Bachelor's thesis

Degree programme in International Business

NINBOS13

2017

Anh Hoang

BITCOIN: THE ADDED VALUES AND CHALLENGES OF ADOPTING BITCOIN.

– cases of Time Bar, Konsolinet & Hug Bike shop

TURKU AMK

TURKU UNIVERSITY OF
APPLIED SCIENCES

Anh Hoang

BITCOIN: THE ADDED VALUES AND CHALLENGES OF ADOPTING BITCOIN.

- cases of Time Bar, Konsolinet & Hug Bike shop

In 2008, on a private mailing list of the Internet dark webs, the tech pioneers were passing around one of the most innovative technologies in the financial field that humanity has ever witnessed, it is called Bitcoin and the blockchain technology.

Throughout the years, the demand for Bitcoin currency has risen exponentially. Based on the demand for the Bitcoin tokens, thousands and thousands of access points are being built globally, providing services for millions of users annually. Moreover, well-known online merchants start exchanging products and services for the ownership of the currency. From the side of brick-and-mortar store owners, Bitcoin seems to be neglected.

Thus, the paper will focus on delivering two well-defined goals. Firstly, it is to equip merchants with a fundamental knowledge towards Bitcoin and the blockchain. Secondly, it will investigate and understand the driven factors which encourage as well as prevent merchants from adopting Bitcoin, through the cases of Finnish store owners.

To retrieve the data, qualitative research was carried out through a series of interviews with Finnish merchants in Helsinki area. Regarding the benefits of adopting Bitcoin, the findings pointed out Bitcoin adoption provides a promising low commission fee while enhancing the company's marketing image. On the other hand, there are challenges that hinder the adoption such as slow transaction execution, lack of knowledge and misconceptions from merchants.

Ultimately, this paper will vision on what is lack from the development of Bitcoin point-of-sale. Through which, solutions may be found which can connect Bitcoin with merchants globally.

KEYWORDS:

Bitcoin, blockchain, block mining, adoption, point-of-sale, merchants, added values, challenges;

CONTENTS

FIGURES

PICTURES

LIST OF ABBREVIATIONS (OR) SYMBOLS & TERMINOLOGIES

Abbreviation

ATM   Automated Teller Machine

POS   Point of Sale

UK   United Kingdom

Yle   Yleisradio Oy - Finnish Broadcasting Company

Terminologies

Virtual currency

Virtual currency is an unregulated digital currency that can be used as a substitute for real and legally recognized currency. Virtual currency can be converted for cash through online exchanges. (Investopedia, 2017a)

Blockchain

The blockchain is described as an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value (Tapscott, 2017). A detailed explanation of the blockchain can be found in section 2.4.

1 INTRODUCTION

1.1 Background

Many people may have heard of Bitcoin, as a currency, a technology, or simply a terminology that dominating headlines of financial newspapers ever since it was announced.

Bitcoin, in fact, has been around for nearly a decade, since its birth in 2009 by an unknown alias of Satoshi Nakamoto. With his whitepaper (Nakamoto, 2008) explaining the concept of Bitcoin, this cryptocurrency brought an innovative technology called the blockchain into existence.

In short, Bitcoin is a virtual digital currency that utilizing an open decentralize peer-to-peer network called the blockchain. (Nakamoto, 2008)

Besides, Bitcoin contains within itself the ability to solve many critical financial issues. To name a few, double-spending, anonymity preserving, and removal of the traditional trusted third parties such as banks or other financial institutions (Nakamoto, 2008). Explanations regarding the design of Bitcoin will be discussed in more details in section 2 of this thesis.

The excitement of what Bitcoin and the blockchain allow led the author to the urge of understanding the technology behind it. However, the complexity of Bitcoin may create confusion to anyone who is not a technical expert. Thus, the struggle contributed partly to why this thesis is conducted. For instance, this paper will try to study and explain in simplified terms of how Bitcoin works, as a currency, a network, and a payment system.

The rising of Bitcoin access points

Regarding the growth in Bitcoin demand, the whole world has witnessed the explosive expansion in its ecosystem, especially in the distribution of Bitcoin access points. In other words, the market of Bitcoin "ATM" is booming as the market demand thrives.

ATM, as for Automated Teller Machine, is an electronic banking outlet, which allows customers to complete basic transactions without the aid of a branch representative or teller. However, different from a traditional ATM, Bitcoin ATM acts as a teller which

convert Bitcoin tokens (or currency) into fiat currencies and vice versa. (Investopedia, 2017d)

Bitcoin ATM is booming as hundreds of Bitcoin ATM locations are popping up globally every year, which expands the reach of Bitcoin to many places all around the world. According to *coinatmradar.com* (2017) – a website provides mapping services of all Bitcoin ATM locations that are currently in cooperation with the company - there are currently 1703 ATMs globally, with an installation rate of 6.72 ATM per day.

Besides, another great insight is that there are more than 39,000 other operators who providing similar services of distributing Bitcoin without using Bitcoin ATM, as stated on *coinatmradar.com* (2017), "*Some are using existing networks of traditional bank ATMs, or existing network of mobile payment terminals, others use retail chains and allow to buy bitcoins via cashier desks*".

As the demand for Bitcoin tokens is rising, people are inquiring shops and stores to spend their tokens as a way of motivating the ecosystem of Bitcoin. However, as a nature of being a digital currency which is suitable for online transactions, Bitcoin has yet witnessed the adoption of merchants into their physical store.

Bitcoin Point-of-Sale allows payment adoption

Before 2015, the only way to spend a Bitcoin was via direct transfer. Similar to a traditional bank transfer, a Bitcoin direct transfer can easily be carried out online via the Internet. However, such transaction can be time-consuming and troublesome for a face-to-face transaction, due to the complex verification process of Bitcoin.

Fortunately, an international Bitcoin payment service provider Bitpay has cooperated with a French-based Point-of-Sale (Hereafter POS) terminals provider Ingenico which allows merchants to start accepting Bitcoin in stores via the point-of-sale system (Redman, 2015). According to a popular Bitcoin newspaper *bitcoin.com* (2015), "*merchants can now accept Bitcoins sent from mobile devices such as phones, tablets using compatible applications*".

After Bitpay, many other Bitcoin payment providers and exchanges start providing similar services. According to *coindesk.com* (2015), Coinbase is one of the biggest global Bitcoin exchange that provides POS services for merchants. In addition, there are many new start-ups rising in the Bitcoin POS market, namely Coinify, Coinkite, Revel, BitXatm, etc.

Adoption of Bitcoin in Finland

Regardless the release of Bitcoin POS and the booming demand for the currency within the last few years, Finnish merchants who own brick and mortar store are still showing cold face to the Bitcoin adoption. For instance, the number of the store which adopting Bitcoin is low. According to *coinmap.com* (2017), currently, there are less than 100 businesses who are accepting Bitcoin POS as a mean of payment in Finland. Each presumably owning 2-3 POS terminals for a small and medium business. Meanwhile, extracted from Figure 1, the total number of POS terminals in Finland from 2015 is roughly 153,370 terminals. To compare, the amount of Bitcoin POS is simply outnumbered. (Statista, 2016)
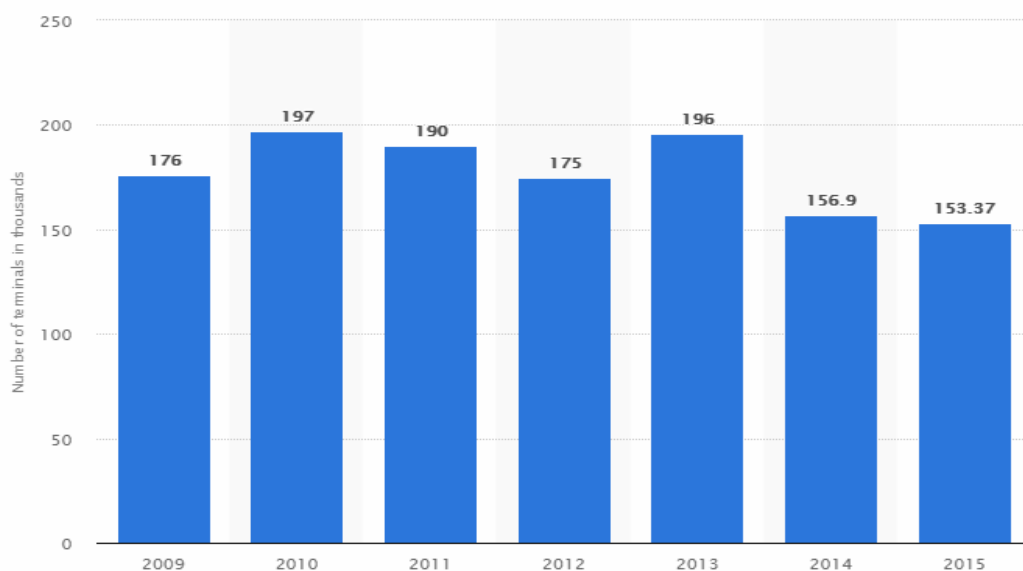
Figure 1. Total number of POS terminals in Finland from 2009 to 2015 (in 1,000) (Statista, 2016)

Moreover, Finland is a country where the electronic transaction is preferred, which means most of the transaction either be done online, via traditional visa cards or via mobile phones. According to *Yle* (2016), only a tenth of customers is using cash for making transaction, while the rest prefer cash-less transactions via POS system. Yle (2016) stated, "*The latest figures show that 7 out of 10 customers use a card, while only 13 percent tend to pay with cash*". Additionally, the sale conducted with card payments is double the sale in cash. Yle (2016) claimed that "*measured in euros, card payments*

account for 42 billion in sales, while cash is used in transactions worth 16 billion. These figures account for 70 and 30 percent of total sales, respectively".

Thus, it is safe to say the rate of Bitcoin POS adoption from a merchant's perspective is still low in Finland regardless of the high usage of card-less transactions via POS system.

1.2 Personal Motivation

From a personal perspective, I am a bitcoin enthusiast. I do believe and support the concept of a decentralized currency where a system is designed purely to overcome the trust issues when it comes to conducting transactions between strangers. With my background knowledge in business administration field as well as economics, I endeavour this technology and want to have a deeper understanding of blockchain and cryptocurrencies.

Moreover, being a Bitcoin hobbyist, it is intriguing seeing Bitcoin being accepted more and more in different stores and businesses. Especially, when conducting a transaction aboard, purchasing an item from an unfamiliar country, I personally prefer Bitcoin over any other currencies due to its security design and non-restricted rules of conducting the transaction. However, witnessing the low rate of adoption triggered my curiosity of answering the question why.

Thus, from my own motivation, this thesis is a way for me to not only showing support for the currency but also as a mean of study for me to get deeper understanding towards the full concept of Bitcoin, as well as investigating what struggles merchants are having when it comes to accepting Bitcoin as payment in their physical stores.

1.3 Objectives

With the combination of both background and personal motivation, we have come to the main purpose of this thesis. The thesis will focus to resolve and answer these two objectives:

1. Explain and understand in simplified terms the concept of Bitcoin, the blockchain and the details of Bitcoin ecosystem & transaction procedure through nodes, block, block mining and Proof of Work.

2. Based on the case of Finnish retailers in Finland, what is the added values as well as the challenges when adopting Bitcoin Point-of-sale system in a physical store?

To clarify, the focus population to solve the second objective will be Finnish small-and-medium enterprise and businesses that currently accepting Bitcoin in their brick-and-mortar stores, excluding online services.

2 ORIGINS OF BITCOIN

2.1 Overview

We have reviewed how Bitcoin expanded through the explosive growth of Bitcoin access points and the allowance of Bitcoin adoption for physical retailers. In this section, we will look deeper into defining the concepts of Bitcoin with its growth in valuation and supporters, the blockchain and how Bitcoin transaction is conducted. The sole focus will be resolving the first objective of this thesis, which is:

1. Explain and understand in simplified terms the concept of Bitcoin, the blockchain, and how the Bitcoin transaction is conducted.

The explanation will be in simplified terms with the purpose of educating readers & merchants to have a brief yet informative understanding of this innovative technology. In details, most of the technical aspects such as mathematical equations, or technical coding will be excluded to retain the simplicity and clarity of this section.

