macro environment in terms of diffusion; focusing on the social status which may have a potential impact upon the rapid production and adoption of certain technologies opposed to looking at the PU and PEU as primary reasons for a technology being adopted. Research from Williams and Edge (1996) agrees stating that, the SST theoretical model is arguably a positive actor in the integration of natural and social science issues, they further extenuate the point with a claim; that this model has a greater comprehension of the relationship between technological innovation, scientific excellence and social well-being.

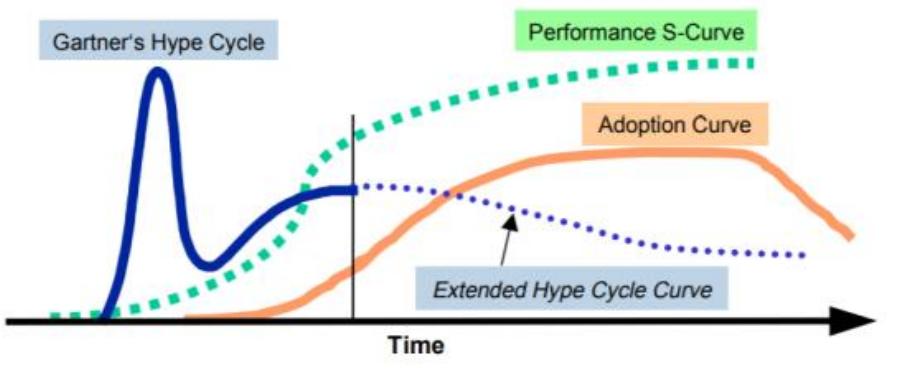
Comparatively, the DOI and TAM when used solely on their own observe individual factors of the adopter thereby, not undertaking a more macro consideration, relative to the SST model; focusing on the micro climate of innovation, po-

tentially ignoring alternative elements which may influence decision making. This disregard toward social-political and macro elements displays that these theories are looking at the picture of innovation from only one perspective.

Furthermore, Botha and Atkins (2005) add that the DOI model has a pro-innovation bias; the model has an automatic assumption that change is always a good thing and thereby reflects it in the categorisation of the groups especially laggards (Kelly, 2012). It could be argued that this model creates and emphasises a sense of individual latency or blame, opposed to focusing on the impact of social structures and how society impacts our choice to innovate, this disregard arguably creates a vacuum of possibilities which has not been discussed or explored potentially due to the complexity in measuring.

Nonetheless, it is vital to understand that all of the previous models attempt to create a level of comprehension using their own variable system around the evolution of a technology as visually displayed in chart 15.

**Chart 15 – The range of diffusion models**



(Linden and Fenn, 2003)

However, GHC creates another dimension to the existing models explained, as this model reflects human attitudes towards technological change. Research argues that a large majority of technologies conform to GHC because the invariance in the equation is people and the psychological element of change, not the technology itself. Therefore, using this methodological approach in alignment with another model will help to facilitate the human element which the other models do not primarily focus upon (Linden and Fenn, 2003; Dedeayir and Steinert, 2016)

In summary, one could argue that Twitter a more recent radical innovation successfully jumped through the hoops of the DOI model, following the theory. However, cryptocurrency appears to follow certain elements and disregards others; this is potentially due to the infancy of such a technology. It is thereby important to note that the newest radical innovations appear to align with the DOI theory securing its validity and importance in the 21<sup>st</sup> century despite this it may be the speed to which diffusion occurs that is the fundamental issue. Recent technologies such as the smart phone and social media have been met with a lot of positivity whereas, cryptocurrency is arguably even more of a radical change which exhibits modification not just on a personal level, but takes aim at governmental control and institutions, a potential change in society which has never been breached; reshaping the value and institutions of money.

As a result, all of the discussed models present users with a potential pathway thereby; to focus on one model opposed to the other will provide the researcher with strengths but also weaknesses in their research. It is important to consider that it may not be possible to fully comprehend the process of innovation and how it truly unfolds and these academic matrixes' act as a simplified version of what could be the truth to the innovation process (Aggeri and Segrestin, 2007).

### **2.6.2 Pathway 2 - Applying the knowledge of the models to radical innovations**

Now, with the understanding of the importance of approaching such research with a synergistic perspective of the diffusion of innovation models, such radical innovations must be primarily put through the models in order to gather an advanced understanding of the mechanics of such systems.

Firstly, in order to do such the researcher has chosen to firstly align Rogers (1995) DOI model with two radical innovations; cryptocurrency and social media, thereby looking at the four key fundamental elements of the model in relation to the definitions given to the DOI theory; 1) innovation, 2) communication channels, 3) time and, 4) the social system.

Secondly, a similar process will be exhibited with TAM, following the perspective of the theory to gain an insight of the viability of the model in regards to the current radical innovations of the 21<sup>st</sup> century.

## 2.7 The Alignment of radical innovations and the DOI model

Social media and cryptocurrencies are arguably two technologies which serve a completely different purpose however, they share a key similarity; exponential growth in the short term. Bitcoin and Twitter have had stints of unprecedented growth; Twitter, in 2009 had a 900% surge in users. Similarly, Bitcoin showed extremely high growth from Q1 (\$900) – Q4 (\$19,000) equating to a growth rate just over 2100% (Kline, 2017; Coinmarketcap, 2018). Therefore, to make this theoretical model more understandable we will put Bitcoin and Twitter through the same mechanism, displaying to the reader the steps which an innovation must take, with the purpose of identifying whether or not there is a difference in terms of rate of diffusion in alignment with Rogers four fundamental elements previously stated.

### 2.7.1 Innovation

Innovation is the first step within the cycle therefore; a need has been met with a potential solution. However, there is no universalised adoption rate of new technology and some technological advancements diffuse over decades, whilst others take only a few years or months to diffuse effectively (Van Everdingen and Waarts, 2003). Rogers (1995) research agrees, stating that different innovations have different speeds of adoption, and these rates are determined by five key characteristics; relative advantage, compatibility, complexity, triability, and observability:

Firstly, relative advantage; does the new technology have the capability to overtake another idea or existing technology? In the case of Twitter, the technology which the founders invented was seen as advantageous due to the ability to quickly blog and write thoughts in real time. Rogers (1995) points out that convenience, social prestige, economic terms and satisfaction are necessary aspects to take into consideration when evaluating the degree of relative advantage and as Twitter followed suit it lead to higher rates of adoption from users.

However, cryptocurrency which is digitalised, faster and arguably less corruptible than fiat currency due to the block chain technology may possess similar traits to that of Twitter (Boyen et al, 2016). On the other hand, in terms of convenience, social prestige, economic terms and satisfaction, it may be lacking

in these categories due to accessibility issues, social stigmas and lack of current satisfaction due to high fluctuation (Seligman, 2014).

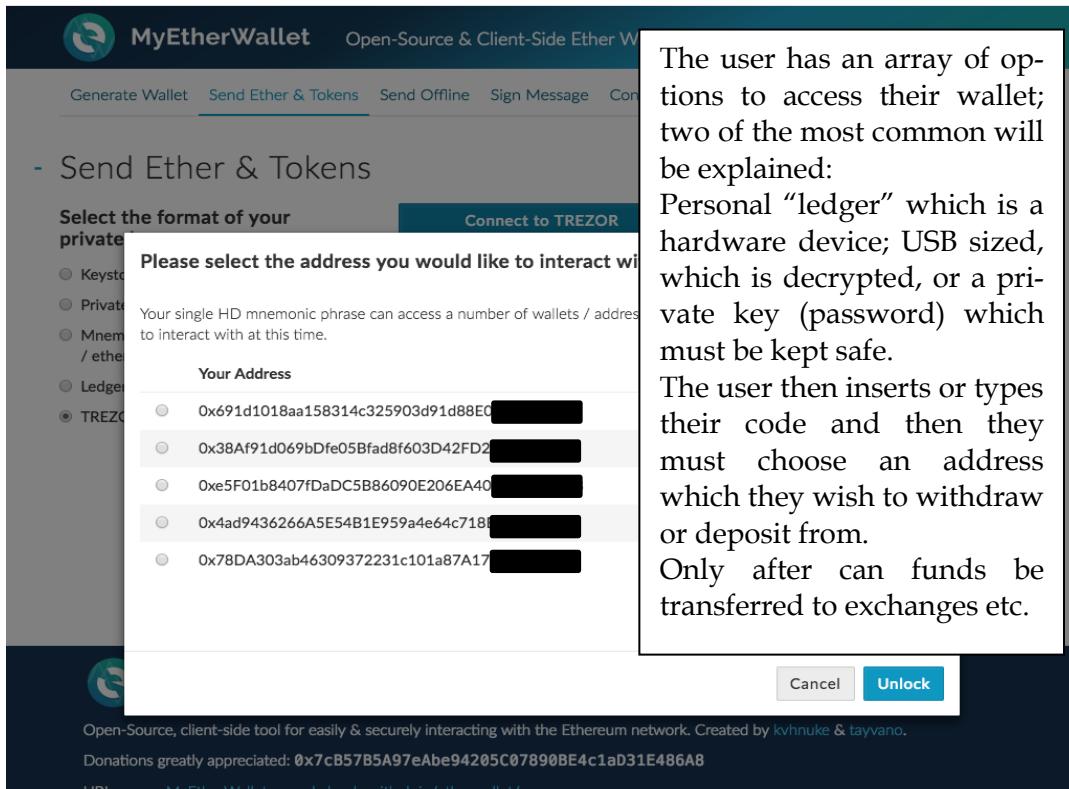
Secondly, compatibility; Rogers (1995) conveys that this indicates how the innovation will suit the current values, past experiences and the needs of those whom may potentially adopt the technology within the given social circle. Arguably, Twitter followed these aspects due to the fact that information has always wanted to be attained quickly by people thereby, providing users with an easy tool to do such (Barnes and Jocobsen, 2013).

Alternatively, cryptocurrency is an innovation which arguably challenges current values, past experiences and needs, opposed to being in alignment with them. One could argue that it aims to redefine convention by creating a shift from standardised fiat currencies controlled by governments, to cryptocurrency which is essentially controlled by the masses thereby, not precisely following Rogers model.

Thirdly, complexity; how difficult the technology is to understand and use. A variety of authors representing different areas of the innovation process argue that an innovation which does not require advanced technological skills and understanding will tend to have a higher rate of adoption if it serves a purpose in alignment with the needs of others (Chang et al, 2007; Black et al, 2001; Venkatraman, 1991). Arguably, Twitter follows precedent; easy to sign up, requires very little knowledge of coding, internet usage or blogging abilities, easy icons and procedures with a clean user interface; lacking complexity.

However, Bitcoin and cryptocurrencies alike require a level of computer knowledge which far exceeds that of Twitter (Wilson-Nunn and Zenil, 2014). An example of a common complexity is the transferring of funds from a "wallet" to another "wallet", this requires the user to "choose an address to interact with" from there the user can send a currency of their choice to another destination by copying a code, if the code is incorrectly copied, this can result in loss of funds which can be a daunting task if large sums of currency are going to be exchanged (Image 5). One could debate that this further accentuates the fundamental hurdles which cryptocurrency needs to overcome to further its diffusion of innovation.

## Image 5 – My Ether Wallet Transfers



(Trezor blog, 2017)

Next, traceability is when the user of the site has the opportunity to try the innovation before it is launched, or something similar to it. In the case of Twitter, the company was launched 2 years after Facebook, as both organisations represent social media it was clear that the social media phenomenon had become more apparent in society thereby reducing the uncertainty of the newer service (Folusruso et al, 2010).

However, in history there has never been a shift from fiat to virtualised currency before thereby, users in this case whom are normal people arguably feel uncomfortable doing something they have never done before, it is different and therefore, an inconvenience to them (Rosecrance, 2000). One could propose that the only time the same phenomenon has occurred was when money was introduced as a universalised form of payment, prior to this bartering occurred therefore, it could be argued that such a psychological change has not happened in recent human history on such a large scale.

Finally, observability, this essentially is the measurement of which identifies the extent of the innovations visibility. Twitter's circumstance is that of a positively observable technology this is partly due to the technologies core business acumen which was to facilitate communication between multiple users around the world, this in turn encouraged celebrity, company, governmental usage, all of which exposed the service to a wider audience, helping to encourage adoption (Java et al, 2007).

On the other hand, Bitcoin and cryptocurrencies alike, have had more negative observability through mass media; links to money laundering, funding terrorism and criminal activity have arguably discouraged people from adopting the technology available (Brenig et al, 2015; Bray, 2016). However, it could be argued that this is because there are high levels of uncertainty around using such a service and thereby, the adoption rates are much slower because there is no previous technology which can be trialled and compared to it (Fry and Cheah, 2016).

In summary, it is clear that the developers at Twitter were able to identify a relatively simple innovation which effectively catered to the needs of the users through the lens of Roger's theorem, allowing for widespread adoption to occur at a faster rate. However, when we look at cryptocurrencies in comparison to a more simplistic technological area it is clear that there are still many areas which this phenomenon must overcome in order for it to progress through the diffusion of innovation model, this arguably includes the communication channel.

### **2.7.2 Communication Channel**

A communication channel is a setting which allows messages to be sent from one person to the other (Rogers, 1995). Furthermore, in the same article Rogers argues that mass media channels and interpersonal channels of communication which are those that involve a personal exchange, primarily face to face interaction, he states that interpersonal channels pose as different actors in terms of their prowess to inform or even persuade people within society to adopt a new innovation.

In March 2007, the South by Southwest interactive conference saw one of Twitter's largest growth spurts in its early history, with more than 60,000 tweets being sent per day at the event, the Twitter team had a large presence at the event, they did this by taking advantage of the viral nature of the attendees at the conference (MacArthur, 2017). However, future events such as terrorist attacks, public news and information sharing became more apparent on Twitter generating large media coverage for this social network and this continued to increase the adoption rate over time (Bruns and Burgess, 2012).

However, in Rogers (1995) study he claims that the user or potential adopter is heavily influenced by interpersonal channels in terms of embracing a newer technology, innovation or idea. He makes a bold claim that it is interpersonal channels which are more prevalent than mass media. One could argue that the rise of Twitter is in conjunction with the previous statement, as popular figures such as politicians, sports stars and general celebrities provided an interpersonal factor. It is important to note that every twitter user is also a different individual, therefore things which appeal to one user may not appeal to others, meaning different people are followed, through shared beliefs, ideas or other aspects, all helping to further diffuse the technology.

Nonetheless, it could be thought that interpersonal and mass media channels working in synergy and have the potential to facilitate higher rates of adoption over a period of time as seen with the adoption of Twitter. However, if we look at the current trends of cryptocurrency, are they following a similar consensus?

Firstly, there has been a growing interest in cryptocurrency which can be seen on social media, internet channels and the increasing interviews with leading investors whom claim that there is "no question that these digital assets are experiencing growing interest" (Boivard, 2017). However, it is important to note that on the diffusion of innovation scale any point leading up to the peak of "early majority" on the lifecycle can be deemed as a point of growing interest, it may still be in the "innovators" section and the interest is currently building but has not reached the tipping point.

