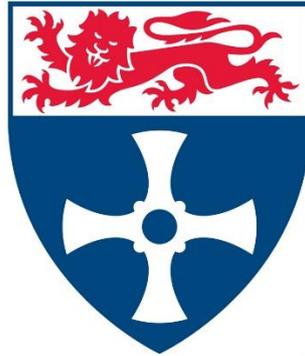


**The future of money:
How Bitcoin and its underlying Blockchain
technology could affect the financial sector**



Newcastle
University

Leonard Pust

Newcastle University Business School

This dissertation is submitted for the degree of
Master of Science
in *Innovation, Creativity and Entrepreneurship*

September 2017

Declaration

I hereby declare that this dissertation is my own work and that I have correctly acknowledged the work of others. This dissertation is in accordance with Newcastle University Business School guidance on good academic conduct and contains fewer than 13,500 words excluding abstract, references, and appendices.

Leonard Pust
September 2017

Table of Contents

Declaration	ii
List of Tables	v
List of Figures	v
Acknowledgements	vi
Abstract	vii
Abbreviations & Key Terms	viii
Chapter 1: Introduction	1
1.1 Introduction	1
1.2 Outline	1
1.3 Research Questions	2
Chapter 2: Literature review	3
2.1 Bitcoin	3
2.1.1 The Bitcoin system	3
2.1.2 Blockchain technology	5
2.1.3 Bitcoin's role within the cryptocurrency environment	7
2.2 Bitcoin's chances of becoming a second monetary system (RQ 1)	9
2.2.1 Inherent characteristics	9
2.2.2 Economic characteristics	11
2.2.3 Trust	13
2.2.4 Regulation	14
2.2.5 Innovative characteristics	15
2.2.6 BIP 148 SegWit2x Lightning Network	16
2.3 Banks and Blockchain technology (RQ 2)	17
2.3.1 Banks' motives	17
2.3.2 Investment overview	17
2.3.3 Permissioned Blockchains	18
2.3.4 Banks' collaborations	19
2.3.5 Banks' internal challenges	20
2.4 Conclusion	20

Chapter 3: Research Methodology	21
3.1 Research philosophy, design, and strategy.....	21
3.2 Access issues	22
3.3 Methodological Limitations	22
3.4 Ethical issues	22
3.5 Data handling and analysis	23
Chapter 4: Results Discussion	24
4.1 Implications on the future of Bitcoin (RQ 1).....	25
4.1.1 Inherent characteristics	25
4.1.2 Economic characteristics.....	27
4.1.3 Trust.....	28
4.1.4 Regulation	29
4.1.5 Impact & potential applications.....	30
4.1.6 BIP 148 SegWit2x Lightning Network.....	31
4.1.7 Future predictions of Bitcoin	32
4.2 Implications on the future of Blockchain within the financial sector (RQ 2)	34
4.2.1 Banks' Motives	34
4.2.2 Permissioned Blockchains.....	34
4.2.3 Future predictions for the financial sector.....	36
Chapter 5: Conclusions	37
5.1 Limitations Recommendations	37
5.2 Conclusion	37
References.....	39
Appendices	44
A) Consent Form.....	44
B) Information Sheet	45
C) Script: Semi-structured Interview.....	46
D) Work Plan.....	47
E) Interview codes and answers	48

List of Tables

Table 1: (Potential) Versions of Bitcoin	16
Table 2: Interviewees - Overview	24

List of Figures

Figure 1: Bitcoin System - Overview	4
Figure 2: Example of a Blockchain.....	5
Figure 3: Total bitcoins in circulation	6
Figure 4: Cryptocurrencies by market capitalisation.....	8
Figure 5: Total transaction fees.....	11
Figure 6: Price per bitcoin	12
Figure 7: Market Capitalisation.....	12
Figure 8: Investments into Bitcoin and Blockchain start-ups	18
Figure 9: Distribution of mining power	27

Acknowledgements

I would like to thank my thesis supervisor and lecturer Dr Karen Elliot, who has been very helpful and supportive during the writing of my thesis. In fact, Dr Elliot was a great help throughout my masters, and greatly supported me in my aim to pursue a PhD. Also, I would like to thank the interviewed experts, who remain anonymous due to the confidentiality of this study. Without their insider knowledge and input, this thesis could not have been successfully conducted. Special thanks to my friends of 'cryptomypto', who share the fascination for cryptocurrencies. Last but not least, I must express my gratitude to my family and especially to my partner Anna Sophie. Thank you.

Abstract

The emerging cryptocurrency Bitcoin could potentially disrupt the current monetary systems. However, there are many challenges, framework conditions, and unforeseen events that could influence Bitcoin's chances of disrupting the financial sector and becoming a second, parallel monetary system. This study will investigate Bitcoin's major challenges such as regulation, trust, and awareness while also emphasizing its strengths and weaknesses compared to the current banking system. In this context, significant improvements of the Bitcoin Network, namely the implications of a specific Bitcoin update (*BIP 148*) as well as the potential implementation of the *Lightning Network*, a new layer for the cryptocurrency, will be evaluated.

Moreover, this study will analyse how banks attempt to adapt Bitcoin's underlying Blockchain technology into their system, examining banks' motives, opportunities and benefits which accompany the potential implementation of Blockchain technology. Additionally, the challenges and limitations that banks face in adapting the, initially decentralised, Blockchain technology into the centralised banking system will be underlined. It will be concluded that it is currently too early to give definite answers and predictions regarding the future of the financial sector, and a potential disruption. Nevertheless, certain improvements within the Bitcoin system indicate positive developments of the cryptocurrency and make potential mainstream adoption within the next 20 years possible. However, while banks face many challenges, they are also very powerful, resourceful, and most importantly backed by nation states, meaning, ultimately, complete disruption of current banking systems is very unlikely.

Abbreviations & Key Terms

Altcoin(s)	alternative cryptocurrencies launched after the success of Bitcoin.
BIP	Bitcoin Improvement Proposal, suggestion for a new feature for the Bitcoin system.
Bitcoin (capital B):	associated with the protocol and payment network. Also used to refer to as the ecosystem as a whole.
bitcoin (small b):	associated specifically with bitcoin the currency. E.g. 'After hearing about Bitcoin, I've installed a Bitcoin client and bought two bitcoins'.
Bitcoin Cash	a cryptocurrency (Altcoin), which is a hard fork from the original Bitcoin Blockchain, providing a different ruleset.
Blockchain	a decentralized database, or 'digital ledger' encompassing different types of shared data that everyone on the network can see. E.g. Bitcoin's Blockchain contains its entire transaction history and can be monitored by all users worldwide.
Hard Fork	a software update which splits the Blockchain into two separate chains, where each chain uses a distinct set of rules to govern the system. The new version is not compatible with the older software.
Lightning Network	could potentially function as a layer on Bitcoin's technology, and facilitate micropayments bypassing the Blockchain and thereby reducing its transaction load
MB	Megabyte(s)
RQ	Research Question
SegWit	abbreviation for Segregated Witness, a soft fork that reduces the size of Bitcoin transactions, thereby increasing Bitcoin's transaction capacity
Soft Fork	a software update for the Blockchain, which introduces new features. The new version remains compatible with the older software.

Chapter 1: Introduction

1.1 Introduction

The emerging cryptocurrency Bitcoin has “...the potential to disrupt existing payment systems and perhaps even monetary systems” (Bohme *et al.*, 2015, p. 2). Presently (August 2017), Bitcoin has a market capitalisation of over \$70bn, and more than 270,000 confirmed daily transactions (*Bitcoin Stats* 2017). In particular, Bitcoin’s innovative underlying Blockchain technology has grabbed the attention of financial institutions, globally. The World Economic Forum has estimated that over “...25 countries are investing in blockchain technology, filing more than 2,500 patents and investing \$1.3bn” (Stafford and Murphy, 2016). These impressive numbers not only underline the economic relevance of Bitcoin and Blockchain, but also demonstrate the anticipated disruptive potential of cryptocurrencies and the underlying emerging technology. Indeed, experts posit that Blockchain will become mainstream in the financial sector by 2025 (Kaminska *et al.*, 2016). Yet, it is uncertain whether Bitcoin itself will achieve mainstream status, or if banks can adapt to its technology in order to maintain their power. It is precisely due to this uncertainty and the importance of the economic implications, that this qualitative research study will examine the potential impact of Bitcoin and Blockchain, and thereby fill an important research gap.

1.2 Outline

This study will firstly define two research questions which explore the opportunities for Bitcoin to become a ‘second’ monetary system, and the potential impact its underlying Blockchain technology could have on the financial sector. Chapter 2 will then explain the basics of Bitcoin and its Blockchain technology, as well as Bitcoins’ role within the cryptocurrency environment. On that basis, it will demonstrate which factors are crucial in order for Bitcoin to become widely accepted, including its innovative and inherent characteristics, and the surrounding framework conditions, such as regulatory and trust issues. This analysis of Bitcoin and its framework conditions is supported with theories of disruptive innovation, trust, and open innovation. Chapter 2 will culminate by outlining how and why banks already collaborate in exploring in what way Blockchain technology could be adapted into their system, while also showing interrelated limitations and challenges. Chapter 3 will then describe the methodological features of this current study, including the research design, ethical issues, methodical limitations, and data handling. In Chapter 4, the results of the conducted interviews will be critically analysed, considering the characteristics of Bitcoin as well as potential future scenarios for Bitcoin and the Blockchain technology. Finally, Chapter 5 summarises the findings of the current study, as well as the limitations and the corresponding recommendations for future research.

1.3 Research Questions

RQ 1. Will Bitcoin emerge as a 'second', parallel monetary system?

RQ 2. How will Bitcoin's underlying Blockchain technology impact the banking sector?

After providing a foundational understanding of Bitcoin and its underlying technology, this study will investigate these research questions, aiming to provide a thorough understanding of the factors and framework conditions that could be influential to the future impact of Bitcoin and Blockchain technology.

Chapter 2: Literature review

2.1 Bitcoin

In 2009, the cryptocurrency Bitcoin was created by an unknown programmer (or programmers) working under the pseudonym Satoshi Nakamoto. Bitcoin is an open source software that operates as a peer-to-peer¹ network and supports the movement of currencies. It is labelled as a cryptocurrency, because its security is guaranteed by cryptographic algorithms, whereas in a conventional payment system a for-profit company operates as middle-man, e.g. MasterCard, thereby centralising and securing payments. Bitcoin's transactions can be monitored by all users worldwide and are recorded in a public ledger called Blockchain (Antonopoulos, 2014; Kostakis and Giotitsas, 2014; Rose, 2015). This Blockchain has the "...functionality to remember and enforce past statements by participants, in a non-localised, resilient and auditable manner" (Tasca *et al.*, 2016, p. 133). So, unlike traditional banking systems, the Bitcoin system is based on decentralised trust, since it has the ability to keep and update records without the use of a trusted third party (Antonopoulos, 2014; Kostakis and Giotitsas, 2014; Rose, 2015). In essence, Bitcoin has the "...potential to disrupt existing payment systems and perhaps even monetary systems" (Bohme *et al.*, 2015, p. 2), because it can make transactions cheaper and safer due to its innovative technology (Fanning and Centers, 2016).

2.1.1 The Bitcoin system

As figure 1 (p.4) illustrates, the Bitcoin system consists of several different actors and components. In the upper part is the user, who can send and receive bitcoins² by using a *wallet*. These *wallets* are simple databases, e.g. an online *wallet* on a smartphone, and contain two different keys, the *public* and *private key*. These keys are independent from the Bitcoin network and enable the users to securely access their bitcoins through cryptography. Simply put, the *public key* can be described as the bank account number and is used to receive bitcoins, whereas the *private key* is the secret PIN number, used to sign transactions in order to spend bitcoins. These two keys ('credentials') enable users to have autonomy over their bitcoins, since they enable ownership attestation. Crucially, however, if users lose their *private key*, there is no other evidence of ownership that will be recognised by the Bitcoin network.

¹ Peer-to-peer or P2P means that the participating computers in the network are equal peers to each other (Antonopoulos, 2014)

² bitcoin (small b): associated specifically with bitcoin the currency.

On the right-hand side of figure 1, are exchange services, which are platforms where users can change Fiat money³ for bitcoins and vice versa (Antonopoulos, 2014; Bohme *et al.*, 2015). From the exchange service, users can then send their bitcoins to their *wallet* or keep them on the exchange. Precisely, users do not store the actual bitcoins but their *credentials*, which verify the ownership of bitcoins, on the exchange or on a *wallet*. However, keeping the *credentials* on an exchange instead of a personal *wallet*, also bears risks and causes loss of autonomy (see 4.1.3).

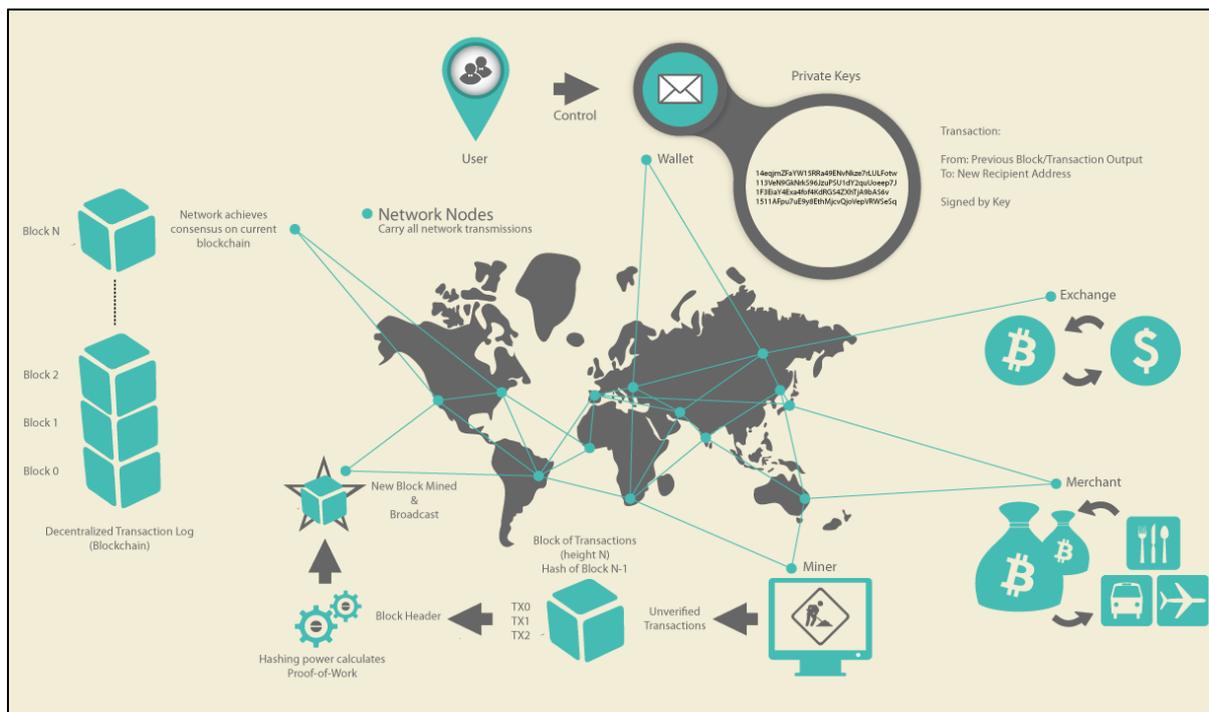


Figure 1: Bitcoin System - Overview (Antonopoulos, 2014, p. 16)

Under the exchange service is the merchant, the retailer who offers products/services via bitcoins. Even though there are currently not a great deal of firms accepting Bitcoin payments, there are already some large companies accepting Bitcoin as a payment method, including Microsoft, Dell Computers, Dish Network, Expedia, Wordpress, and Overstock, thereby indicating the potential of the cryptocurrency (Nair and Cachanosky, 2016). Yet, because the price of Bitcoins has been very volatile since its creation, it is being predominantly used as an asset, not a payment method (see 2.2.3). The map location points distributed across figure 1 represent *full nodes*, which maintain the entire Blockchain, thus the complete transaction history. These *full nodes* have the ability to verify transactions independently, without relying

³ “Common type of currency issued by official order, and whose value is based on the issuing authority's guarantee to pay the stated (face) amount on demand, and not on any intrinsic worth or extrinsic backing. All national currencies in circulation, are fiat currencies” (What is fiat currency? definition and meaning, 2017).

on, or trusting any other system (Antonopoulos, 2014; Bohme *et al.*, 2015). Anyone with enough disk space (150-GB) and an internet connection can run a *full node* on their computer (*What Is A Full Node?*, 2017). Nodes can have four different functions: *routing*, running the Blockchain, *mining* and *wallet services*⁴ (Antonopoulos, 2014).

2.1.2 Blockchain technology

Bitcoin’s underlying Blockchain technology (shown on the left side of fig.1) and its transaction validation process, *mining* (illustrated at the foot of fig.1), form the basis of Bitcoin’s transparent, decentralised, and secure system.

Bitcoin’s Blockchain

A Blockchain is a database consisting of data packages, called blocks. As figure 2 illustrates, each block is ‘chained’ to the previous block going back to the first block ever created: the *genesis block*. A block comprises of multiple transactions (TX1-n illustrated in fig. 2), as well as the hash value of the previous block (‘parent’), a timestamp (time of block generated) and a nonce (random number for verifying the block). Hash values are unique and are therefore commonly referred to as digital fingerprints. The uniqueness of hash values can effectively prevent fraud, because changes to a block would directly change the respective hash value.

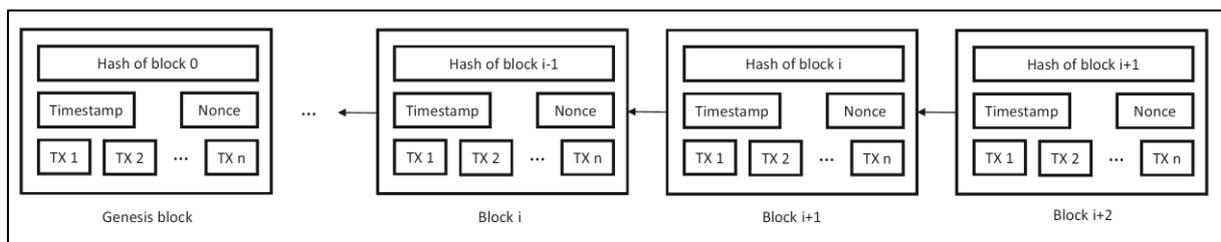


Figure 2: Example of a Blockchain (Nofer *et al.*, 2017, p. 184)

Mining and monetary supply

New blocks are created approximately every 10 minutes by individuals, known as *miners* (specialised *full nodes*), who compete in solving a mathematical problem, which is difficult to solve but simple to check, to verify transactions. The winning *miner* receives two types of reward: (1) new bitcoins which are created with each new block, and: (2) the transaction fees from all transactions included in the block. Hence,

⁴ Please read Antonopoulos (2014) for a full explanation of the different types of nodes.

mining is basically a bookkeeping service, where transactions are verified and added to the public Blockchain, while also creating Bitcoin's money supply. Each new block extends the Blockchain, which represents the complete ledger of all transactions (Antonopoulos, 2014; Nofer *et al.*, 2017). Currently, 12.5 new bitcoins are created with each block; however, this amount halves approximately every four years (see fig. 4). This process began in 2009, with 50 bitcoins per block, reducing to 25 bitcoins per block in 2012, 12.5 bitcoins per block in 2016, 6.25 bitcoins per block in 2020, and so on. After the year 2140, all 21 million bitcoins will be issued and the *miners* will be rewarded solely through transaction fees (Antonopoulos, 2014; Bohme *et al.*, 2015; Nair and Cachanosky, 2016). The incentive scheme is crucial, since it "...aligns the actions of *miners* with the security of the network, while simultaneously implementing the monetary supply" (Antonopoulos, 2014, p. 178).