2.2 Bitcoin

In 2008, the world witnessed the collapse of one of the largest investment bank in the United States, the Lehman Brothers, with $613 billion dollars in debt (Mamudi, 2008). Indeed, the collapse had caused the global crisis which crippled the economy of many countries, making thousands of people jobless. For example, an United-Kingdom (UK) news channel Express (White, 2008) claimed, "*the collapse of the 158-year-old finance house Lehman leaves nearly 5,000 staff in the UK and about 25,000 worldwide facing job losses".* As the whole world is shaken by such event, it opened a door for a new financial system to come into play.

As the timing is just right, in 2008, a whole new monetary system got introduced. It is called **Bitcoin**. In fact, an individual or a collective group of innovative people under the alias of Satoshi Nakamoto submitted a whitepaper or an authoritative complex report called "*Bitcoin: A Peer-to-peer Electronic Cash System*" on the cryptography mailing list metzdowd.com (History of Bitcoin, 2017). It presents in technical terms clearly the idea

of Bitcoin along with the concept of cryptocurrency, blockchain technology, block mining along with proof-of-work algorithm (Nakamoto, 2008)

What is Bitcoin?

In the book "*Mastering Bitcoin*" written by Andreas Antonopoulos (2015), **Bitcoin** is defined as a virtual currency which is built based on the fundamental of a digital monetary system. He stated "*Bitcoin users stores and transmit values through the Bitcoin network. The main communication between users is carried out via Bitcoin protocol, primarily through the Internet*". (Antonopoulos, 2015)

Bitcoin can be exchanged and used in resemblance to traditional currencies. For instance, Antonopoulos (2015) claims that "*Users can transfer bitcoins or bitcoin tokens over the network to buy and sell goods, send money to people or organizations, or extend credit*".

Additionally, Bitcoin is described to be *"the perfect money for the Internet"*, due to its ability of transfer borderless without any restrictions. However, Bitcoins are entirely virtual. There is no physical form of Bitcoins. (Antonopoulos, 2015)

Bitcoin supply is capped at 21,000,000 Bitcoins. This means there can be only 21,000,000 bitcoins ever made. This design of the system creates inflation resistance for Bitcoin. Unlike a fiat currency, which can be printed in infinite numbers by a central bank, bitcoin can never be inflated by printing (Antonopoulos, 2015). For instance, in November of 2017, there are approximately 16,600,000 Bitcoins are mined and being put in circulation, or can be used. This means that 4,400,000 Bitcoin tokens can still be mined in the future. (Blockchain, 2017b)

Bitcoin is built with the complete open-source code and fully-decentralized blockchain technology. In other words, the currency does not require a central authority of the traditional trusted third parties to operate, such as banks or other types of financial institutions. On the website *Bitcoin.org* (2017a) – the main hub of current core developers of Bitcoin, they claim that "*Bitcoin uses peer-to-peer technology to operate with no central authority or banks; managing transactions and the issuing of bitcoins is carried out collectively by the network*". Regarding the open-source code, "*Bitcoin is open-source; its design is public, nobody owns or controls Bitcoin and everyone can take part.*

Through many of its unique properties, Bitcoin allows exciting uses that could not be covered by any previous payment system". (Bitcoin.org, 2017a)

According to proposals made in the whitepaper, Nakamoto (2008) pointed out that Bitcoin can solve many existing critical problems of the financial world, namely *double-spending*, *transaction security*, *user's anonymity preserving* and *the complete removal of the trusted third-parties* such as banks and financial institutions. The proposal of solutions is described clearly using the concepts of blockchain and block mining. (Nakamoto, 2008)

2.3 Bitcoin recognition throughout the year

Bitcoin users

In recognition of the advantages that Bitcoin and the blockchain can bring, the number of Bitcoin users has grown tremendously. Due to the nature of users' veiled identity, it is quite hard to measure precisely the number of users currently having a relationship with Bitcoin. It can mean either own Bitcoin tokens (currency) or run the software and support the network.

However, we can take a glance at 2 figures that might represent the population of Bitcoin community. They are the number of *unique addresses* – the address is used to store and exchange Bitcoin - and the number of *full-node* – which can be described briefly as a computer that runs and supports the Bitcoin network (further explanation on "*full-node*" can be found in the following section).

According to *blockchain.info* (2017c)– an authoritative website provides all data related to Bitcoin blockchain – there are 643,456 unique addresses on the 16th of October 2017, in comparison with less than 100,000 addresses before January of 2014. As can be seen from the figure 1, it shows a sustained incremental growth in the number of unique address.
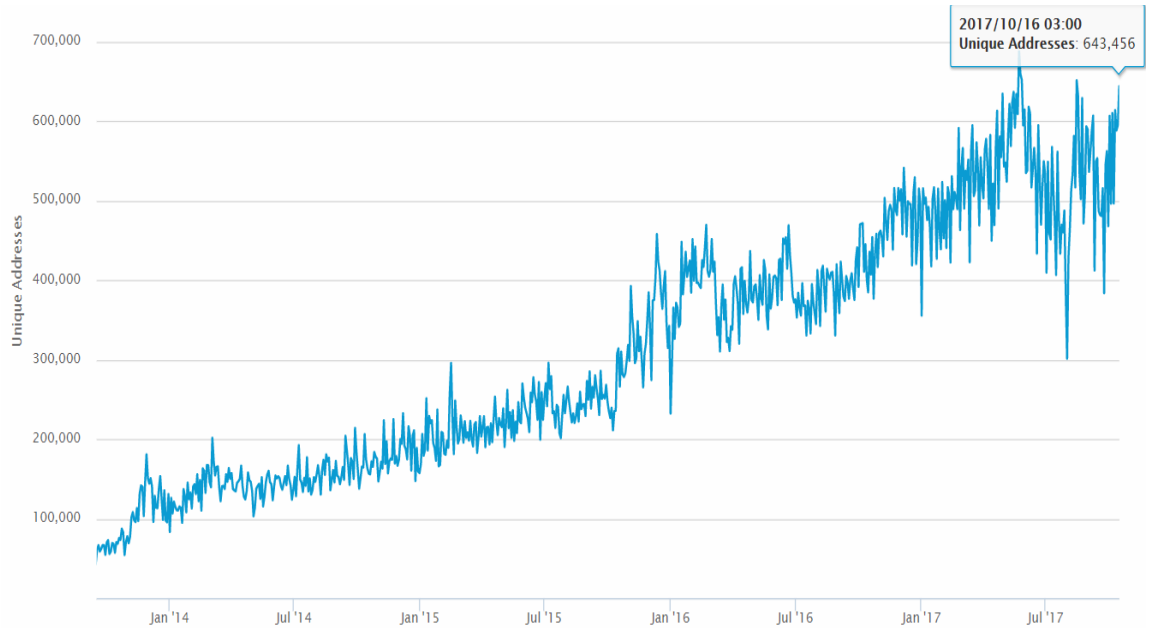
Figure 2. Number of unique address that is currently active on Bitcoin blockchain (Blockchain, 2017c)

Regarding the number of **full-node users**, figure 3 describes generally the image of the full-node community. The data is gathered from the website of *Bitnodes* (2017), the website is designed solely to "*estimate the size of Bitcoin network by finding all the reachable nodes in the network*". As can be extracted from the figure, there are currently 9716 nodes on 18th October 2017. Besides, the website also provides an insightful distribution leaderboard. As can be seen, the United States represents 29.44% of the network, while EU with Germany, France, and Netherlands represent an accumulated amount of 27.2%. (Bitnodes, 2017)

GLOBAL BITCOIN NODES
DISTRIBUTION
Reachable nodes as of Wed Oct 18 2017
12:15:28 GMT+0300 (FLE Summer Time).

9735 NODES
24-hour charts »

Top 10 countries with their respective number of
reachable nodes are as follow.

RANK	COUNTRY	NODES
1	United States	2866 (29.44%)
2	Germany	1516 (15.57%)
3	France	638 (6.55%)
4	Netherlands	495 (5.08%)
5	China	451 (4.63%)
6	Canada	403 (4.14%)
7	n/a	367 (3.77%)
8	United Kingdom	328 (3.37%)
9	Russian Federation	314 (3.23%)
10	Ireland	198 (2.03%)

Figure 3.Global Bitcoin Nodes Distribution (Bitnodes, 2017)

Bitcoin valuation throughout the years

Along with the incremental number of users, follows the valuation of Bitcoin token and total market capitalization. In other words, the non-stop flow of investment has brought the price of Bitcoin to an unimagined level.

Based on the price chart extracted from *blockchain.info* (2017a), a price of a single Bitcoin token is valued below 100$ back in January of 2012. However, an incredible rally has pushed Bitcoin into a hypergrowth mode, marked a new high-level at $1151 in December of 2013 (Figure 4). At this point, the total market capitalization of Bitcoin was $13.5 billion (Blockchain, 2017a). The price represented more than 1000% growth in value, a quite remarkable run-up for a digital currency.
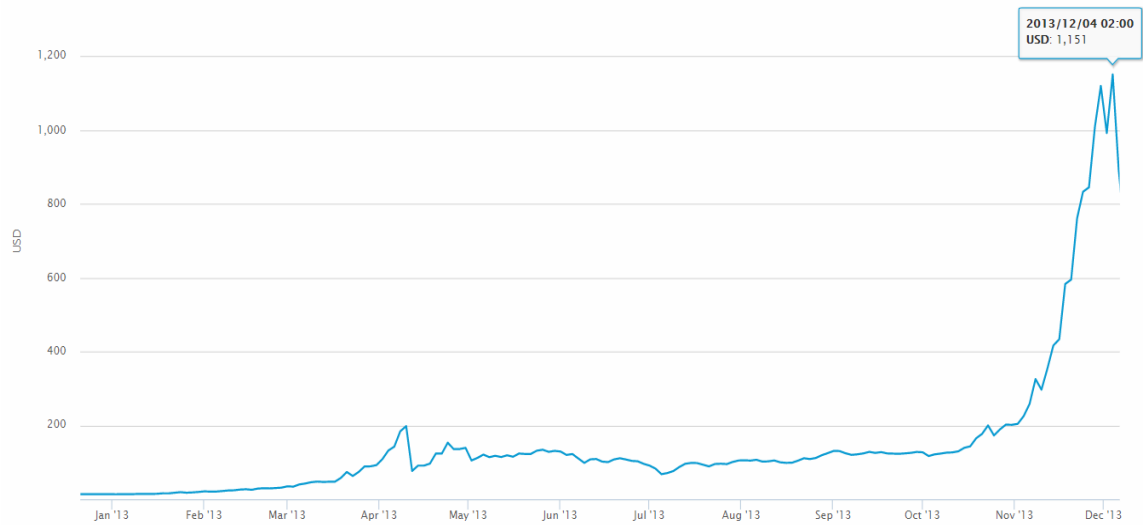
Figure 4. Price chart of Bitcoin currency in 2013 (Blockchain, 2017a)

In 2017, we are witnessing again the second and on-going rally of Bitcoin. As spectated on *cryptowat.ch* (Crypto Watch, 2017), a popular website tracking price of Bitcoin and other cryptocurrencies via different international exchanges, Bitcoin ascended from the lowest point of $735 to an all-time high of $5,920 across all exchanges (Figure 5). This price point has pushed the total market capitalization, according to *coinmarketcap.com*, over $100 billion which is an incredible milestone for Bitcoin. (CoinMarketCap, 2017)
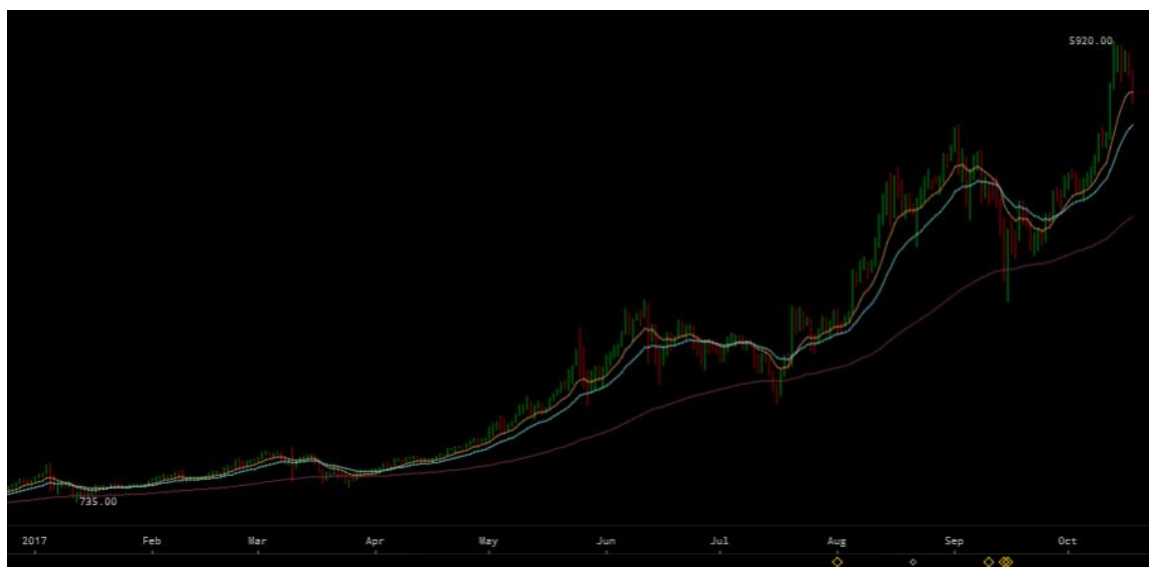
Figure 5 - Price chart of Bitcoin currency in 2017 (Crypto Watch, 2017)

The driven factors of Bitcoin price are controversial. Some said because people purchase it as a store of value due to its nature of being a deflationary currency with a capped supply of 21,000,000 Bitcoins can ever be made. Some other said because the price was driven by manipulative individuals, such as the witness of Bitcoin price surge from below $3000, according to an article about an entity called "*Spoofy*" on *hackermoon.com* (Bitfinex'ed, 2017).