To further explain this point we will look at the interpersonal and mass media communication of this technology. Rogers (1995) made claim that; interpersonal communication is the most poignant weapon in the diffusion of innovation. Famous celebrities have gone to social media to endorse cryptocurrency, celeb-

rities such as the rapper; the Game, whom has invested in a marijuana based block chain technology and singer and actor, Jamie Foxx whom has promoted exchanges in cryptocurrency (Schrodt, 2018). Arguably, these influencers have a large following and the capability to instil their beliefs into others. However, the CEO of Berkshire Hathaway, Warren Buffet, known for being an investment magnate, expresses his doubts about cryptocurrency:

*"In terms of cryptocurrencies, generally, I can say almost with certainty that they will come to a bad ending"*

Therefore, it could be argued that certain individuals may have more significance so to speak in terms of their influential ability to dictate to others potential moves in the market based on their previous success. However, it is important to note that previous success will not always determine future success despite its influential capability and may awaken cognitive biases such as the bandwagon effect; individuals rallying to the majority opinion (Nadeau et al, 1993; Kippenberger, 1996).

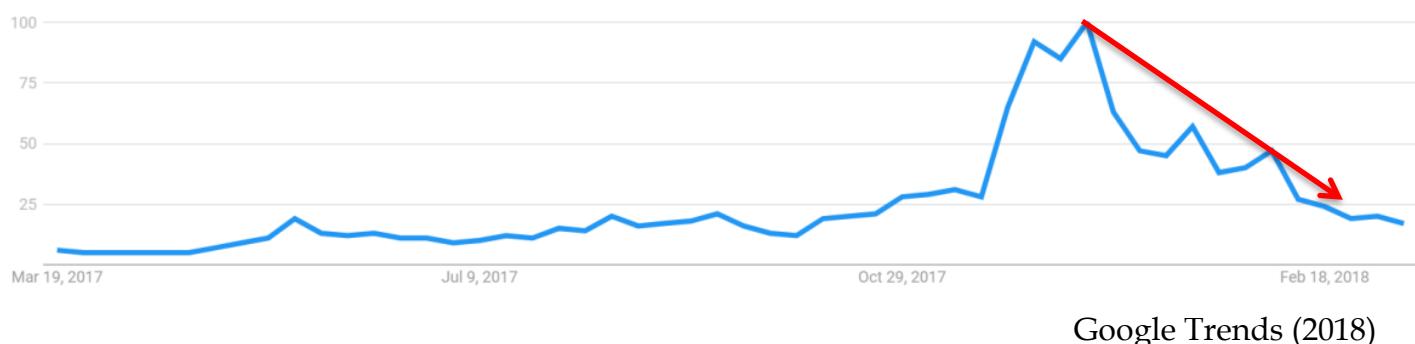
Furthermore, mass media has taken cryptocurrency "under its wing" and has begun to broadcast huge drops and increases in the price. The mass media's power to influence through their display of the current volatility in the market may or may not inflict fear into potential investors as they are unsure about the market situation. For example in 2017, during Bitcoin's highest value spike media outlets were predicting Bitcoin to reach prices as high as \$60,000 in 2018 (Murphy, 2018). However, in 2018 the market saw a huge retracement which then followed media outlets producing stories suggesting that there has been a "massive potential drop in Bitcoin" and "biggest decline since 2015" (Fortune, 2018; Kharpal, 2018).

The power of such words can be better displayed through Google trends, when typing in "Bitcoin" you can see that in December 2017 there was a huge spike in popularity hitting Google's highest popularity point of 100 (see chart 16). However, it is important to note that according to statistical data not even 0.5% of the world population have invested in Bitcoin (Hileman & Rauch, 2018), thereby in order for it to get such overwhelming popularity in a short space of time would require a range of mass media outlets distributing information about such events, controlling the information which is going to be read and perceived.

Therefore, one could argue that the mass media have an influential factor on such currency and thereby have showcased it to audiences as being unpredictable and/or dangerous, something which must be overcome to ensure widespread adoption. To further enhance this point, to ensure the focus is not purely on "Bitcoin" chart 17 displays the Google trend results of the overall sector "cryptocurrency", as you can see the chart follows a very similar pattern to the one of Bitcoin.

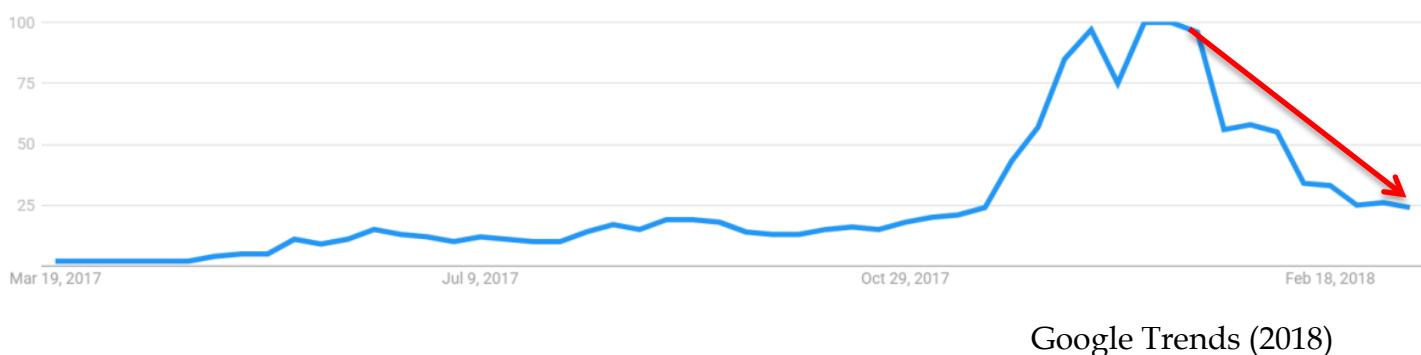
Arguably, this reaction to innovation goes against that of Rogers (1995) belief that interpersonal factors are more apparent in the innovation process; this may not be the current case with large scale media having an intrinsic role in the diffusion and perception of cryptocurrency. However, we are still unaware of the position of diffusion and therefore are unable to essentially criticise this model at this moment in time as it may unfold in the future to be in alignment with the DOI model.

**Chart 16 - Google trends "Bitcoin"**



**Chart 17 - Google trends - "Cryptocurrency"**

Shared downtrend line on both charts



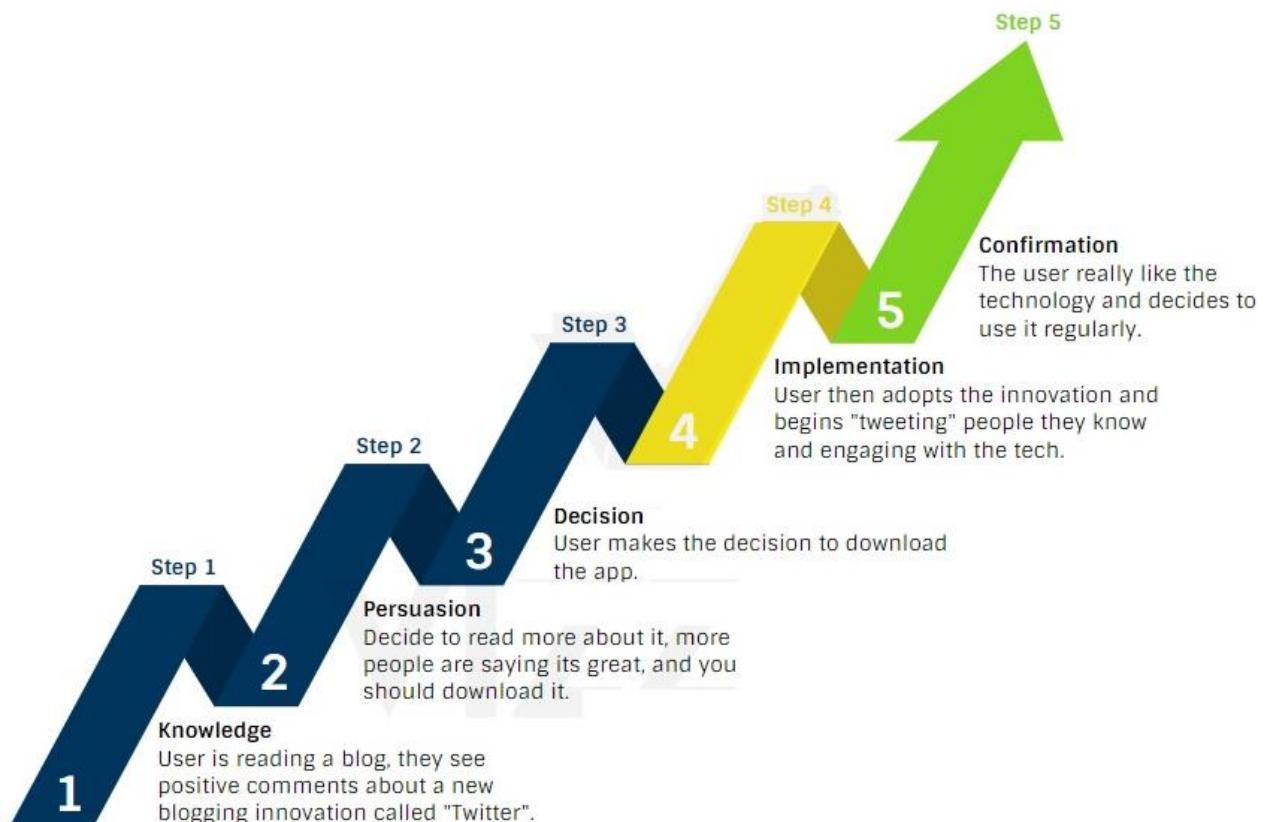
### 2.7.3 Time

In accordance with Rogers (1995) paper, the dimension of time has three essential elements which need to be addressed to further understand the DOI theory. Firstly, the introduction or the appearance in the innovation process can be categorised into 5 fundamental steps; explaining the decision making process that an individual must adhere to in order to deem the technology useful and worthy of adoption:

- |                     |  |
|---------------------|--|
| 1) Knowledge -      | acquiring knowledge of a new innovation            |
| 2) Persuasion -     | forms an attitude toward the innovation            |
| 3) Decision -       | decision is made to adopt or reject the innovation |
| 4) Implementation - | the use of the innovation                          |
| 5) Confirmation -   | the user likes the innovation/ uses it             |

In order to understand these steps thoroughly; a potential adoption scenario has been created below to view the potential thought process which an adopter goes through (see image 6).

**Image 6 – Potential innovation adoption process of Twitter:**

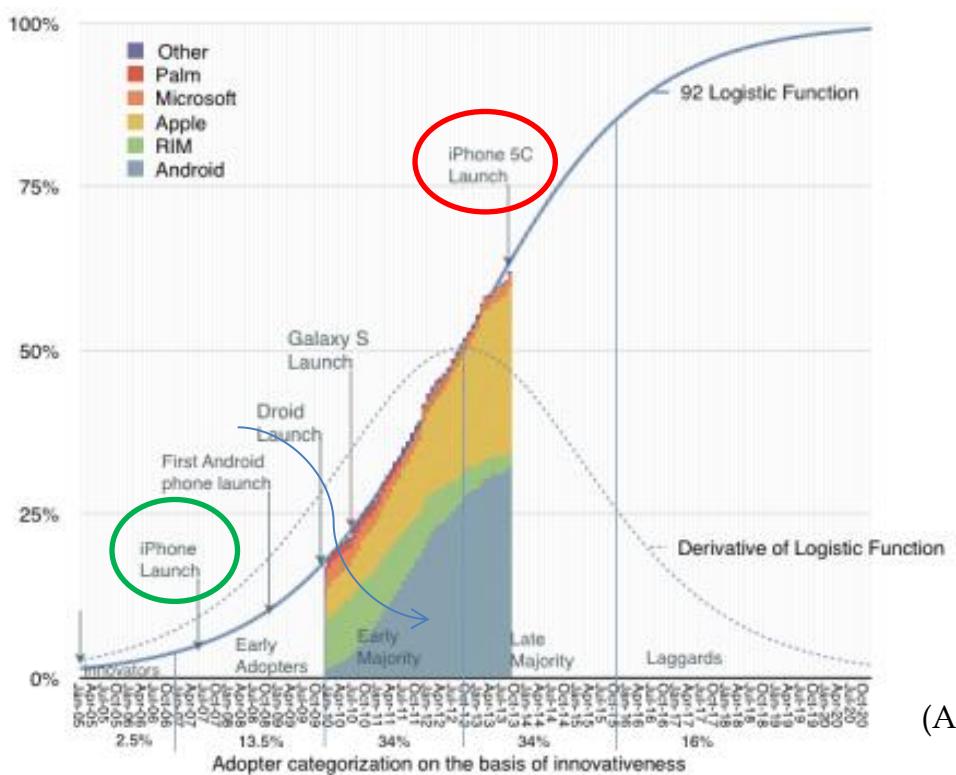


As seen, Image 5 displays the potential process one may go through when adopting the innovation Twitter. However, it's important to comprehend that there are many potential outcomes in this event, one being failure to comply with the technology.

Similarly, cryptocurrency must be put through such a contraption, which is very much dependent on the individuals' power to adopt or dismiss, suggesting that ultimately the power comes down to the individuals despite influential factors, conveying to researchers that if they do not like it, or do not see a need for it they will not use it (Stewart et al, 2017).

Secondly, the following element focuses on the affect which the early adopters have in terms of the innovation process. According to the theory itself, the DOI process is primarily dependent on the early adopters, without such, the technology would not even get off the blocks (Aral et al, 2009; Lee, 2014). It is important to note that this phenomenon is not just prevalent in social media, or cryptocurrency, it is apparent in all aspects of innovation for example, even if we look at the evolution of the iPhone from April 2007 – October 2013 (see chart 18), the importance of the early adopters allowed the phone to continue on its expected route of innovative trajectory. It is clear that after zooming out and looking at the chart from a perspective of hindsight, the iPhone 1 presented itself as being the primary innovator followed by version 2,3,4 which allowed the iPhone and Apple to effectively follow the S-Curve, adhering to its expected plan of trajectory.