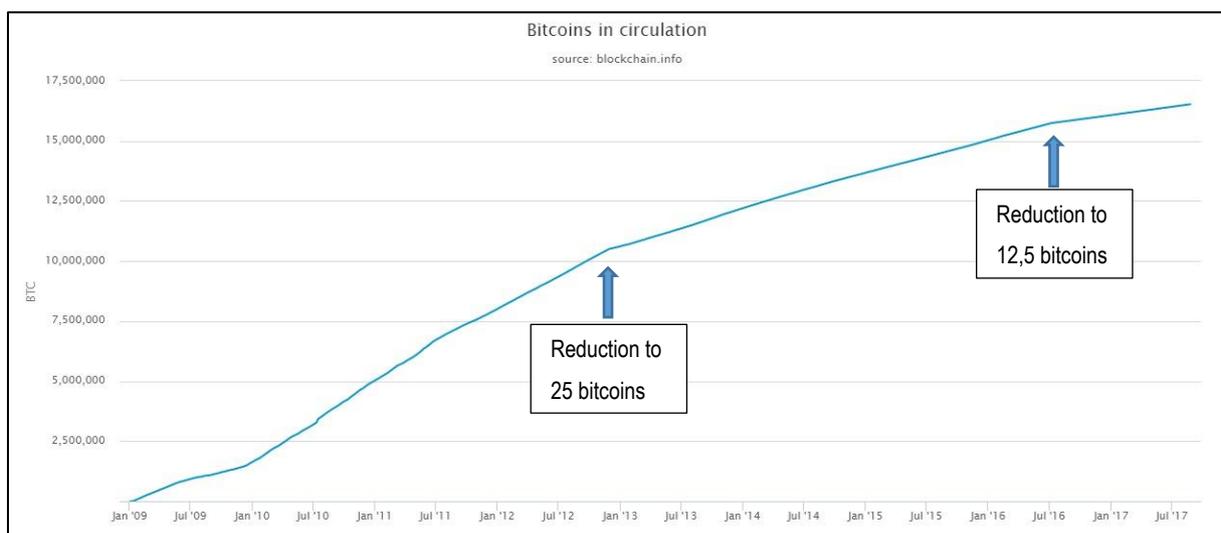


Figure 3: Total bitcoins in circulation ('Bitcoins in circulation,' 2017)

The solution to the difficult mathematical problem, which the *miners* work to solve, acts as proof that substantial computing effort was expended by the *miner*. Once a *miner* finds the correct solution, an arbitrary number named *nonce* (illustrated in fig. 2), which is compatible to the hash of the block; all other *full nodes* check the validity of the *nonce* (difficult to find but easy to check) along with each transaction of the respective block. If the *nonce* and the transactions are correct, the *full nodes* express their confirmation by working on the next block, using the hash value of the accepted block (see fig. 2: 'Block i+1' uses the 'hash of block i'). This process, called *Proof-of-Work*, is Bitcoin's consensus mechanism, and sets the basis for its security model. Once the verified block is added to the blockchain, the transactions within the block cannot be changed, and are considered 'confirmed', allowing the new owners to spend their received bitcoins (Antonopoulos, 2014; Fanning and Centers, 2016; Halaburda, 2016; Nofer *et al.*, 2017).

Blockchain forks

In essence, there are two different types of forks which can occur on a Blockchain: *soft* and *hard forks*. A *soft fork* is a software update, which introduces new features, where the new version remains backwards compatible with the older software. This is similar to an update on *WhatsApp*: when Alice has a newer version of the messenger app, she can still send and receive messages from Bob, who runs an older version. A *hard fork*, however, is a software upgrade that introduces a new rule to the network causing the Blockchain to split into two separate chains, where each chain uses a distinct set of rules to govern the system. This means the software update expands, or changes fundamental rules regarding the validity of blocks and transactions ('consensus rules'), which are not compatible with the older software. All *nodes* of the network must decide which chain they support, by either upgrading to the new version or continuing with the old version (Castor, 2017b).

Due to Bitcoin's scaling debate (see 2.2.3), such a *hard fork* occurred in August 2017, splitting the original Blockchain of Bitcoin into two different chains, Bitcoin and *Bitcoin Cash*. The main difference between the rules of these two currencies is the size of the blocks: 8 MB in the *Bitcoin Cash* Blockchain, and 1 MB in Bitcoin Blockchain. While the larger blocksize of *Bitcoin Cash* enables the cryptocurrency to process significantly more transactions, the majority of *nodes* still decided to support the 'original' Bitcoin, potentially because they have trust and confidence in that existing system (Hertig, 2017a; Ram, 2017). Also, Bitcoin plans to increase its blocksize to 2 MB in November 2017, which may cause another *hard fork*. In fact, even though the previous split into Bitcoin and *Bitcoin Cash* lowered the risk of a new fork, it is still possible that another split will occur, again, due to disagreements within the community regarding the blocksize (Claburn, 2017; Graham, 2017) (see 2.2.6).

2.1.3 Bitcoin's role within the cryptocurrency environment

Besides Bitcoin, there are currently over 800 different cryptocurrencies, also labelled as *Altcoins*, which predominantly use the Blockchain technology as their foundation (*CryptoCurrency Market Capitalizations* | *CoinMarketCap*, 2017). *Bitcoin Cash* is considered as one such *Altcoin*. Most of these *Altcoins* are 'cheap copies' and only differ slightly from Bitcoin; however, some *Altcoins* offer significant innovations (Antonopoulos, 2014). In essence, these *Altcoins* differentiate from Bitcoin in three primary areas, which Antonopoulos (2014, p. 223) expresses as:

- Different monetary policy
- Different Proof-of-Work or consensus mechanism
- Specific features, such as strong anonymity

As of August 2017, the current market capitalisation of all cryptocurrencies accounts for over \$150bn, where the two biggest cryptocurrencies alone constitute over \$100bn, with Bitcoin having over \$70bn, and Ethereum⁵ over \$30bn (*Bitcoin Cash* has over \$10bn). While Bitcoin is still the largest cryptocurrency, it currently 'only' takes up 46% compared to previous figures of around 80% or higher of the total market capitalisation (see fig. 4). This is, because other cryptocurrencies raised in value tremendously, particularly at the beginning of 2017, even sharper than Bitcoin (*CryptoCurrency Market Capitalizations | CoinMarketCap, 2017*).

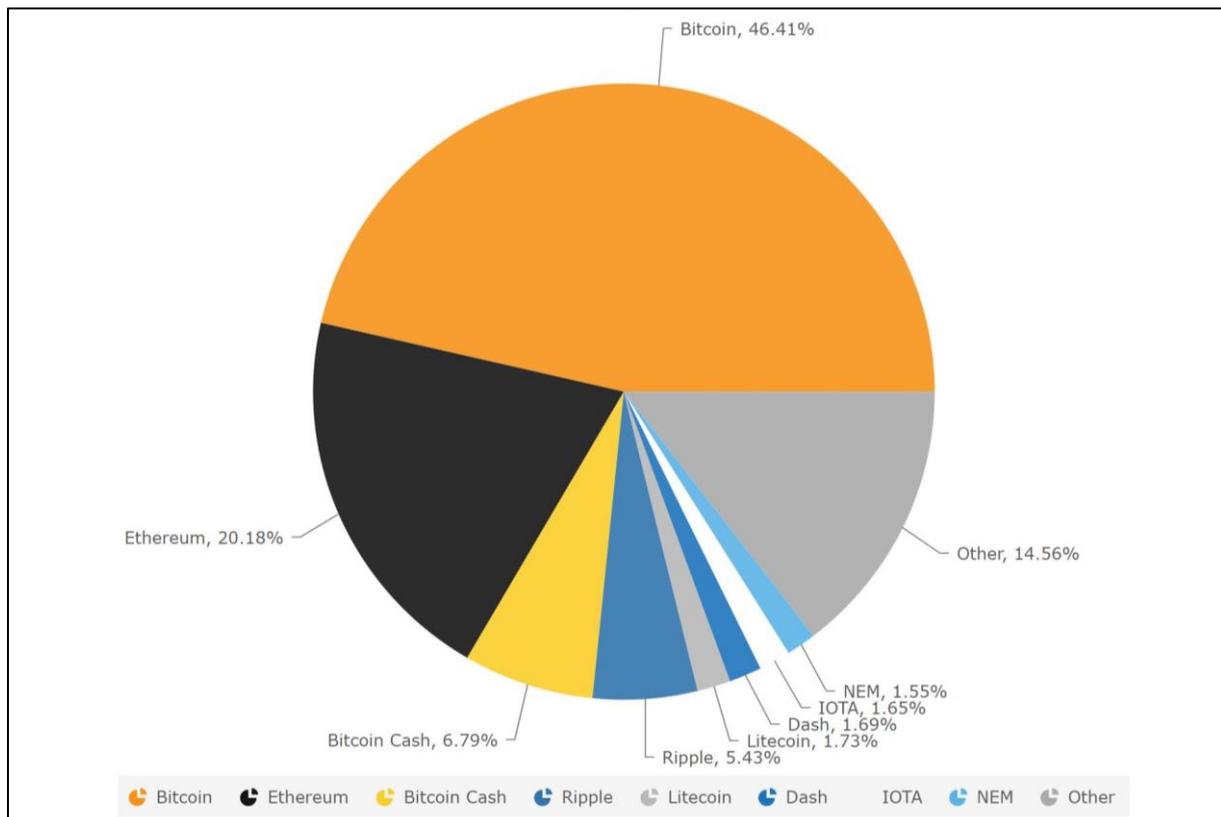


Figure 4: Cryptocurrencies by market capitalisation (*Cryptocurrencies by Market Cap | Coin Dance, 2017*)

This current study chose to investigate Bitcoin, since in terms of awareness, success, security, and value, it is still the number one cryptocurrency. That does not necessarily mean that Bitcoin is the most innovative and effective cryptocurrency, but due to its first mover advantage and its advanced implementation, it currently has the greatest potential among all cryptocurrencies to become a second monetary system.

⁵ Ethereum is based on a public Blockchain technology providing a computing platform featuring smart contract functionality (Ethereum Project, 2017).

2.2 Bitcoin's chances of becoming a second monetary system (RQ 1)

The characteristics of Bitcoin facilitate its advantages, which could lead to its emergence as a widely-accepted second monetary system. However, there are also obstacles and disadvantages which hinder mainstream adoption of Bitcoin.

2.2.1 Inherent characteristics

Access

Bitcoin does not exclude people: an Internet access is sufficient to use the cryptocurrency (Aiganym, 2015; Wild, 2016). Yet, while access is open to anyone, it still requires an understanding and skills in order to handle a Bitcoin *wallet* and make transactions (see 4.1.1). Nevertheless, Bitcoin could be in particular valuable in developing countries, where over 2 billion people simply do not have access to a bank account. Thus, those 'unbanked' people have no access to "...the savings and borrowing mechanisms necessary to drive broad-based economic growth" (Ferenstein, 2016). Bitcoin could help such people by connecting them to a formal financial system (Vigna and Casey, 2015; Wild, 2016).

'Doublespending'

As previously-mentioned, the *Proof-of-Work* mechanism only confirms a new block when all transactions are valid, which also means that the containing bitcoins have not already been spent (see 2.1.2). Accordingly, this mechanism prevents spending a bitcoin twice, thereby solving the *doublespending problem* (Nakamoto, 2008; Sonderegger, 2015; Nair and Cachanosky, 2016). This is a ground-breaking solution to a problem all digital payments, such as online bank transfers or credit card payments, face. Traditional institutions need to keep an extensive ledger about transactions and rightful ownership; such ledgers are open to manipulation and cause high transaction fees. In contrast, Bitcoin cleverly circumvented this problem through its *Proof-of-Work* mechanism, removing reliance on a central verification process (Nair and Cachanosky, 2016).

Security

Since Bitcoin has no central intermediary, but a decentralised network securing its data on the Blockchain with thousands of globally distributed *full nodes*, there is no central computer to hack and manipulate transactions (Nofer *et al.*, 2017). In fact, to change a past transaction would require reproduction of the complete Blockchain "...from the altered transaction forward faster than any other miner can verify the next transaction - a very unlikely event if no one controls the majority of computing power in the system"

(Luther, 2016, p. 561). Indeed, as Luther (2016) highlights, fraudsters would require more computing power than all the thousands of nodes combined to alter a transaction, which is virtually impossible. Even if the computing power were available, they could only alter transactions they were party to, and not between other network users, due to cryptography limits (Ibit., 2016). These features ensure that transactions as well as the rightful ownership of bitcoins are very secure. Still, also the *mining* model bears some risks (see 4.1.1).

Anonymity

A major benefit of Bitcoin is its ability to maintain privacy, while ensuring transparency as it conducts transfers on its Blockchain, anonymously, through its peer-to-peer network (Golden, 2016). Users remain anonymous because the transactions proceed between addresses, and the users do not need to reveal any identification information (Luther, 2016). While this anonymity is arguably beneficial from the individual user's perspective, it may also be exploited to illegal ends, such as money laundering, bribery and illicit trafficking in drugs and weapons (Negurita, 2014). Yet, the cryptocurrency is not as anonymous as perceived (see also 4.1.1), as Bitcoin advocate Andreas Antonopoulos (2014) correctly analysed:

“Bitcoin is often mistakenly characterized as ‘anonymous’ currency. In fact, it is relatively easy to connect identities to bitcoin addresses and, using big-data analytics, connect addresses to each other to form a comprehensive picture of someone’s bitcoin spending habits.”

Nevertheless, Bitcoin has an increased anonymity which can hinder law enforcement to obtain information on criminal users efficiently and quickly (Tu and Meredith, 2015). In 2017, the global cyber-attack ‘WannaCry’, which affected more than 45,000 users and blackmailed them to pay \$300 worth of Bitcoin to retrieve their files, demonstrated the downside of Bitcoin’s increased anonymity (Wong, 2017).

Limited supply

Unlike Fiat currency, Bitcoin has a limited monetary base of 21 million bitcoins (see 2.1.2 and fig. 4) and this underlying rule in Bitcoin’s program base cannot be adjusted. Each of these coins can be divided up to 10 to the 8th power, thereby preventing the possibility of deflation; at the same time, the limited amount of bitcoins can help with inflation risks (Antonopoulos, 2014; Aiganym, 2015). Hence, assuming Bitcoin were to be widely accepted, the limited monetary base “...would prevent governments from saturating financial markets with bitcoins simply because they think the market needs more money” (Sonderegger, 2015, p. 184). Due to its limited supply, Bitcoin is therefore often referred to as ‘digital gold’ (Antonopoulos, 2017b).

2.2.2 Economic characteristics

Transaction volume / Scaling problems

One of the major obstacles to Bitcoin becoming a second monetary system is the limitations on the number of transactions it can handle. Indeed, Bitcoin supports only up to 7 transactions per second, whereas Visa has a peak capacity of 56,000 transactions (Narayanan *et al.*, 2016, p. 72). This capacity problem was also the main reason for disagreement within the Bitcoin community and the resulting *hard fork* into Bitcoin and *Bitcoin Cash* (see 2.1.2). However, the problem might be solved in the near future through a new software update, which increases Bitcoin’s transaction limit and enables the implementation of the *Lightning Network* (see 2.2.3).

Transaction fees

While Bitcoin used to provide very low transaction costs (Fanning and Centers, 2016), these fees heavily increased over the last few months (see fig. 4). The high fees are caused by Bitcoin’s limited transaction capacity and growing popularity, forcing users to pay higher fees in order to acquire transaction confirmation (see 4.1.2). A good metaphor to understand this issue is to imagine that a block in the Blockchain represents a bus and the different transactions the passengers. The bus comes every 10 minutes and can carry a maximum of 10 passengers. As long as there are 10 passengers or less waiting at the bus stop everything functions smoothly; however, when there are more than 10 passengers waiting, it will result in a bad customer experience: delay and overly expensive bus tickets (Zhavoronkov, 2017). The same happens with Bitcoin, causing high fees (‘price per bus ticket’), as illustrated in figure 2, showing the average cost in USD per transaction over the last year. Currently, the fees revolve around \$4 per transaction making micro-payments, which used to be one of Bitcoin’s major benefits, less profitable. Yet, the fees are likely to decrease again once Bitcoin solves its transaction limitations.

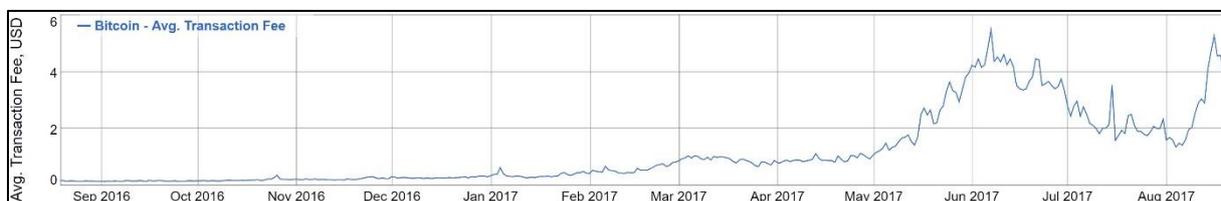


Figure 5: Total transaction fees (Bitcoin Avg. Transaction Fee chart, 2017)

Despite the rise in fees, the transaction costs are still comparably low for cross-border transactions. These low transaction costs could help numerous poor people who depend on money received from relatives working in developed countries (Murray, 2014). This may explain the prevalence of Bitcoin in America among Hispanics who “...send more money abroad than any other group” (Murray, 2014).