Regardless the motives that driving the price rally in the past few years, it is safe to say that Bitcoin has intrigued many investors as well as merchants around the world to consider adopting this currency, due to the constant growth in value as well as its ecosystem. However, rather than looking at the controversial motives that drive the price, it is more important to look at a Bitcoin from the technical aspects, to fully understand the concept of Bitcoin and the underlying technology blockchain. Only by doing so, readers can make sense of why people invest and adopt Bitcoin as their mean of payment. Thus, this led us to the definition of the technology behind Bitcoin, the blockchain.

2.4 What is a blockchain?

2.4.1 Blockchain in a nutshell

In general, this section will attempt to describe the blockchain in a few sentences, with the use of analogy to draw a very simple picture of the concept of blockchain for readers.

It starts with an example of a notebook, which everyone can own a copy of it. This notebook contains valuable information about everyone (user) whoever wrote on it (the identity of the owner is veiled). However, this notebook has a unique feature. It is that whenever someone successfully made a change on their copy of the notebook, everyone else's notebook will be updated with the exact same change. As a result, everybody's notebooks will be synchronized, and precisely similar at all time. However, the change only happens when everyone, who currently owns the copy, agrees that certain information is required to be verified to make such changes. In other words, a change is made only when everyone agreed so. As a result, at all time, owners of the copy can always rely on and agree that everyone else has precisely the same version of the

notebook. In short, the notebook without a doubt always synchronized, and the changes are only made with an agreement of all owners.

That notebook is called the blockchain, in its simplest term.

2.4.2 Blockchain – definition & the potential beyond Bitcoin

This section will discuss in detail the concept of the blockchain with a clear definition of a blockchain, how it differs from the concept of Bitcoin and the showcase of blockchain potentials.

Definition of blockchain

First and foremost, to clear out the confusion which many people may have, it is crucial to understand that **Bitcoin** and **Blockchain** are two identical terms. The concept of blockchain contains more potential than simply accommodating a digital currency. In fact, the concept of blockchain network is being utilized by Bitcoin to operate and transfer valuable tokens through this network. In other words, blockchain is an underlying technology on which Bitcoin is built upon. However, the blockchain technology was only discovered when Nakamoto published his paper: "*Bitcoin: The Peer-to-Peer Electronic Cash*" (Nakamoto, 2008).Thus, people often mistook Bitcoin for the technology behind it, **the blockchain**.

To fully compress the meaning of blockchain in a sentence, the blockchain is an open decentralized database of every transaction that involving values, which means money, goods, property, work, and even votes. According to Nakamoto, the world needs "*an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party*". To achieve so, it creates a common record among all users and the record is persistently reviewed and verified. (Nakamoto, 2008.)

As an "*open database of transaction*", blockchain ledger contains all the information related to the transactions including the amount of value being transacted via the blockchain as well as the person who sent them. In fact, blockchain ledger stores all the transactions have ever made, with the exact address of the senders and receivers at any specific time. To prove the point, all the transactions on the blockchain can be viewed through the website "*blockexplorer.com*". (Block Explorer, 2017)

The next key point is that the blockchain is fully *"decentralized",* which means there is no central authority who is dominating or controlling the system. Instead, all the work of operating the blockchain is distributed equally among all users. It is done through a competition between a group of users called the miners. According to Antonopoulos (2015), "*Bitcoin mining decentralizes the currency-issuance and clearing functions of a central bank and replaces the need for any central bank with this global competition.*"

Ultimately, as a result, blockchain technology creates an open yet immutable database of value. Immutability means the ability to be immutable, unchangeable, unmodifiable, according to *dictionary.com* (2017).

The potential of blockchain

In fact, up until now, many applications have been built on the blockchain as a proof-of-concept of the blockchain. For example, a digital-wallet provider Abra is making their way through the remittance industry. According to *investopedia.com* (2017c), **remittance** is "*the funds of an expatriate – a person works away from their country – sends to their country of origins via wire, mail or online transfer*". As a pioneer in blockchain-based applications, Abra (2017) is competing with big traditional remittances such as World Remit, or the Western Union. The money sent within minutes and the remittance fee is 5 times lower than tradition process.

Another similar bitcoin-based company in remittance industry is Bitspark. On the main website of their Zephyr project (Bitspark, 2017), Bitspark announced that "*Bitspark is launching Project Zephyr to eliminate banks from the remittance industry by rolling out 180+ fiat pegged cryptocurrencies via the Bitshares Blockchain and making Bitspark's Money Transfer Operators a decentralized cash in, cash out network worldwide*".

In another field, there is a company called Aventus who participates in providing event-ticketing service. Claimed on the website of Aventus (2017), "*Our Business-to-Business ticketing software infrastructure uses the blockchain and artificial intelligence to solve some of the biggest problems in ticket sale and resale*".

Including in the whitepaper of Aventus (2017), the resale issue when an autonomous program called "bots" purchase a large amount of ticket at the pre-sale date, then resell it at much higher prices to other people. Thus, Aventus is built mainly to counter the addressed issue by authenticating accounts and information via the blockchain (Vey & Annika, 2017)

To conclude, we have discussed the ideology of blockchain being an immutable open decentralized database of the transaction, with the showcase of its potential. This leads us to the next part of the thesis by understanding the process of transaction Bitcoins via the blockchain as well as the definitions of the elements contributing to the foundation of Bitcoin blockchain, namely nodes, blocks, block-mining.

2.5 Understanding Bitcoin through transaction procedure, nodes, block and block mining

2.5.1 The Process of Bitcoin transaction

To understand Bitcoin, it is vital to look at this currency from a transaction viewpoint. To elaborate, by following a process of a transaction, we can visualize the interaction of all components that construct this complex system of monetary. In details, through the Bitcoin transaction procedure, we can get to know nodes, block, block mining, proof of work and how they are placed in the process of network operation.

As described clearly in the white paper, Nakamoto presented step-by-step the process of Bitcoin transaction and running the network of Bitcoin blockchain (Nakamoto, 2008). The procedure includes 6 steps:

Step 1: New transactions are broadcast to all **nodes**.

Step 2: Each node collects new transactions into a **block**.

Step 3: Each node works on finding a difficult **proof-of-work** for its block.

Step 4: When a node finds a proof-of-work, it broadcasts the block to all nodes.

Step 5: Nodes accept the block only if all transactions in it are valid and not already spent.

Step 6: Nodes express their acceptance of the block by working on creating the next block in the chain, using the **hash** of the accepted block as the previous hash.

To capture the essence of the process, when a transaction is initiated, it will be broadcast along with other transactions to all **nodes** (or computers that support the network). There is a special node called the **miner** who is specialized in collecting transactions and

bundle them into a **block** (or a file contains many transactions). This file can only be created through a competition between miners, this act is called **block mining**. To successfully create a block, miners are required to find the **Proof of Work**, which can only be done by making a random guess. After one miner has found an answer, it will be broadcast to all other nodes. After being verified that the answer is appropriate (valid and transactions are not already spent), the reward will be distributed to the winner, and all miners will continue working on the next block.

By understanding how Bitcoin network procedure works, it opened the gate to understand deeper the meaning of all mentioned concepts, namely **nodes** and their roles; **block**; **block mining** and **miner**; and **Proof of Work**.

2.5.2 Nodes and their roles in a network

First and foremost, we are discussing **nodes**, which are the users of Bitcoin network.

Bitcoin network has 3 types of users, we refer them as "***nodes***". According to *techopedia.com* (2017b) a node, origins from knots, which is a point of connection in a network. A Bitcoin node, in simple words, is a computer that runs and support the network, by receiving and responding with data. In details, there are 3 types of nodes, called the **miner**, **a full-node** and **a light node** (or lightweight node). (Bitcoin Wiki, 2017e)

The most important work of recording the transactions is being done by the many special full-nodes called the **miners**. In brief, miners bundle the transactions into *"a block"* and record it on the blockchain, the act of recording transactions is called "*block mining*". The work is done by using computing power to solve a complex mathematical algorithm called "*Proof of Work"*. After the block-mining process as the new blocks that contains new transaction is formed, miner will broadcast it to all other full-nodes to verify, as mentioned in the first step of **Bitcoin Network Procedure** (Due to its complexity, the full elaboration of "*miner*", "*block mining*" and "*Proof of Work*" will also be addressed clearly in the following sections) (Bitcoin Wiki, 2017c)

After the block is created by a miner, other full nodes (including miners and non-miners) participate in verifying the block (Step 6 in **Bitcoin Network Procedure**). To emphasize, this includes both miners and other full-node users since miner is a special full-node. According to the definition on *bitcoin.org* (2017b), "*A full node is a program that fully*

validates transactions and blocks. Almost all full nodes also help the network by accepting transactions and blocks from other full nodes, validating those transactions and blocks, and then relaying them to further full nodes".

Regarding the verification process, it is important that a full-node must run the software provided by the core developers, to ensure that all nodes agree to the common terms when verifying transactions. It is because all nodes verify transactions following a consensus rule that is approved by the majority. Thus, tampered third-party programs that using different rule will lead a full-node to be rejected. (Bitcoin.org, 2017b.)

Lastly, **light-node** (or lightweight node) is a computer that only sends out the signal of transactions, but not taking part in supporting, verifying or recording transactions. Light-weight users only download a portion of the blockchain ledger and use it to initiate the transaction. Light-weight nodes will follow the rules decided by full nodes. (Bitcoin Wiki, 2017e)

To summarize, Bitcoin network composes of 3 types of nodes, namely full nodes, light nodes, and miners which are special full nodes. In short, miners perform the most important task by proceeding transactions through "*block-mining*". Meanwhile, full-nodes acts as checkpoints, or intersections which help to support the network and to verify the validity of all transactions proceeded by miners. Last but not least, light-node are users who submit the transactions to proceed, but neither support the network nor having any impact on the network, light-node users follow whatever the majority of full nodes decide.