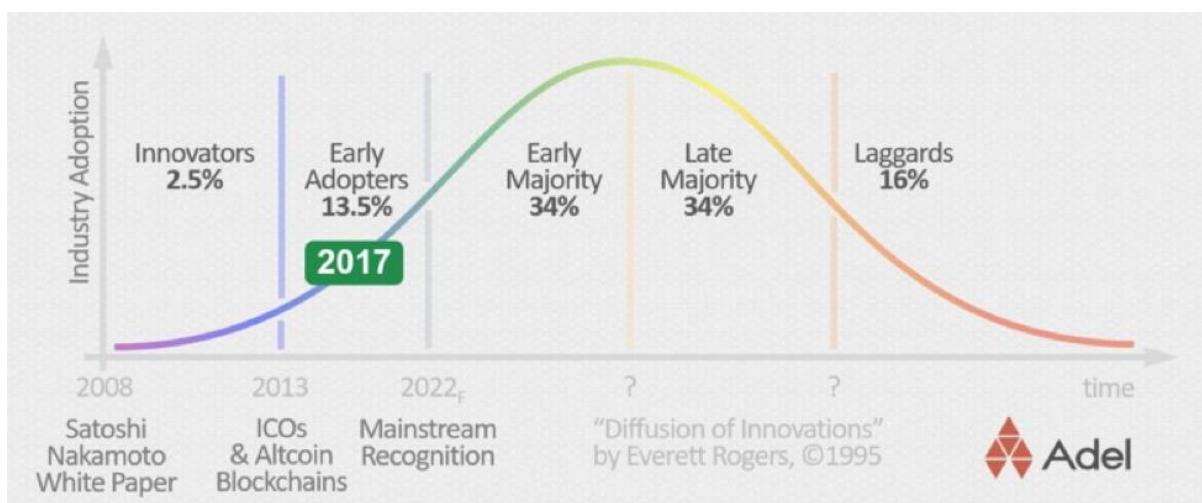
**Chart 18 - US Smartphone Penetration**



(Asymco, 2013)

Similarly, the Israeli angel Investment Company; iAngels, believe that block chain, the technology primarily behind cryptocurrency, has entered the “early adoption phase”, with the release of new SEC regulations in the USA and mass interest from FinTech (financial technology) and business, this further supports theirs and other authors hypotheses that cryptocurrency is a nascent industry with great potential (Filer, 2018; Watanabe et al, 2016; Fujimura et al, 2015; De Fillippi, 2014). However, it is still working through early stages of development as seen in Chart 19.

**Chart 19 – Predicted Area of Adoption for Blockchain Technology**



(Filer, 2018)

Accordingly, Blockchain has arguably entered the early adoption phase of the DOI, with the beginning of ICO (initial coin offering; fundraising mechanism in which new projects sell their currencies in an exchange usually for either Bitcoin or Ethereum, which are the two most accessible and largest coins by market capitalisation, this process is similar to an IPO (initial public offering) at stock exchanges) regulation and alternative Blockchain technology coming to the forefront (Kopke, 2018; Bitcoin Magazine, 2018). However, it is important to understand that this predicament is based on the report of filer (2018) and therefore we cannot take one perspective and assume that it is consistent with all.

The third element of time in regards to the DOI process is the rate of adoption by a certain innovation. Accordingly, Rogers (1995) article focuses on the amount of members of a chosen system which adopt the innovation within a certain time frame. In the case of Twitter in the year of 2009, there was an immense growth spurt of approximately 900% within the year; this sporadic

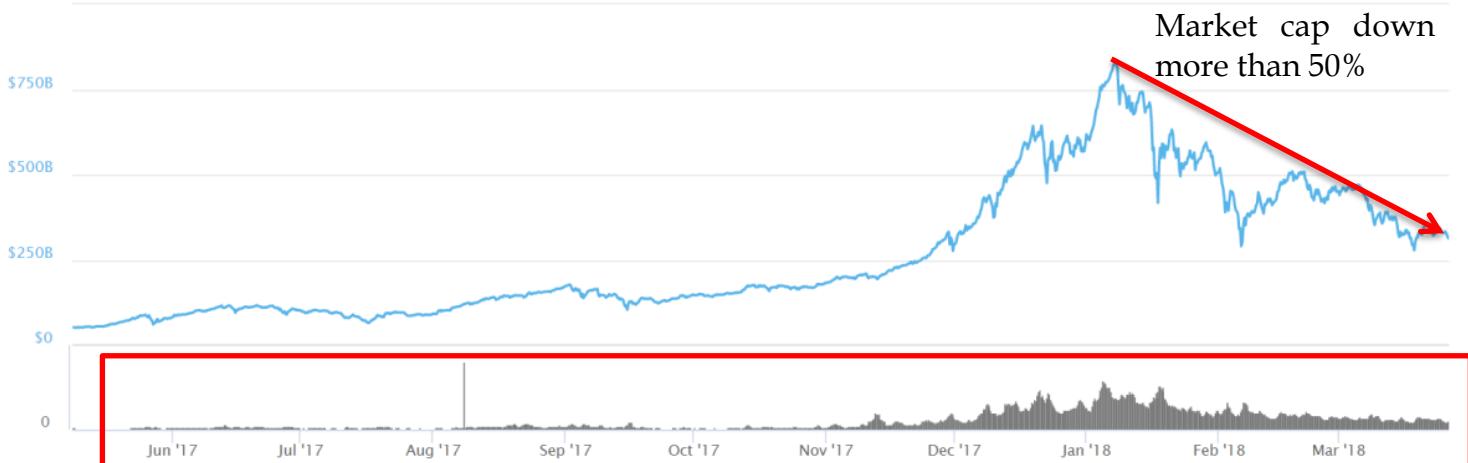
growth thereby verified that Twitter was seen as a positive technological innovation worthy of high adoption.

Correspondingly, cryptocurrency has followed a similar pattern despite a large retracement in Q1 2018 where the price dropped by more than 50% (see chart 20). Nonetheless, it is important to recognise that a similar event has occurred between the months of December 2013 – May 2014 (see chart 21) which saw a large scale recovery afterwards.

Furthermore, the increasing value does not necessarily indicate an increasing amount of people using cryptocurrency, it is crucial to consider volume, which dictates price and in trading an individual can increase/decrease the value of a currency if they have large quantity of capital available.

However, what does seem to be different from the previous period stated is the growing volume in trades has steadily increased over the period of 2017 – 2018 (see chart 20). Consistent higher levels of volume in trading suggests that either the amount individuals are trading is higher or there are more people than ever before entering and trading in this marketplace.

**Chart 20 - Cryptocurrency market capitalisation (July 17' – March 18')**



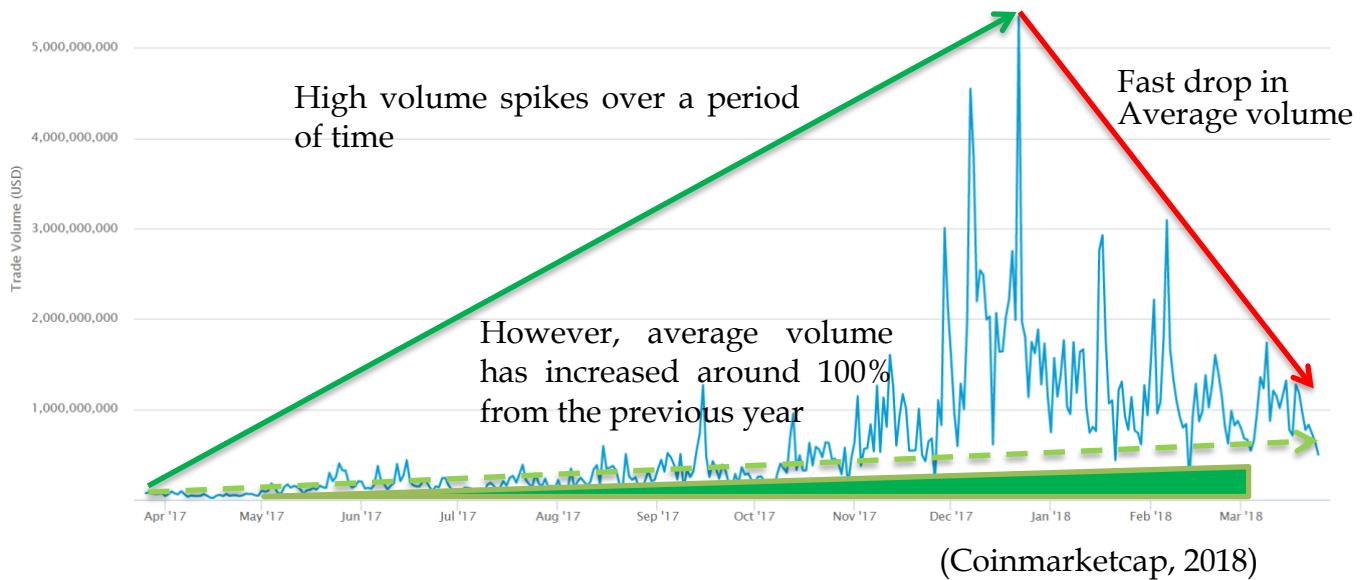
(Coinmarketcap, 2018)

**Chart 21 – Bitcoin (December 2013 – May 2014)**



**Chart 22 – Volume increase from 2017 – 2018**

(Coinmarketcap, 2018)

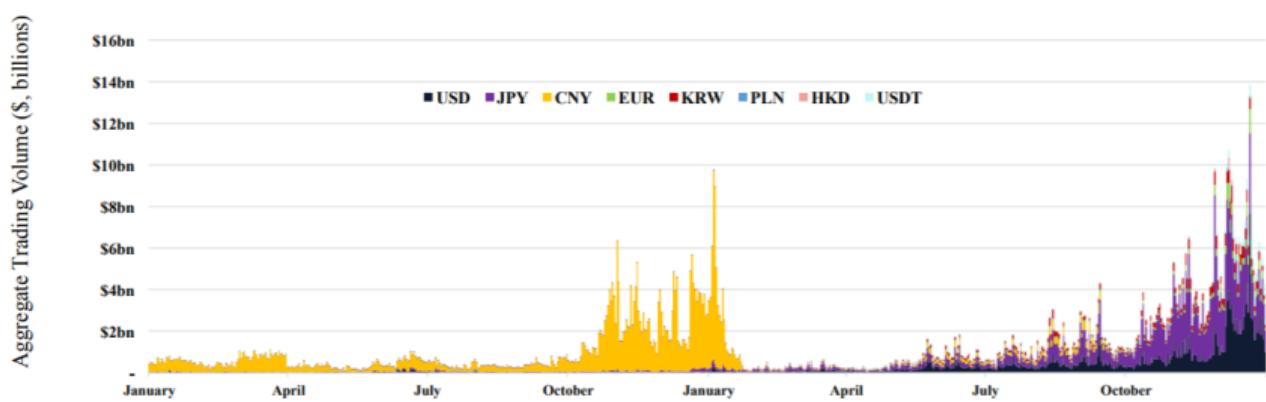


However, chart 22 above displays the average daily number of transactions in accordance with the larger cryptocurrencies, the average growth rate for these larger currencies combined is 103.152% from 2016 – 2017 which is in agreement with Table 5 data on the following page. This finding alongside chart 23 on the following page, displays an average increase in volume purchases from various fiat currencies to cryptocurrencies around the world begins to paint a picture that cryptocurrency is becoming more popular despite its price fluctuations and therefore, coming into alignment with the DOI process of time.

**Table 5: Average daily number of transactions for largest cryptocurrencies**

	Bitcoin	Ethereum	DASH	Q1 2016 - Q1 2017 Growth
Q1 2016	201,595	20,242	1,582	
Q2 2016	221,018	40,895	1,184	
Q3 2016	219,624	45,109	1,549	
Q4 2016	261,710	42,908	1,238	
January - February 2017	286,419	47,792	1,800	Rate via transactions:
	DASH	Monero	Litecoin	
Q1 2016	1,582	579	4,453	Bitcoin = 42.08%
Q2 2016	1,184	435	5,520	Ethereum = 136.10%
Q3 2016	1,549	1,045	3,432	Dash = 13.78%
Q4 2016	1,238	1,598	3,455	Monero = 350.95%
January - February 2017	1,800	2,611	3,244	Litecoin = -27.15%

(Hileman &amp; Rauchs, 2017)

**Chart 23 - Global Daily Bitcoin Exchange trading volume**

(Hileman &amp; Rauchs, 2017)

## 2.8 The Alignment of radical innovations and the Technology Acceptance Model

In the previous section we looked at social media alongside cryptocurrency, both of which are radical innovations. However, in order to gather a wider understanding of the models available and their validity, we will put Bitcoin and smartphones; another recent radical innovation through a similar analysis.

Importantly, the reason for focusing on smartphones alongside cryptocurrency is due to the fact that smartphones and social media are two of the latest radical innovations alongside the internet thereby, making a comparison with a similar technology and model will allow the researcher to identify trends and similarities which may determine a more concrete understanding of whether this model is suitable for analysing technology in this current era or whether it is outdated and therefore aiding in the process of identifying the potential usage in this assignment.

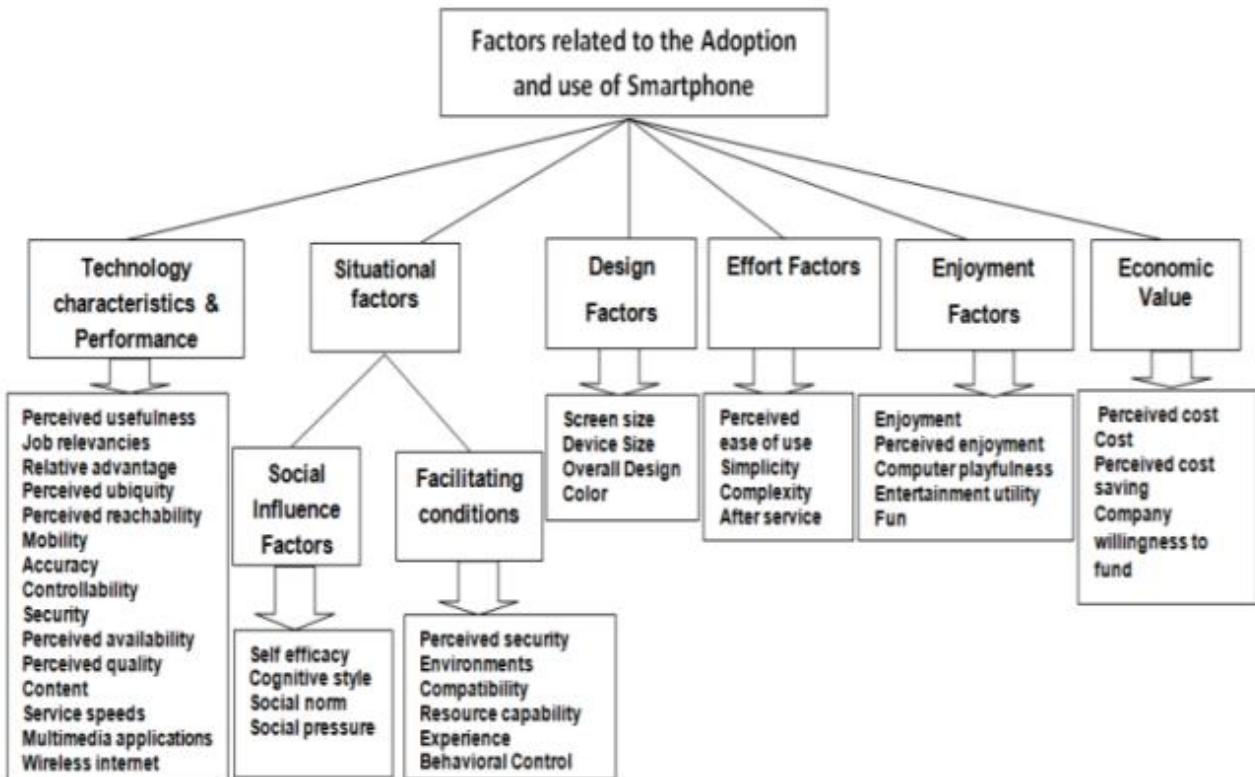
Therefore, once this process is completed, this research would have identified the current reliability of both DOI and TAM and a decision will be made in terms of which model/s will be used in terms of primary research, this will be further discussed at the end of this section.

