

**Bitcoin: Challenges and Opportunities to the Growth of Crypto-
Currencies**

Research dissertation presented in partial fulfilment of the requirements
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2th September 2015

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I certify that the dissertation entitled:

Bitcoin: Challenges and opportunities to the growth of crypto-currencies

submitted for the degree of: MSc in Accounting and Finance Management is the result of the my own work and that where reference is made to the work of others, due acknowledgment is given.

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Dedication

Acknowledgements

Abstract

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1 Introduction

“If the monetary standard, like totalitarian language, becomes so detached from reality as to be useless in the eyes of its users, society can and will improvise an alternative” -Felix Martin, 2013

1.1 Background

In 2008, an unprecedented global financial crisis had caused the collapse of numerous financial institutions, exposing grave flaws in the existing global financial and political system, thus leaving a profound impact on what is known as the Millennial Generation or the people who were born between the early 1980s and late 1990s (Lee, 2014). Having gone through difficult economic conditions just as they were starting their careers, like high unemployment, personal debt and even poverty, the global financial crisis effectively created a crisis of confidence specifically among Millennials and a general need for alternatives to the current system (Pew Research Centre, 2014).

It was during that same year of financial unrest that Satoshi Nakamoto, believed to be a pseudonym for a person or group of persons, published a nine-page paper that described Bitcoin: “a peer-to-peer electronic cash system” (Nakamoto, 2008). The word “bitcoin” meant two different things. First “bitcoin” with a lower-case “b” described an “electronic coin” or crypto-currency and second, “Bitcoin” with an upper-case “B” referred to the technology or system in which bitcoins were transferred (Natan, 2014).

Bitcoin, would allow users around the world to make online payments directly to others without the need for a central controller, authority or financial institution by creating a “de-centralised system of trust operating outside the control of any institution” (Vigna & Casey, 2015) based on cryptographic proof. Credit ratings, documentation, bank accounts, identification, transaction fees, interest rates, and even centralised currency issuance would become a thing of the past. Could bitcoin represent a new way of “creating, holding, and sending money?” (Popper, 2015). The financial world was about to find out.

Bitcoin began trading in 2010 at a value of less than five cents. However, by 2013, the market value of a single bitcoin unit (BTC) had risen from \$13 to almost \$1,000 USD. This dramatic price increase and subsequent volatility (exchange rate with the US dollar was 10 times more volatile than those of the Euro, Yen, and other major currencies), along with high-profile scandals like its association with Silk Road, an online market characterised for selling illegal drugs, substances, prohibited weapons and stolen credit cards, as well as the 2014 controversial closure of the largest bitcoin exchange, Mt. Gox, effectively made bitcoin “a fixture in world financial news” (Yermack, 2014; Grossman et al., 2014).

In less than five years since Nakamoto's paper, Bitcoin media stories had generated interest and polarised opinions from academics, scientists, bankers, economists, entrepreneurs, investors and even governments (Polasik et al. 2014). They all seemed to have the same question: Who was Satoshi Nakamoto and what was the source of increased fascination with an apparent computer code?

By 2015, the figure of Nakamoto had become "one of the greatest mysteries of the digital age" (Popper, 2015), not only because his or her identity remained unknown but because bitcoin had become the world's most widely used and talked-about alternative crypto-currency, as well as one of the most ground-breaking technologies since the Internet, igniting a new wave of innovation across the world (Dodd, 2014).

Nevertheless, as of early 2015, no government or regulated bank accepted bitcoins. As expert Jeffrey Robinson (2014) states, "every country that has looked carefully at bitcoin has expressed doubts and issued cautions to the public". By August 2015, bitcoin had lost more than 50% of its value compared to the previous year (\$220 USD per unit compared to \$505 USD in 2014), leading to question if bitcoin could be considered a "speculative investment" or simply more like a bubble rather than a currency, as NYU Stern professor David Yermack (2014) had established the previous year.

In addition, several large companies that claimed to accept bitcoins (e.g. Microsoft, Expedia, Dell) were not actually receiving them *per se*, but rather through their bitcoin processing partners that converted bitcoins to US Dollars (Davidson and Osborn, 2015). In other words, you could not acquire a new Dell computer by paying directly with bitcoins; the company was only accepting U.S. dollars, Euros, or British Pounds.

Was bitcoin failing as universal money and crypto-currency? What about its disruptive technology that would "give individuals control over their own money and destiny?" Was bitcoin holding out to its promise of "taking power from banks and governments and giving it to the people?" (Voorhees, cited by Popper, 2015).

1.1 Research Purpose

Due to its unique financial and technological characteristics, Bitcoin is considered to be a complex, highly unpredictable and polarising topic among enthusiasts and sceptics (Franco, 2014).

However, regardless of positive or negative views, opinions tend to achieve a consensus in that Bitcoin has a questionable future and that there exists a high degree of uncertainty regarding its survival as crypto-currency and/or a payment system. (Dodgson et al., 2015).

The purpose of this study is to go beyond the general question of whether Bitcoin will succeed or fail as a crypto-currency, payment system, or both, but rather perform an assessment of Bitcoin's current and future role in global financial markets from the point of view of numerous experts who have written articles and books about the topic.

1.2 Significance of the Study

The findings of this study will provide a better understanding of Bitcoin as a crypto-currency and payments system from an objective point of view through exhaustive collection of data from experts on the topic and from existing literature. Due to the growing importance of crypto-currencies, the assessed issues in this study are of considerable significance for investors and companies wishing to invest in Bitcoin. In addition, it will lay groundwork for the continued exploration of the topic, which is still in early stages of development.

1.3 Research Objective

The primary objective of this study is to assess the challenges and opportunities to the growth of Bitcoin.

The research will focus on answering the following questions:

- What is Bitcoin's current situation as a crypto-currency and payment system?
- What are Bitcoin's future prospects?
- What are the challenges and opportunities to the growth of Bitcoin?
- Can Bitcoin successfully become a viable alternative crypto-currency?