2.5.3 Block

In a blockchain, if a transaction wishes to be proceeded and confirmed on the blockchain, it requires a **block** to move that transaction. According to Bitcoin Wiki, "*Transaction data is permanently recorded in files called blocks*". (Bitcoin Wiki, 2017a)

Thus, to define, a **block** is a file that contains transactions. In fact, many transactions can be recorded in a singular block. To emphasize, multiple blocks connect in a singular line called the blockchain. (Bitcoin Wiki, 2017a)

In analogy, with the blockchain as a ledger, the block acts as an individual page within that ledger. All the block linked in a singular sequence and creates the blockchain. Bitcoin

Wiki clarified, "*Blocks are organized into a linear sequence over time*". (Bitcoin Wiki, 2017a)

The picture below shows visualize how a newly created block connects to the outstanding blockchain.
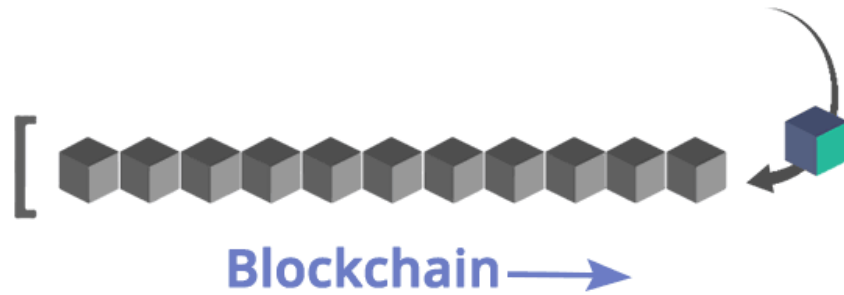
Picture 1. How a new block is visualized added to a blockchain (Edureka!, 2017)

There is a single key point which emphasizes greatly the importance of block and why the concept is being used in blockchain technology. To truly capture the essence of the matter, the block is created using the value from its previous block. In fact, a newly created block contains within itself the **hash value of the previous block**. Even though, hash value or hashing technique is far too complex for the design of this thesis, it can be described as a technique of transforming a file of different sizes into a fixed-size code (or hash). By doing so, it not only masked and preserve the original identity of the data but also streamlined the data that Bitcoin network operates upon. (Antonopoulos, 2015)

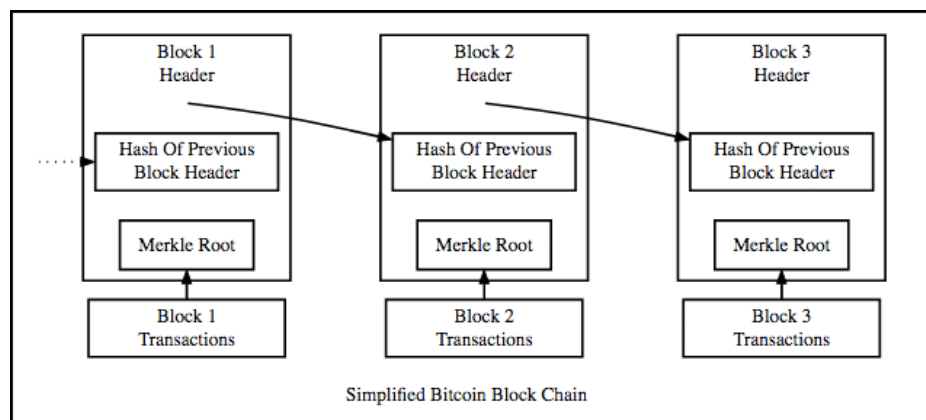The figure below explains describe the linkage between blocks.

Figure 6. A simplified blockchain with multiple blocks connect with each other into a singular line (Nakamoto, 2008)

Due to the nature of hashing, any small change in the original file will lead to a change in the fixed-size code (or hash). As the newly created block is created using the hash from the previous block. Thus, any changes that happened to precedent block which lead to sequences of changes to all the following blocks in the blockchain. Thus, the more blocks are created, the harder it is to change the data of the previously made blocks. (Blockgeeks, 2017)

To summarize, block is a vessel that contains transactions through the blockchain. In fact, blocks are strung together into a singular chain called the blockchain. Each block is generated through block mining, and it uses the hash value from the previous block. Thus, any changes in a specific block will consequently lead to the change of all the following blocks. Otherwise, the blockchain will be rejected.

To continue, it is intriguing to investigate the act of creating new blocks or change information of created blocks. This leads us to the very next point of this paper, by understanding **block mining** and the users who perform the act, the **miners**.

2.5.4 Block-mining and the miner

In this section, the focus will be elaborating the definition of block mining, understanding the ecosystem of the miners, and investigating what it takes to create a block.

Block mining & the reward

Block mining or Bitcoin mining is defined by two main purposes.

The first purpose is to **create the block** through which transactions will be recorded and proceed. The process is being carried out by solving a complex mathematical puzzle, called the Proof of Work. Only by doing so, block mining will provide security and validation of all transactions and blocks. (Nakamoto, 2008)

The second purpose is to create new Bitcoin token which will be distributed as a **reward** for the miner who successfully resolving the puzzle and created a new block. In other words, every time a new block is created, the miner who found that block with be rewarded with Bitcoin tokens (Nakamoto, 2008). Further elaboration on the reward can be found in section 2.6 – "**Proof of Work Reward**".

As a result, block mining creates a **competition** for miners, for the rewards. For instance, miners all around the world use their computing powers to compete with others to see who can solve the Proof of Work faster and earn the reward. (Antonopoulos, 2015)

To emphasize, only the first miner (node) to solve the proof-of-work will receive the reward. After the proof-of-work for a certain block is solved, and the reward for that block is distributed, miners will carry on and find the next block. (Nakamoto, 2008)

Block mining consumes resources

Block mining is a resource-intensive process. For instance, block mining is technically solving a mathematical problem using computing powers, and this act can consume a considerable amount of electricity for computers to solve such problems.

An interesting insight was shown by Digiconomist.com (2017) – a website dedicated to tracking the consumption of electricity on Bitcoin mining. They stated that "*The entire Bitcoin network now consumes more energy than a number of countries, based on a report published by the International Energy Agency. If Bitcoin was a country, it would rank as shown below.*" (Digiconomist, 2017)

As extracted from the chart, Bitcoin ranked 69th with a total consumption of 23.28 TWh (Terrawatts hours) annually. To compare, total electricity consumed by Finland in 2016, is 85.1 TWh, according to report from Statistics Finland (2017).
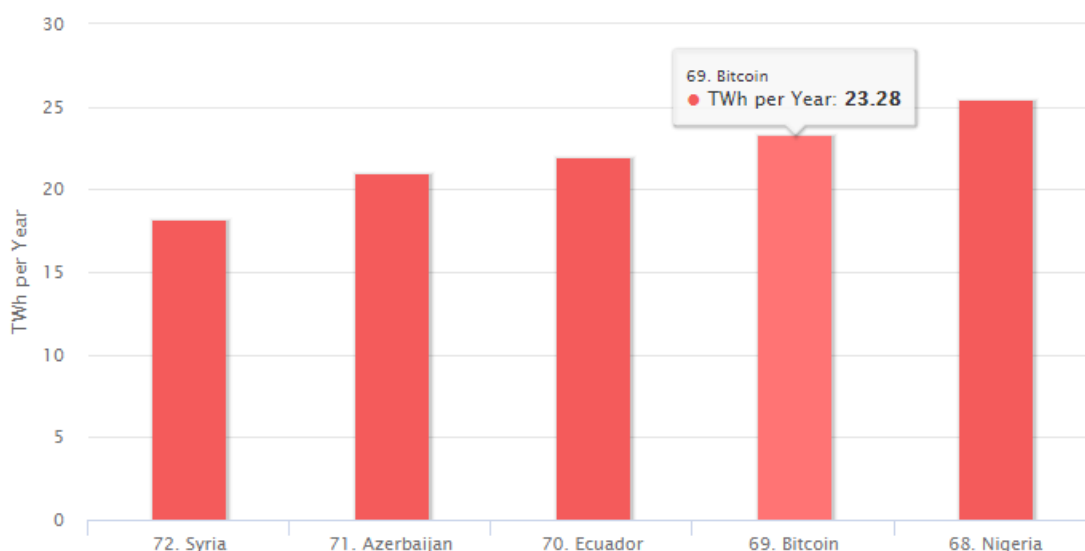

Figure 7.Energy consumption by country chart (Digiconomist, 2017)

The ecosystem of miners

To have a clearer view of block mining, it is most evident to see it through the perspective of a miner – who perform the block mining

Many examples show how bitcoin mining ecosystem has changed within a decade. In the past, people can solve the Proof-of-Work algorithm using a single personal computer (or a laptop). However, due to the constant increase of **block mining difficulty** and massive competition, it would take roughly 10 years for the same computer to solve the same algorithm in 2017.

According to Marco Streng (2017) in his talk at TEDx – a global program where people shares ideas and experiences, Streng is the owner of one of the largest Bitcoin mining facilities in the world. He shared "*a friend of mine used to mine 3,000 Bitcoins on his laptop*". However, he then said, "*the same amount of work would cost me a facility with thousands of supercomputers to perform nowadays*". (Streng, 2017)

Another example is from Long, CEO of FinalHash.com, a big miner in the Bitcoin industry. Interviewed on a documentary film conducted by VPRO (2015), he shared that to mine blocks for the reward (see 2.6, Proof of Work reward), "*all my mining facilities combined consumed up to $100,000 a month for electricity in 2015*".

Beside centralized miners, who owns thousands and even millions of computers which generated a massive amount of computing power, there is also an existence of **mining pool** concept. The idea behind the mining pool is that everyone can participate in mining, regardless of their computing power. To elaborate, as Bitcoin mining is hard and requires a lot of computing power to execute, yet with mining pool, users can join together in a pool and participate in block-mining and share the reward of the mined Bitcoin (see 2.6, Proof of Work reward). (Eyal & Sirer, 2013)

According to Eyal and Sirer (2013), "*all members contribute to the solution of each crypto puzzle and share the rewards proportionally to their contributions*". There are many mining pools that currently operate to serve the community of individuals who want to participate and support the network, such as Slush Pool, AntPool, F2Pool, BTCCPool (Bitcoin Mining, 2017). The ultimate purpose of mining pool is also to keep Bitcoin

blockchain decentralized, as the mining activity is being delegated or shared towards all contributing nodes.

To conclude section 2.5.4, the first purpose of block mining is to create new blocks for transactions to be proceeded, through which the security of Bitcoin is formed. Secondly, block mining also put into circulation new Bitcoin tokens, which is distributed as a reward for miners. Additionally, miners proceed transactions through a resource-intensive competition called block mining. Block mining means solving the **Proof of Work** using computing power. The act can be done via single entities or by a community of mining pool. The conclusion guides us to the very last point of understanding Proof of Work and its attributes.

2.5.5 Proof-of-work

The ideology of Proof of Work

Proof of work is the essence of Bitcoin mining. It is an algorithm that implemented to make sure that Bitcoin is not being created out of thin-air but instead consuming time and resources. According to *bitcoinmining.com* (2017), it is referred as *"to ensure the information (the new block) is difficult (costly, time-consuming) to be made"* which presents the economic sense of Bitcoin.

However, it is important to clear out the potential confusion between 2 terms "*block mining*" and "*Proof of Work*". To elaborate, block mining is a process, while the Proof of Work algorithm is used as a methodology, or mechanism within that process. (Nakamoto, 2008)

Bitcoin uses HashCash Proof of Work for block mining (Nakamoto, 2008). According to Adam Back (2002) in the paper "*Hashcash - A Denial of Service Counter-Measure*", the system is "*originally proposed as a mechanism to throttle systematic abuse of un-metered internet resources such as email and anonymous remailers in May 1997*". Later on, he picked up the concept and develop further. As a result, he came up with "*HashCash Proof of Work that uses Central Processing Units (CPU) to generate Proof of Work.*" (Back, 2002)

In 2008, Nakamoto (2008) put into good use of The Hashcash CPU cost-function and introduced Bitcoin mining that utilizing this cost-function. This explained why Bitcoin mining requires computing power to perform the acts. (Nakamoto, 2008)

Proof-of-Work is designed so that, through block mining, "*the number of blocks found each day by miners remains steady*" (Bitcoinmining.com, 2017). It is mainly to prevent the spam of block-mining as well as the attached reward whenever a block is mined (see 2.5.4). In other words, every time a block is solved, miners will be rewarded with new Bitcoin. Thus, by controlling the time in which is a block is created, means controlling the stability of new Bitcoin supply.

Proof of Work difficulty

Regarding Proof of Work difficulty, it is stated (section 2.5.4) that block mining uses difficulty adjustment of Proof of Work algorithm that changes depends on certain circumstances. (Nakamoto, 2008)

In fact, the difficulty of proof-of-work will be adjusted every 2016 blocks, focuses on a **10-minute target** to produce each block. According to Bitcoin Wiki (2017b), "*The difficulty is adjusted every 2016 blocks based on the time it took to find the previous 2016 blocks*". The website added "*If the previous 2016 blocks took more than two weeks to find, the difficulty is reduced. If they took less than two weeks, the difficulty is increased*". (Bitcoin Wiki, 2017b)

To elaborate, as Bitcoin mining mainly uses Central Processing Units (CPUs) and Graphic Processing Units (GPUs) to solve the Proof-of-Work, Moore's Law suggests that the capacity of such equipment will constantly increase. In fact, Moore's Law states "*the number of transistors in a dense integrated circuit doubles approximately every two years*". (Intel, 2015)

According to Intel (2015), as the largest microchip processor producer, they stated that Moore's law has been accepted as *"the golden rule of electronic industry"*. Thus, it is irrefutable, such development of technology will potentially increase the capacity of processing hardware such as CPUs and GPUs. Indeed, it will consequently lead to a faster speed of block-mining, which is against the original intentional speed limit of 10 minutes. (Intel, 2015)

As a result, whenever the average generation speed of a block is different than the target set by the system, the Proof-of-Work difficulty will be adjusted in response.