Research from Kang et al (2011) focused on adopting the TAM model to analyse the main elements of the adoption process in regards to smartphones. Similarly, Verksalo (2010) conducted a study which additionally adopted the TAM model in order to aid in the identification and understanding of users intention of certain apps on a smartphone device. Furthermore, Hyun (2008) and Chen et al (2009) conducted similar studies with a focus on smartphone adoption however, their combined research uncovered that the TAM model was only able to account for up to 40% of variables in the acceptance and adoption process (Venkatesh et al, 2003).

Therefore, it could be thought that the TAM model itself in theory is applicable to all however, when applied with modern technology there are factors which are yet to be adapted to the current model therefore rendering it useful but not entirely accurate in terms of reflecting the adoption and innovation process. A variance of different authors within this field of research specify that more variables need to be added in order to more accurately associate the model with the human and social factors which are more present now than in the past (legris et al, 2003).

Therefore, the previous researchers created a logically conceptualised model to form the basis of a potential framework, they did this in relation to the adoption and use of the smartphone and discovered that there were six main constructs not just two (Sekaran, 2003) as seen in figure 2:

**Figure 2 – Advanced constructs of diffusion**



(Sekaran, 2003)

However in table 6 on the following page, studies have been identified which emphasise the importance of PU and PEU displaying both as being significant elements in the process of adoption, therefore despite criticism of the model, it is important to note that if this particular framework were to be overly complicated then arguably it could be applied to less technology which would then not reflect the original purpose of such a model.

**Table 6 – Smartphone related research using TAM**

<b>Research Topic</b>	<b>Model</b>	<b>Independent Variables</b>	<b>Dependent Variables</b>	<b>Results</b>
Analyse factors effecting adoption of the smart phone - this research focused on graduate and undergraduate Korean students	TAM	Perceived usefulness (PU) Perceived ease of use (PEU) Wireless internet Design Multimedia	Behavioural intention	Identified that the independent variables were found to affect PU and PEU. Design only affected PU
Investigate factors that may affect the intention to use Smartphone applications across users and non-users	TAM	Perceived enjoyment Perceived usefulness Social norm Behaviour	Preference	Their results exhibited: Perceived enjoyment and usefulness were generally seen as being the main reason to use certain applications over others
Investigate the key factors that influence the adoption of the Smartphone among college students in China	TAM	Self-efficacy, attitude, PEU, PU, social influence, Entertainment utility, compatibility	Behavioural intention	Social influence, entertainment utility, compatibility, all factors had a significant and positive impact upon a user's PU and PEU for smartphones
Users behavioural intention toward using mobile wireless technology	TAM	Perceived ubiquity, Perceived reachability, Job relevance, PEU, PU	Behavioural intention	All 5 variables have a positive relationship with behavioural intention, most significantly PU
Study the adoption of the smartphone among medical doctors and nurses	TAM	Compatibility, observability, trialability, PEU, PU, attitude	Behavioural intention to use the tech	PEU and attitude towards using smartphones significantly influence behaviour to use such tech PEU and PU positively impact users attitudes toward using the smartphone
Investigate the barriers for adopting mobile banking services	TAM & DOI	Trust, credibility, computability, perceived risk cost, PEU, PU	Users behavioural intention	Compatibility, PU and risk are the most significant indicators of users adoption of mobile banking

(Kang et al, 2011; Verkasalo et al, 2010 ; Pan et al, 2013 ; Kim and Garrison, 2009 ; Hyun, 2008 ; Park and Chen, 2007 ; Shin, 2007 ; Chtourou and Souiden, 2010 and Koenig-Lewis et al, 2010)

Therefore, in order for us to equip ourselves with an understanding of whether this generalised model is suitable for cryptocurrency, we need to put this phenomenon through the TAM process. Table 7 below shows the PEU and PU of Bitcoin. This section will focus on the complexity of trading and the speed of transferring as there is a belief that these are fundamental issues in the cryptocurrency space.

**Table 7 - TAM factors applied to Bitcoin for end users (Investors, users, etc):**

BITCOIN USED AS A DIGITAL CURRENCY	
Perceived Ease of Use	Perceived Usefulness
<ul style="list-style-type: none"> <li>• Free participation</li> <li>• Instant transfers</li> <li>• Simple interface</li> <li>• Linkage to traditional currencies</li> <li>• Relative complexity of bitcoin trading</li> </ul>	<ul style="list-style-type: none"> <li>• Control own money</li> <li>• Disintermediation</li> <li>• High speed of transfer</li> <li>• Low cost of transfer</li> <li>• High transaction security</li> <li>• Limited supply</li> <li>• International scope</li> <li>• Lowers merchant costs</li> <li>• Increases customer trust requirements</li> <li>• Higher price volatility</li> </ul>

(Folkinshteyn et al, 2016)

### 2.8.1 Perceived Ease of Use

Firstly, relative complexity of Bitcoin trading; originally before large scale growth, the biggest problem was the purchasing of Bitcoin, in 2009 users had to use exchanges such as New Liberty Exchange whilst, in 2010 Mt Gox became present, dealing with a lot of volume in the marketplace.

However, this required the user to undertake an international bank transfer to Japan in order to buy or sell Bitcoin. Additionally, in this period it was more common for individuals to mine as special hardware was not yet required (mining explained in image 7, next page):

**Image 7 – The Bitcoin mining process**



(Bitcoindaily, 2018)

(When a user wants to send his currency from A to B, a miner is the one whom facilitates the transaction with his/her hardware; therefore they receive a small amount of fees for mining the blocks of the Blockchain)

Arguably, the complexity to just buy Bitcoin alone made it inaccessible for those who were not as computer literate as Engineers, scientists and investors; in turn decreasing the diffusion potential of this particular innovation.

Furthermore, this problem is less poignant today as cryptocurrencies such as Bitcoin can be acquired easily through registering at services such as Coinbase, of which provide a relatively simplified version of purchasing in comparison to 2009/2010, nonetheless it is still something which is hard to trade as previously shown in image 3 (see page 18) which presents a difficulty for users therefore, the perceived ease of use is not as apparent in comparison to an innovation such as Twitter, as previously stated in this report.

### 2.8.2 Perceived Usefulness

There are 1559 different cryptocurrencies currently available (coinmarketcap, 2018), all of which are trying to solve different problems in different sectors from world finance, to medicinal issues. Therefore, this presents a very open and vibrant innovative collection of technologies which all offer different levels of usefulness. However, in this section we will discuss one cryptocurrency by the name of Nano in terms of its PU; this will be further explained on the following page.

Nano, similarly to other cryptocurrencies presents itself to the world as an alternative to fiat currencies and traditional banking; a 24 hour per day, 7 days a week open system which does not close. However, this particular currency unlike other currencies provides users with 3 elements which arguably have instant real world usage potential:

Firstly, Instant transaction speeds provide companies and people with the possibility to send money from one place in the world to another instantly. Secondly, from a traditional perspective there have been bank fees for transferring funds from A to B. However, Nano provides users with free instant transactions, meaning that businesses and individual parties can take advantage of such technology opposed to using traditional means equating to savings being made financially (Maloney, 2018).

Finally, unlimited amounts can be sent in conjunction with the previous two points therefore, an organisation could send 100 million USD's worth of Nano to another organisation instantly with no transaction costs, this would provide an organisation with great financial usefulness.

Taking all previous points into contention it is clear that TAM is limited by its simplified use of PEU and PU, cryptocurrency is such a new phenomenon which thereby raises more complex psychological and economic questions which thereby require a more comprehensive model. It's important however to understand that TAM has effectively understood the adoption of other technological advancements and therefore is suitable for other innovations.

However, after undertaking an extensive analysis of both TAM and DOI model, it is clear that the DOI model provides a more congruent primary methodological approach, and there are two reasons for this. Firstly, the DOI model is similarly condensed and simplified like the TAM model however, what separates this model is that there is a more consistent process which can be applied to a wider range of technology for example, when analysing Twitter and cryptocurrency it was clear that both of these technologies had elements of alignment with the model and importantly both of these innovations are contemporary therefore, positively reflecting the potential outcome of such an innovation.

Secondly, the research which has been completed has led us to believe that there is more of a psychological element to the adoption and diffusion rate of cryptocurrency than initially thought. Therefore, it would be ideal to combine TAM, DOI and SST but due to the fact that there is only one researcher, time is very much limited therefore, to extract the best data possible in a simplified manner the DOI model will be the primary model to be adopted as it best caters for the psychological element alongside other components such as understanding the process behind adoption.

Furthermore, taking the previous points into consideration, it is vital to obtain a wider understanding of this phenomenon and the only way to do so, is combining multiple models together, for this particular assignment the DOI and GHC models will be synergistically applied, there are two fundamental reasons for this.

Firstly, the use of multiple models can provide new and unique insight that can help researchers to understand various properties of data (Patel et al, 2011). Therefore, this approach will arguably give us the opportunity to create a more complete understanding of the cryptocurrency phenomenon as the ranging models allow a plethora of perspectives to be uncovered. Secondly, by using GHC and DOI this may uncover new research which in turn may allow a following researcher to apply their knowledge to these results and create a greater synergistic understanding of the phenomenon at hand.

### **3 DATA AND RESEARCH METHOD**

#### **3.1 Data**

There are two fundamental elements of this study which will be discussed in the data section. Firstly, following the research questions the author aims to acquire a well-rounded objective understanding of the current phenomenon and the limitations of the diffusion process, with the intention of locating the current position of diffusion in regards to the DOI model by extracting significant primary and secondary data findings.

Secondly, the following purpose of the study is to identify if cryptocurrency is here to stay, and if this is likely, how long will it take before it becomes a globalised norm?

In order to understand the second point effectively the author has devised a strategy which requires interviewing investors and potential investors in alignment with secondary research and the DOI process, the actual methodological approach will be discussed in depth in the following section however, this section will go into detail about the second purpose of the study; figuring out a time scale of if/when cryptocurrency becomes mainstream.

In order to successfully complete the study, assumptions need to be made in accordance with the amount of people whom hold cryptocurrency and their ability to aid the diffusion process; these assumptions however will be based on renowned literature from credited sources.

Accordingly, the Boston Federal reserve report estimates that 0.87% of US consumers have owned cryptocurrency, accounting for 2.8 million people in the United States alone. Based on the calculations of such, companies such as Coinbase and ARK research estimated in 2016 than there are around 10 million people whom hold cryptocurrency worldwide. Therefore, 10 million will act as the base figure for the diffusion population however, in order to determine the rate of diffusion; interviews will be undertaken with current investors/users and potential investors/users (Hileman and Rauchs, 2017). There will be two objectives for both interview processes:

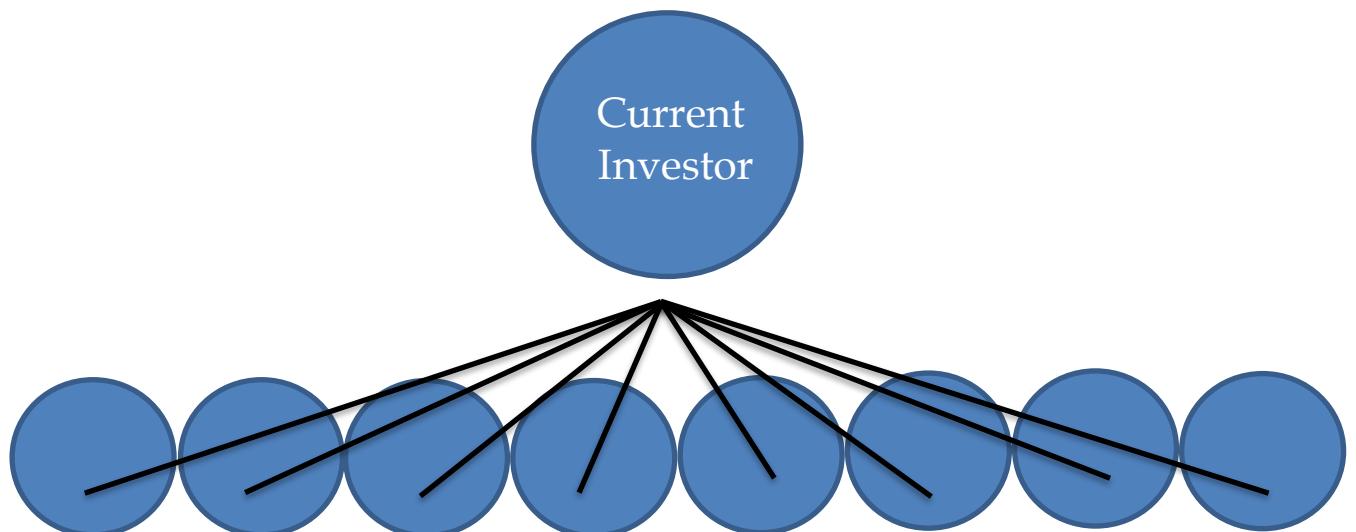
Firstly, potential adopters/users; the purpose of these interviews will be to try to understand why people have not invested/adopted with the intention of uncovering the reasons behind such decisions, this will aid in understanding the steps which will need to be undertaken for the technology to move forward effectively in society.

Secondly, interviewing current investors/users; the purpose of such is to figure out their influential capabilities thereby, understanding their circle of influence and how many people they tell which go on to invest/use, this will help to discover the potential diffusion rate of this phenomenon.