1.4 Structure of the Study

1.5 Definition of Terms

Bitcoin:

bitcoin:

Crypto-currency:

Digital currency:

Mining:

Blockchain:

Fiat currency:

Private currency:

2 Literature Review

“When it comes to bitcoin, what you see is not necessarily what you get” -Jeffrey Robinson, 2014

2.1 Overview

In order to assess Bitcoin’s current and future role in global financial markets, it is essential to analyse where it stands as a crypto-currency and a payment system in relation to current conventional alternatives (For a clear understanding of Bitcoin’s common literature misconceptions please refer to [Figure 1](#)).

Bitcoin is the first and so far, the most successful fully de-centralised crypto-currency in the digital world. As of August 2015, with a total supply of 14,562,925 BTC and price per unit of \$230 USD, its market capitalisation was estimated at \$3.3 billion USD, commanding over 80% of the total crypto-currencies market. It is followed by Ripple, which has a market capitalisation of less than \$255 million USD (Forex News, 2015) (Please refer to [Figure 2](#) for a list of crypto-currencies by market capitalisation)

Even though Bitcoin was created only six years ago, there is a significant amount of research and commentary (more than fifty academic articles) that can be summarised into three categories. The first discusses Bitcoin’s history and background as well as its technological functioning and future impact in the digital world (see for example, Franco, 2014; Plassaras, 2014; Forde, 2014; Trautman, 2014; Antonopoulos, 2015). The second deals with legal and risk issues by covering recent Bitcoin scandals and controversies (e.g. Silk Road, Liberty Reserve and Mt. Gox), current regulations, and its treatment in various legal jurisdictions (e.g. United States or China) (FBI, 2012; Martin 2013; Brito & Castillo, 2013; Robinson, 2014; Trautman, 2014; Vigna & Casey, 2015). The final, and most studied category concerns economic or monetary issues related to bitcoin’s operation as a crypto-currency. It includes economic theories (e.g. Austrian School) and the function of money, bitcoin as a potential investment, and future supply (Brito & Castillo, 2013; Yermack, 2014; Mas, 2014; Bonneau et al, 2015).

Nevertheless, the existing research supports the conclusion that objective (i.e. impartial) analyses on Bitcoin are limited and even more in the media. Bitcoin expert and author Jeffrey Robinson (2014) warns against believing everything we see and read on the media about Bitcoin, arguing that “when it comes to bitcoin, what you see is not necessarily what you get”. He proposes to “get behind the headlines” (Robinson, 2015) in order to maintain an impartial perspective on the topic.

Therefore, the purpose of this chapter is to review the available literature regarding Bitcoin's current and future challenges and opportunities as a crypto-currency and payment system; rather than focusing on Bitcoin's impact as a technological force. In addition, this review does not cover Bitcoin's fiscal, legal, and political issues.

2.2 A Crisis of Confidence and the Millennial Age

Throughout the literature, Bitcoin experts and authors tend to focus on Bitcoin's creation in 2008 by explaining the technological background behind it, and how the increased Internet usage along with its apparent advantages over conventional alternatives led to its worldwide adoption. However, only few authors credit Millennials as Bitcoin's early adopters, which more importantly constitute, as of August 2015, Bitcoin's main user base (Teo, 2015).

Closer analyses of various sources suggest that everything started when Millennials around the world were shaped by two significant events over the course of 2008. First, for many of them, their dreams of working at a multinational company or bank, owning a house, opening a new business, buying a car or even study, were effectively shattered by the global financial crisis. And second, that October 2008 marked the beginning of Bitcoin. It is still impossible to know if Nakamoto chose 2008 because of the events that occurred (e.g. collapse of markets, closure of Lehman Brothers, Bear Stearns) (Lee, 2014; Popper, 2015).

Bitcoin arrived in the mist of a severe crisis of confidence and trust in the global financial and political system, i.e. trust in fiat currencies and governments (Jansen, 2012; Lee, 2014), and immediately was hailed as "an escape from centralised control" (Natan, 2014) that offered an "alternative solution to those who have little faith in a centralised monetary system" (Lee, 2014). Some were driven by their lack of trust in the government, others by their hate towards large banks, and others by personal experiences like loss of a job, house, or money that caused them to express their opposition against the system (Bradbury, cited by Polasik et al., 2014; Popper, 2015), Bitcoin had become "a matter of belief, even faith" (Ferguson, 2008).

Franco (2014) correctly understood what was being offered to Millennials (although he never mentions them in his book): "The antithesis to the core problem of that moment in history: a currency that required no government, no banks, and no financial intermediaries, no "trusted third party". In addition, a Goldman Sachs study (2015) correctly identified Millennials as "agents of change", determining that the 2008 financial crisis had caused a "shift in behaviour" among Millennials, who were now demanding "transparency, convenience and lower

costs/higher returns” from financial companies (Please refer to [Figure 3](#) for more information on Millennials’ beliefs as “agents of change”)

Bitcoin’s success among Millennials is also shared by another technological application that was created in 2011 by Stanford U.S. students Evan Spiegel and Bobby Murphy, who wished “there was an app to send disappearing photos” (Forbes, 2014). Hence, they developed an alternative to social media called Snapchat, a mobile application where users could take photos and record videos, known as “Snaps”, and send it to their contacts (i.e. peer-to-peer) where they will only be available for a time limit ranging from 1-10 seconds, subsequently self-destructing entirely from the recipient’s phone. According to Spiegel, these “Snaps” represented “who Millennials were and how they felt exactly at that moment” without worrying about privacy and security concerns, social trust, censorship or unintended consequences (e.g. losing their jobs), in other words, Snapchat offered “digital liberty” for “digital natives”, amid a crisis of trust in social media.

By 2013, more than 50 million “Snaps” were sent every day and one year later, the company released “Snapcash”, a feature that allows its users to send and receive money via text-chat (peer-to-peer) by entering their debit card. As of June 2015, the four-year old company had a market capitalisation of approximately \$16 billion after raising \$848 million in seven funding rounds, with 100 million daily active users across the world (Bloomberg, 2015).