As the results drawn from Figure 8, the difficulty of block mining witnessed an upward trend in response to the increasing hashing power (computing power), in the period of 9 months in 2017. The red line represents the difficulty, while the green line represents the average hashing power (hash rate) of every 2016 blocks created. (Bitcoin Wisdom, 2017)
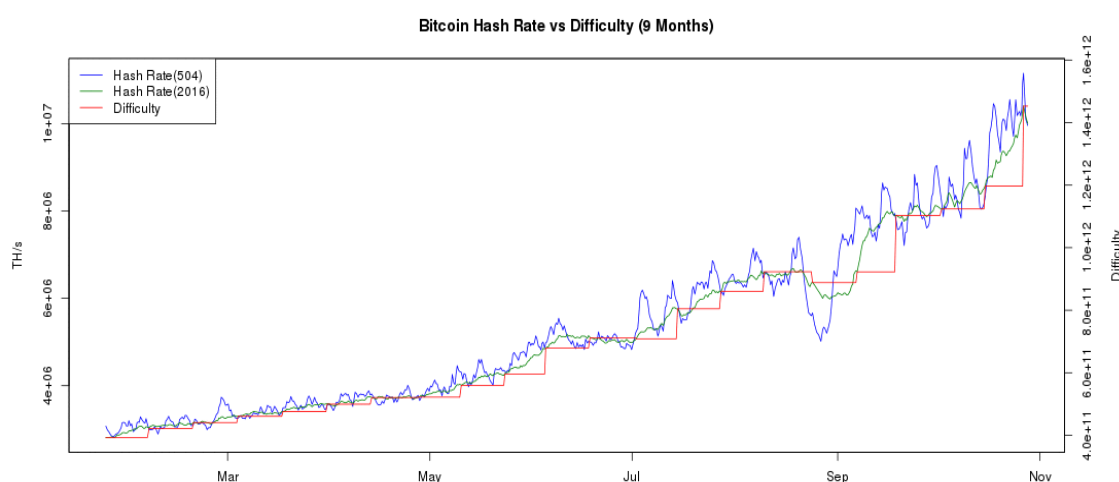
Figure 8. Bitcoin Hash Rate vs Difficulty (9 Months) (Bitcoin Wisdom, 2017)

After the Proof-of-Work is solved, the system will present a **block hash** (see 2.5.3) for the winner to prove they have solved the Proof of Work, and collect the reward.

In fact, the block hash acts as a "*Proof of Work*" to prove that the miner did spend the time and effort to generate this piece of information. An example drawn from Bitcoin Wiki of a block hash is *000000000019d6689c085ae165831e934ff763ae46a2a6c172b3f1b60 a8ce26f.* (Bitcoin Wiki, 2017d)

Proof of Work Reward

Previously mentioned, after successfully solved the Proof of Work, the miner will be rewarded with new Bitcoin. However, it is important to reveal that the reward decreases at a fixed rate through time. (Antonopoulos, 2015)

According to Antonopoulos (2015), for every 210,000 blocks, or approximately every four years, the rewards or the new issued Bitcoin will be reduced by 50% per block. During

the first 4 years of Bitcoin network operation, each block rewards miners with 50 Bitcoins. In 2017, according to Bitcoinblockhalf.com (2017)– a website tracking Bitcoin reward statistics - each block contained only 12,5 new bitcoins.

Finally, after 13.44 million blocks, in approximately 2140, a total amount of 21,000,000 Bitcoins will be distributed. After that, the system will produce no more new Bitcoins. Thus, instead of receiving Bitcoin as a reward, miners will be benefited solely through the transaction fees. (Antonopoulos, 2015)

Summary

To conclude, the ideology of Proof of work is reinforcing the fact that block mining is an intensive and difficult process. It prevents miners from spamming blocks to receive rewards. Moreover, with a self-adjusted difficulty algorithm. Proof-of-Work will also negate the impact of mining hardware development on block mining. Combined with a fixed-rate decrease in mining reward, it results in stability of new Bitcoin supply.

2.6 Summary

In section 2, the paper has resolved the first objective of the paper:

- Explain and understand in simplified terms the concept of Bitcoin, the blockchain, and how the Bitcoin transaction is conducted.

It is described through the concept of Bitcoin as a digital currency as well as the growth of the currency through the incremental number of nodes (users). Moreover, the paper also tapped into the understanding of Blockchain and its ability to be an immutable decentralized database.

With the knowledge regarding the blockchain, we explained how the transactions are conducted via the act of block mining, through the competition of miners by solving the Proof of Work.

Even though, the results might only touch the surface of Bitcoin and the blockchain technology, along with many in-depth technical terms which are left unfold, such as cryptographic hash, hashing technique, Merkle root, simplified verifications, etc. Regardless, it will draw a brief picture with knowledge for any newcomers, especially

merchants, who are having thoughts of adopting this innovative invention into their daily business.

3 LITERATURE REVIEW

3.1 Definitions

3.1.1 Overview

As mentioned, in 2015, the cooperation of Bitpay and Ingenico has resulted in a Point-of-Sale system for Bitcoin (Redman, 2015). It opened the gates for merchants all over the world to start accepting Bitcoin as mean of transactions in their physical store. From accepting only online transactions, Bitcoin can now be physically accepted through the use of debit cards, or mobile devices such as phones, tablet, etc.

Therefore, this section will provide clear definitions about the Point-of-Sale system and the integrated QR-code technology which is heavily used in accepting Bitcoin. The purpose is to provide readers with an understanding towards the technology that is already widely adopted by merchants globally in the traditional transacting method.

Additionally, as the 2nd objective of the thesis is to investigate the added values and the challenges of accepting Bitcoin through the Point-of-Sale system, it is crucial to understand fully the concepts of Point-of-Sale, with the extra knowledge toward QR-codes and the procedure of accepting Bitcoin at the POS.

3.1.2 Point of sale (POS)

Point of sale (POS) is the places where transactions are conducted. POS can be described either on a macro scale as a market, a mall, or a city. However, often on the micro scale, it is the area where customers finalize their transactions, such as checkout counter. POS is also known as Point of purchase. (Investopedia, 2017b)

Point of sale system can be visualized as a set of hardware which automates the transacting process as well as tracking important sales information. A fundamental system includes an electronic cash register and a software which act as the data tracking assistant. Furthermore, a POS can be added to extra functionality such as soft-touch devices, card or code scanner (barcodes & QR codes). (Investopedia, 2017b)

3.1.3 Bitcoin POS

In the case of Bitcoin, the Point-of-Sale system has its application for both online and physical transactions. However, as the focus of the thesis is to investigate the use of POS in-store, thus this section will only address the use of Bitcoin POS in physical stores.

There are two different ways that Bitcoin POS can be set up. According to *coindesk.com* (2015), merchants who accept Bitcoin in their stores can either do it by themselves or through a popular method of using **a third-party POS solution**.

Regarding the first solution, merchants can generate their own Bitcoin address and start accepting Bitcoin which is deposit directly to their address. In this case, merchants will conduct the transactions in Bitcoin, and receive Bitcoin as a final currency. However, due to the fact that price of Bitcoin can be extremely volatile, it can be financial-risky when it comes to a processing large amount of orders. Thus, many merchants seek for the alternatives of accepting Bitcoin without exposed themselves to the risk of price fluctuation. (Coindesk.com, 2015)

The alternative is to use a third-party POS solution, which involving exchange Bitcoin into fiat currency at the time of sale. In other words, merchants will receive the payments in Bitcoin, however, the Bitcoin will be exchanged into fiat currency as a final currency for merchants. By doing so, merchants can still welcome Bitcoin transactions without having a fear of the fluctuation risk. (Coindesk.com, 2015)

Bitcoin POS services are now provided by many companies, such as Bitpay, XBTerminal, Coinify, Coingate (Coindesk.com, 2015). Their Bitcoin POS technology is reported heavily rely on the use of QR-codes to execute the transactions.

Extracted from the website, all the mentioned companies implemented QR-code into their solution (Coindesk.com, 2015). Especially stated on both Coinify (2017) and Coingate (2017) websites that QR-code is the only solution for the mobile applications.

In a short definition of mobile wallet and mobile Bitcoin wallet, according to *techopedia.com* (2017a), the **mobile wallet** is "*a virtual wallet that stores payment card information on a mobile device*". Meanwhile, mobile Bitcoin wallet is an application that stores Bitcoin on mobile devices, such as phones, tablets, with the example of Bread Wallet – a popular mobile wallet for Bitcoin. (Bread, 2017)

3.1.4 QR-code

Quick Response Code (QR Code) is a technology that uses a machine-readable label that stores transaction information (ABA, 2016). The label or the code is a matrix barcode, often referred as a two-dimensional barcode (2D barcode). Figure 9 shows an example of a QR code (Cline, 2015). The QR code was first designed to be used in the automotive industry during 1990s period, tracking throughout the manufacturing process. Nowadays, it is used for many different purposes such as product-tracking, item identification and obtaining information via scanning a QR code with mobile devices.

For example, when a code is a scan, the code activates a connection with a contact information or a website address which is embedded in the code (Wonderopolis, 2017) For the use of Bitcoin, QR codes often represent the address of the receiver, due to the reality that a Bitcoin address can be long and risky to re-write without making mistakes. Thus, by using QR-codes, the sender only need to scan without any re-writing activity.

Figure 9. An example of a QR Code

In use, according to Cline (2015), there are two main cases for enabling a mobile payment with QR code:

- The consumer scans the unique QR code for the store with their smartphone and then make the payment. In the case of Bitcoin, the QR-code is often the wallet address of the store.
- The store scans the consumer's smartphone-screen, containing the consumer specific QR code and then the transaction is made.

In the case of Bitcoin, the technology proved its compatibility due to its synergy with Bitcoin address. For instance, Bitcoin address is often long and easily exposed to the

risk of mistyping. An example of a Bitcoin address can be "*16UwLL9Risc3Q fPqBUvKofHmBQ7wMtjvM*", which is random and hard-to-remember for common eyes. Therefore, by implementing a Bitcoin address into a QR-code for scanning purposes, it reduces the risks of mistyping, hence the permanent loss of Bitcoin.

3.1.5 Process of accepting Bitcoin using QR-code POS

The procedure of accepting Bitcoin via the use of QR-code is simple. As mentioned, the QR-codes used by merchants is often linked directly with the address of the stores, thus by scanning the QR-codes, the address of the receivers is automatically filled without risk of the mistyping situation. It is important to mention that Bitcoin transaction is irreversible, due to the characteristics of a block and the process of block mining (see 2.5.3)

According to Coingate (2017), a company that provides third-party POS solutions for merchants to accept Bitcoin listed 4-step guide on how to receive Bitcoin using QR-code POS.

- Step 1: The product is being sold in-store with a preset price of choice, in any currencies.
- Step 2: Coingate will then calculate how much bitcoins it is worth, in real-time, by selecting the best price from several Bitcoin exchanges.
- Step 3: Customers will then pay in Bitcoin or other types of cryptocurrencies
- Step 4: Store will receive payments in pre-set currency, instead of Bitcoin.
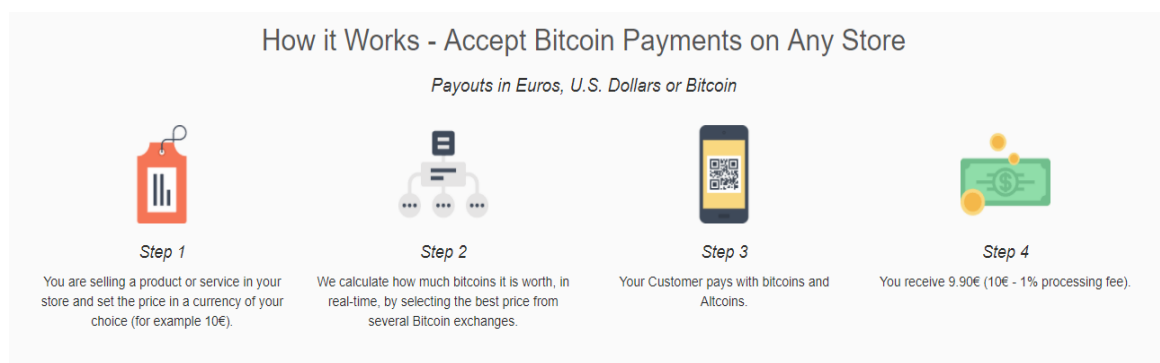
Picture 2. Instruction on Bitcoin transaction using Coingate POS (Coingate, 2017)

3.2 Framework

3.2.1 Overview

The idea of this section is to create a framework which can be used as a backbone to answer the 2nd objectives:

- Based on the case of Finnish retailers in Finland, what is the added values as well as the challenges when adopting Bitcoin Point-of-sale system in a physical store?