Price and volatility

The price per bitcoin is determined by supply and demand. Not only have the transaction fees fluctuated, but also the price per bitcoin has fluctuated greatly (Hampton, 2016), thus concerning both users considering Bitcoin for transactions, and those using it as a long-term store of value (Bohme *et al.*, 2015). Yet, it is arguable that “...Bitcoin is not inherently volatile, but rather, that its volatility is a product of its newness” (Sonderegger, 2015, p. 186). Figure 6 shows the price per bitcoin and its development over the last year, and figure 7 the corresponding growth of Bitcoin’s market capitalisation⁶.

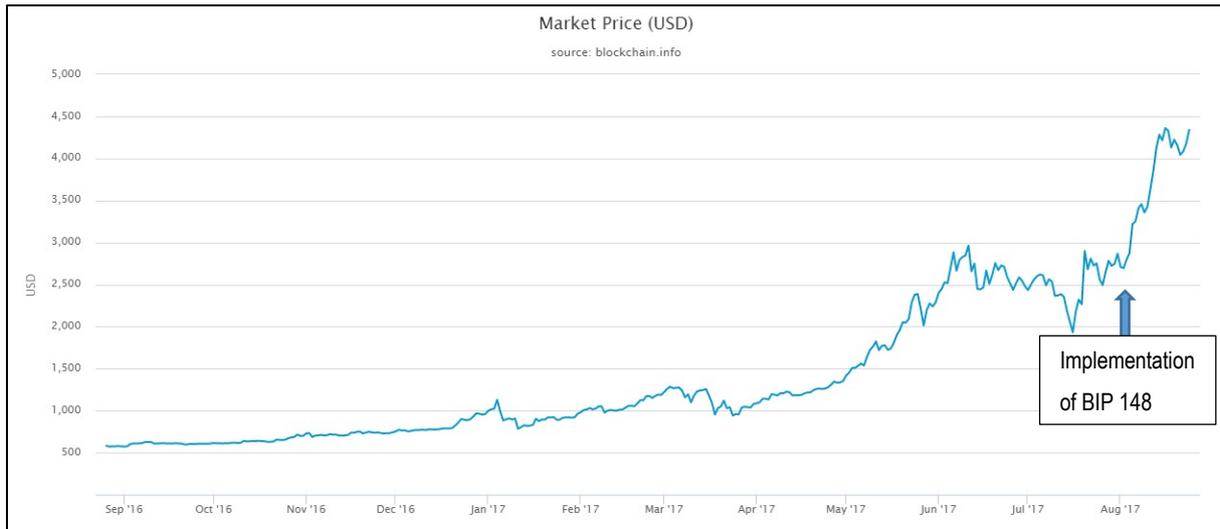


Figure 6: Price per bitcoin (Market Price (USD), 2017)

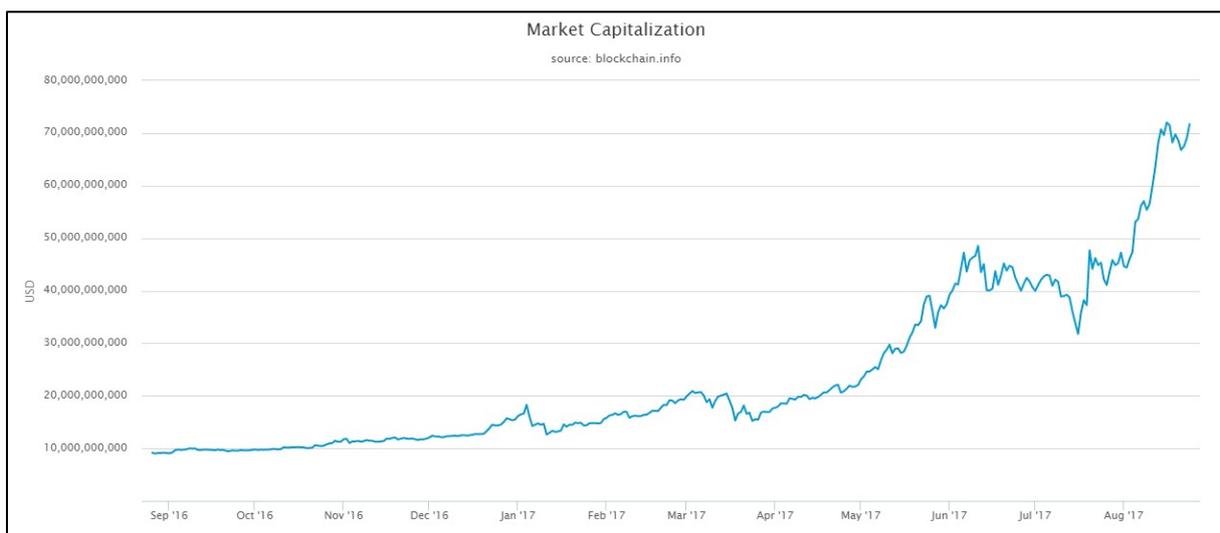


Figure 7: Market Capitalisation (Market Capitalization, 2017)

⁶ The total USD value of bitcoin supply in circulation, as calculated by the daily average market price across major exchanges (Market Capitalization, 2017).

While it shows that the price of Bitcoin is indeed very volatile, it also shows a significant price rise in particular since January 2017, reflecting the potential people see in Bitcoin. Indeed, as of August 2017, the price per bitcoin rose enormously, up to \$4.400 per bitcoin in accordance with its market capitalisation of over \$70bn (see fig. 7). The significant price fluctuations combined with the risen fees are likely to be one important reason why bitcoins are currently mainly used as a store of value or as a speculative asset, rather than as a medium of exchange (Luther, 2016). Nevertheless, from a technological point of view, Bitcoin is applicable as an effective unit of exchange, because it is "...fungible, portable, and secure" (Hampton, 2016, p. 353), yet, in order to function as an effective payment system, Bitcoin's price needs to stabilise (along with other improvements, see 4.1.2).

2.2.3 Trust

"Trust is the fundamental currency of commerce" (Etwaru, 2017).

Before the outbreak of the financial crisis in 2008, the majority of people did not realise the significant risks within the financial sector, and therefore they simply trusted in banks (Blöbaum, 2016, p. V). As a result of the financial crisis, however, people lost trust and confidence in the current banking system (Leiser *et al.*, 2010; Blöbaum, 2016). This loss of trust is critical for banks, because without trust, organisations cannot act. In fact, trust serves as a 'social glue', which establishes choices for decision-making and actions. The mistrust in the banking system is legitimate, as banks used a specific derivative model for making profits⁷, and the inherent risks of this model should have been recognised and corrected well before the outbreak of the financial crisis (Rossi and Malavasi, 2016). Unfortunately, it appears that banks did not learn from their mistakes, as there are still "...trillions of dollars' worth of obscure financial derivatives in the system, and there is every chance of further banking collapses" (Grey, 2013, p. 112). Nevertheless, most people still trust the current banking system, perhaps also because there is no true alternative yet. Still, it is wise to consider whether the current banking system is a trustworthy system for the future.

Bitcoin could be the answer to this trust issue, because it embodies "...the need for autonomy from the centralised financial system" (Kostakis and Giotitsas, 2014, p. 432). In contrast to banks, Bitcoin establishes trust through technology (Tasca *et al.*, 2016), which basically means rules are enforced purely technologically, without relying on a central authority (Narayanan *et al.*, 2016). Therefore, the Bitcoin system is labelled as 'trustless' (Tasca *et al.*, 2016) and users do not need to judge the trustworthiness of an

⁷ A detailed explanation of this model goes beyond this dissertation. Read Rossi and Malavasi (2016) for a full explanation.

intermediary or network participants (Nofer *et al.*, 2017). However, it remains to be seen whether people are willing to put their faith solely in technology, without a trusted intermediary. In fact, many people use Bitcoin exchange service as such an intermediary by choice, indicating the need for a trusted middleman (see 4.1.3). Yet, even then Bitcoin transactions are irreversible; hence, there are no procedures to reverse an accidental or unwanted purchase. Certainly, with Bitcoin, the user has more responsibility over his money, which can have both positive and negative implications (see 4.1.1).

2.2.4 Regulation

The innovative nature of Bitcoin does not fit neatly into existing regulation models. Indeed, the traditional regulatory system is not applicable for Bitcoin, because, conventionally, the financial institutions that facilitate transactions are subject to financial regulatory requirements, such as background checks for their customers (Tu and Meredith, 2015). Yet, Bitcoin's decentralisation means that, without a trusted intermediary, such a regulation is simply not possible, because Bitcoin has "...no central regulatory entity" (Sonderegger, 2015, p. 177). In fact, Andreas Antonopoulos (2016) rightfully argues that the Bitcoin network itself cannot be regulated:

"The question is not whether #bitcoin should be regulated, but whether it *can* be regulated. The reality is 'No'. The rest is nostalgia".

Therefore, new legislation is required, which explicitly "...addresses the novel issues posed by virtual currencies, fosters the use of virtual currency in transactions, and still collects tax revenues from investors" (Hampton, 2016, p. 331). New legislation is not only challenged by Bitcoin's decentralisation, but also by its complexity and unpredictability; consequently, regulators have struggled to decide whether and how to regulate cryptocurrencies. Moreover, electing the right level of regulation is very difficult, because "...too much regulation in a disruptive environment like that of the digital currency arena could have a negative impact, completely stripping away its inherent benefits" (Golden, 2016). As a consequence, the global regulatory and legal response has been varied (Tu and Meredith, 2015). Still, as Sonderegger (2015) suggests, a clarification of the legal and regulatory framework surrounding Bitcoin is highly important for its future, and for its potential mainstream adoption.

Since governments cannot regulate the Bitcoin network itself, they attempt to regulate the different companies or individuals conducting business with Bitcoin such as Exchange Services (see 4.1.4).

However, even though it appears that Bitcoin operates unregulated, Andreas Antonopoulos (2013) also correctly points out:

“Bitcoin is not ‘unregulated’. It is regulated by algorithm instead of being regulated by government bureaucracies. Un-corrupted”.

This statement reflects the idea that the cryptocurrency is indeed “...imbued with ideas drawn from a certain political framework” (Kostakis and Giotitsas, 2014, p. 437) and shows that Bitcoin has a clear system of rules. That said, Bitcoin’s system of rules is not infallible: it does not prohibit sales or purchases of illegal items, and does not oblige any institution or exchange service to verify the user’s identity. In contrast, traditional payment systems offer reversal procedures of accidental purchases, prohibit transactions of an illegal nature and verify the user’s identity (Bohme *et al.*, 2015).

2.2.5 Innovative characteristics

Disruptive Innovation

Bitcoin embodies the characteristics of a disruptive innovation, which is to enhance a service or product in a way that the market does not expect. Accordingly, disruptive innovations help to create a new market, and eventually disrupt an existing market (Christensen, 2016). In the case of Bitcoin, it has already created a new market for cryptocurrencies and could potentially disrupt the existing banking sector (Bohme *et al.*, 2015). However, critics could argue that Bitcoin has already existed since 2009 and has not been capable of disrupting the banking sector so far. While Bitcoin has clearly disruptive potential, it needs to improve its speed, volume and usability along with gaining more awareness to increase its chances of disrupting the financial sector (see 4.1.2). However, banks are very powerful and backed by governments, making an absolute disruption unlikely (see 4.1.7).

Open Innovation

A crucial advantage of the Bitcoin network is that it uses open innovation to continuously improve. Open innovation integrates internal and external knowledge into the innovation process (Chesbrough, 2011). By using valuable, widely spread knowledge of developers, the Bitcoin network continuously innovates its technology. The improvement of this network is implemented through ‘Bitcoin Improvement Proposals’ (*BIP*), which are “...design documents providing information to the Bitcoin community, or describing a new feature for Bitcoin or its processes or environment” (Antonopoulos, 2014, p. 259). In August 2017, such a new Proposal (*BIP148*) was implemented, which could be major step forward for solving Bitcoin’s scaling problems (see 2.2.2).

2.2.6 BIP 148 | SegWit2x | Lightning Network

In order to solve its capacity problem, Zhavoronkov (2017) suggests that Bitcoin needs to increase the size of its blocks ('on-chain' solution), while also implementing 'off-chain' solutions. The 'on-chain' transactions would be used for large transactions (e.g. Alice sends Bob 1000 bitcoins), whereas the 'off-chain' transactions would facilitate micro transactions (e.g. Bob sends Alice 0,0002 bitcoins). It is crucial that Bitcoin solves both of these problems in order keep its position as number one cryptocurrency, but also to be able compete with players like Visa on an equal level in the future (Zhavoronkov, 2017).

The new software update, named *BIP 148*, could significantly increase Bitcoin's transaction volume in two steps. Firstly (August 2017), it reduces the size of the transactions through *Segregated Witness* (often abbreviated to *SegWit*), which is a *soft fork* that reduces the size of signatures (commonly referred to as witnesses), making up a great part of the total transaction size⁸ (Marshall, 2017). In a second step (November 2017), *BIP 148* will double the size of each block to further increase Bitcoin's transaction limits, therefore it is often referred to as *SegWit2x*. However, both of these steps will only temporarily ease Bitcoin's capacity problems, assuming the cryptocurrency will continue to grow. As Zhavoronkov (2017) suggested, a long-term solution of Bitcoin's transaction problem also requires an off-chain solution (along with further increase of the blocksize). Such a solution could be the *Lightning Network*⁹, which is enabled through *SegWit*. The *Lightning Network* would function as a layer on Bitcoin's technology, facilitating "...micropayment channels whose transfer of value occurs off-blockchain" (Poon and Dryja, 2016, p. 1) and thereby reducing the transaction load of Bitcoin's Blockchain (see 4.1.6).

The doubling of the blocksize might cause another *hard fork*, because some people within the Bitcoin community do not agree with that increase, hence, it would result in three different versions of Bitcoin as table 1 shows.

Table 1: (Potential) Versions of Bitcoin

Bitcoin Version	Bitcoin (Core)	SegWit2x ¹⁰	Bitcoin Cash
Blocksize	1 MB	2 MB	8 MB
Implementation of SegWit	Yes	Yes	No

This could lead to confusion as businesses could consider the forking chain, which only accepts 1 MB blocks as the 'real Bitcoin', because it runs the traditional 'Bitcoin Core' software client. However, currently

⁸ A transaction essentially consists of the sender, the receiver and the signatures (Marshall, 2017).

⁹ Please read Poon and Dryja (2016) for a full explanation of the *Lightning Network*.

¹⁰ There is no official name for the potential new/updated version of Bitcoin yet (if no fork occurs it stays the 'original' Bitcoin).

most *nodes* signal support for *SegWit2x* (2 MB blocks), which would make it the cryptocurrency with the largest network, and greatest potential of mainstream adoption. Understandably, the *SegWit2x* chain also wants to keep the already widespread name 'Bitcoin' (Dinkins, 2017). Yet, there is no given rulesets to determine which Blockchain is entitled to have the name Bitcoin, making it a very controversial topic (Levine, 2017). In the end, it is also possible that the entire community will agree to *SegWit2x*, and that no fork will occur.

2.3 Banks and Blockchain technology (RQ 2)

The financial sector sees significant potential in Bitcoin's underlying Blockchain technology. Currently, banks are exploring the innovative technology and the potential for it to fit into their existing system. Firstly, banks' motive for implementing the Blockchain technology will be examined and then an investment overview will be given. Secondly, the benefits and limitations of implementing Blockchain technology into banks centralised systems will be analysed. Finally, the internal challenges banks' face will be evaluated along with bank collaborations aiming to develop their own Blockchain.

2.3.1 Banks' motives

Whereas Bitcoin's Blockchain is a public, *permissionless* Blockchain, which is open to anyone at any time, banks explore private, *permissioned* Blockchain, where people need access to permission, and everyone who operates on it needs to be audited to some degree (Garzik 2015; Walch, 2015; Chwierut, 2016). Banks invest in *permissioned* Blockchains, because these distributed ledger systems are more compatible with their existing system (Garzik 2015; Swanson, 2016) and enable banks to make specific improvements to their current system (see 4.2.1). Most importantly, it would save banks money, back office costs and capital (Jenkins and Arnold, 2016; Shubber, 2016). To put this in numbers, according to research reports there are potential annual efficiency gains to financial services from Blockchain of between \$15bn and \$20bn (Bussmann, 2016). In addition, it allows transparency for the participating banks of a *permissioned* Blockchain (Jenkins and Arnold, 2016).

2.3.2 Investment overview

As figure 4 (p.18) illustrates, over 50 financial services firms or their strategic investment arms, have invested in a Blockchain or Bitcoin-specific start-up since the start of 2014 (*The March Of Financial*

Services Giants Into Bitcoin And Blockchain Startups In One Chart, 2017). These investments demonstrate that banks have realised that a more open approach to innovative technologies is favourable, even though banks seem to be compelled to invest in Blockchain technology in order to stay competitive.

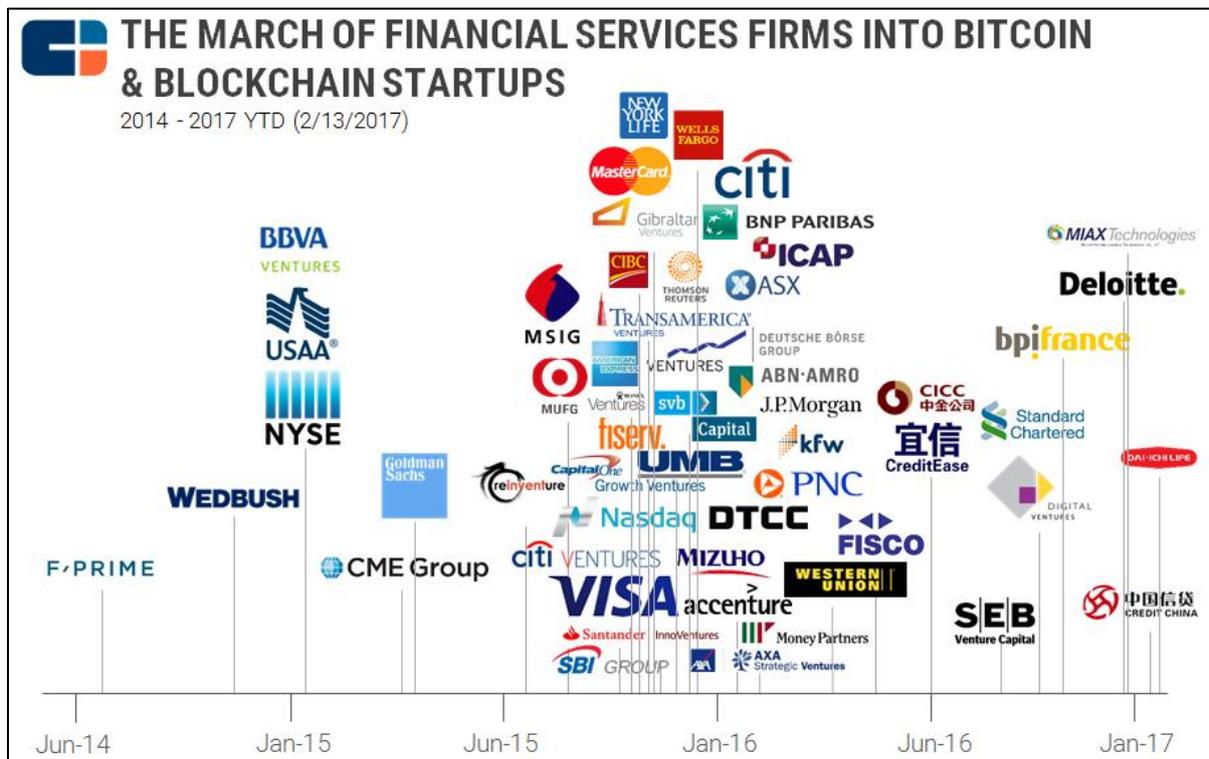


Figure 8: Investments into Bitcoin and Blockchain start-ups (The March Of Financial Services Giants Into Bitcoin And Blockchain Startups In One Chart, 2017).