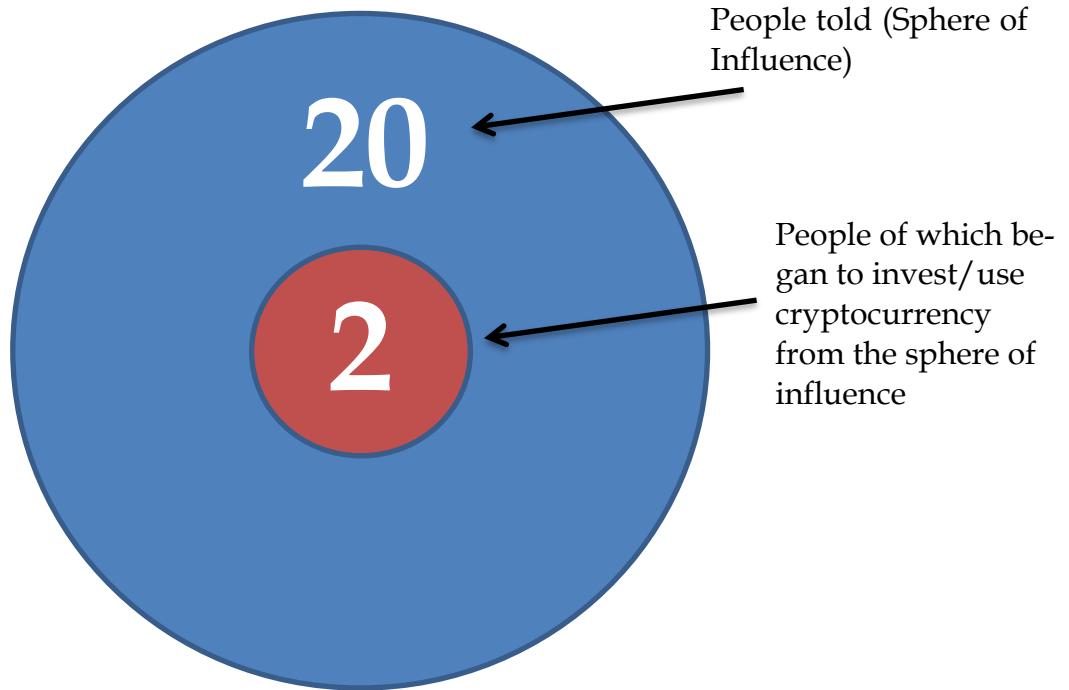
Additionally, from these interviews an average will be found in terms of identifying their circle of influence and then an additional average will be found of the individuals which they have influenced into the space, this will aid in determining the average cryptocurrency diffusion rate per person, an example will be displayed on the following page.

#### **Example 1: Step 1 – identifying the sphere of influence:**

After interviewing 10 people, the research identifies that the average sphere of influence is 20 people. However, only 10% of those informed decided to act on the advice and invest/adopt cryptocurrency.



### Step 2 - identifying average amount of future adopters:



Using this data we will create a fixed diffusion rate for cryptocurrency with the intention of relating such diffusion speed to the most contemporary radical innovations; social media, the smart phone alongside other radical technological innovations thereby creating a formula which represents past diffusion elements. This will thereby enable us to predict a future date of when cryptocurrency will reach 60% adoption in conjunction with U.S Statistics.

However, in order to effectively model the diffusion of innovation for cryptocurrency a formula must be devised which presents an accurate account of the cryptocurrency environment. Therefore, using the theory of epidemiology, this fundamental model of the diffusion of the cryptocurrency innovation can be expressed using the following equation:

$$\frac{dN(t)}{dt} = g(t)(m - N(t)),$$

(Anghion and Howitt, 1998)

"N (t)" stands for the numbers of adopters at a chosen time "t", "m" stands for the maximum amount of potential adopters, (figure will be taken from the av-

verage current adoption of smartphones and social media) “ $g(t)$ ” represents the rate of diffusion. Thereby, this formula dictates that the diffusion rate is a function of the amount of potential adopters whom are yet to adopt cryptocurrency and the rate of diffusion. The rate of diffusion, “ $g(t)$ ” resembles the probability that potential adopters of cryptocurrency will adopt such innovation in regards to the interval of time represented by “ $t$ ”. Furthermore, “ $g(t)$ ” is dependent on external factors which will influence the rate of diffusion (Wang et al, 2006).

### **3.2 Method**

It is vital to consider the importance of collecting valuable information as this will aid the researcher in gathering a comprehensive perception and understanding of the future of cryptocurrencies, in order to achieve this outcome this study will be evaluating both primary and secondary data, the researcher has decided to use both approaches to gather a greater understanding of the research topic.

Primary and secondary data will be initially collected through a variation of different sources such as an initial interview process, academic abstracts, internet search engines and academic databases such as ‘Google Scholar’ and University accessible sites, by following such it will help to provide a greater insight into the past and present research of cryptocurrencies. Additionally, the data collection will facilitate and aid the researcher by providing a ‘platform’ of knowledge to critically discuss comparisons in research literature thereby, gathering an understanding of the origins and characteristics of cryptocurrency before conducting primary research.

Prior to acquiring valuable primary research, it is imperative to consider how to effectively collect data which will positively reflect this academic study thereby; a particular methodology needs to be identified which will have the capability to extract key information aiding in identifying and uncovering information in alignment with the research questions of the study at hand. Jamil (2015) and Livesey (2006) dispute that an ‘interpretivist’ methodology focuses and emphasises the collection of qualitative data, using methods such as semi-structured interviews. Furthermore, this approach aligns with the aim of this study as the complexity of the topic will require a qualitative research approach to identify contributing factors in the understanding of cryptocurrency on a globalised scale.

Nonetheless, it is crucial to comprehends that cryptocurrency is arguably a new phenomenon in academia and finding individuals whom are willing to be interviewed is rare thereby, this study will have to be conducted using a 'hybrid approach' combining both interpretivism and Snowball sampling; this process consists of identifying respondents who are then used to refer researchers on to other respondents (Vogt, 1999; Faugier and Sargeant, 1997).

There are two fundamental reasons for choosing to use a synergy of both 'snowballing' and an 'interpretivist' research philosophy. Firstly, a range of authors' dispute that a researchers emphasis on making sense of what is happening can unveil surprising findings beyond the current common scientific knowledge (Blumberg et al 2011, Fagerberg et al, 2005; Im et al, 2003; Murtha et al, 2001). Therefore, it could be contended that using such methodology may reveal something unknown about the diffusion of cryptocurrency however; the purpose of this investigation is to generate research with the intention of identifying the diffusion of cryptocurrency, thereby using this approach will provide a suitable platform to identify key events.

Secondly, it is important to note that 'Snowball Sampling' contradicts many of the assumptions underpinning conventional notions of sampling in the sense that it uses a targeted approach. However, this methodological approach has a range of advantages for sampling populations such as the deprived, the socially stigmatised and elites (Saunders, 1979). As previously stated, cryptocurrencies are a new phenomenon in the academic world and also in society thereby, having wide access to a range of sources is arguably an unrealistic feat, thereby the use of this methodological approach will allow the researcher to delve deeper into this 'world' thereby, providing a means of accessing vulnerable and more impenetrable social groupings (Atkinson and Flint, 2001).

Moreover, in an investigation it is important to consider the method of data collection as this can determine the quality of information collected (Bryman, 2012). To gain an extensive understanding of the topic the researcher will be collecting primary and secondary qualitative research. In accordance with Curry *et al* (2009) mixed methods of qualitative research are increasingly recognised as being valuable for a study.

Accordingly, a qualitative research approach highlights a range of multi-faceted complexities through the process of thought provocation and discussion, in turn shedding light on a range of understandings (Garcia and Gluesing, 2013 and Smith et al, 2013). Thereby, this investigation will be conducting semi-structured interviews as this approach will not only provoke thought but shall

facilitate an exploration of the complexity of cryptocurrencies (Saunders et al, 2016).

Moreover, the semi structured interviews will be adopting a thematic approach allowing the subject to be guided, this will aid in the illustration process with the intent on aiding the subject in effectively describing an event and/or process (Bryman, 2015). Therefore, in order to ensure the interview participants understand the situation at hand they will receive the themes of the interview before an arranged meeting, this approach will help in regards to providing the participants with time to 'gather their thoughts', complementing the reliability and quality of the data they will provide (Saunders et al, 2016). The themes will correspond with the research questions of the study as this should aid the researcher in achieving the overall aim.

Additionally, through the use of semi-structured interviews, the study at hand will also be undertaking an inductive research approach, this will allow for the researcher to draw conclusions from one or more particular documents and/or sources of evidence (Blumberg et al, 2011). Arguably, this research approach shall provide the researcher with a logical route of analysis, influencing the researcher to identify and thereby narrow the information received helping to identify the key factors of the diffusion for cryptocurrency (Bendasolli, 2013).

Regarding sampling, initially purposive sampling will be identified and used as the researcher will try to discover suitable candidates to interview which are in alignment with the research questions. However, as previously explained snowball sampling will aid to further the research; when used in qualitative research it allows the researcher to identify 'information rich' data (Parker, 2016) as this study proposes to uncover key information about cryptocurrency; experienced knowledgeable participants will be identified and selected in regards to user and adopters of cryptocurrency as this sample selection will not only provide value to the investigation but shall also contribute to the research aim and questions. However, in regards to non-investors and/or adopters it is crucial to reflect the population therefore, this sample will not be chosen in accordance with the same system (Saunders et al, 2012; Palys 2008).

The researcher aims to identify two categories of individuals to interview whether through primary or secondary research in order to gather a comprehensive understanding of cryptocurrencies and their potential future in the economic environment; current cryptocurrency investors/users and potential investors/users

The purpose of this sample is to provide multiple viewpoints on the cryptocurrency phenomenon therefore, drastically reducing the possibility of a confirmation bias being developed. Furthermore, this methodology will positively correspond with the aims and research questions of this study. However, it is important for the researcher to emplace a contingency plan as acquiring the acceptance of primary interviews with a range of cryptocurrency investors may be unlikely, therefore to ensure valuable research is undertaken the researcher will also pursue high quality secondary data which has an emphasis on the topic at hand.

Moreover, in order to acquire research information on the topic of cryptocurrencies, the researcher aims to complete ten semi-structured interviews approximately 30-40 minutes each, applying the thematic approach previously stated will help to keep a logical structure which the participant will understand thereby, allowing the researcher to identify 'information rich' data and expand upon it during the interview process (Parker, 2016).

However, it is important to consider the reliability and effectiveness of the interview questions thereby, the interview questions will be trialled through the piloting process, this procedure will allow the researcher to identify any potential issues or problems which may occur during an interview, thereby allowing the researcher to resolve any issues in good time before conducting the official interview process. Furthermore, when undertaking research it is crucial to take into consideration multiple issues to ensure that a particular study has been conducted in an ethical manner (Miller et al, 2012; Oliver, 2010). Therefore, this research study will be in alignment with the ethical guidelines in accordance with the University of Jyvaskyla.

Accordingly, in order to follow such regulations individual participants will be made aware of the overall aim and research questions of the investigation at hand this will allow for boundaries to be created, ensuring the comfort of the participants. Importantly, due to the optional nature of the interviews this study will allow the withdrawal of meetings or data if the participant deems this necessary, following ethical guidelines (Blumberg, 2011).

## 4 RESEARCH FINDINGS

### 4.1 General Information

Qualitative data is often deemed difficult to analyse therefore, due to the qualitative nature of this study the researcher has used a 'Thematic Network Tool'; used to organise thematic analysis of qualitative data (Attride-Stirling, 2001; Clarke and Braun, 2013). This tool employs three stages to qualitative data analysis; reduction of the text, exploration of the text and integration of the exploration.

All methods have specific limitations alongside particular strengths; however, Kelle (2006) proposes that qualitative and quantitative methods should be combined, by doing so it creates a synergistic approach which overlaps the weaknesses of each study, creating more reliable material. This approach will be undertaken as the researcher was able to find quantitative data in alignment with the questions from the qualitative study therefore; adopting such an approach will allow a greater conceptual understanding of the diffusion and future processes of cryptocurrency.

The text has been reduced using an adapted version of the thematic network tool; identifying the key trends and quotes within the interviews and secondary surveys, dissecting the most prevalent points within the quotes and identifying trends from all the conducted interviews, finally categorising the trends by the regularity of that trends occurrence within the interviews and surveys with the most prominent trends being discussed. Extracts from the interviews will be displayed and discussed in relation to the research question.

## 4.2 Findings & Discussion

### 4.2.1 The Nature and Benefits of Cryptocurrencies

<b>Potential Investors/Users</b>		
<b>Trends from interviews</b>	<b>Alternative thoughts</b>	<b>Survey Trends</b>
Need to obtain more knowledge about cryptocurrency and how it works	<i>"The only advantage I see is an ability to buy something illegal or covertly"</i>	technological interest and curiosity, monetary gains and investment where reasons where the main trends in terms of why to adopt cryptocurrency
Higher Levels of disposable income in order to be able to safely invest	<i>"It is a self-improving system where the community updates itself"</i> (Tokenisation in itself is a form of such, where companies use the Ethereum Blockchain to create their own forms of currency, this community then becomes stronger as products are based on other products like Facebook being on the internet)	N/A
Cryptocurrency is not controlled by a single entity, higher levels of speed and security in regards to payments	N/A	N/A
<b>Current Investors/Users</b>		
<b>Trends from interviews</b>	<b>Alternative thoughts</b>	<b>Survey Trends</b>
Investments are chosen by a range of different variables; good technology, strong team, economic viability, applicability in real world environments	No relevant alternative thoughts	No relevant trends
Majority of investors and/or users adopted cryptocurrency based on profit potential	N/A	N/A
Belief that Blockchain technology is the future of the monetary system	N/A	N/A

Firstly, interviewees whom are both potential investors/users and current investors/users emphasise the importance of having enough knowledge arguing that this provides a benefit to the overall understanding of the phenomenon. What is interesting about these results is that if investments/users were categorised into the two stages above it is clear that the resulting evidence suggests that knowledge is obtained once an investor/users decides to start undertaking the process, as many argued that "good technology, strong team, economic viability" where methods used to adopt the technology, this in itself displays a universalised model like process which has been created and adhered to.

However, a second trend arguably uncovers the potential reasoning for adhering to such a model and this is due to the sole purpose of using cryptocurrency for profit purposes opposed to actually using them as an alternative or replacement for existing currency. These particular results lead us to question what is the current universalised understanding of cryptocurrency. This question arises because it is currently seen as an investment pathway, people with lack of knowledge appear to be afraid of its technicality and arguably see cryptocurrency as something which rivals the stock exchange opposed to an alternative form of currency. It is important to note that today the current ideology and understanding of cryptocurrency is shifting from its original vision which may have implications attached to it including its purpose on an internationalised scale.

Additionally, the secondary results from the survey are in alignment with the primary results conducted in the interviews in regards to the trend suggesting that monetary gains where one of the prominent features behind the usage and/or adoption of cryptocurrency. It is important to note that monetary gains provide users and investors with financial benefits however, there appears to be a stigma attached, that users can only gain money as if it were some sort of game. However, in order to fully comprehend the psychological meaning behind such it is important to conduct more research on this phenomenon therefore, potentially uncovering something which this research was unable to do so.