In order to do so, this paper will use the theory of Roger's Five Factors with the purpose to create a general overview of the factors that potentially affect the new technology adoption rates. From these characteristics, a set of questions will be built in order to point the focus toward understanding the benefits and challenges of adopting Bitcoin POS for retail shops.

3.2.2 Diffusion of Innovations: Roger's Five Factors

This paper will implement the theory of Diffusion of Innovations called Roger's Five Factors to find out the main influences factors affecting merchants when it comes to implementing new technology (Bitcoin POS). Then, we can debate, apply and generate our own framework using this theory as the background literature.

For the innovations itself, Rogers' has identified five characteristics, called Rogers' Five Factors, that facilitate the rate of adoption (Rogers, pp. 213-232):

- **Relative advantage** is the perceived advantages of the innovation over other alternatives, e.g. lower cost, better performance, or superior design.
- **Compatibility** is how well the innovation in compare with existing values, previous experiences, and needs of adopters. For example, adopters tend to expect new products to work in a similar way as their previous experiences.
- **Simplicity** is how easy it is to understand and use the innovation.
- **Trialability** is the ability to try and experiment with an innovation without having to buy it first. This is especially important for later adopters who require less uncertainty before they make a buy decision.

- **Observability** is the possibility to see the results of the innovation. If it is easy to see other people use and get advantages from a product, or if it is easy to demonstrate the product to customers, it will increase the rate of adoption.

3.2.3 Applying the theory

This section will debate the theory of Roger's Five Factors (Rogers, pp. 213-232) to point out how the mentioned five factors will be applied to generate the findings for the thesis. Furthermore, this section will also generate a preset question which is based on and aligned with the characteristics of Roger's Five Factors Theory. The pre-set questions will then be used to develop a more specific series of questions, which will be used as the questionnaire for the findings.

According to Roger's Five Factors, the five characteristics mentioned are **relative advantage, compatibility, simplicity, trialability** and **observability.** It is crucial to remember that these five characteristics are used to facilitating the adoption rate of a new technology.

However, the focus of the 2nd objective is to find out the added-values and challenges that the adoption of Bitcoin brings out for the merchants, which serves different goals. Yet, from different perspectives, it can still be applied to produce the desired results. Initially, we need to examine each of these all five characteristics through its potential of addressing the objectives. At the same time, it is necessary to eliminate the characteristics that are out-of-focus.

Relative advantage

Relative advantage is the perceived advantages of the innovation over other alternatives.

The characteristics point directly to the perceived advantages that the technology or the adoption of Bitcoin POS has over other alternatives. In other words, it focuses on the intrinsic values that the new system contains in comparison with other payment systems.

Thus, by applying these characteristics, we can generate the questions regarding the performance of Bitcoin POS over other the traditional POS that merchants have perceived. For example, the potential results can be about the initial cost of set up, cost of transactions, the speed of transactions, security, etc.

The questions generated in terms of **Relative advantage** are:

- o In comparison with traditional currency and point-of-sale system, what do you think of Bitcoin and its payment system?
- o What are the competitive edges that Bitcoin payments have?
- o What do you think about the initial cost of setting up the system?
- o What do you think about the fees for making transactions?
- o What do you think about the complexity of conducting the transactions?
- o What about the security of the system as a whole? Have you witnessed any fraud?

Compatibility

Compatibility is how well the innovation in compare with existing values, previous experiences, and needs of adopters.

Compatibility directs the answers toward how the new technology fits into the existing infrastructures, experiences and the needs of adopters. In fact, by applying these characteristics, we can investigate the satisfaction of merchants regarding the adoption. Furthermore, the **Compatibility** characteristics also promise the results in changes that Bitcoin adoption has brought to the stores, with either negative or positive result. For example, merchants may reveal whether Bitcoin adoption brings more customers to the store, or the change is too minimal. As a result, we can investigate whether merchants think the investment is worthy or not.

Thus, the question generated from this characteristic are:

- o What changes since the adoption of Bitcoin have you witnessed?
- o Are you satisfied with these changes? (Do you think the investment worth your effort?)

Simplicity

Simplicity is how easy it is to understand and use the innovation.

Simplicity explains the ease of understanding and uses the technology. It can be elaborated towards the process of making transactions using Bitcoin POS. In fact, the characteristics can be used to investigate the familiarity of the merchants toward QR-codes technology, or how to use the Bitcoin POS. The results will show the potential

challenges that merchants perceived during the period of adopting Bitcoin payment system.

The questions generated from **Simplicity** are:

Setting up procedure:
- o What do you think about the process of setting up the system?
- o How do you feel when learning how to use the system?
- o How do you feel when educating staff on how to use the system?

During the implementation:
- o How do you feel when using the system? For example, running the software, making payments?
- o Regarding the convenience, how is the process of conducting a Bitcoin payment?
- o Have you ever experienced a technical difficulty?

Post-purchase:
- o How do you feel towards managing Bitcoin payments, regarding taxations, accounting?

Trialability

Trialability is the ability to try and experiment with an innovation without having to buy it first.

Trialability will be used to understand whether it is an initial fixed cost to try accepting Bitcoin through the POS or not. If there is, how is the fixed price affects the decision of adopting Bitcoin POS from the perspective of merchants. Through Trialability, potential challenges may arise.

The questions generated from **Trialability** are:
- o Can you try the Bitcoin POS before adopting it?

Observability

Observability is the possibility to see the results of the innovation.

This characteristic is irrelevant regarding the thesis topic. It refers mainly to how the success of one adoption will influence others to adopt the technology. In other words, observability shows the contagiousness of the adoption. Regarding the topic, it points towards the benefits and challenges of adopting the system rather than how fast does

the adoption spread. Thus, the characteristics will not be addressed so as to retain the focus of the topic.

4 METHODOLOGY

4.1 Data Type

Based on the objectives of the thesis, which focus mainly on extracting subjective opinion towards the benefits and challenges of adopting Bitcoin through the point of sale system in a physical store. Thus, the research of this paper focuses on collecting **qualitative data**.

To define, qualitative data is "*based on meanings expressed through words*". Furthermore, "*collection results in non-standardized data requiring classification into categories*". (Saunders, Lewis, & Thornhill, 2009)

4.2 Population

As the objective of this paper is to investigate the added values and challenges of accepting Bitcoin through Bitcoin POS as a mean of payment for Finnish merchants. As Bitcoin POS can only be conducted during the transacting process occurs in a physical store, the target population of this paper will be toward Finnish merchants who are operating brick-and-mortar stores, regardless their field of business. Furthermore, due to the limitation of resources, the location of the population will be fully within Helsinki area of Finland. However, according to the data on *coinmap.org* (2017), a considerable percentage of 30% of physical stores that accepted Bitcoin in Finland are in Helsinki, which contributes to the decision of choosing Helsinki as the targeted location.

To clarify, as there are no large enterprises that currently accept Bitcoin as a mean of payment in Finland. The research targeted at Small-and-Medium Enterprises and Businesses (SMEs). In fact, the majority of potential population are retailers in the different business fields, such as music stores, clothing retailers, and bars.

4.3 Sample

Among 30 potential stores, this paper focuses on a sample of 10, with the estimated success rate of 50% of 10 stores will agree to participate in the interview. As a result, this gives an estimation of 3 - 5 physical stores.

4.4 Method of collecting data

The list of 10 potential Finnish merchants was randomly picked from the approximately 30 mentioned merchants within Helsinki area.

As the only qualitative data will be collected, thus it was most convenient for both author and merchants to conduct a face-to-face interview, which approximately lasts for 20-40 minutes.

The objective was to contact all 10 physical stores to inquire appointments with the merchants. Due to potential unexpected failures in contact, more merchants will be selected from the unpicked lists to ensure the targeted sample.

The interview, in different scenarios, can be done both face-to-face or online (via online communication such as Skype, Facebook). The whole process of conducting interview was recorded under the consensus between both interviewer and interviewee, as well as the publication of such information.

The interview will focus on answering all most of the designed questions in the questionnaire to extract the most precise information toward the potential added-value and challenges that Finnish merchants perceived when adopting Bitcoin POS as a mean of payment.

4.5 Implementation

This section describes how the data collection process occurred.

Firstly, the author collected a list of 10 potential Finnish merchants, who currently own one or multiple physical stores in Helsinki areas and announced that they accept Bitcoin in their business by listed on coinmap.org.

Name	Website	Type	Address
Hantti	https://www.hantti.com	Tattoo	Caloniuksenkatu 3
Gurkha	http://www.gurkha.fi/	Restaurant	Hiihtäjäntie 1
Stadin Ruoka Taksi	http://stadinruokataksi.fi/	Food Delivery	Nahkahousuntie 5
Mansteri	https://store.mansteri.com/	Electronic Shop	Hauhontie 6 B 5B
Belle Modeste	http://www.bellemodeste.com/	Wedding dress	Ruoholahdenkatu 6
Hug Bike Shop	https://hugbikeshop.fi/	Bike Shop	Köydenpunojankatu 4 (City Center)
Time Bar	http://www.timebar.fi/	Bar	Mikonkatu 8
Äx	https://www.levykauppax.fi/	Music Store	Fredrikinkatu 59
Konsolinet	http://en.konsolinet.fi/	Game Store	Kamppi 4.krs
Varus Teleka	https://www.varusteleka.fi/fi/	Military stuff	Ruosilantie 2 (Near old house)
SPIS	http://spis.fi/	Restaurant	Kasarmikatu 26
Habibi	http://www.habibi.fi	Restaurant	Malminrinne 6

Picture 3. List of 10 potential contacts within Helsinki areas

However, the author successfully made direct contact with 8 out of 10 stores. In details, one store owner did not speak the English while the other insisted have never heard of Bitcoin, which was not qualified to be interviewed. To continue, 2 out of 8 do not accept Bitcoin in their store, which is Äx and Gurkha, regardless of their listings.

Among the last 6 potential stores, 3 of the stores have agreed to participate and conduct a face-to-face interview with the author. While other 3 stores refused to cooperate. Two store owners claimed to be busy during the high season of Christmas, while the other claimed to be an employee who refused to give contact with the manager who is in charge of Bitcoin adoption.

As a result, the 3 stores that participated this research are Time Bar, Konsolinet video game store, and HUG Bike Shop. The owners of the place are Antti Pietarinen, Juho Korkeaoja and Henri Tikkanen, respectively

The structured interview took place at directly at their stores through a series of 18-20 questions. The results can be found in Appendix 1, 2 and 3.

The questions were carefully designed so that it will start with an introduction about the business and the owner, then leads to how and when the owner adopted Bitcoin POS. After that, different information regarding the frequency of Bitcoin transaction and the model of Bitcoin POS used.

To the main idea, the questions used to tackle the main objective were carefully brainstormed by aligning the author understanding of Roger's Five Factors theory with the definitions of Bitcoin and Bitcoin POS.

Combined with knowledge extracted from multiple sources, different aspects of a mobile POS performance were generated. For example, according to Graham (2017), to measure the impact of a Point of Sale system, "*average number of transactions per day per store, average dollar amount per transaction, associate sales per hour, add-on sales and transaction duration*".

Furthermore, most of the knowledge regarding Bitcoin and how transactions work was extracted from the book "*Mastering Bitcoin*" of Andreas Antonopoulos (2015). As a result, a set of questions were self-generated, as will be listed in the next section.

4.6 Questionnaire

The 24 questions (including the optional questions) will be carried out, however, some optional question will be skipped if the information was already mentioned or revealed by the interviewee.