2.3.3 Permissioned Blockchains

Banks attempt to use the Blockchain technology in a completely different way than previously thought and intended. In 'permissioning' the Blockchain, an important benefit of Bitcoin's public, *permissionless* Blockchain technology is diminished. As Nick Szabo, a well-known cryptographer, points out:

"They keep trying to re-inject points of control, and thus points of vulnerability, into Blockchains, e.g. through 'permissioning'; but this nullifies their main benefits, which come from removing points of vulnerability" (Szabo cited by Allison, 2015).

Furthermore, former Bitcoin Foundation director Jon Matonis is convinced that private, *permissioned* Blockchains fall short of their objectives, because the result could be very similar to the centralised payment networks that currently exist, but without the benefit of Bitcoin's network effect (Matonis cited by Prisco, 2015). Yet, arguably, both statements are biased, considering Szabo and Matonis respective pro-Bitcoin positions. In contrast, the IBM Vice President of Blockchain Solutions and Research, Gopinath

(2016) persuasively suggests that virtually all business applications will be on *permissioned* Blockchains. He emphasises the anonymity of Bitcoin as being unsuitable for businesses, because in business the parties need to know with whom they are engaging in a particular transaction. This can only be ensured through *permissioned* Blockchains. Despite the validity of Gopinath's point, his perspective could also be biased, given the fact that IBM is fully committed to the Linux Foundation's *Hyperledger project* to build a *permissioned* Blockchain for business (Gopinath, 2016).

2.3.4 Banks' collaborations

Banks are already collaborating to develop their own *permissioned* Blockchain technology. A highly important consortium partnership of over 50 of the world's leading financial institutions constitute the financial innovation firm *R3* (*About R3*, 2016). The consortium realised that an open innovation model, with a decentralised approach, is more effective, because no bank or even consortium, no matter how capable or how big, can innovate effectively on its own (Chesbrough, 2011). Therefore, *R3* made its distributed ledger platform, named *Corda*, open source, in order to grant the global developer community universal access to its source code. In doing so, they hope to encourage collaboration, review and contribution to their platform (Lambert, 2016). This specific form of open innovation is called selective revealing, whereby consciously selected insider knowledge is made available to outside agents for free, and without contractual agreements (Alexy *et al.*, 2013). However, whether the developer community will demonstrate the same effort and motivation for this project as for Bitcoin remains questionable. Additionally, *R3* researchers and developers recently stated "No blockchain because we don't need one" (Young, 2017). This could be interpreted as admitting that the utilisation and implementation of Blockchain technology does not fit their technological capability, or reflect the complexity of Blockchain integration into banks' systems. Nevertheless, *R3* still has a development team with high technological knowledge and experience, therefore, keeping its ability to create a technology, which could drastically improve the global financial industry (Young, 2017).

The collaboration of banks also revealed diverging interests among participants. The early backers of *R3*, Goldman Sachs, Santander and Morgan Stanley left the consortium (Stafford and Murphy, 2016), though this does not imply that these institutions no longer believe in Blockchain technology. In fact, the former *R3* member Santander recently colluded with the Swiss bank UBS, Deutsche Bank and the investment company, BNY Mellon, to develop a new form of digital cash that they believe will become an industry standard, to clear and settle financial trades using Blockchain (Arnold, 2016). The alliance of four of the world's biggest banks has ambitious aims, and targets the first commercial launch of their 'Utility Settlement Coin' by early 2018 (Arnold, 2016).

2.3.5 Banks' internal challenges

While there is huge potential for banks in implementing the Blockchain technology, there are also various challenges, which prevent banks from innovating effectively. Firstly, banks need to attract fresh talent, in order to cope with the demands of the digital transformation and the complex Blockchain technology. Indeed, banks currently rely mostly on buying Blockchain-related software, instead of building their own. Secondly, they need to accelerate their decision-making process, which can currently take months, due to various layers of hierarchy. Here, it is also crucial to consider the opinions of the technological experts into policy and economic decisions for currency. Thirdly, banks need to incentivise forward and innovative thinking; however, many central bankers are career central bankers, which consider change as threat and therefore prefer the status quo. Finally, obtaining licenses and regulations from different stakeholders will be a time-consuming and diplomatic obstacle (Shubber, 2016; Etsebeth, 2017).

2.4 Conclusion

While existing research has empathised with Bitcoins technical innovations and investigated its future potential, there is still the need to investigate further, since Bitcoin is changing and developing so rapidly. Indeed, in the four months this study was written alone, the Bitcoin network forked (see 2.1.2), the price per bitcoin and the total market capitalisation more than doubled (see fig.6, p.12) and a new, potentially path-breaking *BIP* was implemented (see 2.2.6). This research, therefore, aims to investigate these recent events which all impact the chances of Bitcoin becoming a second monetary system (RQ 1), a question which needs to be researched continuously (see 5.1). Moreover, it is also crucial to analyse how banks aim to use Bitcoin's underlying technology for their purposes as their significant investments demonstrate the importance and potential value of Blockchain technology (RQ 2). At the same time, the research shows how complex and controversial the field of Blockchain technology presently is.

Chapter 3: Research Methodology

This chapter first introduces the research philosophy, design, and strategy, in order to provide a rationale for the methodological foundations of this research. Access issues and limitations will then be outlined, before concluding with ethical considerations.

3.1 Research philosophy, design, and strategy

The present research uses a subjective ontology approach as its research philosophy, since social entities need to be perceived subjectively (Dudovskiy, 2017). Accordingly, a qualitative, interpretive, and exploratory research methodology was applied (Myers, 2013). Interpretive research is applicable in this context, since it focusses on “...the complexity of human sense-making as the situation emerges (...) and attempt[s] to understand phenomena through the meanings that people assign to them” (Myers, 2013, p. 39). Further, the exploratory research design aims to discover and explore a new phenomenon (Myers, 2013) suiting the dissertation topic and its research questions. Indeed, Bitcoin is a relatively new innovation, which is highly complex and constantly changing. Consequently, the dissertation is a temporal analysis, using expert interviews as a data source. In qualitative research, interviews aim to investigate identities, experiences, beliefs, attitudes and orientations, opinions and perspectives of a specific topic (Besant, 2015; Dunsby, 2016). Therefore, interviews allow the gathering of insider knowledge in order to explore the characteristics of Bitcoin and its potential impact, as well as banks’ motives and strategies to explore Blockchain technology. The interviewees represent two research experts from the field of Bitcoin and Blockchain technology, one holding a PhD in the area of cryptocurrencies and one specialising in disruptive innovation. Both have published various papers in the field of cryptocurrencies. A third interviewee has expertise in cryptocurrency investment along with a high technical understanding of Bitcoin, and a final interviewee, the Chief Innovation Officer of a new emerging mobile bank, will provide insider knowledge of Blockchain implementation in the financial sector.

3.2 Access issues

The interviewees were acquired by using strong and weak ties, as well as open events at the Newcastle University Business School, such as the 'Gain Global Advantage lecture' and the 'Goldman lecture'. Three interviews were conducted in person in the North East of England, with the a fourth conducted via Skype, due to the interviewee's base being outside the UK. As well as the interviews, academic journals provided a key source of information, as there are presently over 750 peer-reviewed journals on Bitcoin accessible in the online library of Newcastle University. Due to the speed of change and development around Bitcoin, the current study required access to non-academic sources, such as articles from the Financial Times and Bitcoin-specialised websites, for the latest information. While there is already a great deal of accessible information on Bitcoin itself, it is more complicated to acquire information on Blockchain integration into financial sector, because most banks did not start exploring with the technology until 2016 (see fig. 8, p.17) and have not disclosed much information regarding this.

3.3 Methodological Limitations

As previously mentioned, this study used qualitative data from four interviews with different insider perspectives. The number of interviews reflects the 16-week time constraints brought upon this Master's dissertation. However, even though the number of interviewees is limited, it is more important that interviewees represent various voices (Myers, 2013). In fact, Ahuvia (2005) conducted only two in depth-interviews for an article published in a top marketing journal, which proves that the number of interviews is not decisive for the quality of a paper. Although a mixed methods approach could have provided broader results, this qualitative study aimed to have a narrow and deep approach, by gathering insider knowledge, in order to deliver answers to complex questions.

3.4 Ethical issues

Each interviewee received an information sheet explaining the research purpose, and then signed a consent form (see Appendix A and B). To ensure confidentiality and anonymity, the real names of the interviewees are not revealed, and the research data is saved on password encrypted devices. The data will remain confidential and the names of the interviewees are known only to the author and dissertation supervisor, Dr Karen Elliot. The fact that some of the interviewees, and the author, have a pro-Bitcoin mindset, and each represent a subjective opinion, was considered during the interviews analysis, because "...facts themselves have to be reconstructed in the light of interpretation" (Myers, 2013, p. 41).

3.5 Data handling and analysis

The interviewees were selected based on their knowledge and expertise, while also considering different contexts and links to Bitcoin/Blockchain, thereby ensuring balanced and valid results. Accordingly, purposive sampling was used to arrange in-depth interviews with experts in the field of Bitcoin and Blockchain technology (Myers, 2013; Silverman, 2013). Each interview lasted between 30 to 45 minutes and was audio-recorded on an encrypted device, ensuring a safe storage and transportation of the sensitive data. Once the data was saved on a password encrypted computer, the interviews were anonymously transcribed to further safeguard data confidentiality. The interviews were semi-structured, using pre-formulated questions (see Appendix C), but not deviating from them where appropriate. The advantage of a semi-structured interview is that the questions provide a basis of comparability, while also allowing new and emerging questions to be asked (Myers, 2013; Silverman, 2013). With two of the interviewees, who have a significant technical understanding of the Bitcoin system, a written follow-up interview was conducted, since crucial changes happened within the Bitcoin system (*BIP 148*, see 2.2.6) after the first interviews conducted in June (for detailed actions and timescales please see the work plan in Appendix D). Again, confidentiality was guaranteed by anonymising the data and saving it on encrypted devices.

By using thematic content analysis, the data was processed in three different steps. First, the interviews were transcribed (data assembly). Then the data was selected and simplified by using codes/categories (data reduction). Finally, conclusions were drawn (data verification) (Myers, 2013). In order to draw robust conclusions, triangulation was applied, by verifying the accuracy of the interview transcription with the interviewees concerned, prior to analysis (Silverman, 2013). The interviews were then clustered and evaluated, allowing analysis of the interview data, and valid, defensible conclusions and recommendations to be reached. For this study, 10 codes were created (see Appendix E) (Gioia *et al.*, 2013) and corresponding answers will be compared to the findings of the existing literature and analysed in the following chapter.

Chapter 4: Results | Discussion

This study aimed to investigate whether Bitcoin could become a second, ‘parallel’ monetary system. In order to answer this question, it is important to understand what can kind of benefits Bitcoin can offer users, its strengths and weaknesses (see 4.1.1, 4.1.2) as well as external and internal obstacles of the cryptocurrency (see 4.1.3, 4.1.4). Then, Bitcoins impact, its possible application and the potential of the *Lightning Network* will be analysed (see 4.1.5, 4.1.6). On that basis, predictions on Bitcoin’s future will be evaluated (see 4.1.7). The second research question, regarding the potential impact of the Blockchain technology on the banking sector, requires an understanding of banks’ motive (see 4.2.1), the benefits and application possibilities of the technology, but also the risks and limitations of *permissioned* Blockchains (see 4.2.2). Finally, predictions on how the Blockchain technology could change the financial sector will be made (see 4.2.3). All relevant paraphrased or shortened interview quotes are listed in Appendix E with the corresponding Code/Topic (C1-C10). Table 2 shows the areas of expertise of the different interviewees with their assigned number, which will be used accordingly throughout this chapter.

Table 2: Interviewees - Overview

	Degree	Bitcoin / Blockchain expertise
Interviewee 1	PhD	Chief Innovation Officer of a new emerging mobile bank, which currently explores the potential Blockchain integration
Interviewee 2	prospective PhD	Experience in cryptocurrency investment along with a fundamental understanding of Bitcoin and its Blockchain technology
Interviewee 3	PhD	Focus on disruptive Innovations with publications in the field of Blockchain technology, Distributed Ledgers, and Cyber Security
Interviewee 4	PhD	Holds a PhD in the area of Bitcoin/Ethereum, high technical understanding with various publications in the field of cryptocurrencies

4.1 Implications on the future of Bitcoin (RQ 1)

4.1.1 Inherent characteristics

Motive, Access, Anonymity and Autonomy

As discussed, Bitcoin has easy accessibility (see 2.2.1). Certainly, the motive behind Bitcoin's creation was "...to be open and accessible to all and to benefit all" (Interviewee 3). However, despite this, it still requires skills and understanding about how to buy bitcoins and use an individual *wallet* (Interviewee 3, see C1 in Appendix E). Indeed, currently Bitcoin is not as easy to use as the current banking system (Antonopoulos, 2017b) and is not as anonymous as perceived, in fact "...Bitcoin is most traceable currency in the world" (Interviewee 4). Nevertheless, Bitcoin provides crucial benefits, in particular for developing countries, where millions of 'unbanked' people do not have access to the urgently needed saving and borrowing mechanisms of banks (see 2.2.3).

The creation of Bitcoin also arose from a dislike and lack of trust for the traditional banking system, in particular to its unethical behaviour that led to the financial crisis in 2008 (Interviewee 3 & 4, see C1 in Appendix E). Potentially therefore, Bitcoin's creator(s), who remain unknown, implemented autonomy as a crucial feature of Bitcoin. This feature gives users complete responsibility of their money, ensuring that as long as the *private key* is kept safe, their bitcoins cannot be confiscated (Interviewee 2 & 4, see C1 in Appendix E). Consequently, Bitcoin could be particularly valuable as "...a plan B for countries where the leader confiscates money or property of the people" (Interviewee 2). Even in stable countries, there are negative examples of not having true autonomy over money as the Cyprus bailout deal with the EU proved:

"Cyprus had this banking crisis because of the financial crisis and anyone with more than 100.000 € in their account got a 'haircut' of 10 or 20 percent. And the banks could do that, because they have the control over money. Well, with Bitcoin they no longer have that" (Interviewee 4).

In fact, in 2013, people with savings over 100.000 € in Cyprus had even losses of up to 30%. The confiscated money was used for the bailout deal with EU in order to prevent Cyprus being forced out of the European Monetary Union (Traynor, 2013). Such personal losses would have been impossible for those with savings in Bitcoin, if users kept their private key secret. However, it needs to be stated that the individual responsibility for the owned bitcoins also has its downsides such as irreversibility of transactions (see 2.2.3). Additionally, many Bitcoin users rely on exchange services to keep their *private key*, thereby stripping away the autonomy effect of Bitcoin (see 4.1.3).

Decentralisation

Another unique feature of Bitcoin is that it is a decentralised and *permissionless* currency, which can be used as both, a store of value and as a payment system (Interviewee 2 & 4, see C3 in Appendix E).

“The beautiful thing about bitcoin is that it is decentralised global currency that can be maintained by anybody, it is *permissionless*” (Interviewee 4).

However, Bitcoin’s decentralisation and the interrelated consensus mechanism also creates a slow decision-making process. Though, this is not necessarily a disadvantage as it also increases the security of the system, because if decisions take time and are well considered, they are likely to be good decisions (Interviewee 2, see C3 in Appendix E). Nevertheless, if Bitcoin wants to play a significant role in the economy it has to change faster than previously since there are many competitors, both banks and other cryptocurrencies. In fact, the disagreements within the Bitcoin community over scaling issues have already led to competitors gaining ground on Bitcoin (Interviewee 4, see C3 in Appendix E).

“One of my fears is that Bitcoin could implode. And that’s not because of the technology but because of the community” (Interviewee 4).

This statement shows that one of Bitcoin’s greatest danger and challenge is not external (e.g. regulation) but internal. However, the split into Bitcoin and *Bitcoin Cash* in August, which was already predicted during one interview in June, will “...be beneficial in the long term” (Interviewee 4) and resolve much of the disagreements within the community, because the split not only creates two different currencies, but also two different communities, with diverging interests (Interviewee 4, see C7 in Appendix E).

Security

Bitcoin’s Blockchain technology ensures a dispute-free consensus along with a transaction history where everything is publicly verifiable (Interviewee 4, see C2 in Appendix E). Moreover, Bitcoin “...has the biggest mining power in the world, it is the most secure system which was ever built in this Blockchain technology” (Interviewee 2). However, even though Bitcoin’s mining model provides a very high level of security, that *permissioned* Blockchains cannot provide (see 4.2.2), it also bears risks:

“Because of the role of the problem solvers [*miners*], which is basically how much computational power can bring each instance. As a result, you create an opportunity of concentration and power. I don’t like that at all” (Interviewee 1).

This potential merger of different mining pools¹¹ is indeed a threat to Bitcoin's security, even though the current distribution of mining power is well-balanced making such a concentration of power unlikely, as figure 6 shows.