Even though Bitcoin and Snapchat are considered to be “the two biggest forces in tech today” (Carney, 2015), they appear to be unrelated given the fact that the first one is an open-sourced project considered to be both a crypto-currency and a payment system while the latter is a smartphone application, which is part of a private company. In addition, there seems to be no literature to support any similarities between them except for one article written by Tom Sharkey (2014) that offers a comparison between crypto-currencies and technology companies: “If digital currencies were popular technology companies”.

However, a closer analysis suggests that in their most basic form, both were created by and for Millennials, are peer-to-peer, a direct result of lack of trust in the system, and both provide a global, fast, and scalable technological alternative against fiat currency and social media. One represents the idea of “digital liberty” or independence against the political and financial system, while the other one against lack of security and privacy.

However, while there is sufficient information regarding the founders of Snapchat, what do we know about Bitcoin’s? What does the literature tell us about the mysterious Satoshi Nakamoto?

2.3 Satoshi Nakamoto: The Keyser Söze of the Financial World

“Nobody believed he was real. Nobody ever saw him or knew anybody that ever worked directly for him. You never knew. That was his power” – Christopher McQuarrie, 1995

As of August 2015, Satoshi Nakamoto, believed to be a pseudonym for a person or group of persons, is Bitcoin’s unknown creator. Few authors (Antonopoulos, 2015; Popper, 2015; Hall, 2013; Plassaras, 2013; Davis, 2011) have written about Nakamoto’s background or motivation behind Bitcoin’s creation. Their main sources are apparently a series of e-mails (well-encrypted) that Nakamoto sent from 2008-2011.

So far, it is only known that a “Satoshi Nakamoto” published a paper detailing the creation of Bitcoin by posting it on the Cypherpunks mailing list (Bonneau et al., 2015) The Cypherpunk movement as born in the 1990s and its members, cryptographers, “advocate the use of cryptography as means to change society” (Franco, 2014). Nakamoto released the software in January 2009; everything was done through e-mails, never in person or on the phone. Two years later, in April 2011, Nakamoto apparently went into hiding and withdrew from the public; the e-mails stopped. Since then, he/she has left all main development and responsibility of Bitcoin to the “bitcoin community” (Antonopoulos, 2015; Popper, 2015).

Venture capitalists, exchange platforms, anarchists, humanitarians, technology developers, miners, academics, and journalists compose the “bitcoin community”. This community, which compares the creation of Bitcoin to the invention of the Internet, has been well documented (Roberts, 2015; Vigna & Casey, 2015; Popper, 2015; Franco, 2014; Dingle 2013; Brito & Castillo, 2013; Grinberg 2011). According to the community, also known as the “Satoshi Faithful” (Robinson, 2014) or “The cult of Bitcoin” (Roose, 2014), Bitcoin is the new revolution that will change everything, a disruption to the global financial system that “will lead to a more just and peaceful world in which governments would not be able to pay for wars and propaganda” (Voorhees, cited by Popper, 2015). Bitcoin, “would utterly transform the way the world stores and exchanges value” (Sidel, 2014).

As of 2014, thousands of people conformed the “bitcoin community” by sharing their loyalty to Bitcoin’s ideology and the opportunities it represents for them, by using the crypto-currency albeit in disruptive ways and imagining a place where economies are less dependent on central banks, governments, and large banks (Ford, 2014).

Nevertheless, it is known that neither Nakamoto nor anyone from the bitcoin community is able to exert control over the system (still debatable), which operates on a de-centralised basis (based on cryptographic principles) and is not controlled by any entity (Antonopoulos, 2015).

In 2011, Davis (2011) published an article in the *New Yorker*, an American magazine, claiming that Nakamoto was 36 years old and had spent more than one year working on Bitcoin's software, "driven in part by anger over the recent financial crisis". There have been other articles. In 2013, Plassaras (2013) argued that Nakamoto had been inspired to create Bitcoin by Wei Dai, a graduate student from the University of Washington, who had "envisioned a system in which untraceable pseudonymous entities...[could] cooperate with each other more efficiently, by providing them with a medium of exchange and a method of enforcing contracts." (Dai, 1998, cited by Plassaras, 2013).

One year later, Leah McGrath Goodman, a reporter from *Newsweek*, erroneously reported that she had discovered Satoshi Nakamoto, also known as "Dorian Nakamoto", a 64-year old Japanese-American living in Temple City, California. The article was later revealed to have misguided readers into thinking that he was the real "father of Bitcoin" by not presenting any reliable proof of identity or connection to Bitcoin. It was also claimed that Nakamoto might possess one million bitcoins, which would be worth, as of August 2015, more than \$230 million USD, making him a target against possible attacks (McGrath Goodman, 2014; Robinson, 2014; Popper, 2015).

Regardless of who Satoshi Nakamoto might be, the literature concurs that the identity of Bitcoin's creator is no longer significant for its future development and success (Popper, 2015; Robinson, 2014) due to the fact that he/she apparently stopped working on Bitcoin in 2011, thus most of the system's code has been written by other programmers. What matters now is his/her accomplishment, which is mainly Bitcoin's technology, and how the community is "building it, improving it, and using it" (Robinson, 2014).

2.4 bitcoin: a crypto-currency

Bitcoin encompasses two simultaneous concepts: a crypto-currency (bitcoin) and a payment system (Bitcoin). However, before reviewing each, it is important to define what exactly is a virtual, digital or crypto-currency, as sometimes bitcoin is referred to in the literature.

2.4.1. Digital currencies defined

Lee & Lam (2014), simplify and provide the most accurate terminology. For example, even though *digital* and *virtual* are sometimes used interchangeably when describing an e-currency or electronic money, they argue that the term *virtual* refers to something that is “seemingly real but not exactly real” when in fact virtual currencies are considered to be “very real in the sense that they do exist”.

Therefore, the term *digital currency* is considered more accurate than *virtual currency*. Then we have “alternative currencies”, which refer to a medium of exchange that is not a standard fiat or sovereign currency. Bitcoin falls into this category and is classified as a de-centralised digital currency, individually known as a crypto-currency (e.g. Bitcoin, Ripple, and Dogecoin). Crypto derives from cryptography, which not only guarantees transaction security but also represents the foundation for Bitcoin’s philosophy (Polasik et al., 2014).