1. When did you start accepting Bitcoin?
2. How do you receive the payments, to a personal wallet or through third-parties POS?
3. Why did you decide to accept Bitcoin as the means of payment?
4. How often do you receive a Bitcoin payment, per week (month)?
5. Can you give me an estimation of revenue from Bitcoin?
6. Which system/hardware do you use to receive Bitcoin?

Relative Advantages

7. In comparison with traditional currency and point-of-sale system, what do you think of Bitcoin payment system? (What do you think about the system as a whole?)
8. In which aspects do you think Bitcoin payment system perform better, in comparison with the traditional POS?
9. (Optional) What do you think about the initial cost of setting up the system?
10. (Optional) What do you think about the fees for making transactions?
11. (Optional) What do you think about the complexity of conducting the transactions?
12. (Optional) What about the security of the system? (Any potential security flaws?)

Compatibility

13. What changes since the adoption of Bitcoin have you witnessed?

14. Are you satisfied with these changes?

Simplicity

Setting up procedure:

15. What do you think about the process of setting up the system?

16. How do you feel when learning how to use the system?

17. How do you feel when educating staff on how to use the system?

During the implementation:

18. How do you feel when using the system?

19. (Optional) Regarding the convenience, what do you think of conducting the transactions?

20. (Optional) Have you ever experienced a technical difficulty?

Post-purchase:

21. How do you feel towards managing Bitcoin payments, regarding taxations, accounting?

22. What do you think is the issue that prevents people from accepting Bitcoin in their store?

23. To sum up, what is the biggest challenge/benefit of adopting Bitcoin as payment?

24. Are you satisfied with the adoption as a whole? Will you recommend it to others?

5 ANALYSIS

5.1 The case of Time Bar

Overview

The first interview conducted was with Antti Pietarinen, the business owner of Time Bar. Time Bar has been receiving Bitcoin since 2014, with the help of third-party payment processing services BitPay. Antti revealed that all the transactions were done face-to-face directly at Time Bar counter, using a dedicated tablet.

Overall, Antti stated that he is satisfied with the added-values that Bitcoin adoption brings back, yet he revealed many challenges that potentially prevent other merchants from adopting it.

Relative advantage

Regarding the system itself, the owner of Time Bar said that Bitcoin POS payments have lower commission fees than traditional VISA debit and credits payment. To be specific, it is about 1% for every Bitcoin transaction. The commission fees will go directly to Bitpay as the processing agent. He added, "*If everything goes well, it is more profitable for us to accept payments in Bitcoin, in comparison with credit cards or American Express*".

Regarding the technical challenges of the POS system, Bitcoin payment has a long execution time. To be specific, Antti claims that because Bitcoin uses QR-code to scan and pay, a single transaction may take a longer time to complete, in compare with swipe-cards and pin codes. Thus, when there is a line within the store, it will be frustrating for both owner and customers.

Regarding security, Pietarinen said there are no differences between Bitcoin transactions and traditional means of payment.

Compatibility

After the adoption in 2014, Pietarinen said the changes Bitcoin adoption brings are noticeable yet marginal.

Positively, Bitcoin adoption has brought back to the store a whole new customer base. Pietarinen claimed that "*a few people who are Bitcoin hobbyists often come to try out the system, some even throw a Bitcoin-themed celebration*".

Furthermore, Pietarinen consider Bitcoin adoption as a way of refreshing the image of the company. In other words, the Bitcoin adoption contributes directly to the marketing image of Time Bar. He claimed, "*By adopting Bitcoin, we show to our customers that we are modern.*"

On the other side, even though there is a new customer base with extra revenue retrieved, the profit obtained from Bitcoin payments is really marginal. Pietarinen claimed that "*Bitcoin payments only accumulates to less than 1% of our revenue every year*".

Simplicity

Regarding the simplicity of setting up the system, Pietarinen revealed that such the instalment and implementation is simple and easy-going. However, he also mentioned it is because of his background knowledge of computers. Therefore, for other merchants with less experience in such field, it may be more complicated.

Secondly, during the implementation of Bitcoin POS, the transactions are carried out easily and seamlessly between both bar owner/employees and the customer. Pietarinen revealed that he has no issues in educating the staffs on how to use the system. It is a simple and easy-to-understand process. Pietarinen added, "*all you have to do is open the application, put amount want to receive, wait for customers to scan the code and the transaction confirms itself*".

Last but not least, after the payments are completed, Pietarinen considered the process of payment management simple and easy-to-manage. He claimed that Bitcoin payments are processed similarly to other types of payment thanks to the monthly report from Bitpay.

Trialability

Pietarinen indicates that trialability is not a problem. As the setup cost can be none as the owner use his personal phone to conduct the transaction, thus the only fee he has to pay is the commission.

Additional insights

The owner of Time Bar shows his concerns towards the lack of knowledge from merchants towards Bitcoin adoption. He claimed that other merchants resist such trend because they do not understand how the adoption works. As the fear of the price fluctuation, merchants consider such investment in receiving Bitcoin is highly risky. However, "*if they understand they can receive Bitcoin payments in Euro, they might do it*", he said.

Furthermore, Pietarinen also revealed that Bitcoin POS system has no competitive edges toward the traditional POS system. Thus, as a result, merchants do not see the need of adopting an extra mean of payment.

Summary

In summary, Antti Pietarinen as the owner of Time Bar has shown his impressions toward Bitcoin POS adoption as a low-fee, easy-to-use payment system.

Regarding the added value that Bitcoin adoption has to bring, Pietarinen showed that Bitcoin brought a new base of customers, even though the additional revenue is still marginal. Moreover, the adoption contributes directly to the marketing image of the company, which is modern and trending.

Regarding the perceived challenges of such adoption, Pietarinen stated clearly 3 issues that might prevent others from adopting such payment method. Firstly, the low execution speed of the transaction might cause problems, especially during the rush-hour. Secondly, there is still a lack of demand from the customer, revealed through the small marginal profit. Thirdly, other merchants are not well-informed on how the system works. Thus, combined with the fear of price fluctuation, merchants will reject to take the risk.

5.2 The case of HUG Bike Shop

Overview

HUG Bike shop is a local bike shop selling bikes along with accessories and bike maintaining services. The shop located at Köydenpunojankatu 4a in Helsinki. It is owned by Henri Tikkanen, who participated in the research. According to Tikkanen, HUG Bike shop has been accepting Bitcoin payments since 2015. At HUG bike shop, customers can pay with Bitcoin through the QR-code system on the store's computer, or

transactions can be completed online via the website. Overall, after 2 years of adoption, Tikkanen reveal his positive impressions towards the system.

Relative advantage

Regarding the advantages in performance of Bitcoin system in comparison with the traditional method, Tikkanen revealed that Bitcoin POS contains better security methods than the traditional one. Moreover, he claimed that Bitcoin has a lower transaction fee, from 0.5% to 1% in comparison with 3 to 5% in average of traditional methods. Additionally, Tikkanen perceived Bitcoin to be easier and safer to manage than cash. For example, receiving Bitcoin is instantaneous while cash will require a time-gap when recording at the bank before the profit can be recorded.

Regarding the challenges of the new system, Bitcoin payments are still slower than traditional card payments. Tikkanen shared that Bitcoin mobile payments and card payments are both running behind traditional contactless transactions and VISA card payments, regarding transaction speed. Additionally, the Bitcoin transactions can be delayed sometimes due to network congestion.

Compatibility

Tikkanen witnessed positive changes within the stores after the 2-year adoption of Bitcoin POS. However, the revenue is marginal regardless the exponential growth in Bitcoin popularity.

According to the owner of HUG bike shop, he stated that the revenue in Bitcoin, both online and face-to-face payment, accumulated to a total of mere 1% every year.

Regardless the fact that Bitcoin did bring extra revenue stream, Tikkanen shared that only approximately 7 bikes have been sold with Bitcoin since 2015, with 3 of the transaction were conducted in-store.

Simplicity

Regarding the simplicity of implementing the new Bitcoin POS system, Tikkanen shows that setting up process is easy while conducting the transactions sometimes can be a hassle. In details, the whole process of setting up the system was done easily by the shop owners, without having to pay any extra fee regarding the setting up.

Furthermore, in terms of conducting payments on Bitcoin POS, Tikkanen revealed that Bitcoin transaction can be delayed sometimes, which potentially lead to the payment congestion. In other words, during the rush-hour or high season, such payments can be a burden for both shop owner and customers.

Post-payment management regarding Bitcoin payments is a simple process to Tikkanen. He stated with the monthly report from the third-party solutions, the accounting and tax processing can be done the same way as the traditional method.

Trialability

Regarding the ability to try out the system before adopting it, Tikkanen stated the process of setting up requires no extra fee, trialability of Bitcoin POS is completely feasible.

Additional insights

For the HUG Bike shop owner, having Bitcoin accepted within the store is mainly for the purpose of uplifting the shop image regarding marketing and customer services. He wants to show to the customer that the store is open to new ideas. Therefore, regardless of the marginal profit, such enrichment of the company image is worth the investment.

In terms of the challenges that Bitcoin adoption is facing, Tikkanen shares his viewpoint that most of the merchants are risk-averse, thus adopting new payment system without proper knowledge will be challenging, especially getting to know and managing a new type of money or currency.

Summary

To conclude, Henri Tikkanen, the owner of HUG bike shop, has revealed many insightful viewpoints toward his adoption of Bitcoin in-store payment, including both positive benefits that the system brought back, but also his perceived challenges that the system still needs to overcome.

Regarding the added value, Bitcoin POS system is easy to use and manage. Moreover, the system thrives with its high security as well as a low transaction fee. To emphasize, he stated the biggest benefit of adopting Bitcoin is to polish the image of the company regarding marketing and customer services.

On the opposite, Tikkanen claimed that Bitcoin transactions might be cheaper yet slower than most traditional cards payment. Critically, transaction delay can be a threat during

high season or rush hours. Additionally, the profit from Bitcoin payments is still marginally, which results from the lack of customer demand.

Last but not least, due to fact that Bitcoin price fluctuates and merchants are lack of awareness towards the system, it is still considered high-risk investment when it comes to implementing Bitcoin POS in store for many merchants, Tikkanen shared.

5.3 The case of Konsolinet

The third and also the last interview was from Konsolinet store, which located on the 4th floor of the famous Kamppi shopping mall within the centre of Helsinki city. The shop owner is Juho Korkeaoja – an entrepreneur in video games and video-game consoles accessories. According to Korkeaoja, Konsolinet has been accepting Bitcoin since 2013.

The case of Konsolinet store is special because Konsolinet does not actually accept Bitcoin through physical payment, but via their online solutions only. However, as they are owning a physical store and use the same services for processing payments with Time Bar. Majority of the experiences when adopting Bitcoin are highly relevant.

Moreover, as the refusal of adopting the physical payments, this case will be used mainly to reveal the challenges why the owner chose only to accept Bitcoin through his website, not in the store.

Thus, the case will focus mainly on **Relative Advantage** of the online Bitcoin adoption as well as the **Compatibility** or changes that merchants witness after the adoption. However, the **Simplicity** explains how easy to use the POS system will be neglected.

Relative advantage

Regarding the competitive edges of Bitcoin transaction in comparison with other traditional means, Korkeaoja considers that Bitcoin payment has a lower fee. To clarify, he said that "*Bitcoin transaction fee is slightly higher than VISA debit card payments but lower than VISA credit card payments and other online payment such as Paypal*".

When inquiring why Korkeaoja did not have a physical Bitcoin POS system in the store, he stated clearly that Bitcoin POS requires a dedicated tablet/computer to complete the job which will require extra space on the counter such device. Moreover, he extracted from his annual online revenue that the one of Bitcoin payments and the demand from

the customers is relatively low. Therefore, the investment for a dedicated device can be wasteful. Korkeaoja also added that most of the revenue of the store is from an online purchase, therefore by focusing on improving online volume is sufficient.

Additionally, the owner of Konsolinet store shares that Bitcoin physical transaction is more complicated than traditional card payment, which can be a big problem during rush-hour for the store.

To complete his point, Korkeaoja insists that a part of the reason why he adopted Bitcoin was that it was available from his payment-processing company. Otherwise, the adoption would not take place.

Compatibility

When asking about the changes Korkeaoja witnessed after adopting Bitcoin, he stated firstly that Bitcoin adoption brings a new stream of revenue to the company. However, Korkeaoja said that the revenue is still really marginal. In details, he compares with the annual revenue of the company, which is around EUR 1.5 million, in which Bitcoin accumulate merely EUR 5000.