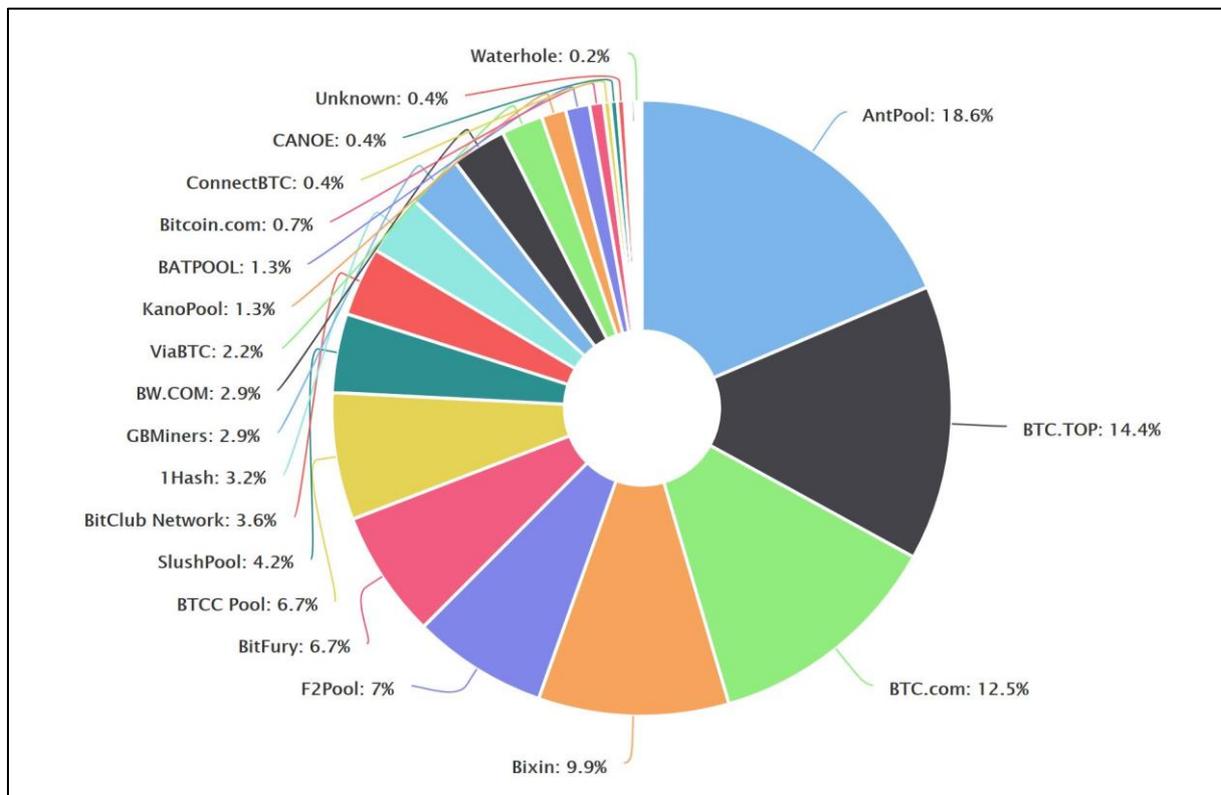


Figure 9: Distribution of mining power (Hashrate Distribution 2017)

However, while the distribution in terms of size is balanced, mining requires vast amounts of computational energy causing a centralisation of mining pools in areas of the world where electricity is cheap (Castor, 2017a). As a consequence, Bitcoin forfeits its decentralisation to some extent as well as consuming a great deal of energy, which will grow in accordance with Bitcoin's price and user numbers.

4.1.2 Economic characteristics

Scalability

As already discussed (see 2.2.1), the scalability, speed, and transaction volume of Bitcoin reflect crucial limitations, which prevent it from becoming a widely-accepted monetary system (Interviewee 1 & 3, see

¹¹ association of different miners who share their rewards between the members ('What is a Bitcoin Mining Pool?', 2014).

C3 in Appendix E). The implementation of *BIP 148*, was a first step to increase Bitcoin's transaction volume; however, Bitcoin still has "...too few blocks, too little in each block. Can't possibly cope with world economy" (Interviewee 1). Indeed, in order to become widely accepted "Bitcoin itself will need to show an ability to drop some of his inherited characterises and start to demonstrate ability to become more useful, both in terms of volume, in terms of speed, in terms of how sources of trust are enabled and identified" (Interviewee 1).

The issue on how to solve Bitcoin's scaling problem was the main reason for the dispute within the community (Interviewee 4, see C3 in Appendix E). If Bitcoin does not solve this problem, other cryptocurrencies will overtake it. Bitcoin took a major step, by implementing *BIP 148*, to solve the scalability problem. However, those solutions are only temporary assuming Bitcoin will continue to grow, therefore the implementation of 'off-chain' solutions, such as the *Lightning Network*, is necessary in order to truly scale Bitcoin (see 4.1.6).

Price fluctuations & Transaction fees

As discussed (see 2.2.2), Bitcoin's price fluctuates greatly, however, Bitcoins volatility is contingent on its newness, since "...everything that it is new is always volatile. You do not know where it's going to go. But I think the signs are that it's probably going to be the next big thing" (Interviewee 3). In fact, the high price of Bitcoin reflects the potential people see in it. Due to its popularity and limitations regarding the transactions it can handle, the fees of Bitcoin rose enormously in the last few months.

"Two years ago, the fee would be a cent or half cent and today is one or two dollars"
(Interviewee 4).

The average fee per transaction was around \$2 per transaction in June 2017, when the Interview was conducted. However, the cost per transaction even increased further to currently around 4\$ per transaction (see fig. 5).

4.1.3 Trust

Trust is a big issue, in particular when comes to money. Although, people lost trust in the banking sector after the financial crisis (see 2.2.3), and are aware of banks' responsibility for the crisis, now "...nobody really questions the bankers anymore" (Interviewee 3). On the other hand, many people do not trust Bitcoin, which stems from misunderstanding and biased media coverage. As described, Bitcoin is a complex topic and in order to fully understand the benefits of Bitcoin, people also need to understand how the Fiat currency system works. However, since the media coverage of Bitcoin in the mainstream media is

often connected with negative implications, many people already have a certain mistrust towards Bitcoin (Interviewee 2 & 3, see C4 in Appendix E).

“There is a lot of misunderstanding out there and I think that feeds in the public perception as well, because it’s an issue of upskilling people” (Interviewee 3).

But even the people who understand Bitcoin to a certain degree and own bitcoins often misuse the cryptocurrency by keeping their private key on an exchange service such as Coinbase. In doing so, they effectively use the exchange service as bank to keep their money safe. This is highly dangerous, because such exchange services “...do not have the same security level or the same collateral as banks” (Interviewee 4). Still, people are willing to trust these exchange services with their money, even though that is far riskier than keeping it in a traditional bank (interviewee 4, see C4 in Appendix E). This behaviour could be interpreted as falling back into old patterns, because people are not used to having total control over their money, and also affirms the need for people to upskill in order to use Bitcoin optimally.

4.1.4 Regulation

The regulation of Bitcoin is highly complex (see 2.2.4), but also decisive for Bitcoin’s potential mainstream adoption. It was emphasised by Interviewee 2 that the motive to regulate Bitcoin is often an attempt to control Bitcoin, which is plausible considering that “...the finance of the country is linked to the state and backed by the government” (Interviewee 3). However, regulation is still necessary and in particular the taxation of Bitcoin, as interviewee 1 rightfully observed:

“Well, its [taxation] fundamental, because if you create a parallel monetary system (...) that is outside of taxation and allowing you and me to do peer-to-peer transactions. I give you this and you give me some bitcoins. There is no record of that as far as the revenue is concerned, no one that is taxing that, no one's taxing the gain that you've made, no one's putting VAT on me as the ultimate beneficiary.

Who pays for hospitals? Who pays for roads to be built? Who pays for defence? Who pays police? Who pays for Education? Oh, the people who are not using Bitcoin”.

Certainly, when Bitcoin will not be taxed correctly it would ultimately “...undermine the value of work” (Interviewee 1). While taxation is crucial, other regulations should consider that Bitcoin itself is already regulated by its protocol (see 2.1.6 & C5 in Appendix E) and therefore “...not touch the whitepaper” (Interviewee 2). So, while attempting to change the rules of the whitepaper, e.g. increasing the limited amount of bitcoins, would be indeed very harmful for Bitcoin’s future, it is still important to regulate the

exchange services. In fact, "...the best chance for the regulators is on exchanges, where you get money in and out" (Interviewee 4). Accordingly, most current regulations focus on those intermediaries when implementing their policies.

4.1.5 Impact & potential applications

Impact of Bitcoin

A major impact of Bitcoin so far is that it actually exists and can be used as a plan B if necessary. Through its existence, people do not need to rely entirely on the current banking system, hence, preventing control of money by financial institutions (Interviewee 2, see C8 in Appendix E). This is a crucial improvement, particularly, for developing countries, which suffer from the disadvantages of the current banking system.

"Well, with the banking system. One: it is not transparent, so if bank creates money and we cannot see that and two: We have to trust the bank with our money as well" (Interviewee 4).

In fact, banks, respectively governments, which excessively print money can cause inflation, which cannot happen with Bitcoin, as its limited supply is immutable. For instance, in Venezuela, which currently has the highest inflation rate in the world, Bitcoin is already used as a plan B. Indeed, the user numbers of Bitcoin in Venezuela rose from 450 in August 2014 to more than 85,000 in November 2016. The easy accessibility (many Venezuelans have internet-enabled mobile phones), with no need for a physical bank account make bitcoins valuable for Venezuelans, who use bitcoins to buy Amazon gift cards, in order to purchase goods. In fact, some Venezuelan companies are even exclusively accepting payments via bitcoins, knowing that the local currency is largely useless at the moment (Rands, 2017; Russo, 2017).

Potential applications

While Bitcoin has the technological ability to function as a payment system, and is already used as such (e.g. Venezuela), the question remains whether developed countries actually need a new payment system:

"You could also ask the question whether we need a new payment system. Maybe there is another place for Bitcoin than to be a payment system, because we have quite good payment systems, such as Amazon Pay and PayPal or even the normal banking system works quite well for transactions" (Interviewee 2).

In fact, for normal customers our current banking system is working well and, in particular, other payment services, such as Amazon Pay or PayPal provide an effective and simple method for transactions. Therefore, Bitcoin is not very likely to be used as a mainstream payment system, because there are good alternatives and Bitcoin currently only provides "...an inferior solution to send money: it is expensive and limited due to Bitcoins design" (Interviewee 2). However, this might change, because disruptive innovations can take time. For instance, in the early 90s it was more complicated to send an Email than a fax, because with a fax you could send charts, drawings, or handwritten notes, whereas with Emails it was not possible because the capacity for such attachments was not there (Antonopoulos, 2017b). Yet, as we see today, those problems are solved and faxes are obsolete. Cryptocurrencies will develop further, and "...we will see interesting dynamics in the race for the superior payment network, which is a good thing in the long run" (Interviewee 2), which will also pressure established payment systems. Whether banks will become obsolete is questionable; however, the rise of cryptocurrencies provides an alternative, and is likely to result in better conditions for customers.

4.1.6 BIP 148 | SegWit2x | Lightning Network

Recently, a new Bitcoin Improvement Proposal (*BIP 148*) was implemented, which creates more space in the existing blocks by reducing the size of the transactions and, in a second step (November 2017), will double the size of each block. This *BIP* could have significant implications on Bitcoin's future, the scaling debate, and its ability to become more mainstream. However, the way the decision for *BIP 148* was made is also a reason for discrepancies within the Bitcoin community, as Interviewee 4 explains:

"The issue here is governance - not necessarily the technical aspects. This deal was agreed in a room at Manhattan that did not consult any bitcoin core developers. It shows that there are influential members of the community willing to pursue a boardroom-style of governance to changing Bitcoin's consensus rules. Whether consensus rules should be governed in this matter or not - is what is causing debate in the community. Most people agree that transaction malleability¹² (i.e. SegWit) should be fixed, and that blocks should be bigger - it is just finding the most appropriate approach to achieving those new rules".

¹² This refers to an implementation flaw that allows the modifications in the transaction data without changing the hash value (Decker and Wattenhofer, 2014).

This shows that while the problem is Bitcoin's limited capacity, disagreements within the community are mainly being caused by how the fundamental rules of Bitcoin should be changed and not that they should be changed. Indeed, many users are disappointed that the decision for *SegWit2x* was made by only a few influential people, which contradicts Bitcoin's decentralisation (Hertig, 2017b). However, this is a very unclear situation, with some arguing that Bitcoin core developers were invited to the meeting on *SegWit2x*, but declined for unknown reasons (Levine, 2017).

The software update enables the implementation of the *Lightning Network*, "...which technologically has the opportunity to scale Bitcoin to do your day-to-day payments" (Interviewee 4). Indeed, while Bitcoin's transaction currently can take hours (depending on the capacity), the *Lightning Network* promises to reduce this process to seconds (Graham, 2017). The *Lightning Network*, which is currently being developed by four different teams, is likely to be implemented within the next two years, and could ease the capacity load on Bitcoin's Blockchain, because it facilitates private transactions among users 'off-chain'. Whether and to what an extent such a system will be used is speculation at this point of time; however, it provides the technological requirements for Bitcoin to become widely-used and effective payment network (Interviewee 2 & 4, C6 in Appendix E). The private transactions of the *Lightning Network* involve a second peer-to-peer network with new 'routes', however, it remains to be seen whether users are willing to use such an additional network or if they prefer to rely "...on central providers like Coinbase (i.e. landmarks) to route payments on their behalf" (Interviewee 4). While only a second peer-to-peer network would allow a desired decentralised system, it is also "...possible (as most people keep their coins on exchanges anyway) that the landmark approach will be the outcome" (Interviewee 4). Indeed, if users will use Exchange services or other intermediaries, then it would result in a centralised system as the users would operate through the intermediaries (Zavoronkov, 2017).

4.1.7 Future predictions of Bitcoin

The future predictions from the interviewees are controversial; however, all observed that Bitcoin needs to scale in order to gain a mainstream role while also facilitate its use. Only then, Bitcoin can unfold its disruptive potential (see C7 in Appendix E). Yet, due to Bitcoin's current limitations and inflexibility, one interviewee, is convinced that Bitcoin will not become a second monetary system:

"It's demonstrated some resilience, it demonstrated ability to learn. It still has some deeply inflexible characteristics, which make it easy for me to say you know whether it will emerge as parallel monetary system – absolutely not as Bitcoin" (Interviewee 1).

Therefore, Interviewee 1 argued that Bitcoin is "...a classic example of first mover does not always win" (Interviewee 1) and that banks and other financial institutions will fill that role by adapting the Blockchain technology (see 4.2.3). However, Interviewee 1 also emphasised that, if Bitcoin wants to become mainstream, it is required to become part the norm:

"So, the question for the people at the heart of Bitcoin is: Are we ready to be part of the norm and destruct from within or do we think that our future is destructing from the outside" (Interviewee 1).

Other interviews were more optimistic regarding Bitcoins future, noting that with the implementation of the *Lightning Network*, "...it has the potential to be parallel system" (Interviewee 4, see 4.1.6). However, to do so, Bitcoin needs to greatly increase the public's awareness of it (Interviewee 3, see C7 in Appendix E). In fact, this lack of awareness is one reason Bitcoin will likely remain in the world of techies and banks in the near future; however, also the internet existed for around 30 years before it really took off (Interviewee 4, see C7 in Appendix E). Currently, public interest raises, particularly for using Bitcoin as an investment (Kharpal, 2017). If Bitcoin continues to raise awareness and to provide more larger-scale use like in Venezuela, it could indeed become one of "...the 20 biggest currencies in the world. It's possible, because it is a currency which can be used all around the world" (Interviewee 2). However, banks are extremely powerful and will attempt to prevent such a disruption of their sector. Undeniably, banks belong to the biggest businesses in the world underpinned by nation states, which also need to secure and defend their nationwide financial boundaries (Interviewee 2, see C5 in Appendix E).

Taking those arguments into account, it will be very interesting to see whether Bitcoin will overcome the internal (community issues, scaling problems) and external obstacles (regulation, trust, banks) in order to become a second, parallel monetary system.

4.2 Implications on the future of Blockchain within the financial sector (RQ 2)

4.2.1 Banks' Motives

As discussed (see 2.3.2), banks see great potential in the Blockchain technology; however, in fact banks are obliged "...to adapt in order to survive and that's the key thing" (Interviewee 3). A major motive behind the implementation is to "...solve a coordination problem" (Interviewee 4) in order to facilitate interbank transfers without relying on trusted third parties (see C8 in Appendix E). In a sense, banks' approach is similar to Bitcoin, while Bitcoin aims to make banks as intermediary for customers obsolete, banks try to do the same with clearing houses. This is demonstrated by the Swiss bank UBS, Deutsche Bank and the investment company, BNY Mellon which currently develop the 'Utility Settlement Coin' to clear and settle financial trades using Blockchain technology (see 2.3.3).

4.2.2 Permissioned Blockchains

Applications & challenges

In order to implement the Blockchain technology into their system, banks could apply their own ruleset without accepting Bitcoin's ruleset (Interviewee 1, see C9 in Appendix E). For this, banks will need to "...work out the permissions, who holds the keys, how many blocks are going to be created, by whom, how you stop a chain and how you start again" (Interviewee 1). A major challenge for banks in implementing a *permissioned* Blockchain will be regulation, because regulations within in the financial sector are very high (Interviewee 4, see C11 in Appendix E). If banks can overcome these regulatory challenges, they would have plenty of different uses for implementation of Blockchain technology, whether it is high-value assets, securing mortgages or interbank settlements, while also providing transparency and efficiency in asset managing (Interviewee 1, see C9 in Appendix E).

In particular, for national banks transfers, e.g. transfers among different American banks, a *permissioned* Blockchain could make sense, because the banks would share the legal system and regulation. The banks would need to decide who maintains the Blockchain, an intermediary such as SWIFT, the government or the participating banks themselves through distributed consensus. Another crucial decision for the participating banks of their *permissioned* Blockchain is whether all banks can see any transfer in order to verify it, or if only the banks involved in a specific transfer can see it. Banks tend to prefer encrypting all transactions, so only the involving banks of a transfer see the specific transfer, but thereby they lose the public verifiability and weaken the security (Interviewee 4, see C9 in Appendix E).

A solution to this problem would be an implementation of ZeroCash, a *permissionless* cryptocurrency that can completely protect the privacy of transactions using zero-knowledge cryptography (*HOW ZCASH WORKS*, 2017), as Interviewee 4 suggested:

“ZeroCash is built in such a way where we can privately transact on the Blockchain and any observer can publicly verify the transaction as legitimate. If I transfer you a coin that I own, then nobody can see how many coins I send and in fact, they can’t even see the sender or the receiver. They only see that there was a transaction, and that transaction was 100% correct but they can’t say anything about it”.

Banks are already starting to acknowledge that ZeroCash could indeed be very beneficial when implementing a *permissioned* Blockchain model. Therefore, JPMorgan has recently partnered with ZeroCash to explore how their security model could be implemented into banks systems (Interviewee 4, see C9 in Appendix E) (del Castillo, 2017; Shin, 2017).