Bitcoin, a crypto-currency, is an open-source, de-centralised “peer-to-peer version of electronic cash” (Hall 2013; Lee & Lam, 2014). In order to understand what bitcoin the crypto-currency represents and how it works, it is essential to analyse several key terms that most authors mention in the literature: open-source, de-centralised, peer-to-peer, and electronic cash or digital money.

Bitcoin is open-source, meaning that bitcoin’s code is available to the public (i.e. public domain source code). Therefore, bitcoin’s code can freely be used, modified or distributed by anyone, with the purpose of “increasing the quality of the software” (Franco, 2014). Examples of open-source software products are Linux, Android and the free Firefox web browser. Satoshi Nakamoto, bitcoin’s creator, has never owned the code or the technical aspects behind bitcoin, as opposed to proprietary software like Microsoft Windows or Apple’s OS X Yosemite, which maintain ownership of the code. Kostakis & Giotitsas (2014), argue that bitcoin’s open source protocol has greatly contributed to its worldwide adoption, facilitating “the creation of a rich ecosystem around the project”.

Bitcoin is also de-centralised, meaning that there is no person, government or financial institution backing or controlling it, in other words, no one apparently controls bitcoin (Franco, 2014). Whereas the term peer-to-peer refers to “participating computers that are directly linked to each other through the Internet, without any central authority or controller” (Lemieux, 2013). BitTorrent is one of the best-known peer-to-peer (P2P) networks.

Although virtual currencies are well defined in the literature, authors tend to have a different scope and understanding as to what constitutes a virtual currency. Thus, authoritative sources (e.g. ECB, IMF, FinCEN) tend to offer a more accurate definition that was most likely the result of a professional and thorough investigation by a group of experts.

The European Central Bank (ECB, 2012) defines virtual currency as “un-regulated digital money, which is issued and usually controlled by its developers, and used and accepted among the members of a specific virtual community”. In other words, the “unit of account it employs has no physical counterpart with legal tender status” (Passaras, 2013).

The European Commission defines virtual or electronic money as the “digital equivalent of cash, stored on an electronic device or remotely a server” (European Commission, 2014). However, for the United States Financial Crimes Enforcement Network (FinCEN, 2013), virtual currency is not a “real currency” but rather “a medium of exchange that operates like a currency in some environments, but does not have all the attributes of real currency. [Virtual Currency] does not have legal tender status in any jurisdiction”. Nevertheless, as of August 2015, there were no legal definitions for virtual or digital currencies (Wilson & Ursua, cited by Natan, 2014; Trautman, 2014).

2.4.2. Before bitcoin: DigiCash, Hashcash, Bit Gold and B-Money

Bitcoin is not entirely the result of Nakamoto’s work (Trautman, 2014; Moore, 2013). Since 1982, David Chaum, considered to be the inventor of digital cash, published a paper in which he proposed the creation of digital cash (e-cash). Chaum’s paper also included the idea for “un-traceable payments based on blind signatures” which involved “bank-issued cash in the form of blindly signed coins” (Bonneau et al., 2015). In 1990, he founded DigiCash, a company to commercialise his technology by utilising cryptographic features to process electronic payments. A central server was indeed required, as opposed to Bitcoin’s des-centralised nature. DigiCash failed in 1999.

Although not a digital payment system, Adam Back’s 1997 Hashcash is another invention that contributed to bitcoin’s creation. Hashcash was created to limit e-mail spam by adding a specific hashcash, or token, to the header of all e-mail messages in order to prove the sender’s reliability, in other words, to prove that he/she was not a spammer. As the sender took a certain amount of time to solve a cryptographic puzzle (proof-of-work) to generate the stamp, it became highly unlikely that he/she was a spammer. The receiver could also verify that the stamp was valid. It was based on the idea that spammers would not dedicate enough time to solve a puzzle

when sending large amounts of e-mails (Franco, 2014).

It has also been argued that Bitcoin's protocol also contains the ideas of Nick Szabo's Bit Gold and Wei Dai's B-Money, which were "distributed digital money schemes" that functioned without any central authority and all balances were stored in a distributed database. It is important to mention that both Bit Gold and B-Money were only theoretical ideas, due to the fact that they never operated. In summary, none of these schemes actually achieved a substantial deployment. However, they are still considered to be part of the "first wave of crypto-currency research" (Trautman, 2014).

Nevertheless, the most serious problem with these first schemes was that fraudulent transactions, often known as "double-spending" could not be prevented because there was no controller that authenticated the transactions in the system. However, bitcoin successfully overcame that challenge (Franco, 2014).

2.4.3. bitcoin: road to becoming the most widely-used crypto-currency

It has been established that in January 2009, Nakamoto made the first test in the system by sending 10 bitcoin units (BTC), worth less than \$1 US cent at the time, to a cryptographer known as Hal Finney (Robinson, 2014). The first transaction was successful and bitcoin became a reality. However, it was not until October of that same year that bitcoin's first exchange rate was revealed, listing the value of 1,309 BTC at \$1 USD. In addition, through the following year they continued to trade for only fractions of \$1 USD cent (The Rise and Rise of Bitcoin, 2014; Robinson, 2014).

It is believed that bitcoin was first used as a crypto-currency until May 22 2010, when Lazlo Hanyecz, a computer programmer from the U.S. successfully purchased two pizzas with 10,000 bitcoins (Bonneau et al., 2015; Yermack, 2014). According to bitcoin's August 2015 price, those two pizzas would be worth more than \$2 million USD. Nevertheless, Bonneau et al., (2014) and other authors fail to mention that the transaction was only possible through a third-party or another bitcoin user who used a credit card to pay for the pizzas due to the fact that Papa John's did not accept bitcoins (Polasik et al., 2014; Robinson, 2014). In other words, it was a person but not the company who accepted bitcoins.

By November 2010, four million bitcoins had already been created or "mined" (the term will be explained in the next section) and bitcoin was already worth \$50 USD cents, with a total market capitalisation of \$1 million USD. In February 2011, bitcoin reached parity with the U.S. Dollar,

reaching a peak of \$31 USD per BTC in June before crashing down. In addition, during that same year bitcoin had inspired the creation of new crypto-currencies like Altcoin (derived from the bitcoin open-source protocol), Litecoin and the philanthropic Dogecoin who raises money for charities and special causes (The Rise and Rise of Bitcoin, 2014).