However, a potential user whom is currently a non-user/adopter of cryptocurrency expressed in the dialogue that “the only advantage I see is an ability to buy something illegal or covertly”. Importantly, it is vital to note that this particular interviewee had only undertaken mainstream media research suggesting a potential for mass media to have influential factors upon the idea of the benefits and nature of cryptocurrency. This particular individual alongside other members of the interview process made claims in relation to the security issues and safety of cryptocurrency however, a large majority concluded in the interviews that they had not conducted any in depth research thereby leading us to question the source of their knowledge and how influential this is in their decision making process to adopt and/or use cryptocurrency.

On the other hand, it is important to note that not all of the non-investors had done minimal research some of which had read through scientific peer review journals which display information in a more objective format than mainstream media. One of the interviewees of which conducted this particular approach said that, “it is a self-improving system where the community updates itself”, this perspective is completely different to the previous explained and is arguably different due to the calibre of information supplied by different avenues of information. Despite this, it is important to understand variables such as inter-

est in the phenomenon as well which are immeasurable elements nonetheless the results from different information sources poses different mind-sets in accordance with the same issue.

Through an analysis of the most prominent points raised numerous conclusions can be drawn in regards to the nature and benefits of cryptocurrency in relation to the literature.

Firstly, it has been stated that Bitcoin has multiplied almost 1 million times since 2010 (Shen, 2017). Thereby, displaying mesmerising growth with many authors claiming that this growth originates from the confused situation after the 2008 global economic crisis, where others sort refuge in a currency which could not be controlled by one entity.

Accordingly, a trend from the interviews coincides with the previous literature, in the sense that the main benefits seen from this industry are focused primarily on capital gains from individual adopters/users, of which classify themselves as investors not users of the currency. It could be thought that this in itself provides a potential positioning element in regards to the diffusion of innovation suggesting that it is in the realms of "early adopters". Due to the lack of investors/users on a globalised scale once there is a mass increase or this phenomenon reaches mainstream adoption then the psychological approach of such may change however, currently it is clear that there is a contemporary belief that the benefits of cryptocurrency are for financial gain.

Secondly, it has been stated that cryptocurrency originally started as an anarchic computing subculture with the intention of realising the benefits of a non-governmental institution creating a platform which did not allow governments, companies and other people to essentially track your behaviour (Frisby, 2014).

However, there is a clear severance in understanding between those whom are investors/users and those whom are not. Therefore, it is clear that the idea of the nature and benefits of this particular phenomenon are incoherent and are not universalised which in itself provides a problem as despite being able to only interview 10 people, there was no level of agreement between both sides (users and non-users), suggesting that if there is lack of universalised knowledge it would be extremely difficult for a cryptocurrency to become universalised and used globally.

## 4.2.2 Barriers to the Expansion of Cryptocurrencies

<b>Potential Investors</b>		
Trends from interviews	Alternative thoughts	Survey Trends
The drawbacks including not knowing how the system works, the complexity compared to existing methods and the instability/unpredictability of the cryptocurrency market	<p><i>"Evidence displaying an absolute certitude of its profitability"</i></p> <p>(an assumption that cryptocurrency can only make profits? Important to understand that individuals do not look at FIAT currencies in this manner)</p>	No relevant trends
Hard to know when and in which one to invest especially when you are a beginner	<p><i>"I see no reason why I would use it, other than to buy something from the dark web, but given that I have no interest in doing so, I cannot foresee needing it".</i> (Focus on using it for illegal reasons)</p> <p><i>"Earning easy money"</i> (this is an interesting point, because this comes from someone whom is not an investor thereby, they have made assumptions based on the potential)</p>	N/A
High fluctuations and security breaches	<i>"It is not "real money" so you cannot use it every day"</i> (the emphasis on the point that it is not "real money" leads us to question what is truly real? Value is just a representation of something we give to something, this displays a psychological bias to fiat over cryptocurrency)	N/A
Higher levels of security and speed of payments		N/A
<b>Current Investors</b>		
Trends from interviews	Alternative thoughts	Survey Trends
Current state of cryptocurrency is in the "Wild West" lacking regulations	Interviewees going against their long term investment philosophies in order to make a <i>"quick buck"</i>	No relevant trends
General belief that the landscape of the phenomenon will change in the coming future	Choose to invest in particular currencies with the sole intention of just making profit (It's called Cryptocurrency but it is being used as an investment, is this stopping people from adopting? (Barrier may be occurring by the two divergent pathways being created: 1) those whom believe in the tech and vision, 2) those that want to just make profits)	N/A
N/A	<i>"Cryptocurrency seemed more casual and a fun financial asset in comparison to traditional assets".</i> (Is there a psychological element to cryptocurrency where it's seen as a game and not a real form of value, making it easier to invest for certain people?)	N/A

Firstly, one of the most prominent trends identified within this particular objective was the fact that a lot of individuals whom are non-investors/ users spoke about the difficulty in identifying the correct coin or token to invest into, saying this was a difficult element in the process of cryptocurrency. What is striking about this response is the focus on "investing"; this appears to be consistent throughout all of the interviews. For example, one interviewee of which was a non-investor/user said, "I need evidence displaying an absolute certitude of its profitability". What is prominent about this point is the interviewee has arguably made an assumption that cryptocurrency is a system which only provides users with profits.

This appears to be a growing trend amongst non-adopters of which claim they have not undertaken substantial research suggesting, that mass media and other forms of open platform communication are having an influential factor on particular individuals understanding about the cryptocurrency phenomenon. Additionally, a different non investor/adopter interviewee stated that their purpose for the usage of cryptocurrency would be to “earn easy money”, further extenuating the previous point. However, the point raised by another interviewee poses as a potential insight into why this issue is in occurrence, “It is not real money, so you cannot use it every day”, it is important to note that this quotation comes from another non/user investor of cryptocurrency nonetheless, their addition highlights that there could be a “game” like ideology towards this phenomenon and therefore, presenting a barrier in the form of not thinking of it as a real asset or form of value.

This ideology is not just solely shared upon those whom have yet to invest or use cryptocurrency, it is also prevalent in current users and investors as from the interviewee process one investor/user said that “cryptocurrency seemed more casual and a fun financial asset in comparison to traditional assets”. It could be thought that the cryptocurrency phenomenon is currently undertaking a separation process where once there was the original pathway of following the vision and technological aspect of certain coins and tokens whereas, now it seems more apparent from the primary and secondary research undertaken that a new pathway has unveiled itself in the form of profits/game complex where individuals see cryptocurrency as an arena for making financial gains.

Through an analysis of the most prominent trends withdrawn from the research multiple conclusions can be extracted in regards to the barriers to the expansion of cryptocurrency.

Firstly, there is a worldwide governmental dispute in identifying and classifying what cryptocurrency is, in early 2018, testimonies from the Chairman of the Commodity Futures Trading Commission (CFTC), Christopher Giancarlo and the chairman of the Securities and Exchange Commission (SEC) Jay Clayton, of which understood and highlighted the potential problems with cryptocurrencies but continued to cite that they need to be open minded in the approach.

Accordingly, from the research obtained during this process a trend has unveiled displaying a focus on cryptocurrency as a form of investment opposed to being seen as a currency of use. What is interesting about these results from the interviewees is that it suggests that potentially governments’ attempt of classification is starting to encourage general users to classify the currency as an in-

vestment and thereby changes the outlook and understanding of the phenomena potentially addressing a new pathway forward in cryptocurrency which has a discouraging factor for those whom are non-technically literate. Thereby making it appears as if you need to have computer knowledge to purchase cryptocurrency whereas comparatively to purchase fiat currency would be much easier.

Secondly, it could be disputed that there are an array of issues working synergistically that provide a layered barrier explained in the literature; Bitcoin and cryptocurrencies alike, have had more negative observability through mass media; links to money laundering, funding terrorism and criminal activity have arguably discouraged people from adopting the technology available (Brenig et al, 2015; Bray, 2016). Additionally, “hype” can be seen in the cryptocurrency market which creates a “herding effect” (Wermers, 1999) this investment behaviour can create large rallies or selloffs based on little or no evidence of an event occurring, creating high levels of uncertainty around using such a service and thereby, the adoption rates are much slower because there is no previous technology which can be trialled and compared to it (Fry and Cheah, 2016).

The interview process is arguably in alignment with such a synergistic approach as there appears to be a focus on the unclassified asset that is cryptocurrency and due to its lack of classification by authorised governments it has created a vacuum of misunderstanding where mass media, standard media, word of mouth and scientific knowledge are all scrambling to make sense of the phenomenon and this opens it up for contradiction and misunderstanding as seen with some interviewees claiming it is a “fun asset”, “not real money” or claim it is only an asset to purchase something from the dark web. The misunderstanding and overall lack of a dogmatic approach from governments and countries has created a confused state which appears to be one of the primary yet fundamental barriers which needs to be addressed before the process can become more prevalent in society.

### 4.2.3 Strategies for Overcoming Barriers to the Development of Cryptocurrencies

<b>Potential Investors</b>		
<b>Trends from interviews</b>	<b>Alternative thoughts</b>	<b>Survey Trends</b>
80% of interview participants of which are not invested/users of cryptocurrency argue that they will use the tech in the future or in the near future	"At first it was more of a game for me, but now I would like to do something good with crypto" (a "Game" this is an interesting insight, at first it was seen as a game, and then overtime when more research was undertaken there was a realisation that it is not a game, could it be possible that due to the intangible form of such a currency it is looked at in a different psychological manner than FIAT?	87 non-users shared their thoughts with us. We clustered the answers and found: stability, security, payment means, used as currency, usefulness, accessibility, greed, wanting a sample, and "I do not know".
Security breaches (hacking)	"Should a need arise I would require certain guarantees that purchasing it/using it would offer me the same protections as conventional methods of payment such as PayPal or Credit Card". (Ideas in alignment with current system, thereby, making comparisons to what is known opposed to what is different, like in the literature review it says about Twitter being an easy comparison between Facebook which was made 2 years prior, with cryptocurrency we are not able to make such comparisons)	N/A
N/A	"The pros are that cryptocurrency could maybe become a really good alternative to normal money. In Sweden one of the most cash-less country in Europe for instance, the government are set to release the first national cryptocurrency called the e-krona".	N/A
	"Although the concept of money is already a fake "Imaginary order" to quote Yuval Noah Harari in his book Sapiens. Therefore, why giving so much importance to its virtual form". (The concept of money was something which was manufactured, the giving of value however is a universalised concept, and thereby the same phenomenon may occur in relation to cryptocurrency).	
<b>Current Investors</b>		
<b>Trends from interviews</b>	<b>Alternative thoughts</b>	<b>Survey Trends</b>
Investments are chosen by a range of different variables; good technology, strong team, economic viability, applicability in real world environments		No relevant trends
Majority of investors and/or users adopted cryptocurrency based on profit potential	"The tech is ground breaking in some industries but we must learn to implement it in the right places in order for mass adoption	N/A
Belief that Blockchain technology is the future of the monetary system	N/A	N/A

80% of all the potential users/investors of which were interviewed stated that they wish to adopt this technology in the future. This display of results shows that there is a growing integration in terms of the thought process one goes through in regards to thinking about the future use of cryptocurrency. Importantly, one interviewee in particular states that "at first it was more of a game for me, but now I would like to do something good with cryptocurrency". This point coincides with points previously raised in the past objective it could thereby be thought that once a user/investor sees the potential in cryptocurrency they undertake more research and have a change of perception on the matter.

However, this is not always the case as seen from another non user/investor whom states, "should a need arise I would require certain guarantees that purchasing/using it would offer me the same protections as conventional methods of payment such as PayPal or credit cards". This interviewee raises a substantial point about the need for it in regards to his/her location in Western Europe. It is important to note that westernised banking is superior to many banking systems today and thereby changing from one system to another without seeing any benefits is not only a hindrance but not necessary in the eyes of someone whom does not see the advantages through the lens of cryptocurrency, therefore in order to cater for such individuals the technology will have to evolve overtime to facilitate such needs

"Cryptocurrency could become a really good alternative to normal money. In Sweden, one of the most cashless countries in Europe for instance, the government is set to release the first national crypto/digital currency called the E-Krona". The point which was raised by another non investor holds the potential answer to the previous interviewee through the lens of governmental intervention; this will arguably aid in the diffusion process as a government having the ability to back a digitalised currency provides guarantees that the funds are safe in a centralised location but also provides a need of use because the government may start to adopt the E-Krona as their major currency replacing that of the existing Fiat currency.

However, a non-user/investor raises a psychological point, "Although the concept of money is already a fake "Imaginary order" to quote Yuval Noah Harari in his book *Sapiens*. Therefore, why giving so much importance to its virtual form" to get a better understanding the book delves into the concept of humans creating intangible elements which shape the way in which we live;

*“Ever since the Cognitive Revolution, Sapiens have been living in a dual reality. On the one hand, the objective reality of rivers, trees and lions; and on the other hand, the imagined reality of gods, nations and corporations. As time went by, the imagined reality became ever more powerful, so that today the very survival of rivers, trees and lions depends on the grace of imagined entities such as the United States and Google.”*

(Harari and Perkins, 2017)

Thereby, this particular interviewee focuses on the fact that if everything around us has been created from our imaginations then this gives power to the possibility that a change in concept can occur in regards to the way in which money is seen and valued. This point raises the contention of “value” itself, money in fiat form is the contemporary issue of value transition however, it is important to note that value has consistently changed throughout human history; as exchanges originated through bartering, evolving into coin, gold, and now fiat currency, suggesting that virtualised currencies potentially may be part of that life cycle within the “imaginary order” of money and value.

Through an analysis of the collected information, a range of conclusions can be drawn in regards to the strategies for overcoming the barriers to the cryptocurrency innovation. Firstly, it was stated in the literature that governmental acceptance and/or policy can have an “endorsement effect” that legitimises and increases the salience of individuals whom want to adopt something new. Thereby, the validation and enhanced attention towards that area provided by state or governmental policies can support the work of interested parties.

Accordingly, the literature directly coincides with some of the significant points raised as there is an understanding that due to the lack of governmental endorsement there is not necessarily a need for such cryptocurrency in the westernised world due to the established nature of the current banking system. However, other elements of the literature contradict such trends; over a billion people worldwide own a mobile device or smartphone and do not possess a bank account and thereby can only store finance in the form of cash (Department for International development, 2014). However, cryptocurrencies are accessible via smartphones, where users can set up wallets and interact with others instantly. Essentially, currencies such as Bitcoin can allow those whom cannot undertake banking to instantly be able to trade locally and internationally, providing users with a safer, cheaper, faster and more private way of exchanging money than the leading African competitor M-Pesa (Hoyle, 2013).

Secondly, the research highlights that there is arguably a different conceptualisation of the value of money depending on the current economic situation that an individual is within. The literature raises the point from Joseph Stiglitz that the EU did not take into consideration the inherent diversity, disputing that the EU assumed that a highly diverse region could be managed by the same macroeconomic standards. Thereby, due to the fact that the majority of those whom were interviewed may potentially have a westernised bias, they are only able to see the advantage of cryptocurrency from their own perspective (Velden, 2018).