Security & Limitations

Certainly, in terms of security, *permissioned* Blockchains, cannot compete with Bitcoin:

“If they [banks] want to use the strengths of the system of Bitcoin, they should probably use Bitcoin. Because the strength of the system is not the use of the Blockchain, but the use of Blockchain embedded in the mining security model” (Interviewee 2)

As Bitcoin provides transparency and high security, the latter due to its mining power, it could indeed be beneficial for banks, in terms of international remittance. Assuming the Bank of America wants to transfer money to the Bank of Somalia or vice versa, then “...the only way they could actually reach consensus that a transfer is complete and can’t be reversed is to use a public Blockchain like Bitcoin - that’s the perfect use case there” (Interviewee 4). For such a transfer, *permissioned* Blockchains would not be suitable as both banks would require a shared legal system and regulation of the Blockchain, which is highly unlikely in this particular case. Accordingly, banks could actually use Bitcoin for particular international transfers (Interviewee 4, see C in Appendix E).

4.2.3 Future predictions for the financial sector

The future of the financial sector is very likely to be significantly influenced by Blockchain technology. It is to be expected that the big banks will maintain their position of power in the near future, though, they might play a slightly less important role in the economy due to platforms such as Amazon, which will "...sit between the consumer and the bank" (Interviewee 1). Due to their power and influence, interviewee 2 predicts that banks will also be around 10-20 years from now with probably fewer employees, yet, with "...the same amount of money, (...)" so there will be some virtually Monopoly in the monetary system" (Interviewee 2). While most interviewees predict that banks will keep their position of power in the future, Bitcoin advocate Andreas Antonopoulos (2017a) is convinced that banks will have significantly less power and will be solely used for legacy applications. He also argues that it might take 20-30 years until an open Blockchain, e.g. Bitcoin, will change the financial sector entirely, yet, he has no doubt it will happen. Therefore, he is sure that "Banking as an Institution is obsolete. Banking is now a protocol. Banking is now an app" (Antonopoulos, 2017a).

Additionally, it was predicted that customers will probably not see a difference in the near future, because "...banks are going to use the blockchain mostly for their internal operations, at least for the next 10 years, so they can experiment with the technology and see how it works" (Interviewee 4). However, this also depends on the support given by central banks, for instance the Bank of England envisions a *permissioned* Blockchain, which would act as a platform for smaller banks and payment providers, which could use and extend this Blockchain for their services and "...then they could offer pounds that originate from the Blockchain to customers". In the end, all digital transactions in the UK would be recorded on the Bank of England ledger (Blockchain) (Interviewee 4, see C10 in Appendix E). Hence, Interviewee 4 concludes:

"So, if central banks get involved and adopt that vision and go for it, then customers going to see the difference. If it is just banks like JPMorgan and the Bank of America, it is mostly going to be internal operations for now while they experiment".

Moreover, it was suggested that there could be a "...two-tier system" (Interviewee 3), where you would have banks, which integrate a *permissioned* Blockchain solution to keep their power and control, resulting in "...a different version of what they already got. It's just an incremental innovation" (Interviewee 3). On the other side, however, you would have Bitcoin as an open alternative, providing certain features, which likely be convincing for younger people with a general interest in new technologies.

Chapter 5: Conclusions

5.1 Limitations | Recommendations

The cryptocurrency Bitcoin is continuously evolving, making this study a temporal analysis, which has thrown up many questions in need of further investigation. Future research needs to focus on the changes and developments of Bitcoin starting with the potential *hard fork* in November (due to the doubling of the blocksize) and its implications. In this context, the development of Bitcoin's community in terms of the consensus issues, also needs to be researched. Going further, the potential implementation and applied usage of the *Lightning Network*, and the development of *Bitcoin Cash* is worthy of further work. Additionally, further studies need to be conducted to evaluate different regulations and policy responses on cryptocurrencies, since they play a crucial role regarding Bitcoin's future.

The implementation of the Blockchain technology within the financial sector is at the beginning of its life, but is already very promising. This current study was limited in this context, as insider information from banks are rare, as is peer-reviewed research on this novel topic. However, its importance makes it worth researching. Future research should concentrate on how banks actually implement their *permissioned* Blockchains and how they counter their different challenges, most importantly, regulation, along with maintaining and securing the Blockchain. It is also important, to research the development of the different bank collaborations, since reaching consensus for different banks will also be a necessary condition before and during a potential Blockchain implementation. Further work needs to be done to establish whether such an implementation will have actual changes or improvements for the customers, e.g. having more autonomy over their money, or will solely benefit the financial institutions.

5.2 Conclusion

The present study questioned whether Bitcoin will emerge as a second monetary system (RQ 1), and how its underlying technology will impact the financial sector (RQ 2). For both questions, no definite answer can be given, because of various influencing factors, framework conditions as well as unforeseen events, which will affect Bitcoin development and the potential adaption of its underlying technology by financial institutions. However, the literature review and, in particular, the interviewed experts gave decisive insights, arguments, and analysis which provide valuable indications regarding the future of Bitcoin and the impact of Blockchain on the financial sector. Thereby, the current findings add to a growing body of literature on the emerging field of cryptocurrencies and Blockchain technology.

RQ 1

It has been shown that Bitcoin provides innovative characteristics, which reflect advantages but also disadvantages over the current banking system such as autonomy, security, usability, and easy accessibility. In fact, Bitcoin is already making a difference in countries like Venezuela, where people suffer from the downsides of inflation and therefore use Bitcoin as an alternative. By demonstrating the effects of *BIP 148* and the potential of the *Lightning Network*, it plausible that while the Bitcoin community has crucial disagreements, the cryptocurrency has, now more than ever, the chance to become a second monetary system. Whether, this will happen remains to be seen, yet the technological potential exists and cannot be erased. Bitcoin's existence gives people a plan B, which can be particularly beneficial for those without access to traditional saving mechanisms, or fear their money will be confiscated. Since most developed countries have well-functioning payment and banking structures, Bitcoin is likely to continue as currency for techies and as a store of value / investment asset in the near future. However, the fact that it can also be used as payment system makes it even more valuable and it is quite possible that Bitcoin will become a global currency with mainstream adoption within the next 20 years.

RQ 2

The current research suggests that the Blockchain technology will have a significant impact on the financial sector. The first major Blockchain application will likely change national interbank transfers. However, banks will need to determine how to implement the Blockchain into their system, while considering regulatory issues. Banks will likely stay in power over the financial market, yet, to an extent they will become less relevant because other players such as Amazon will be in a role where they provide not only the products but also the payment process. Hence, banks use case will be reduced to savings and investments. Additionally, assuming decentralised cryptocurrencies will keep growing, banks will forfeit even more relevancy. However, it is also possible that bank collaborations overcome their obstacles and build various functioning international Blockchains enabling the major banks to become more efficient and save significant costs. This would result in the need for fewer employees, but would also reinforce the power of banks. Either way, banking will change: a change triggered and maybe shaped by Bitcoin.

References

- About R3 (2016). Available at: <http://www.r3cev.com/about/>. [Accessed Aug. 30th 2017]
- Ahuvia, Aaron c. (2005) 'Beyond the Extended Self: Loved Objects and Consumers' Identity Narratives', *Journal of Consumer Research*, 32(1), pp. 171-184.
- Aiganym, S. (2015) 'The Conceptual Principals of Bitcoin Crypto Currency', *Journal of Computer Science*, 11(10), pp. 995-995.
- Alexy, O., George, G. and Salter, A. (2013) 'Cui bono? The selective revealing of knowledge and its implications for innovative activity', *Academy of Management review*, 38(2), pp. 270-291.
- Allison, I. (2015) *Nick Szabo: If banks want benefits of blockchains they must go permissionless*. Available at: <http://www.ibtimes.co.uk/nick-szabo-if-banks-want-benefits-blockchains-they-must-go-permissionless-1518874>. [Accessed Aug. 30th 2017]
- Antonopoulos, A. (2016). Available at: <https://twitter.com/aantonop/status/815112826822029312>. [Accessed Aug. 30th 2017]
- Antonopoulos, A. (2017a) 'Bitcoin Q&A: Why developers are leaving banks - YouTube'. [Online] Available at: <https://www.youtube.com/watch?v=GqOZ4IAQ-xQ>. [Accessed Aug. 30th 2017]
- Antonopoulos, A. (2017b) 'Open Blockchains for Cashless Developed Economies - YouTube'. [Online] Available at: <https://www.youtube.com/watch?v=eo-0BgrKxil>. [Accessed Aug. 30th 2017]
- Antonopoulos, A.M. (2014) *Mastering Bitcoin: Unlocking Digital Cryptocurrencies*. O'Reilly Media, Incorporated.
- Arnold, M. (2016) *Big banks plan to coin new digital currency*. Available at: <https://www.ft.com/content/1a962c16-6952-11e6-ae5b-a7cc5dd5a28c>. [Accessed Aug. 30th 2017]
- Bessant, J.R. (2015) *Innovation and entrepreneurship*. Third Edition.. edn. Hoboken : Wiley.
- Bitcoin Avg. Transaction Fee chart* (2017). Available at: <https://bitinfocharts.com/comparison/bitcoin-transactionfees.html#1y>. [Accessed Aug. 30th 2017]
- Bitcoin Stats* (2017). Available at: <https://blockchain.info/en/stats>. [Accessed Aug. 30th 2017]
- 'Bitcoins in circulation' (2017). Blockchain.info. Available at: <https://blockchain.info/charts/total-bitcoins?timespan=all>. [Accessed Aug. 30th 2017]
- Blöbaum, B. (2016) *Trust and Communication in a Digitized World*. Springer International Publishing.
- Bohme, R., Christin, N., Edelman, B. and Moore, T. (2015) 'Bitcoin: Economics, Technology, and Governance', *Journal Of Economic Perspectives*, 29(2), pp. 213-238.
- Bussmann, O. (2016) *Banks will not adopt blockchain fast*. Available at: <https://www.ft.com/content/8fc96cbc-8ed9-11e6-a72e-b428cb934b78>. [Accessed Aug. 30th 2017]
- Castor, A. (2017a) *A (Short) Guide to Blockchain Consensus Protocols - CoinDesk*. Available at: <https://www.coindesk.com/short-guide-blockchain-consensus-protocols/>. [Accessed Aug. 30th 2017]
- Castor, A. (2017b) *A Short Guide to Bitcoin Forks - CoinDesk*. Available at: <https://www.coindesk.com/short-guide-bitcoin-forks-explained/>. [Accessed Aug. 30th 2017]

- Chesbrough, H. (2011) 'Everything You Need to Know About Open Innovation'. Available at: <http://www.forbes.com/sites/henrychesbrough/2011/03/21/everything-you-need-to-know-about-open-innovation/>. [Accessed Aug. 30th 2017]
- Christensen, C. (2016) *Home Page*. Available at: <http://www.claytonchristensen.com/>. [Accessed Aug. 30th 2017]
- Chwierut, M. (2016) *Asking Permission: What's the difference between a public and private blockchain? - Smith + Crown*. Available at: <https://www.smithandcrown.com/permission-blockchains/>. [Accessed Aug. 30th 2017]
- Claburn, T. (2017) *For fork's sake! Bitcoin Core braces for another cryptocurrency split*. Available at: https://www.theregister.co.uk/2017/08/08/bitcoin_core_fork_cryptocurrency/. [Accessed Aug. 30th 2017]
- CoinDesk (2017) *Bitcoin Price Index - Real-time Bitcoin Price Charts*. Available at: <http://www.coindesk.com/price/>. [Accessed Aug. 30th 2017]
- Cryptocurrencies by Market Cap | Coin Dance* (2017). Available at: <https://coin.dance/>. [Accessed Aug. 30th 2017]
- CryptoCurrency Market Capitalizations | CoinMarketCap* (2017). Available at: <https://coinmarketcap.com/currencies/views/all/>. [Accessed Aug. 30th 2017]
- Decker, C. and Wattenhofer, R. (2014) 'Bitcoin Transaction Malleability and MtGox'.
- del Castillo, M. (2017) *JPMorgan Partners With Zcash on Blockchain Security - CoinDesk*. Available at: <https://www.coindesk.com/jpmorgan-partners-zcash-team-add-enterprise-security/>. [Accessed Aug. 30th 2017]
- Dinkins, D. (2017) *Bitcoin Core Developers Remain Adamant in Opposition to SegWit2x, Potential Showdown in November*. Available at: <https://cointelegraph.com/news/bitcoin-core-developers-remain-adamant-in-opposition-to-segwit2x-potential-showdown-in-november>. [Accessed Aug. 30th 2017]
- Dudovskiy, J. (2017) *Ontology - Research Methodology*. Available at: <http://research-methodology.net/research-philosophy/ontology/>. [Accessed Aug. 30th 2017]
- Dunsby, M. (2016) *The UK is now home to over two million micro-businesses | Startups.co.uk: Starting a business advice and business ideas*. Available at: <http://startups.co.uk/the-uk-is-now-home-to-over-two-million-micro-businesses/>. [Accessed Aug. 30th 2017]
- Ethereum Project* (2017). Available at: <https://www.ethereum.org/>. [Accessed Aug. 30th 2017]
- Etsebeth, E. (2017) *10 Reasons Why Central Banks Will Miss the Next Currency Renaissance - CoinDesk*. Available at: <https://www.coindesk.com/10-reasons-why-central-banks-will-miss-the-next-currency-renaissance/>. [Accessed Aug. 30th 2017]
- Etwaru, R. (2017) 'Blockchain: Massively Simplified | Richie Etwaru | TEDxMorristown - YouTube'. TEDx Talks. [Online] Available at: <https://www.youtube.com/watch?v=TDGq4aeevqY>. [Accessed Aug. 30th 2017]
- Fanning, K. and Centers, D.P. (2016) 'Blockchain and Its Coming Impact on Financial Services', *Journal of Corporate Accounting & Finance*, 27(5), pp. 53-57.
- Ferenstein, G. (2016) *Former Obama Tech Advisor Explains How Bitcoin Could Transform Government (In 5 Quotes)*. Available at: <http://www.forbes.com/sites/gregoryferenstein/2015/07/29/former-obama-tech-advisor-explains-how-bitcoin-could-transform-government-in-5-quotes/>. [Accessed Aug. 30th 2017]
- Garzik, J. (2015) *Public versus Private Blockchains, Part 1: Permissioned Blockchains White Paper*. Available at: <http://bitfury.com/content/5-white-papers-research/public-vs-private-pt1-1.pdf>. [Accessed Aug. 30th 2017]

Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013) 'Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology', *Organizational Research Methods*, 16(1), pp. 15-31.

Golden, P. (2016) *BitLicense not template for UK, say experts @Euromoney*. Available at: <http://www.euromoney.com/Article/3606101/BitLicense-not-template-for-UK-say-experts.html>. [Accessed Aug. 30th 2017]

Gopinath, R. (2016) 'THINK Checking the Ledger: Permissioned vs. Permissionless Blockchains', 2015-04-11. Available at: <https://www.ibm.com/blogs/think/2016/07/28/checking-the-ledger-permissioned-vs-permissionless-blockchains/>. [Accessed Aug. 30th 2017]

Graham, L. (2017) *As bitcoin comes off its record high, the next step is to avoid a 'lightning fork'*. Available at: <https://www.cnbc.com/2017/08/09/bitcoin-segwit-milestone-paves-way-for-lightning-network.html>. [Accessed Aug. 30th 2017]

Grey, C. (2013) *A very short, fairly interesting and reasonably cheap book about studying organizations*. 3rd edn. Los Angeles [Calif.] ; London: Los Angeles Calif. ; London : SAGE.

Halaburda, H. (2016) *Beyond bitcoin : the economics of digital currencies*. New York City, NY : Palgrave Macmillan.

Hampton, S. (2016) 'Undermining bitcoin', *Washington Journal for Law, Technology & Arts*, 11(4), pp. 331-354.

Hashrate Distribution (2017). Available at: <https://blockchain.info/pools>. [Accessed Aug. 30th 2017]

Hertig, A. (2017a) *Bitcoin Cash: Why It's Forking the Blockchain And What That Means - CoinDesk*. Available at: <https://www.coindesk.com/coindesk-explainer-bitcoin-cash-forking-blockchain/>. [Accessed Aug. 30th 2017]

Hertig, A. (2017b) *Bitcoin's Battle Over Segwit2x Has Begun - CoinDesk*. Available at: <https://www.coindesk.com/bitcoins-battle-segwit2x-begun/>. [Accessed Aug. 30th 2017]

HOW ZCASH WORKS (2017). Available at: <https://z.cash/technology/index.html#how-it-works>. [Accessed Aug. 30th 2017]

Jenkins, P. and Arnold, M. (2016) 'Banks hijack bitcoin technology'. Available at: <http://podcast.ft.com/2016/08/24/banks-hijack-bitcoin-technology/>. [Accessed Aug. 30th 2017]

Kaminska, I., Taylor, S. and Hoyos, C. (2016) *Bitcoin and blockchain: the future of money or just hype?* Available at: <https://www.ft.com/content/3bea303c-7a7e-11e6-b837-eb4b4333ee43>. [Accessed Aug. 30th 2017]

Kharpal, A. (2017) *Bitcoin is outperforming major assets but hedge funds are still staying away from the cryptocurrency*. Available at: <https://www.cnbc.com/2017/05/30/bitcoin-price-hedge-funds-not-investing.html>. [Accessed Aug. 30th 2017]

Kostakis, V. and Giotitsas, C. (2014) 'The (A)Political Economy of Bitcoin', *tripleC - Cognition, Communication, Co-operation*, 12(2), pp. 431-440.

Lambert, J. (2016) *R3 offers global developer community open source access to Corda distributed ledger platform*. Available at: <http://www.r3cev.com/press/2016/11/30/4z3tvor7so1ccizi1cw0uwtz8ipa0v>. [Accessed Aug. 30th 2017]

Leiser, D., Bourgeois-Gironde, S. and Benita, R. (2010) 'Human foibles or systemic failure -- Lay perceptions of the 2008-2009 financial crisis', *The Journal of Socio-Economics*, 39(2), pp. 132-141.

Levine, A.B. (2017) 'Let's Talk Bitcoin! #341 - The Everything Bitcoin'. Available at: <https://letstalkbitcoin.com/blog/post/lets-talk-bitcoin-341-the-everything-bitcoin>. [Accessed Aug. 30th 2017]

Luther, W.J. (2016) 'CRYPTOCURRENCIES, NETWORK EFFECTS, AND SWITCHING COSTS', *Contemporary Economic Policy*, 34(3), pp. 553-571.

Market Capitalization (2017). Available at: <https://blockchain.info/charts/market-cap>. [Accessed Aug. 30th 2017]

Market Price (USD) (2017). Available at: <https://blockchain.info/charts/market-price>. [Accessed Aug. 30th 2017]

Marshall, A. (2017) *SegWit, Explained*. Available at: <https://cointelegraph.com/explained/segwit-explained>. [Accessed Aug. 30th 2017]

Murray, I. (2014) 'Sending Money Home: Technology or Bureaucracy?', *Freeman*, 64(9), pp. 10-11.