By March 2013, bitcoin now had a \$134 price per BTC and a \$500 million USD capitalisation and approximately 60,000 daily transactions (Michael, 2013). As Dingle (2013) notes, people who bought bitcoins in 2011 when bitcoin reached parity with the U.S. Dollar, would have made more than 300% in 2013 despite its fluctuations. By the end of 2013, there were approximately 11.8 million bitcoins units compared to December 2010, when there were only 5 million (Velde, 2013). In December 2013, a bitcoin unit was worth more than \$800 USD.

The next year, leading sources estimated that there were approximately 5.8 million bitcoin users (a seven-fold increase from last year), even though bitcoin users are difficult to estimate due to the system's pseudo-anonymous nature (Segendorf, 2014, cited by Polasik et al, 2014) (Please refer to [Figure 4](#) for a summary of bitcoin's milestones).

Nevertheless, the literature may be misleading regarding the actual number of bitcoin users. For example, bitcoin users are estimated by existing bitcoin electronic wallets (digital wallets for holding bitcoin units). For example, it may be stated that if there are 5.8 million wallets in existence, then there are 5.8 million bitcoin users. However, Polasik et al. (2014) and Robinson (2014) warn against a possible over-representation of users due to the fact that many wallets are inactive, others are empty, and many users own more than one wallet. Therefore, the actual number is impossible to know. Now, considering that there are 2.9 billion Internet users, it means that "bitcoin users are widely dispersed and that the system may not have achieved critical mass" (Evans & Grover, 2014, cited by Polasik et al., 2014).

Only Franco (2014), Yermack (2014), Yelowitz & Wilson (2014) attempt to study these pseudo-anonymous bitcoin users and their motivations for adopting bitcoin. Yelowitz & Wilson (2014) identified three key drivers leading to bitcoin adoption: curiosity, profit and political aspirations. They argue that most bitcoin users are speculative investors, libertarians, computer programmers, those seeking new bitcoins (miners), and criminals (for anonymity). Whereas Yermack (2014) identifies bitcoin users as "technology enthusiasts who embrace bitcoin for online commerce" and "pseudo-Libertarians" who find it attractive for its "lack of connection to any government". He even affirms that some of these users "openly distrust the world financial system".

Nevertheless, Yelowitz & Wilson's (2014) study concludes that computer programmers' enthusiasm and criminal activity are the main drivers in bitcoin's increased adoption; while finding limited evidence for political and investment motives. However, given bitcoin's increased volatility over a limited supply, it may be inferred that speculation is the main motive.

2.4.4. bitcoin: the most widely-used crypto-currency

Money changes, in form and operation. For hundreds of years, money only had a physical form (notes and coins) but in recent years, electronic or digital money has gradually replaced paper money with plastic cards (debit and credit), electronic transfers, and payments (Guttman, 2002; Ferguson, 2008; Velde, 2013)

The way we understand money has changed along with technology. The question of whether bitcoin is a “real” crypto-currency or not is the most debated issue in the literature. Bitcoin's “fiercest believers” or “faithful”, have no doubt that bitcoin is a new free currency that is under no control of banks or governments. On the other hand, bitcoin's “sceptics” or “haters” view it as a “non-event” (Robinson, 2014), “a speculative investment or financial asset rather than a currency” (Wilson & Ursua, 2014, cited by Natan, 2014; Yermack, 2014), “a poor substitute for fiat currency (Posner, 2014, cited by Natan, 2014).

The only way to understand these differing points of view is to review the definition of what constitutes money. We know that money is an asset that can be exchanged for goods and services, i.e., a medium of exchange or account. Money is the solution for inefficient barter. It is also a unit of account that can easily be calculated; and a store of value, that facilitates “economic transactions to be conducted over long periods and at geographical distances” (Ferguson, 2008), in other words, the ability of maintaining its value over time (low volatility).

Therefore, money needs to function as a medium of exchange, unit of account, and store of value. To put it simply, it needs to be “available, affordable, durable, fungible, portable, and reliable” (Ferguson, 2008).

Since then a growing literature has identified hidden-but-important properties of the system, discovered attacks, proposed promising alternatives, and singled out difficult future challenges. Meanwhile a large and vibrant open-source community has proposed and deployed numerous modifications and extensions. (Bonneau et al., 2015)

3 Methodology and Research Design

3.1 Overview

This chapter will outline how the study for this project was designed and how it will be conducted.

3.2 Research Philosophy and Approach

Constructivism's basic assumption is that "knowledge is socially constructed by people active in the research process" (Schwandt, 2000, cited by Mertens, 2014, p. 16). As a result, the researcher will then have the main task of understanding "the complex world of lived experience from the point of view of those who live it" (Schwandt, 2000, cited by Mertens, 2014, p. 16).

Based on the nature of ethics, reality, knowledge, the relationship between the knower and would-be known, as well as its approach to systematic inquiry, the paradigm that will guide and direct this research is Constructivism (Mertens, 2014). Concerning the nature of ethics, this research will seek to engage participants, by sharing their level of understanding and presenting a balanced representation of their own views and opinions. As a result, there will not be a single reality but multiple constructive realities, where participants will seek to modify existing realities and also construct them "*de novo* for a new situation" (Turoff & Linstone, 2002, p.35). The researcher's main goal will be to understand them.

The research will be an interactive process, which means that the researcher and participants will be expected to influence one another, thus, the researcher cannot remain independent from the study. Both the researcher and participants will therefore be "interactively linked with the findings" (Trevor & Amos, 2008). All data, its interpretation and outcomes, will be based on the participant's own background and knowledge; in other words, the majority of data will exist inside the minds of the participants (Mackenzie & Knipe, 2006)

Therefore, the research will rely primarily on qualitative data collection (e.g. participants' judgement and opinions) by open-ended questioning (Round One), which will be known as "exploration", however, quantitative data will also be required to gather numerical data (e.g. respondents will be asked to provide a rating in subsequent rounds), where statistical analysis techniques will be used (e.g. mean, median, mode, standard deviation, among others).