However, the macroeconomic standards seem to be changing and certain governments are undertaking harmonious relationships with companies in which FIAT currency and cryptocurrency are in alignment and are not being used as weapons against one another. This is currently being exhibited in China through a cryptocurrency called Walton Chain. Walton chain is already contracted by a range of governmental organisations to offer Internet of things (IoT) Blockchain solution to their cities and industrial zones, providing "smart city solutions" (Velden, 2018). This change in perception from a governmental level may create a globalised awareness of the phenomenon creating a universalised endorsement effect.

#### 4.2.4 The Future of Cryptocurrency in the Global Economy

<b>Potential Investors</b>		
<b>Trends from interviews</b>	<b>Alternative thoughts</b>	<b>Survey Trends</b>
80% of the participants argued that cryptocurrency has a future in the global economy however; they focused on the need for government regulation to occur to make it safer.	<i>"I believe there will be a future however, central banks and financial institutions need to figure out how to control and deal with this phenomenon".(One participant focuses on the point that the central banks need to somehow control the currencies, this is in alignment with the IMFs perspective with their own SDR currency)</i>	N/A
N/A	<i>"In light of my own situation (seeing no advantage or need to use it) I fail to see how or why it would come to replace mainstream currencies in countries such as the UK"</i> (current first world banking is far more effective than that of developing countries' currencies and banking systems therefore, in countries like the UK there may not be a demand or even a need for it)	N/A
<b>Current Investors</b>		
<b>Trends from interviews</b>	<b>Alternative thoughts</b>	<b>Survey Trends</b>
No relevant trends	<i>"While others scream "cryptos are crashing! Your bubble popped" big companies are desperately hiring Blockchain specialists to develop their own Blockchain solutions".</i>	No relevant trends
	<i>"In my recent Blockchain courses, a very high status professor told the class that there is a huge shortage in blockchain developers and there will certainly be jobs available to those who master the tech"</i>	

From the conducted interviews 80% of all of the participants argued that cryptocurrency has a future in the global economy. However, they focused on the need for government regulation to occur thereby suggesting that cohesion with the government would allow for the technology to become more widespread in a shorter period of time.

Accordingly, one of the potential investor/user interviewees went into depth about the importance of the role of central banks and financial institutions in regards to them needing to find a way to deal with the rise of the cryptocurrency phenomenon. This insight was particularly interesting because it displayed that some of the current non investors wanted a system identical to the current system thereby, suggesting that they do not believe there is a problem or issue with current western banks.

Furthermore, there is an understanding that there is not a direct need for cryptocurrency in westernised countries where the banking systems are established. However, it is important to note that this is the perception of an individual whom resides in highly developed European countries. Nonetheless this argument is skewed in favour of western society, in order to balance this it would be vital to understand the importance of those whom do not live in such developed conditions, potentially interviewing those who are unbanked, by understanding their perspective it would give a more universalised understanding of the current phenomenon in regards to its need/usage on a global economic level.

Despite such, there appears to be a high demand for Blockchain technological developers, this suggests that the technology itself which is tied to cryptocurrency is seen as being economically advantageous in a range of different fields, this may thereby have an influential factor on the growth or decline of the phenomenon at hand.

Through an analysis of the most significant elements of the previous research, a range of conclusions can be drawn in relation to the future of cryptocurrency in the global economy.

Firstly, it was stated in the literature that over the past ten years there has been an increasing development in the understanding that governments play a key role in the ability to enable and spread innovation at a faster pace than just the private sector alone. Mazzucato (2018) and Pilling (2018) have disputed that governments play an intrinsic role in driving industrial and economic change, their research displays that China is evident of such remarks, as many of its most promising sectors of technology from cryptocurrency to artificial intelligence have been the benefactors from state inclusion which has arguably created a “race” within governments to become the number one player in this arena.

The interviews display an alignment with such statements as many of the non-investors/users focused on the importance of having guarantees and having a controlled system, this suggests that they want a new system which arguably reflects the same tendencies as the old, potentially showing a lack of understanding in regards to the differences between fiat and digital/cryptocurrencies. However, what is prominent about this issue is the fact that 80% of those whom were interviewed believe that this phenomenon has a place in the future global economy, what is interesting about this notion is, despite their scepticism of such phenomenon from previous questions in the interview process it is clear that a large majority of those interviewed believe it has future implications which may be contrary to their current beliefs, “I’ve been amazed that the

strongest believers in cryptocurrency often start out the most sceptical. It's a healthy scepticism. But at some point the perception shifts, and for many institutions – I think we're finally there." (Popper, 2018). This quotation within the literature and those within the interview process convey an understanding of the potential inevitability of this technological advancement entering global economics.

Secondly, Tawney (2017) and Levi-Faur (2017) findings suggest that major economies GDP are being squeezed, forcing them to look for innovative forms of income to continue on their capitalistic pathways. It could therefore be disputed that cryptocurrencies and the Blockchain are an ever present solution to the possible issues which larger GDP governments are currently facing, cryptocurrencies open up potential financial avenues and the Blockchain allows companies to follow Dunning's efficiency seeking model; enhancing efficiency through innovation, allowing more profit to be administered from the advancement of the same processes (Brouthers et al, 2015).

The interviewers are in agreement with the literature presented arguing that the Blockchain is "the future of the monetary system" and it "can be applied to a lot of areas". It could be thought that from the research obtained in alignment with the secondary and primary data there is a clear case displayed within this particular assignment that there is a belief that the Blockchain is an advantageous technology which has the capability to disrupt many industries. However, it is important to note that cryptocurrency and the Blockchain are currently two technologies which are entwined and fused together with the purpose of decentralisation nonetheless, it could be a possibility that the technologies become separated and used in manners which do not fulfil their original purpose.

### 4.3 The Current Diffusion Location

After conducting primary and secondary research it is clear that trends can be extracted and identified which help to uncover a greater understanding of where the location of the diffusion of cryptocurrency is in regards to the diffusion of innovation model.

Despite having significant research results, the process of a technology going through a diffusion cycle is something which is not universalised and therefore cannot be fully understood from the analysis of other radical innovations. Thereby, in order to estimate more precisely the information gathered in alignment with the theoretical model, GHC needs to be expressed as this caters for information which will aid in the plotting of the current cycle location of cryptocurrency, this will be explored in alignment with the DOI literature and interviewee trends in the table 8:

**Table 8 – Combined trends in alignment with theoretical models**

Rogers Elements	DOI Literature summarised	Gartner's Elements Explained	Interview Trends	Literature and Trends suggest
<b>Relative Advantage</b>	Cryptocurrency lacks elements that enable widespread adoption such as terms of convenience, social prestige, economic terms and satisfaction (Boyen et al, 2016 and Seligman, 2014)	<b>Innovation Trigger:</b> A potential technology breakthrough kicks things off. Early proof-of-concept stories and media interest trigger significant publicity. Often no usable products exist and commercial viability is unproven.	-Lack of need for it in Western countries -Uncertainty around the tech/usage -Focus on profitability	-Seen as being a “future technology”, thereby advancements need to be made -lots of speculation around cryptocurrency having high value -commercial viability is barely proven as not many cryptocurrencies are widespread and usable
<b>Compatibility</b>	Cryptocurrency challenges current values, psychological implications more so than that of social media. Not currently in alignment with Rogers model (lacking in terms of this section)	<b>Peak of Inflated Expectations:</b> Early publicity produces a number of success stories – often accompanied by scores of failures. Some companies take action; many do not.	-Difficulty to understand and use the tech for the average person with limited tech knowledge -Focus on it being an investment opposed to a currency, presenting change in mind-set towards the phenomenon	-There is a difficulty in understanding why this is needed with the general populous as there is an idea that it is an investment opposed to a currency system -high fluctuations in price, people lose and win money causing uncertainty
<b>Complexity</b>	Cryptocurrency far exceeds the relatively standard technology seen in recent radical innovations such as Twitter and Facebook (Wilson-Nunn and Zenil, 2014).	<b>Trough of Disillusionment:</b> Interest wanes as experiments and implementations fail to deliver. Producers of the technology shake out or fail. Investments continue only if the surviving providers improve their products to the satisfaction of early adopters.	-Misunderstanding of the phenomenon -Complex for standard users to purchase cryptocurrency -Misunderstanding of funding system and usage due to complexity	-Overall complicated tech in comparison to previous radical innovations, potentially displays a lack of development -Cryptocurrency has not had a shakeout period, many companies still joining the arena as the amount of currencies continue to grow

<b>Trailability</b>	Lack of trailability of previous similar technology thereby, it is new and potentially misunderstood and seen as an inconvenience (Rosecrance, 2000)	<b>Slope of Enlightenment:</b> More instances of how the technology can benefit the enterprise start to crystallize and become more widely understood. Second- and third-generation products appear from technology providers. More enterprises fund pilots; conservative companies remain cautious.	-Current Westernised banking systems are relatively good on a global level, individuals questions change -Nothing comparable in real world economy apart from in virtual world gaming such as World of Warcraft (see page 48).	-No previous technologies in the real world economy bar virtual world economies -Due to complexity more difficult to trial and there appears to be a lack of need for it from the perspective of non-invested/user interviewees. -Cryptocurrency yet to enter the phase of widespread understanding
<b>Observability</b>	Negative observability in regards to the way in which mass media focus on money laundering, big price drops and discouraging behaviour such as fraud etc	<b>Plateau of Productivity:</b> Mainstream adoption starts to take off. Criteria for assessing provider viability are more clearly defined. The technology's broad market applicability and relevance are clearly paying off.	-Interviews speak about lack of knowledge, corruption and the need to use it to do something illegal.	-Mass media having a large influential factor on the current understanding and meaning behind the phenomenon -lack of mainstream adoption

(Rogers 1995 and Linden and Fenn, 2003)

From the analysis of the results in alignment with the models it could be disputed that the diffusion of the cryptocurrency innovation is still in the early adopters (13.5%) phase, there are three fundamental reasons for this belief.

Firstly, there is a clear resemblance between Rogers's model and Gartner's model, chart 24 displays Gartner's model juxtaposed onto the DOI model, what is interesting about this juxtaposition is it allows individuals to see both models together. However, the most important element of this image is the fact that Gartner's cycle takes into consideration many psychological elements which the DOI model is unable to do so thereby, coming together to form a much stronger alternative model

**Chart 24 - Gartner's Hype Cycle and DOI Model Combination**



(Bontempo, 2014)

What is evident is that the technological trigger in this case, the rise of Bitcoin has created a huge interest in cryptocurrency however, in accordance with the results from Rogers elements in alignment with recent radical innovations such as Twitter and the smartphone it is clear that the technology is lacking in many of these areas which prevents it from spreading quickly, this lack of alignment suggests that the technology is still primitive in terms of its overall capability and potential use in the global economy.

Secondly, in accordance with Rogers Theorem “early adopters” play a slightly different role in the sense that, this population tend to have leadership roles within the overall social system which the innovation is currently diffusing through. The leadership in this case can be seen through advice distribution about the innovation and because of their individual status within society their attitudes in regards to the innovation has an authoritative and positive role on others which in turn reduces uncertainty amongst other people. Interestingly, each member whom was a user/investor of cryptocurrency displayed an average sphere of influence of 48 people, with 26 of those whom adopted; this figure arguably suggests a high adoption ratio in regards to being informed and adopting (54.16%). It could therefore be proposed that many of those whom were interviewed reflect the tendencies of early adopters having the authoritative roles which reduced the uncertainty amongst potential investors.

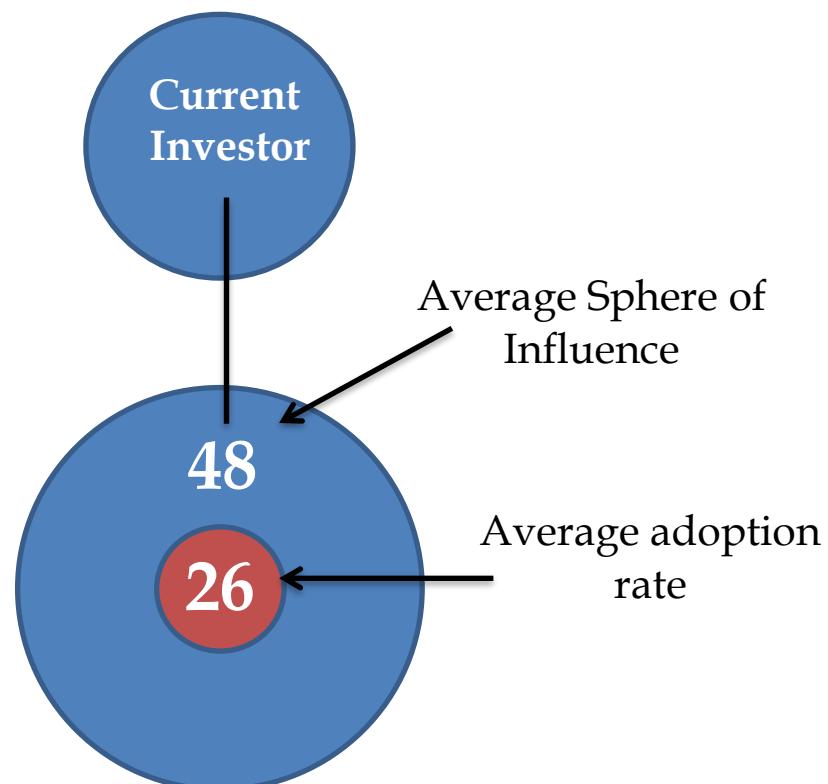
However, it is also important to understand that these investors/users whom were interviewed may only reflect a small sample of the populous and therefore could have positively reflected those whom have more of a tendency to discover new innovation. Nonetheless, the summary of the secondary data observes that issues of payment and currency are dominating elements in the decision making process. This may be due to the introduction of the secondary survey where they described Bitcoin as a "digital currency". It may also imply that the majority of the participants (135 people) have a limited comprehension of the concept of Bitcoin and/or cryptocurrencies, since the participants frequently stated “*No idea*” or “*I do not know*”, suggesting an early stage within the DOI cycle (Presthus et al, 2017).

Furthermore, the primary and secondary data found differences; the secondary data discovered that existing users are motivated by technological curiosity, and not by monetary incentives or external influences, whereas, a large majority of those whom were interviewed in the primary data displayed a motivation towards capital gains. However, universally, the users/investors perceive themselves as a group that is somewhat detached from the non-users/investors. The secondary data suggests that the non-users/investors are demonstrating little interest, on the other hand, the primary data displays a universalised understanding with 80% of those interviewed believing that cryptocurrency has a place in the future of money. Nonetheless, non-users/investors seem to question the benefits and security, and are waiting for other non-users/investors to start to use Bitcoin and cryptocurrency, suggesting that strong leadership roles within society from respected people in alignment with the DOI model could provide the tipping point to further the diffusion process (Presthus et al, 2017 and Rogers, 1995).