Myers, M.D. (2013) *Qualitative research in business & management*. Second edition.. edn. London: London : SAGE.

Nair, M. and Cachanosky, N. (2016) 'Bitcoin and entrepreneurship: breaking the network effect', *Review of Austrian Economics*, pp. 1-13.

Nakamoto, S. (2008) *Bitcoin: A Peer-to-Peer Electronic Cash System*. Available at: <https://bitcoin.org/bitcoin.pdf>. [Accessed Aug. 30th 2017]

Narayanan, A., Bonneau, J., Felten, E., Miller, A. and Goldfeder, S. (2016) *Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction*. Princeton University Press.

Negurita, O. (2014) 'BITCOIN - BETWEEN LEGAL AND FINANCIAL PERFORMANCE', *Contemporary Readings in Law and Social Justice*, 6(1), pp. 242-248.

Nofer, M., Gomber, P., Hinz, O. and Schiereck, D. (2017) 'Blockchain', *The International Journal of WIRTSCHAFTSINFORMATIK*, 59(3), pp. 183-187.

Poon, J. and Dryja, T. (2016) 'The Bitcoin Lightning Network: Scalable Off-Chain Instant Payments'. Available at: <https://lightning.network/lightning-network-paper.pdf>. [Accessed Aug. 30th 2017]

Prisco, G. (2015) *Nick Szabo on 'Permissioned Blockchains' and the Block Size*. Available at: <https://bitcoinmagazine.com/articles/nick-szabo-permissioned-blockchains-block-size-1441833598>. [Accessed Aug. 30th 2017]

Ram, A. (2017) *Bitcoin splits into two as transaction volumes increase*. Available at: <https://www.ft.com/content/89d551ee-76ce-11e7-90c0-90a9d1bc9691>. [Accessed Aug. 30th 2017]

Rands, K. (2017) *Why Venezuela's Currency Crisis Is A Case Study For Bitcoin*. Available at: <https://www.forbes.com/sites/realspin/2017/02/03/why-venezuelas-currency-crisis-is-a-case-study-for-bitcoin/#4ed92e5719b2>. [Accessed Aug. 30th 2017]

Rose, C. (2015) 'The Evolution Of Digital Currencies: Bitcoin, A Cryptocurrency Causing A Monetary Revolution', *IBER*, 14(4), p. 617.

Rossi, S.P.S. and Malavasi, R. (2016) *Financial crisis, bank behaviour and credit crunch*. Cham : Springer.

Russo, C. (2017) *Venezuelans Are Seeking a Haven in Crypto Coins as Crisis Rages*. Available at: <https://www.bloomberg.com/news/articles/2017-06-15/venezuelans-are-seeking-a-haven-in-crypto-coins-as-crisis-rages>. [Accessed Aug. 30th 2017]

Shin, L. (2017) *JPMorgan Chase To Integrate Zcash Technology To Its Enterprise Blockchain Platform*. Available at: <https://www.forbes.com/sites/laurashin/2017/05/22/jpmorgan-chase-to-integrate-zcash-technology-to-its-enterprise-blockchain-platform/#5de4c4757a33>. [Accessed Aug. 30th 2017]

- Shubber, K. (2016) *Banks find blockchain hard to put into practice*. Available at: <https://www.ft.com/content/0288caea-7382-11e6-bf48-b372cdb1043a>. [Accessed Aug. 30th 2017]
- Silverman, D. (2013) *Doing qualitative research*. 4th ed. / David Silverman.. edn. London: London : SAGE.
- Sonderegger, D. (2015) 'A regulatory and economic perplexity: Bitcoin needs just a bit of regulation', *Washington University Journal of Law & Policy*, 47, p. 175.
- Stafford, P. and Murphy, H. (2016) *Has the blockchain hype finally peaked?* Available at: <https://www.ft.com/content/5e48f9ec-b651-11e6-ba85-95d1533d9a62>. [Accessed Aug. 30th 2017]
- Swanson, T. (2016) *Consensus as a Service: a brief report on the emergence of permissioned, distributed ledger systems - Smith + Crown*. Available at: <https://www.smithandcrown.com/open-research/consensus-as-a-service/>. [Accessed Aug. 30th 2017]
- Tasca, P., Aste, T., Pelizzon, L. and Perony, N. (2016) *Banking beyond banks and money a guide to banking services in the twenty-first century*. Cham]: Cham : Springer.
- The March Of Financial Services Giants Into Bitcoin And Blockchain Startups In One Chart* (2017). Available at: <https://www.cbinsights.com/blog/financial-services-corporate-blockchain-investments/>. [Accessed Aug. 30th 2017]
- Traynor, I. (2013) *Cyprus bailout deal with EU closes bank and seizes large deposits*. Available at: <http://www.theguardian.com/world/2013/mar/25/cyprus-bailout-deal-eu-closes-bank>. [Accessed Aug. 30th 2017]
- Tu, K.V. and Meredith, M.W. (2015) 'Rethinking virtual currency regulation in the bitcoin age.(III. Current Legal and Regulatory Environment B. Effects to Regulate 2. United States Response c. Virtual Currency Specific Legislation through Conclusion, with footnotes, p. 311-347)', *Washington Law Review*, 90(1), p. 311.
- Vigna, P. and Casey, M. (2015) *Much more than digital cash*. Available at: <http://www.economist.com/news/business-books-quarterly/21638093-rise-and-fall-crypto-currency-good-news-authors-least-much>. [Accessed Aug. 30th 2017]
- Walch, A. (2015) 'The Bitcoin blockchain as financial market infrastructure: a consideration of operational risk', *New York University Journal of Legislation and Public Policy*, 18(4), pp. 837-893.
- 'What is a Bitcoin Mining Pool?', (2014).
- What Is A Full Node?* (2017). Available at: <https://bitcoin.org/en/full-node#what-is-a-full-node>. [Accessed Aug. 30th 2017]
- What is fiat currency? definition and meaning* (2017). Available at: <http://www.businessdictionary.com/definition/fiat-currency.html>. [Accessed Aug. 30th 2017]
- Wild, J. (2016) *Central banks explore blockchain to create digital currencies*. Available at: <https://www.ft.com/content/f15d3ab6-750d-11e6-bf48-b372cdb1043a>. [Accessed Aug. 30th 2017]
- Wong, J.C. (2017) 'Massive ransomware cyber-attack hits nearly 100 countries around the world'.
- Young, J. (2017) *R3 Appears to Admit Defeat, Stops Blockchain Development*. Available at: <https://themerkle.com/r3-admits-defeat-stops-blockchain-development/>.
- Zhavoronkov, N. (2017) 'The Future of Bitcoin Conference 2017 | Why Bitcoin needs a Scaling Solution - YouTube'. Available at: http://www.youtube.com/playlist?list=PLW5YLqBF2qh_1NKB3hW24cg26KSTCsTjY. [Accessed Aug. 30th 2017]

Appendices

A) Consent Form

  	
<p>Research Participant Consent Form // Dissertation - Leonard Pust</p> <p><i>“The future of Banking. How Bitcoin and its underlying Blockchain technology effect the financial sector.”</i></p>	
<p>This is to confirm that I understand the research purpose and have agreed to take part.</p>	
<p>Please tick box to indicate the following:</p>	
I have received sufficient information about the project and what my involvement will entail	<input type="checkbox"/>
I have had sufficient opportunity to ask questions of the researcher and have received satisfactory answers	<input type="checkbox"/>
I understand that all data pertaining to me as an individual will be treated with the highest confidentiality and includes anonymity of my identity when using data in this research	<input type="checkbox"/>
I understand that I may take part in as much or as little of the research as I choose without having to give any reasons	<input type="checkbox"/>
I understand that I may withdraw from the research at any time without having to give a reason and with no negative consequences to myself	<input type="checkbox"/>
I agree to take part in this study	<input type="checkbox"/>
<p>Name: Signature: Date:</p> <p>(Participant)</p>	

B) Information Sheet



Interviewee Information Sheet // Dissertation - Leonard Pust

“The future of Banking. How Bitcoin and its underlying Blockchain technology effect the financial sector.”

Background and context

The emerging cryptocurrency Bitcoin has the potential to disrupt existing payment systems. Presently, Bitcoin has a market capitalization of over \$18bn and more than 270,000 daily confirmed transactions. In particular, Bitcoin's innovative underlying Blockchain technology has globally grasped the attention of financial institutions. The World Economic Forum estimated that over 25 countries are investing in blockchain technology, filing more than 2,500 patents and investing \$1.3bn. These impressive numbers not only underline the economic relevance of Bitcoin and Blockchain, rather, demonstrating the anticipated disruptive potential of cryptocurrencies and the underlying emerging technology. Indeed, experts posit that Blockchain will become mainstream in the financial sector by 2025. Yet, it is uncertain whether Bitcoin itself will become mainstream or if banks can adapt to its technology to maintain their power. Precisely due to the uncertainty and the economic importance, a qualitative research study examining the potential impact of Bitcoin and Blockchain could deliver a highly interesting dissertation while filling a research gap.

Research questions

Q1. Will Bitcoin emerge as a 'second' parallel monetary system?

Q2. What type of impact can Bitcoin and its underlying Blockchain technology have on the banking sector?

The dissertation will profoundly investigate these research questions, aiming to provide a deep understanding of the influencing factors and frameworks conditions leading to the future impact of Bitcoin and Blockchain technology.

Confidentiality

To ensure confidentiality and anonymity, the real names of the interviewees will not be revealed and the research data will be saved on password encrypted devices. The data will remain confidential and the names of the interviewees are only known to the author and dissertation supervisor, Dr. Karen Elliott.

Contact Details:

Name: Leonard Pust
Function: Postgraduate Student
Address: 404 Gallowgate,
Newcastle upon Tyne, NE1 4SP
Mobile: 0049 17624885796
Email: l.pust2@newcastle.ac.uk

Name: Dr. Karen Elliott
Function: Supervisor // Lecturer in Enterprise
& Innovation/Ethics Convenor
Address: Newcastle University Business School
5 Barrack Road, Newcastle upon Tyne
NE1 4SE
Mobile: +44 (0) 7757 159160
Email: Karen.Elliott@newcastle.ac.uk

C) Script: Semi-structured Interview

Prepared questions

- When did you first heard of Bitcoin and the Blockchain technology?
- In your opinion, what are the characteristics which make Bitcoin innovative?
- Do you trust in Bitcoin? Why? Why not?
- Why do you think many people do not trust in Bitcoin/cryptocurrencies?
- How would you predict the future of Bitcoin? Why?
- What are the obstacles for Bitcoin?
- What are the advantages and disadvantages of Bitcoin compared to banks?
- In your opinion, what are the characteristics which make Blockchain technology innovative?
- How would you predict the future of Blockchain technology?
- How can the blockchain technology impact the financial sector?
- What are the difficulties in adapting the technology? How can it be secured?
- How would you envision the financial system in 10 years?
- Is there anything important I missed?

D) Work Plan

No.	To Do's	Start	Deadline
1.	Research Proposal		
	Submission	01/03/17	24/03/17
	Analyse Feedback		
2.	Research		
	Secondary data	01/03/17	07/17
	Interview data	10/04/17	07/17
4.	Conducting Interviews		
	Interview 1	10/04/17	
	Interview 2	12/04/17	
	Interview 3 & 4	06/17	
	Two written follow-up interviews	08/17	
5	Analysing Interviews		
	Data assembly	06/17	30/06/17
	Data reduction	06/17	07/17
	Data verification	06/17	07/17
6.	Writing		
	Outline / Table of Contents	06/17	
	Literature review	06/17	08/17
	1st Draft	07/17	
	2nd Draft	08/17	
7.	Proof reading & Presentation		
	Proof reading by friends	05/08/17	10/08/17
	Proof reading by native speaker	10/08/17	20/08/17
	Finalise and check format		25/08/17
	Finalise and review References		28/08/17
8.	Submission		
	Time buffer	28/08/17	01/09/17
	Submission		01/09/17

E) Interview codes and answers

Topic/Code	Interview Answers
<p>C1:</p> <p>Inherent characteristics</p>	<p><u>Motive behind Bitcoins' creation</u></p> <p>“the whole point of Bitcoin is to be open and accessible to all and to benefit all, it might be utopian idea but that's why it was created“ (Interviewee 3).</p> <p>“So, if look at the history of bitcoin in 2009, the very first block has a message from the <i>Times</i> in the UK, which basically said that the chancellor has announced for second bailout” (Interviewee 4).</p> <p><u>Access</u></p> <p>“So, the ease of access, it's having the skills, you know some people still could not understand how to buy bitcoin, where to buy bitcoin, what do they do with it once you've got it and once you got your wallet with your bitcoins and what do with it. And then again who do they send it to, because if their network of contacts doesn't use it or do not access it. Then you got a problem, it's like a chicken and egg problem. Once people start to understand how it works. This is what Bitcoin paternity need to address: They need to make it easier to access, they need to upgrade this tech so people can do transactions quicker” (Interviewee 3).</p> <p><u>Autonomy</u></p> <p>“And the idea there is that Satoshi Nakamoto invented this currency because he did no longer trust the bank to hold our money. Instead he wants everybody else to have true autonomy over their money. (...) What we learned in Bitcoin, so the idea in Bitcoin is you have autonomy over your money. So, you have these secret credentials that only you have. Assuming I keep my <i>credentials</i> safe, then nobody can get my money. (...) And what we seen in 2013 in Cyprus, was that Cyprus had this banking crisis because of the financial crisis and anyone with more than 100.000 € in their account got a 'hair-cut' of 10 or 20 percent. And the banks could do that, because they have the control over money. Well, with Bitcoin they no longer have that” (Interviewee 4).</p> <p>“I think it is the decentralised structure. That it is hard to change the general system and the transactions in specific. It is also hard to confiscate. Like if it's yours – it's</p>

	<p>really yours. This is almost completely new. (...) I think, Bitcoin's advantage and disadvantage the same time is that you are much more responsible for your money. But it's also that it cannot be confiscated" (Interviewee 2).</p> <p><u>Anonymity</u></p> <p>But one of the problem with bitcoin is, that is described as an anonymous currency where you can buy stuff on the dark market and nobody can trace you. But what we learned three years later is that Bitcoin is most traceable currency in the world. So, in fact, that was the irony. All the potential use cases were wrong (Interviewee 4).</p>
<p>C2: Strengths & Features of Bitcoin</p>	<p><u>Use cases</u></p> <p>"I think Bitcoin's best thing is to be a store of value with the option to use it as a payment system. And that's the big difference to gold or something. That's quite great" (Interviewee 2).</p> <p><u>Maintenance</u></p> <p>"The beautiful thing about Bitcoin is that it is decentralised global currency that can be maintained by anybody, it is <i>permissionless</i>. So, anybody who is willing to invest in the hardware can maintain the Blockchain and confirm transactions. If I transfer money to you, anybody willing to invest in the hardware can confirm that on the network" (Interviewee 4).</p> <p>"I think it's better to look at it as plan B. It's an alternative system – not better or worse. It could be better system in some situations, like when there this a crisis in the current monetary system. It could be a plan B for countries where the leader confiscates money or property of the people. Those people could use Bitcoin to get out of the country. But It can also be misused" (Interviewee 2).</p> <p><u>Decision-making process</u></p> <p>"That's the big question. It can be, but it doesn't need to be. It could also be seen as a good thing, because you can really trust the system because it's hard to change. Also, it is better protected if it not easy to change something and changes take a long time. This is like in Lord of the Rings, with the trees which take a very long time to make a decision but when they decide - their decision is good" (Interviewee 2).</p>

	<p><u>Bitcoin's Blockchain</u></p> <p>“The only benefit really is that, there is two components, there is a consensus protocol, so given a network of people: how they are going to get consensus that the Blockchain they are given is the correct Blockchain? So, to ensure that everyone has a consistent view on the Blockchain. And two is the fact that everything is publicly verifiable. If I give you a copy of the ledger and its entire history, you can go from the genesis block, which is the very first block to the current time and you can verify that everything is correct. So, there is no dispute, it has dispute free property. And that’s what most people like about” (Interviewee 4).</p> <p>“Like Bitcoin is bootstrap, its big and has the biggest mining power in the world, it is the most secure system which was ever build in this Blockchain technology. If they [banks] want to use the strengths of the system of Bitcoin, they should probably use Bitcoin. Because the strength of the system is not the use of the Blockchain, but the use of Blockchain embedded in the mining security model” (Interviewee 2)</p> <p>“Because of the role of the problem solvers [<i>miners</i>], which is basically how much computational power can bring each instance. As a result, you create an opportunity of concentration and power. I don’t like that at all” (Interviewee 1).</p>
<p>C3: Weaknesses of Bitcoin</p>	<p><u>Scalability, Speed, Volume</u></p> <p>“But Bitcoin itself will need to show an ability to drop some of his inherited character-ises and start to demonstrate ability to become more useful, both in terms of volume, in terms of speed, in terms of how sources of trust are enabled and identified (...)</p> <p>Too few blocks, too little in each block. Can’t possibly cope with world economy. (...)</p> <p>Should the blocks be created much quicker or should be hold a lot of more infor-mation? If Bitcoin wants to play any role in monetary system – of course they have to do that. Because people do not want to wait and people do not want to have 1 MB of information capped. This is a massive limitation of Bitcoin. Not for Bitcoin, that is plenty for the number of peer-to-peer transaction but that is nothing really where the rest of the market will get to” (Interviewee 1).</p> <p>“They need to make it easier to access, they need to upgrade this tech so people can do transactions quicker” (Interviewee 3).</p>

	<p><u>Scaling debate, community issues & Transaction Fees</u></p> <p>“One of my fears is that Bitcoin could implode. And that’s not because of the technology but because of the community. For the past couple of years, well the fundamental problem is back in 2010, Satoshi Nakamoto wrote one line of code says that in the Blockchain there is a block every 10 minutes, also that does store transactions and that says that these transactions are now confirmed and the payment are complete. This is restricted to one megabyte, which means up to 4000 transactions every 10 minutes, which is roughly 3-7 transactions per second. Because of that and bitcoin got so popular, you have a backlog of transaction and because of backlog of transactions if you want your transaction to get in a block and then get confirmed, you have to pay a high fee or a larger fee than previously. Two years ago, the fee would be a cent or half cent and today is one or two dollars” (Interviewee 4).</p> <p>“Yeah, exponentially nearly and because of that, Bitcoin got the first mover advantage but now because of high fees and the community cannot reach consensus on how to remove this limit, Bitcoin is starting to lose to competitors. And as we seen in the past few weeks, If you look at the entire marketcap, Bitcoin only represent 45% of that. Now every other currency combined is worth more than bitcoin and it only going to get worse until this blocksize can be solved” (Interviewee 4).</p>
<p>C4: Trust</p>	<p><u>Understanding & Media</u></p> <p>“First, because they probably do not understand how normal currency systems are working. Second, they obviously do not understand how Bitcoin is working. Thirdly, they get told not to trust the system - like most people are probably quite depending on media, like if you read it and get there - it’s probably hard to trust the system” (Interviewee 2).</p> <p>“There is a lot of misunderstanding out there and I think that feeds in the public perception as well, because it’s an issue of upskilling people” (Interviewee 3).</p> <p><u>Trust in exchange services</u></p> <p>“What is happening in Bitcoin is that most people keep their credentials on a central webserver such as Coinbase. So, I go on Coinbase, I register, I give them password</p>