3.3 Research Strategy

As of 2014, there was limited objective academic research regarding Bitcoin. According to Chen Y. Wu & Pandey (2014), one of the reasons is the lack of general knowledge or “obscurity” surrounding Bitcoin for those outside the technological community. Another reason is that so far, the number of traded Bitcoins has been relatively small compared to national currencies, along with the difficulty of using it to purchase goods and services outside of the digital world. Thus, the literature or lack thereof, supports the need for more understanding and knowledge of crypto-currencies like Bitcoin.

Faced with conflicting opinions from experts regarding Bitcoin, where “judgements of individuals are needed to address a lack of agreement or incomplete state of knowledge” (Stitt-Gohdes & Crews, 2004), the method employed in this research is the Delphi method, named after the Greek City of Delphi, in whose famous temple the oracle Pythia was believed to predict the future.

Olaf Helmer and Norman Dalkey first introduced it in the 1950s and it is “uniquely suited to studying topics with little historical evidence, related to rapidly changing events, great complexity, and that requires expert opinion” (Franklin & Hart, 2007). Compared to other research methods, the Delphi method is the only one that focuses on future events and allows to “pool experts on the subject” (Sprenkle & Piercy, 2005, p. 238). It is based on the assumption that “n heads are better than one” (Dalkey, 1972, cited by Sprenkle & Piercy, 2005, p. 239)

There are three types of Delphi methods: classical, decision-making, and policy Delphi. For the purposes of this research, the policy Delphi will be adopted, which consists of gathering experts for a topic discussion with relevant knowledge and understanding, polling their opinions and judgements through the administration of sequential questionnaires or rounds of questionnaires, summarising data from each one and providing feedback and comments for each round, all with the purpose of establishing diverging and converging arguments for differing opinions (Franklin & Hart, 2007). Therefore, the purpose of the research is mainly to generate ideas and explore opinions regarding the viability of Bitcoin as a crypto-currency in the global financial markets.

The Delphi method has three basic characteristics; members of the panel may remain anonymous; there is controlled feedback, which allows interaction between participants by comparing answers and re-evaluating, preventing any conflict between them; the opinion of every member of the panel is reflected in the final group response (Dalkey, 1967, cited by Yousuf, 2007)

There are various phases in the Delphi method, the first one is the selection of experts, which consists in identifying potential experts, sending them a formal invitation (via e-mail) and completing the constitution of the panel of experts (Vázquez-Ramos et al., 2007). According to Hsu & Sanford (2007), the selection of participants is the most important step in the process because it is directly related to the expected quality of the results that will be generated. There are no established set of standards to select experts, however, the individuals required to participate must have a background and experience in relation to the topic, as well as highly trained and competent within the specialised area of knowledge related to the problem or issue.

The second phase is known as Exploration or Round One, where the researcher will send via e-mail a questionnaire with approximately two open questions related to the problem or issue. The participants will then be given two weeks to respond between each Round or iteration (Hsu & Sanford, 2007). The results will be collected and a qualitative method will be used. (e.g. Emerging coding) for content analysis. The results will be used to develop the second questionnaire. Special steps should be taken to avoid any chance of research bias in order to ensure the integrity of the whole process (Vázquez-Ramos et al., 2007). In every stage, the researcher follows a feedback process by informing participants of the various opinions of their counterparts (which may remain anonymous or not).

The third phase is known as Evaluation or Round Two where the second questionnaire will be distributed, collected, and assessed. However, this second questionnaire will require respondents to rank-order items (e.g. Likert rating) to establish priorities among various items. They will also be invited to justify their answer, add items or modify existing ones. Central tendency measures will be used for the results and the items that fall under the required measure will be included for the construction of the third questionnaire.

The fourth phase is known as Re-evaluation or Round Three where participants will be required to practically re-evaluate their last answers based on the panel's responses. The results will then be assessed in the same way as questionnaire two. The fifth phase will consist in identifying all converging and diverging opinions, analysis, and summary of the final results (Vázquez-Ramos et al., 2007).

3.4 Collection Primary Data

3.4.1 Sources

The success of the Delphi method depends on primary data. However, secondary data for the literature review will be obtained from books and journals.

As mentioned in the previous section, data for this research will be collected from questionnaires, which will be administered via e-mail or the Web in order to accelerate the waiting time between Phases or Rounds. The Delphi method has been characterised as being time consuming regarding data collection, with the average study taking 45 days to 5 months (Okoli & Pawlowski, 2004). These questionnaires are a mixture of qualitative and quantitative data. The analysis of the Round One questionnaire, which is composed of open-ended questions, is essentially qualitative. However, subsequent Rounds (Two and Three) involve ranking, a form of quantitative data.

All data will be collected in the form of questionnaires, which will be distributed to an expert panel. The questionnaires will be made through a programme called Qualtrics, which will also perform the numerical analysis of the data. Please refer to Appendix B for the official One-Page invitation that was sent to experts.

The questions of the Delphi Questionnaire (Round One) are the following:

1. What is your current exposure to crypto-currencies?
2. Identify any trust issues with fiat currencies (e.g. USD; EUR; JPY; GBP) and Bitcoin.
3. To what extent do you think Bitcoin will replace fiat currencies?
4. What use or benefit might Bitcoin have over fiat currencies? (e.g. forces driving the demand for bitcoins) Do you think Bitcoin will solve any of the issues of the global financial system that caused the 2008 crisis?
5. Currently, are there any alternative solutions to the use of crypto-currencies?
6. Bitcoin's decentralised nature contrasts with fiat currencies, can a currency operate outside the control of any institution (e.g. Governments; Central Banks; Financial Institutions)?
7. To what extent is Bitcoin a challenge to governments and institutions? Will it retain its independence from sovereign/state influence?
8. What risks would you associate with Bitcoin? (e.g. Security; Volatility; Tradability)
9. What is the possibility of banks and other financial institutions exchanging crypto-currencies?
10. How would you rate Bitcoin as a payments platform? What are its advantages and disadvantages over other options (e.g. Apple Pay; PayPal; Android Pay)?