Finally, the literature and data clearly represents a large peak of inflated expectations which occurred in early 2018; this boost in expectation saw a rapid decline however, it is important to note that the decline in value mirrored the decline in widespread media stories and generalised hype which was arguably created by an artificial “networking effect” through widespread media, causing a rapid increase in use and perceived value. Whilst this solidifies the early adopters section, in regards to the Gartner’s cycle it is imperative to note that during the same period, the technology was still unable to effectively advance in alignment with Rogers 5 elements thereby, displaying a direct correlation between a peak in inflated expectation and a lack of advancement in regards to such factors essentially meaning that the phenomenon needs to be developed much further in order for there to be higher levels of usage and adoption.

#### 4.4 Diffusion Rate

After conducting the interview process, the research results displayed that the average sphere of influence from the investors was 48 people. However, of the 48 people told 26 decided to invest in cryptocurrency.



However, it is important to note that only a small population were interviewed, thereby an assumption has been made which could be more accurately represented with quantitative research studies such as surveys.

## 4.5 Calculation Process

$N(t)$  – the cumulative numbers of adopters at time  $t$ ,  $m$  – ultimate ceiling of potential adopters,  $g(t)$  – the coefficient (rate) of diffusion. With the point of inflection being represented by  $(dN(t)/dt)$  (a point of a curve at which a change in the direction of curvature occurs.)

By definition, S-shape diffusion initially expands at an increasing rate, the cumulative number of adopters' increases over time. As time goes by, the curve reaches a point of inflection, and the adoption rate starts to decrease. Finally, the diffusion reaches saturation level.

$$\frac{dN(t)}{dt} = g(t)(m - N(t)),$$

$N(t)$ = adopters at a given time	<b>10,000,0000</b>
$m$ = smartphone US Statistic + Social media US statistics	<b>Smartphone US Adoption in 2018</b> $69.6\% \text{ of } 325.7 \text{ million} = 226,687,200$ <b>Social media US Adoption in 2018</b> $37.875\% \text{ of } 325.7 \text{ million (combined average of YouTube 73%, Facebook 68%, Instagram 35%, Pinterest 29%, Snapchat 27%, LinkedIn 25%, Twitter 24%, WhatsApp 22%) of } 325.7 \text{ million} = 123,358,875$ $226,687,200 + 123,358,875 / 2 = 288,366,637.5$
$g(t)$ = ratio of adoption	$26 \text{ (adopters of cryptocurrency) / 48 (sphere of influence of cryptocurrency)} = 0.5416666666666667$

(Census, 2018; Statista, 2018; Smith and Anderson, 2018)

$$\frac{dN(t)}{dt} = 0.5416666666666667 (226,687,200 - 10,000,000)$$

$$= 117,372,233.333 \text{ (million people)}$$

The data above gives the point of inflection in regards to the information collected, it could therefore be seen that if/when cryptocurrency reaches a population use of around 117.3 million people in the US it will start to stagnate.

However, to discover when this will occur we must look at the average diffusion rate of various radical innovation, both from the 20<sup>th</sup> and 21 century there is one fundamental reason for looking at innovations throughout the centuries; some innovations have more of a radical impact on human behaviour and thereby, finding the average will allow us to take that element into consideration opposed to solely focusing on the recent innovations of the 21<sup>st</sup> century.

Type of Diffusion	Time taken to hit 60% adoption in US
Telephone	40 years
Airplane Usage	10 years
Smartphone	7 years
Social media	7 years

(Cox and Alm, 2008)

The average diffusion to 60% = 16 years

Time taken to reach inflection point:

117,372,233.333 / 16 years

= 7,335,764.58331 (Average growth per year of cryptocurrency in the US alone)

The average growth rate per year for 16 years will be 7,335,765 new investors/users each year, using this formula the date of stagnation and when the currency system is mature will be of the year 2034.

## 5 CONCLUSION

In this thesis, the researcher reported on a qualitative study delving into the diffusion process of the cryptocurrency innovation. The key purpose of this study was to identify key factors which would aid in the understanding of the potential outcome of the cryptocurrency phenomenon. This thesis allowed for the researchers observations to outline the drivers and/or barriers of the development, adoption and diffusion of this innovation, drawing attention to a range of different developments through the four research questions. Thereby, the research obtained highlights a range of different micro and macro variables all of which are synergistically connected and need to be understood and overcome in order for there to be a greater chance of developing the cryptocurrency innovation (governments, psychological implications, behaviour towards the innovation, mass media information output).

During this project the researcher identified four themes, all of which directly coincide with the research questions. Therefore, the research questions have determined the approach of the project and the way in which the work has been organised, allowing the researcher to effectively answer the questions. The researcher's observation of the study at hand begins to uncover the most important elements of the research in regards to how the cryptocurrency innovation is currently diffusing and potential problems with the current situation; two key findings have been identified.

Firstly, the literature suggests that there are an array of issues working synergistically that provide layered barriers; cryptocurrencies have had more negative observability through mass media; links to money laundering, funding terrorism and criminal activity discouraging people from adopting the technology available (Brenig et al, 2015; Bray, 2016). Additionally, "hype" can be seen in the cryptocurrency market which creates a "herding effect" (Wermers, 1999) this investment behaviour can create large rallies or selloffs based on little or no evidence of an event occurring (Fry and Cheah, 2016). The data obtained from the interviews is in alignment with the literature further enhancing the potency of a range of micro and macro issues working synergistically, pressuring the current system through variables such as, lack of classification by authorised governments of which has created a vacuum of misunderstanding where mass media, standard media, word of mouth and scientific knowledge are all scrambling to make sense of the phenomenon and this opens it up for contradiction and misunderstanding as seen with some interviewees claiming it is a "fun asset", "not real money" or claim it is only an asset to purchase something from the dark web. The misunderstanding and overall lack of a dogmatic approach from gov-

ernments and countries has created a confused state which appears to be one of the primary yet fundamental barriers which needs to be addressed before the process can become more prevalent in society.

These key findings have been discovered in conjunction with the purposive sampling strategy; identifying 10 interviewees from a range of different countries allowing the researcher to identify "information rich" data (Parker, 2016) this approach allowed for two pathways of research to occur. Firstly, the non/potential investors of which had basic cryptocurrency knowledge and secondly, current users/investors of which had an overall understanding of the cryptocurrency phenomenon, this range of candidates reflected a much wider audience providing greater value to the study at hand (Saunders et al, 2012, Palys, 2008).

Secondly, cryptocurrency is a radical innovation which is attached to a radical technological advancement; the Blockchain. The synergistic combination of the two technologies arguably has created a coalition of barriers however, the source needs to be identified in order for the problem to be synergistically overcome allowing for the innovation to advance further. The literature raises the point from Joseph Stiglitz research that the EU assumed that a highly diverse region could be managed by the same macroeconomic standards. However, the macroeconomic standards seem to be changing in certain areas of the world and certain governments are undertaking harmonious relationships between fiat currency and cryptocurrency displaying an alignment with Stiglitz theory (Velden, 2018).

However, the research acquired raises a point which cannot be ignored, "Although the concept of money is already a fake "Imaginary order" to quote Yuval Noah Harari in his book *Sapiens*. Therefore, giving so much importance to its virtual form". Importantly, humans have historically created intangible elements which shape the way in which we live; "Ever since the Cognitive Revolution, Sapiens have been living in a dual reality. On the one hand, the objective reality of rivers, trees and lions; and on the other hand, the imagined reality of gods, nations and corporations. As time went by, the imagined reality became ever more powerful, so that today the very survival of rivers, trees and lions depends on the grace of imagined entities such as the United States and Google" (Harari and Perkins, 2017).

This evidence in alignment with the research literature raises the contention of "value" and the perception of value. Currently, money in fiat form is the contemporary issue of value transition however, it is important to note that value has consistently changed throughout human history. The research points to the possibility that a change in perception from an individual level takes a large amount of time however, a governmental campaign as witnessed in China may create a globalised awareness of the phenomenon creating a universalised endorsement effect fostering a new perception of value through the lens of virtualised currency.

The methodological approach enabled this data to be identified by the use of adopting an interpretivist research philosophy, the emphasis on this approach allowed the researcher to make sense of the current situation of the cryptocurrency phenomenon and how it is currently developing, thereby enabling the researcher to generate surprising findings beyond the current common knowledge (Fagerberg et al, 2005; Im et al, 2003; Murtha et al, 2001) through revealing the importance of the synergistic barriers and need for a synergistic solution.

However, due to the limiting circumstances of this investigation, the research study arguably possesses weaknesses. Firstly, due to the desire to understand the current diffusion rate of cryptocurrency this emphasis provided many problems through the need to rely on assumptions based on theoretical models and data which may not reflect the current situation of the innovation itself. Additionally, by doing so the researcher was unable to acquire a large amount of interviews, thereby to enhance this research it could be concluded that a primary interview process alongside a primary quantitative study would allow for a much greater understanding and more precise reflection of the cryptocurrency innovation.

Secondly, the inadequacy of a research team; this investigation had only one individual whom had to collect all of the data whereas, if there was a team of individuals the work could be divided, adding to this the study at hand spans over a period of months whereas, other studies can last years this arguably implies that the reliability and accuracy of the study at hand will not be as high.

On the other hand, this project also possesses strengths. Firstly, the primary emphasis on the study was to understand the current situation of the diffusion of the cryptocurrency innovation. However, this document went further into detail than was necessary with the ambition of extracting key information from diffused radical innovations in the attempt of understanding how quickly contemporary technologies advance through the DOI model, by doing so this allowed for predictions of widespread adoption which may be useful for those whom have much greater mathematical knowledge. Therefore, such researchers can use these basic statistics to advance their studies with the intention of creating more reliable and accurate research. Secondly, working individually allowed the researcher to decide which approach to take without any potential conflict occurring, thereby allowing the researcher to quickly devise a plan and to follow that approach.

The research project has provided the researcher with a range of newly found knowledge. Firstly, this project has allowed the researcher to identify that there are many micro and macro elements which are synergistically combined with the cryptocurrency innovation thereby, all of which must be addressed suggesting that it will take a large amount of time for this particular innovation to effectively enter and diffuse within society. Secondly, the research points that there are many psychological implications alongside the micro and macro elements this makes it very difficult to pinpoint the initial source of the issues. However, by attempting to understand this phenomenon through an analysis of primary and secondary data this has enhanced the researchers understanding of how to adopt methodological approaches in research which will ultimately allow the researcher to conduct similar or more intense studies in the future.

Additionally, the author of this literature encourages future researchers to devote greater time to the study by using a primary research approach in conjunction with psychological primary qualitative data collection, the use of this type of primary qualitative data collection will allow a researcher to extract information which will shed light on issues which this work was unable to do so helping to further enhance the understanding of the cryptocurrency innovation.

## 6 ABBREVIATION LIST

BAT – Basic Attention Token

BTC – Bitcoin

DOI – Diffusion of Innovation

GBP – Great British Pound

GHC – Gartner's Hype Cycle Model

IOT – Internet of Things

TAM – Technology Acceptance Model

UI – User Interface

USD – United States Dollar

## 7 APPENDIX

### 7.1 Semi Structured Interview Questions

- 1) What is your age?
- 2) What is your gender?
- 3) What is your nationality?
- 4) Do you own, or have you owned any cryptocurrency?



If yes, which currency and why did you choose this/those currencies in particular?

Why did you decide to invest in cryptocurrency in general?

How long have you been doing cryptocurrency for (month and year of start?)

On Average how many people have you encouraged to adopt cryptocurrency?

Of those told, how many have adopted cryptocurrency?

Do you believe cryptocurrency has a future in the global economy?

If no, what would it require for you to start using cryptocurrency?

What are the pro's and con's to using cryptocurrency over normal money?

If your requirements were met do you think you would actually use cryptocurrency?

What do you think would be your main reason for using cryptocurrency?

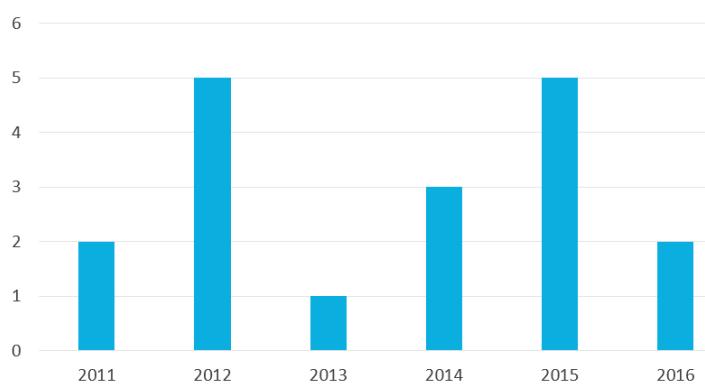
Do you believe cryptocurrency has a future in the global economy?

## 7.2 Secondary Survey Data

Findings from the survey

Question 1. Do you own, or have you previously owned, a Bitcoin? Of the 135 participants, 30 answered yes.

Question 2. When did you become a Bitcoin owner? Only 18 out of the 30 participants from the previous question wanted to share an answer. Although the amount of answers are small, we present the numbers in the chart below. Please note that we closed the survey on August 1st 2016, which makes the data collected for 2016 inadequate.



*Illustration of what year the participants became bitcoin owners.*

Question 3. Why did you become a Bitcoin owner? 18 participants chose to answer, and the two main reasons are technological interest and curiosity. In addition, three participants stated monetary gain and investments.

Question 4. How many Bitcoin's do you own, approximately? We found a large diversity of the amount of Bitcoin's that each participant had. Seven of the participants owned one or less Bitcoin's. Six owned between 2 and 99 Bitcoin's, two owned respectively 100 and 180, and one participant owned considerably more than the rest: 850.

Question 5. What would it require for you to start using Bitcoin? 87 non-users shared their thoughts with us. We clustered the answers and found: stability, security, payment means, used as currency, usefulness, accessibility, greed, wanting a sample, and "*I do not know*".

Question 6. What you think it would require for your family and/or our circle of friends to start using Bitcoin? The majority of the answers were similar to the previous question, including eleven participants that stated "*No idea*" or "*I do not know*". (We present more findings from this question in the cross-analysis below.)

Question 7. Your age 98 participants answered. The average age was 38 years. The youngest was 19, the oldest 66 years old.

Question 8. Gender 100 participants answered. 24 were women, 76 were male.

Question 9. For the students: which faculty do you attend? We got 22 answers. 13 attended the faculty of technology, the rest 5 attended the faculty of communication, management, Film & TV, and Arts.

Question 10. If you are working: what is your title? We got 81 responses. Since the survey had been sent to certain groups, such as employees of the university college and brokers, the corresponding titles were stated (mainly *lecturer* and (*associate*) *professor*, and *broker*). For the rest, we noted a large diversity, including bartender, senior analyst, systems developer, IT consultant, freelancer, project manager, and finally one instance of "*I do not work*".

(Presthus et al, 2017)

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