	<p>and authenticate who I am and I use their website to buy bitcoins but I don't take the bitcoins of the website. And so now you are thinking what is Coinbase, is Coinbase a bitcoin exchange or is Coinbase actually a new bank? Using those tokens to represent money. And a lot of people are doing that.</p> <p>So, the thing is that people do trust other people to hold their money but the dangers of trusting bitcoin companies is that they don't have the same security level or the same collateral as banks. Actually, the fact that Bitcoin exist is amazing but is not amazing how people are using it. So, while they trust these Coinbase companies, there actually more at risk than keeping at a bank" (Interviewee 4).</p> <p><u>Trust in banks</u></p> <p>"Yeah, I mean that's true. I mean after the crush in 2008 people, gradually slip into but nobody really questions the bankers anymore. I mean, yes they are hated and people do not like it if you say you're a banker still people will argue: you are responsible for our economic crisis. However, again what choice do people have over them to bank in a bank. So, it could be if people take the time to think and really look into what it is understand it. I think that's the problem of the people in the industry when I started asking questions around this thing. What if they start to use Blockchains to hack how are you going to defend against bankrupt at the moment it's unbreakable tried to hacking tool and the guy just said: we need to talk, because I don't know how it works. (...) So, you could say that the open Blockchain system, would benefit the greater good of the community whereas you can see why the banks want to make it close and make it access only like what they are doing in the Department of Work and Pensions - it won't be an open one. It will be one that is closed, so can access it etc. Again, they'll keep that level of power and control and then only certain people will be able to feed in-to that closed network. So, again it's trying just to do a different version of what they al-ready got. It's just an incremental innovation" (Interviewee 3).</p>
<p>C5: Regulation</p>	<p><u>Motive behind regulation</u></p> <p>"I think the attempts to regulate Bitcoin, are often attempts to control Bitcoin. One can say ok, its fine to control it, I think it's fine to control it in some ways, you do not want to use for money laundering. But you also have to look at the perspective and see ok well what's the intention of the regulations. Is really for the customers or is their system build for controlling the system or having power of Bitcoin" (Interviewee 2).</p>

Implementation of regulation

“This is really complicated. I was belonging to the groups of guys who said regulation is very important, otherwise you could not use Bitcoin properly. But one has to admit that the system of Bitcoin is regulated by its white paper. That is the contract, the most beautiful thing is, that it is extremely hard to change this. All regulations from outside should not touch the whitepaper. Regarding regulation of exchanges, it makes sense, because it also like an institution. But it is probably not that necessary. There are exchange services, which operate and are not regulated, but I see the argument for regulation. But I would be very careful in regulating Bitcoin itself” (Interviewee 2).

“Yeah, the problem is enforcing that regulation. The best chance is for the regulators is on exchanges, where you get money in and out. It’s really the only change. But what is quite interesting if you look at the other companies like Hyperledger or R3, their Corda - it’s not even a blockchain there, they publicly advertise that is not a blockchain but the main issue is they are facing these regulations. Because, if they want banks to be their customers, there is some much regulation, where they can’t really innovate. In terms of regulation the other facing these troubles. Bitcoin companies don’t care, they set up their businesses in the Bahamas. They register there and can be what they want” (Interviewee 4).

The need of taxation

“Well, its [taxation] fundamental, because if you create a parallel monetary system (...) that is outside of taxation and allowing you and me to do P2P transactions. I give you this and you give me some Bitcoins. There is no record of that as far as the revenue is concerned, no one that is taxing that, no one's taxing the gain that you've made, no one's putting VAT on me as the ultimate beneficiary. Who pays for hospitals? Who pays for roads to be build? Who pays for defence? Who pays police? Who pays for Education? Oh the people who are not using Bitcoin” (Interviewee 1).

Reaction from banks

“We have to be very careful about anybody who thinks that the banking system, yes is completely right of disruption, completely right for challenge and innovation, but they're not going to get a reaction from businesses, some of the biggest businesses

	<p>in the world. Of course, you are, absolutely you going to get a reaction. They are very powerful and underpinning them are even more powerful things called nation states. At the moment, I do not think there is many more fundamental questions, then can a nation-state defend its own boundaries? And one of those boundaries is its financial boundaries” (Interviewee 1)</p> <p>“So, hopefully they be able to understand that bitcoin or using a thing that's based on the technology we actually be easier to free them from having to pay fees, from being under the governance of their banks, only being charged for the money out of cash machines. They wouldn't need to do that, when they are abroad being charged for your exchange rate etc. You would not need to do that with a cryptocurrency. So, it would be interesting to see where it goes. But I definitely think that the banks are going to try to govern it. (...) Yeah, but also if you think about it, the financial system is linked to the state and to the government. So, if we think about it, sitting back and thinking objectively: on the one hand it's an exciting technological innovation, all right, if its disruptive or not, we can debate. On the other hand, because the finance of the country is linked to the state and backed by the government. (...) They use encryption but actually the end user probably doesn't realise that they getting paid by a Blockchain. So that would be one way where you can see where all the banks are going to go ok this is a major threat a risk to the Status Quo as is” (Interviewee 3).</p>
<p>C6: BIP 148 / Lightning network</p>	<p><u>BIP 148 SegWit</u></p> <p>“The issue here is governance - not necessarily the technical aspects. This deal was agreed in a room at Manhattan that did not consult any bitcoin core developers. It shows that there are influential members of the community willing to pursue a board-room-style of governance to changing Bitcoin's consensus rules. Whether consensus rules should be governed in this matter or not - is what is causing debate in the community. Most people agree that transaction malleability (i.e. SegWit) should be fixed, and that blocks should be bigger - it is just finding the most appropriate approach to achieving those new rules” (Interviewee 4).</p> <p>“Well as far as I understand it the segwit implementation gives one possible solution for the scaling debate. at this point of time, bitcoin offers a very special way of storing money, with an inferior solution to send money: it is expensive and limited due to</p>

	<p>bitcoins design. with the implementation of segwit, we will probably see emerging solutions for sending money, which can be comparable to today's traditional solutions of sending money but are not limited to these solutions. if they will be used cannot be said at this point of time, but it is possible that bitcoin will also be a proper and special way of sending money. I have to add that the second idea for solving the scaling problem was also implemented as a fork (Bitcoin Cash). I think we will see interesting dynamics in the race for the superior payment network, which is a good thing in the long run" (Interviewee 2)</p> <p><u>Lightning network</u></p> <p>"There are several teams already working on an implementation of <i>Lightning</i> (blockstream, Ind, etc). The first <i>Lightning</i> payment has already occurred on Litecoin (by Christian Decker). I believe <i>Lightning</i> will be deployed within the next year or two on Bitcoin. The impact of a system like Lightning is that the Blockchain becomes an arbitrator to resolve disputes as opposed to an on-chain cash system. The benefit of this approach is that participants can privately transact amongst themselves without consulting the network. Its biggest obstacle I believe will be co-ordination and finding "routes" on the network. For it to remain decentralised - it is going to require a second peer-to-peer network (i.e. gossip protocol), but will people use this network? Or will they rely on central providers like Coinbase (i.e. landmarks) to route payments on their behalf? No one really knows the answer to that. I'm hoping for the decentralised approach, but it is possible (as most people keep their coins on exchanges anyway) that the landmark approach will be the outcome" (Interviewee 4)</p> <p>"I have to admit that my own research regarding the <i>Lightning Network</i> is limited at this point in time. I do not feel save enough to give a qualified answer to the question. Nevertheless big solutions always take a long time for being implemented into bitcoin as far as I know it is a kind of add-on to segwit (!) which offers even more innovative and fancy ways of transferring money" (Interviewee 2)</p>
<p>C7: Future predictions of Bitcoin</p>	<p><u>Impact of Bitcoin</u></p> <p>"I think the biggest impact will be, that Bitcoin is there and can be used as plan b. I think it stay for at least one decade more. It will stay in a quite similar state where it is now. I think it is not even that bad to have a system besides the normal monetary</p>

currency system. It will be probably possible, with some complications, to live fully on Bitcoin. You are not depended on the normal banking system. I think it will be like Windows and Linux. If Bitcoin gets in the situation of Linux, it would be great. Yeah, maybe this analogy works even further, when you see that Windows is nowadays even using some parts of Linux. Let's see. I think the biggest impact is to be at this point, that you cannot control the citizen over the monetary power completely anymore" (Interviewee 2).

Blockchain fork

"To avoid imploding, they have some issues with the community. And actually, what is interesting is what happened to Ethereum last year was that one of their smart contracts got hacked and they lost 150million dollars but the developers decided to reverse that change, to wanted to reverse that theft. But some members did not want to do that, because the blockchain should be immutable and nothing should ever change. So, they actually forked. So, the blockchain went into two different directions, into Ethereum Classic and Ethereum and in the long run that worked out better for Ethereum. So while it split, Ethereum is now worth 20 billion dollars and has the support of the community behind and has the market behind it etc. Whereas Ethereum Classic still exist, but is not worth as much. And if that happens to Bitcoin, it's going to be beneficial in the long term" (Interviewee 4).

Future predictions/ Use cases

"Yeah, I think it is possible, but it is dependent on many factors. One factor is technology - at this point of time it's not really possible for Bitcoin to become monetary system due to the limitations in the transactions and also it is quite complicated to use. There are also competitors which work fantastic like Amazon Pay and PayPal. Maybe it will change a little, when machines pay for other machines. Like in one these futuristic scenarios, where we do not need to do a transaction by hand. Then Bitcoin would be great. Maybe it is also possible that is not Bitcoin, maybe I would not say an Altcoin. Maybe Bitcoin Unlimited could become the payment system and Bitcoin Core could be the store of value. But I think of time we do not need it – like a payment or monetary system of a new kind. Maybe it changes in the future. I think the best thing to describe Bitcoin is plan B. (...) I think, if we will see a very big cryptocurrency in the next 15 or 20 years and it will be Bitcoin, and it will be Bitcoin done right. There need to be some

	<p>really dramatic things happening around the normal monetary system to make this happen. I think, there is a chance, but they are low. But maybe if Bitcoin is done right, it will maybe belong to the 20 biggest currencies in the world. It's possible, because it is currency which can be used all around the world" (Interviewee 2).</p> <p>"And my second point is if Bitcoin survives and it get over this blocksize issue and one or two technological issues, it won't be used as payment system in terms of going to a coffeeshop and pay for your coffee in Bitcoin, because it can't scale that way. But what I think, it will be used as a payment network where you have banks in sense, I call them banks, they called hubs, but when you think about it is a bit like a bank. But the difference is that I deposit money as bank but I still have full autonomy over my money. So, the banks still can't run away with your money" (Interviewee 4).</p> <p>"But it doesn't have to be. I think there is choice there. The regulators want to make use of the underpinning technology. So, the question for the people at the heart of Bitcoin is: Are we ready to be part of the norm and destruct from within or do we think that our future is destructing from the outside" (Interviewee 1).</p> <p>"Bitcoin is just in exemplar: I think it is a classic example of first mover does not always win. (...) It's demonstrated some resilience, it demonstrated ability to learn. It still has some deeply inflexible characteristics, which make it easy for me to say you know whether it will emerge as parallel monetary system – absolutely not as Bitcoin" (Interviewee 1).</p>
<p>C8: Banks' motive</p>	<p><u>Motive</u></p> <p>"The banks are trying to solve a coordination problem. So, you have several banks and they are doing all these payments amongst each other, but they have no real way to coordinate that. Now, they rely on SWIFT or Mastercard or other trusted third parties to do the payments when really, they want to do it amongst themselves.</p> <p>So, they think the Blockchain will help with that. So one: it solves a coordination problem, because now everybody has the same copy of the ledger. And if you draw a transaction, then everybody will update their ledger and also provides a consistent view. When I talked to the banks, some of the problems they have is that, if bank A transfers money to bank B, bank A may have a bug in their software and they don't</p>

	<p>account for that transfer properly and then bank B can say you owe us less money than you think or more money than you think. So, what Blockchain solves there is that, because both people have the same copy of the Blockchain and because everything is publicly verifiable you can't make a mistake. Because if compute something wrong and you transfer the money to bank B, bank B will have the same copy of the ledger as you" (Interviewee 4).</p> <p>"It is interesting experiment. It shows us that people can get over some of the hyperpallia and start to use it for meaningful transactions in an economy which useful, rather than in an economy which is subversive. I have no interest in supporting subversive economy, because all they do is, they do not pay tax and into welfare systems and ultimately, they undermine the value of work. I have no interest in that and I have no reason why anybody should want to be. Unless it is pure greed. So, I am not interested in that and I think it should be fought hard. And as result, I more interested in the existing institutions finding their way of adopting a Blockchain. Work out the permissions, who holds the keys, how many blocks are going to be created, by whom, how you stop a chain and how you start again. All these things which are relatively simple concepts and apply it to their own terminology and their own ruleset. Because I am all for removing inefficiency in the open, positive and public markets" (Interviewee 1).</p>
<p>C9: Use cases for permissioned Blockchains</p>	<p><u><i>Banks and public Blockchains</i></u></p> <p>"I don't think banks themselves should use a public Blockchain yet. There are a couple of scenarios. The first scenario is that, if they want to use a Blockchain that only makes sense for remittance. So, if the bank of America wants to transfer money to the bank of Somalia, then it only makes sense to use a public Blockchain, because there is no regulation that can cover Somalia or the bank of America. So, the only way they could actually reach consensus that a transfer is complete and can't be reversed is to use a public Blockchain like Bitcoin - that's the perfect use case there" (Interviewee 4).</p> <p>"So, you could say that the open Blockchain system, would benefit the greater good of the community whereas you can see why the banks want to make it close and make it access only like what they doing in the Department of Work and Pensions - it won't be an open one. It will be one that is closed, so can access it etc. Again, they'll keep</p>

that level of power and control and then only certain people will be able to feed into that closed network. So, again it's trying just to do a different version of what they already got. It's just an incremental innovation" (Interviewee 3).

Use cases for permissioned Blockchains

"I think that is huge. And change virtually everything from consumer purchasing to providing transaction into opaque market whether that is high value assets or trade in endangered species or trade in arms and weaponry, all the way through to the securitisation of mortgages and interbank settlement. There is no boundary. (...)

"Will some the underlying technology will be fundamental to elements of our wholesale cash management – absolutely, wholesale liquidity management between institutions -absolutely, providing transparency and efficiency in asset management – absolutely. All those things definitely – the underlying technology" (Interviewee 1).

"If they want to do it for American banks, there could be some type of *permissioned* Blockchain there. It depends then how you maintain the Blockchain. Is it maintained by SWIFT, Mastercard or it is maintained by the federal government, which sort of happens at the moment, or do they have distributed consensus where you have 20 banks and every single bank is partly in charge of taking care of the Blockchain. And in that sense, it is going to be a permissioned Blockchain. If its permissioned than that makes sense inside a country, because if it permissioned than you can rely on the legal system to help enforce that the protocol runs correctly or that the Blockchain is actually correct. The next aspect is if it is private or public in sense that: are the transactions that are stored in the network are encrypted so nobody can read it, or is it public where I could look at the Blockchain that transaction A send money from this address to this address. Should I be able to see that information. What they are doing, the encrypt everything but the problem is that they lose the public verifiability. Whereas if there are seven banks, and bank A sends money to bank B. Bank A and B can see that transaction but the other banks can't. So, if they store this in their Blockchain or in their copy of the database, they can't verify that that transaction was legitimate" (Interviewee 4).

	<p><u>Use case of ZeroCash in permissioned Blockchains</u></p> <p>“But if they put ZeroCash in there, which still has these private transactions. ZeroCash is built in such a way where we can privately transact on the Blockchain and any observer can publicly verify that that transaction as legitimate. If I transfer you a coin that I own, and nobody can see how many coins I send and in fact, they can’t even see the sender or the receiver. They only see that there was a transaction, that transaction was 100% but I can’t say anything about it.</p> <p>So, these banks, for example the Bank of America, it makes sense there to have some type of <i>permissioned</i> model using ZeroCash under the hood. And the banks are starting to acknowledge that. So, JPMorgan has recently partnered with ZeroCash to explore this type of area. And that’s really exciting, because that is the perfect use case” (Interviewee 4).</p> <p><u>Challenges for banks</u></p> <p>“Regulation. 100% regulation” (Interviewee 4)</p>
<p>C10: Future scenarios for the financial sector</p>	<p><u>Future predictions</u></p> <p>“I envision a lot less change than people expect. They will still be in the UK at least a very few large players in retail banking, the same names that you recognize today. I envision that they play a slightly less important role in the economy because I think that the presentation of payments in the control of payments individual plans of the purchase of goods and services they will get distant. And platforms that control retail or whatever will sit between the consumer and the bank. To such an extent that the bank will become less relevant in your day today” (Interviewee 1).</p> <p>“Yes, they have so much power and influence, their people who have so much interest, they will be around. But there will not so many people working there, but I think they will be around with the same amount of money, like this so there will be some virtually Monopoly in the monetary system” (Interviewee 2).</p> <p>“So, I think you might have a two-tier system: you have Bitcoin as is it now, as an open and more beneficial and then you get people who still want to be with banks. The banks blockchain version, the closed one because they are risk averse and probably because of lack of understanding and skills to access and use it” (Interviewee 3).</p>

“I don’t think customers will actually see a difference. I think banks are going to use the blockchain mostly for their internal operations, at least for the next 10 years, so they can experiment with the technology and see how it works. It also depends on the support given by central banks, so the bank of England has this plan, their vision is that they want to have a blockchain that they maintain, so again the government issue- why is it single party maintaining this blockchain? But, they want to maintain this blockchain and they want to offer is a bit like a platform for banks and payment service providers, like small banks. And then banks could build on top of their blockchain and then they could offer pounds that originate from the blockchain to customers. So then, you would not actually deal with the bank of England, you would deal like with a small bank. You would register an account on their website and then every digital transaction you do, would be recorded on the banks of England’s ledger. So, if central banks get involved and adopt that vision and go for it, then customers going to see the difference. If it is just banks like JPMorgan and the Bank of America, it is mostly going to be internal operations for now while they experiment” (Interviewee 4).