11. How influential or important do you think Bitcoin will become considering its long-term survival

3.4.2 *Access and Ethical Issues*

In the last years, Bitcoin has been surrounded by several controversies including its lack of regulation, security breaches, theft, and its relation to illegal drug trade. Therefore, experts are free to refrain from participating at any time if the topic conflicts in any way with their activities or beliefs. Their anonymity would also be respected and their comments and opinions will not be individually identified or shared with anyone. The most important part of the study is for them to remain free of every constraint related to other methods of data recollection like face-to-face interviews, panels, among others.

3.5 Approach to Data Analysis

Data from the First Questionnaire is essentially qualitative; therefore, one approach is to use emergent coding (as opposed to *a priori*). Experts recommend the use of emergent coding in Delphi studies because the researcher possesses hardly any knowledge in regards to the comments the members of the panel will make. Codes will be based on ideas, concepts, and phrases. (Taylor & Gibbs, 2010).

Data from the Second and Third Questionnaires will be essentially quantitative; therefore, a proposed approach is to use a Likert scale through the Qualtrics program. Most of the statistics used in Delphi are measures of central tendency (e.g. mean, median, mode), standard deviation, among others.

4 Presentation and Discussion of the Findings

4.1 Overview

4.2 Findings

4.2.1

4.2.2

4.2.3

4.3 Discussion

4.4 Conclusion

5 Concluding Thoughts on the Contribution of this Research, its Limitations and Suggestions for Further Research

5.1 Implications of Findings for the Research Questions

5.2 Contributions and Limitations of the Research

5.3 Recommendations for Practice

5.4 Recommendations for Future Research

5.5 Final Conclusion and Reflections

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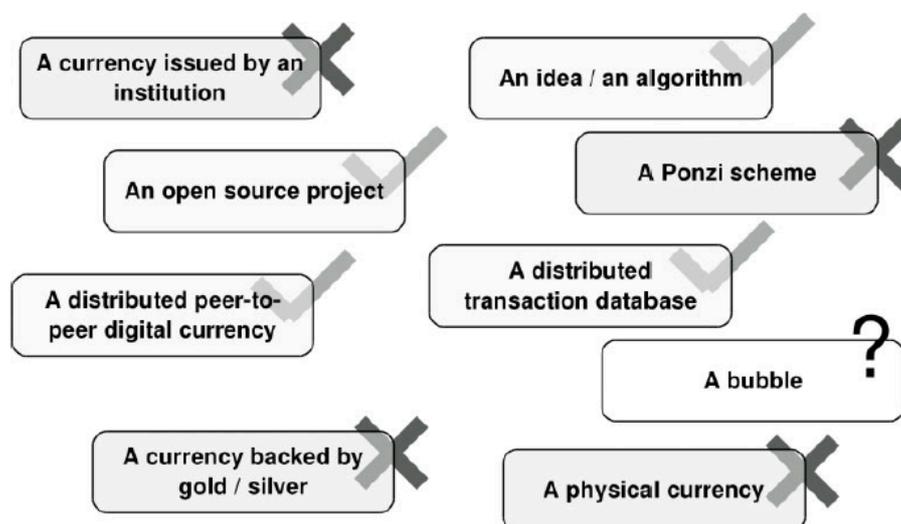
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- Cryptocurrencies market capitalisations

Appendices

Appendix A – Figures

Figure 1 Common Bitcoin Misconceptions



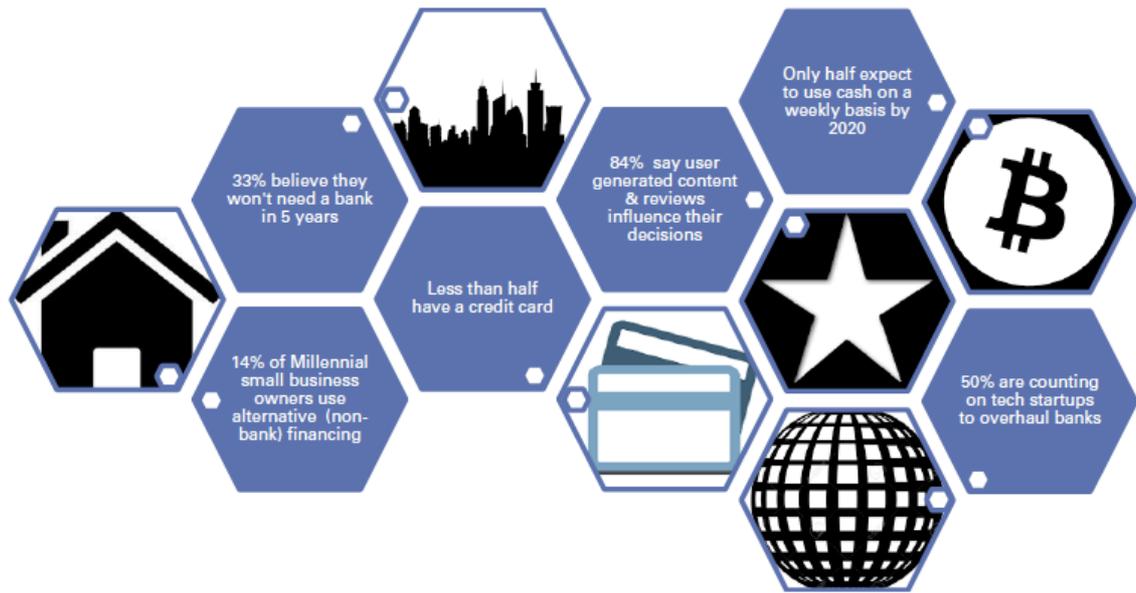
Source: (Franco, 2014)

Figure 2 Crypto-currencies' market capitalisation

Crypto-currency	Price	Total Supply	Market Cap
1. Bitcoin	\$ 228.27	14,562,925 BTC	\$ 3,324,322,579
2. Ripple	\$ 0.007824	32,488,247,336 XRP	\$ 254,174,727
3. Litecoin	\$ 2.82	42,087,835 LTC	\$ 118,710,003
4. Peercoin	\$ 7,955,424	22,597,490 PPC	\$ 7,955,424
5. DogeCoin	\$ 0.000129	100,815,018,992 DOGE	\$ 13,003,222

Source: (CoinMarketCap, 2015; Forex News, 2015)

Figure 3 Millennials' beliefs as "agents of change"



Source: (Goldman Sachs, 2015)

Figure 4 Bitcoin's milestones

Bitcoin Milestones	
2008	Creation and bitcoin.org is registered
01/12/2009	First bitcoin transaction
10/05/2009	Exchange rate established (USD 1 = 1,309.03 BTC, or \$0.00076)
5/22/2010	First real world transaction -Jacksonville U.S., 10,000 bitcoins are used to pay for pizza
12/08/2010	First mobile bitcoin transaction
7/20/2011	Bitcoin app is released
6/20/2012	Coinbase, one of bitcoin's largest wallet and platform is founded in California
Jan-13	Bitcoin reaches \$13 USD per BTC
04/10/2013	Bitcoin reaches a new high of \$266 USD per BTC
05/02/2013	First bitcoin ATM unveiled in San Diego, California
11/19/2013	Bitcoin rises above \$1,000 USD (tops out at \$1,242 USD) per BTC
12/05/2013	China's Central Bank bans bitcoin transactions
01/09/2014	Overstock retailer starts accepting bitcoins and receives 840 orders on the first day

Source: (PwC, 2014; Parthemer & Klein, 2014)

Bitcoin : Challenges and opportunities to the growth of cryptocurrencies
A Delphi Study



Research Overview

In 2008, an unprecedented global financial crisis had caused the collapse of numerous financial institutions, exposing grave flaws in the existing global financial and political system, thus leaving a profound impact on what is known as the Millennial Generation or people who were born between the early 1980s and late 1990s. Having gone through difficult economic conditions just as they were starting their careers, like high unemployment, personal debt and even poverty, the global financial crisis effectively created a general need among Millennials for alternatives to the current system. It was during this crisis of confidence that Satoshi Nakamoto, believed to be a pseudonym for a person or group of persons, published a paper that offered one of these alternatives by describing and sharing the creation of Bitcoin, "a peer-to-peer electronic cash system" (Nakamoto, 2008). Bitcoin would allow users around the world to make online payments directly to others without the need for a central authority by creating a "decentralised system of trust operating outside the control of any institution" (Mgna & Casey, 2015) based on cryptographic proof. Credit ratings, bank accounts, transaction fees, interest rates, and centralised currency issuance would become a thing of the past.

Numerous authors have written about the need to understand Bitcoin mainly from a technical point of view, however, going beyond its technological force, it becomes difficult to explain how the figure of Nakamoto remains to date "one of the greatest mysteries of the digital age" (Popper, 2015), not only because his or her identity is a complete mystery, but because Bitcoin is, as of July 2015, the world's most widely used and talked-about alternative cryptocurrency as well as one of the most ground-breaking technologies since the Internet that has been igniting a new wave of innovation across the world. How did an apparent computer code capture the attention of Millennials, academics, bankers, economists, entrepreneurs, investors and even governments?

Nevertheless, despite apparent success, challenges pose a severe threat to Bitcoin's continued growth and ultimate survival. Since Bitcoin's creation, it has been debated whether it is a cryptocurrency, a payment system, ponzi scheme, or simply a bubble that will eventually burst. Bitcoin's rising popularity has been scoured by scepticism regarding its ephemerality, security and regulation, alarming price-volatility, transaction irreversibility, and long-term survival, which has prompted warnings from successful investors such as Warren Buffet to "stay away from it. It's a mirage" (Buffet, 2014).

A Delphi Study

The future of the financial and technological world is characterised as being highly unpredictable due to its complex behaviour and rapidly changing events. Despite experiencing remarkable growth in the last years, adoption and respectability are still considered to be the main determinants in Bitcoin's current and future growth, causing a high level of uncertainty and scepticism among academics, investors, and users.

The existing literature and academic research support the conclusion that further understanding and knowledge of Bitcoin is needed due to the scarcity of research on the topic and various conflicting opinions among authors, making the available information incomplete and highly subjective. Therefore, a Delphi study approach will be used for this project, which is designed to convene a group of experts with relevant knowledge and understanding of the topic, in order for them to share their perspectives and opinions based on their own experience and expertise regarding the challenges and opportunities to the growth of Bitcoin through a consensus (or not) about a likelihood of future events.

Rather than meeting in person, Delphi allows experts to remain anonymous and participate at a geographical distance through the administration of a questionnaire, summarising data, providing feedback, and comments for every question, with special consideration for each point of view. Therefore, as a masters candidate at Griffith College Dublin (Ireland) and as part of my dissertation, I invite you to participate in this Delphi study to answer various open-ended questions. Your participation is completely voluntary and confidential. If you do not want to participate, please feel welcome to let me know. In addition, I will keep your decision to participate or not participate entirely confidential. At the conclusion of the study, a report will be made available to all participants.

Topics

- Crisis of confidence and the Bitcoin effect
- Satoshi Nakamoto: The Keyser Söze of the Financial World
- Bitcoin: cryptocurrency and alternative payment system
- Benefits and risks of using Bitcoin
- Regulation, controversies, and legal issues regarding Bitcoin
- The future and technological impact of Bitcoin

If you are willing to participate, please use the link below to access the questionnaire.
[Click Here](#)

Thank you in advance for your help and participation. I am looking forward to learning more about the challenges and opportunities to the growth of Bitcoin. If you have any questions about the research, please contact me at bryanhodges@gmail.com

Kind Regards,

Bryan Hodges
Masters candidate
Griffith College Dublin

Appendix C –

In early 2014, a Gabonese friend studying a Masters in Griffith College Dublin discussed the disadvantages of living in a foreign country. While he enjoyed living in Ireland, he could not hide his discontent with Western Union, an American financial and communications company that had just charged him a more than 10% processing fee for receiving money from his home country. In addition, using his local bank in Gabon would have resulted in high currency conversion fees. “Is there an alternative to the system?”, he asked.

Appendix D –