However, Korkeaoja is still satisfied with the adoption of Bitcoin regarding the additional touch on the company image that the adoption brought. He perceived his brand to be modern and open to new ideas. Thus, adopting Bitcoin means more towards the marketing side of the company.

Therefore, regarding compatibility, Korkeaoja is satisfied with the adoption.

Trialability

Similar to previously interviewed stores, Konsolinet uses the same third-party solution which provides no initial cost for setting up the accounts to start receiving Bitcoin. Furthermore, most of the application for physical payments are also free-of-charge which also make the trialability of Bitcoin POS viable.

Additional insights

Beside the shaped focus of the questionnaire, the owner of Konsolinet store also share many insights regarding the challenges of Bitcoin adoption.

Firstly, Korkeaoja stated most merchants perceived Bitcoin being used by illegal activities whose transactions requires concealments. Because of that, many merchants do not initiate to inquire knowledge towards the currency and learn how to adopt it.

Secondly, Bitcoin is often being seen as a mean of investment, not a mean of payment. In details, most of Bitcoin users store their Bitcoin carefully but rarely have a need to spend it. Thus, lack of demand leads to the lack of adoption from merchants.

Thirdly, Korkeaoja shows a bit of disappointment because of the high relevance of the business and the nature of Bitcoin payments. To elaborate, since Konsolinet business is about video games, for both online and physical retailing, and the majority of Bitcoin users are intermediate to advanced users of computers. Yet, the results in revenue are still low. Thus, he pointed out that business with less relevance in the digital field will yield less positive results. Therefore, he concluded it is not profitable for merchants.

Finally, he shared that most merchants who adopted Bitcoin does not involve in the Bitcoin themselves. In other words, merchants accept Bitcoin mainly because of the demand from the customers. Thus, without the driven-demand, the adoption will hardly take place.

Summary

The owner of Konsolinet game store has shared many interesting viewpoints toward the adoption of Bitcoin POS system, from both aspects regarding benefits and challenges of the adoption.

In short, regarding the benefit, Korkeaoja stated that the online payments of Bitcoin are simple to conduct and easy to manage. Above all, he claims that the intention of such adoption was mainly to improve the marketing image of the company, to be modern and open to new ideas.

In terms of challenges, Korkeaoja pointed out several key points. Firstly, Bitcoin POS requires extra initial fees for the hardware to start making payments which are not worth it because of the marginal revenue. Secondly, Bitcoin physical transactions take more time to complete in comparison with another traditional method such as VISA card payments, or mobile payments. Thirdly, most Bitcoin users perceive Bitcoin as a mean of investment, not a mean of payment which means that they intend keeping the tokens rather than spending them. Fourthly, Bitcoin is perceived to be used by illegal activities who want to conceal their transactions. As a result, the unappealing image led to the

reality that many merchants do not want to get involved with the currency. In the end, he stated that it is unnecessary for a new system to be born since the current traditional systems are working effectively.

6 FINDINGS

This section will extract the findings from the analysis summary to give final answers to the second objective of this paper:

1. "Based on the case of Finnish retailers in Finland, what is the added values as well as the challenges when adopting Bitcoin Point-of-sale system in a physical store, as conducting physical payments?"

The idea of this section will be to figure out the common answers among 3 merchants regarding added-value and challenges of adopting Bitcoin POS in a physical store. Furthermore, by aligning the findings with the theory of Roger's Five Factors, we can achieve clear viewpoints on the matter.

6.1 Overview

Through the 3 cases of Konsolinet store, Time Bar and Hug Bike Shop, all the owner of these store agrees that the adoption is a worthy investment. Many of the key points on the added-values that Bitcoin adoption brought back to their store are commonly shared such as low transaction fees, low cost of investment, the easy-and-cheap implementation.

Regardless, each store owners shared their own perceived challenges when it comes to adopting this new payment system, from both their experiences and personal viewpoints on the adoption.

6.2 The added-values

There are 4 key points when it comes to addressing the added-value of adopting Bitcoin POS in a physical store. They are low-fee transactions, easy and low-cost to set-up and implement and they bring a new stream of revenue as well as a renewal of the company image.

Regarding the **relative advantage** of using Bitcoin POS in compared with the traditional system, all 3 merchants agreed on a sole key point. It is that the commission fees for

each transaction of Bitcoin payment are low. In fact, Time Bar owner and HUG Bike shop owner agreed that Bitcoin POS system provides the lowest transaction fees than most of the traditional payment methods.

In details, all 3 stores use the same solution provided by a common third party, BitPay, all 3 merchants agreed that Bitcoin payments have an average fee of 0.5% to 1% per transaction, compared with an average of 3-5% when traditional VISA credit card and 7% of Paypal transactions. Additionally, Time bar owner, Pietarinen claimed that accepting payments with Bitcoin is most profitable if everything goes well.

Regarding the **simplicity** of Bitcoin POS implementation, the 2 cases of HUG Bike shop and Time Bar agreed on the ease of setting up and use the system, while Konsolinet does not have the system.

The Bitcoin POS adopters take advantage of their existing infrastructure of mobile phones and personal computer to receive Bitcoin payments. The transactions are conducted via the use of free-of-charge applications that provides QR-code payments.

As both owners have an adequate knowledge of the computer, thus the installation of system and applications are easy. However, both agreed that additional instructions and assistance might be required for people with less technical knowledge.

Additionally, Time bar owner taught all his employees on how to use the system seamlessly, while HUG bike shop performs the task on his own.

In terms of **compatibility**, which addresses the changes that merchants witness after welcoming Bitcoin payments in their store.

In detail, accepting Bitcoin payments opened the door for Bitcoin hobbyists or enthusiasts to come and making purchases using their favourable currencies. In the figure, all 3 cases witness a 0.5 to 1% increase in their annual revenue which is recognized as Bitcoin payments.

Additionally, all 3 store owners claimed that the act of accepting Bitcoin payments in their store allows them to position their store as being modern and open to new ideas, which is important to the image of a company.

To summarize, the adoption of Bitcoin POS brought some valuable benefits to merchants who accept Bitcoin in their stores. Above all, Bitcoin transactions propose lower commission fees than most cases of the traditional method, plus with a low initial cost of

investment and maintenance, it is risk-free when it comes to adopting Bitcoin. Welcoming Bitcoin also means open doors for Bitcoin enthusiasts and hobbyists to come and spend their money, as a result, it will create a new stream of revenue, along with a new customer base. Additionally, Bitcoin adoption provides a reinforcement on the marketing image of the companies.

6.3 The challenges

Regardless the benefits of the adoption, many challenges are perceived by the owners while implementing the system. It is clear to point out the 3 key points regarding long transaction execution time, lack of customer demand, the lack of knowledge.

Regarding the **relative advantage** aspect, Bitcoin POS payments at the current stage have longer execution time in comparison with traditional methods. Interestingly, the problem becomes serious when all 3 merchants mention the implementation during the rush-hour or high season. During these time, slow execution of payments will damage customer satisfaction when waiting for making transactions.

Regarding **compatibility** of Bitcoin payment, despite the increase in revenue from Bitcoin payments, it is agreed among all 3 merchants that the customer demand for such payments is still low, with an average of less than 1% of the annual revenue. However, they are all satisfied with the extra revenue received, based on the minimal amount of investment required.

Regarding the **simplicity**, it is shared among 3 participants that most merchants who do not understand how the adoption works. Shared by Pietarinen, most of the merchants look at Bitcoin as a risky adoption due to its fluctuation in valuation. However, they do not understand that there are third-party solutions who exchange the Bitcoin into fiat currencies immediately at the point-of-sale. As a result, many merchants resist being exposed to such risk.

Beside the 3 key points regarding the challenges which are agreed by all interviewees, some additional interesting insights regarding the challenges was revealed from their personal perspective as the pioneer in Bitcoin adoption in Finland.

To list a few, a challenge expressed by Pietarinen from Time Bar is that Bitcoin POS, in close-up, has no noticeable advantages that can overthrow another existing system.

Regarding Konsolinet case, Korkeaoja stated that many people perceive Bitcoin as a mean of investment, rather than a mean of payment. As a result, the demand for spending the token reduces, followed by the resistance of the adoption from merchants.

Additionally, Korkeaoja also said many people perceived Bitcoin as a mean of payment for illegal business who intentionally want to veil their transaction information. Thus, such activities scarred the image of Bitcoin in the eyes of other merchants. Hence, merchants would avoid any type of currency or system that may bring bad image to their company.

To summarize, Bitcoin POS systems still have many flaws and disadvantages that needed to be adjusted to become more mainstream and widely adopted. The 3 key challenges are long and complicated transaction execution, the lack of customer demand and the lack of knowledge from merchants regarding understanding Bitcoin POS.

Additionally, the interviewed merchants share the extra insightful challenges which can also be addressed, such as Bitcoin users are not using Bitcoin to make a purchase, but to invest and speculate, or Bitcoin is being perceived a tool for illegal activities, which hinders merchants from accepting them. If these challenges will soon be addressed, it will easier for merchants globally to welcome such innovative monetary technology into their store.

7 CONCLUSION

The idea of this paper is to provide authors and readers with a simple yet comprehensive viewpoint on Bitcoin and its implementation as a mean of payment in physical stores, with the case study of Finnish merchants.

The idea of Bitcoin ecosystem may be complex to fully understand. However, on the surface, it put into use one of the most underlying innovative technology ever known in the financial industry, called the blockchain.

The understanding of Bitcoin and blockchain concept

On one hand, we have discussed and answered the first objective of this paper with a few key points to remember.

Bitcoin is a cryptocurrency that use blockchain technology to create an immutable record that is controlled by all users, or nodes that is running and support the network.

In order for the network to operate and be secure, transactions are being resolved by special nodes called the miners through the act of Bitcoin mining, or block mining. The process of block mining is demonstrated through the 6-step of **Bitcoin network procedure**.

1) New transactions are broadcast to all nodes.

2) Each node collects new transactions into a block.

3) Each node works on finding a difficult proof-of-work for its block.

4) When a node finds a proof-of-work, it broadcasts the block to all nodes.

5) Nodes accept the block only if all transactions in it are valid and not already spent.

6) Nodes express their acceptance of the block by working on creating the next block in the chain, using the hash of the accepted block as the previous hash.

Through Bitcoin network procedure, bitcoin miners intensively compete with others to create a secured network and bring more Bitcoin into market circulation. They solve a complex mathematical logarithm called the Proof-of-Work.

Proof-of-Work is a process of ensuring each new block which contains new transactions will be created every 10 minutes. The more miners participate in solving the Proof-of-Work will lead to faster solving time. Consequently, the system will adjust the difficulty of the Proof of Work with the ultimate purpose of retaining the 10-minute target. Therefore, the more miners participate in the network, the harder the block mining gets. Additionally, we have revealed how the reward system of Bitcoin works.

Added-value and challenges of adopting Bitcoin as a mean of payment

On the other hand, we attempted to find out the factors that allow and motives merchants to adopt Bitcoin as the physical mean of payment, as well as the current challenges that hinder others from the adoption.

Through a study and careful implementation of Roger's Five Factors theory, with the contribution of 3 Finnish merchants from Konsolinet store, HUG bike shop, and Time Bar. The study has revealed a few yet effective benefits and challenges of Bitcoin adoption.

When it comes to the added-value of having Bitcoin accepted in-store, Bitcoin transactions fee is recognized to be much lower than another traditional mean of payment. Moreover, the variability of Bitcoin POS is feasible, as its application can be done via personal mobile devices or computers, which lowers the initial cost of such adoption to merely nothing, which is a considerable benefit for many merchants. The adoption of a new technology always attracts its enthusiastic users to come and try out, which leads to a new stream of revenue as well as customer base, it is similar in Bitcoin case. In addition, with the acceptance of Bitcoin payments, it allows merchants to polish their marketing image of being open to new ideas and retain modern.

Regardless, there are many potential challenges that Bitcoin and its POS system still need to overcome. Firstly, the execution of the transaction still takes a long time, which can be an imminent issue during the high season. Secondly, the lack of customer demand is one of biggest concerns which hinder merchants' interests. Thirdly, the lack of knowledge towards accepting Bitcoin via third-party POS solution, with a payment that does not expose to price fluctuation is also present a barrier for merchants. Additionally, it is often perceived by Bitcoin user that Bitcoin tokens are normally owned for investing purpose, not to be a mean of payment, which also contributes to the decrease in customer demand. Moreover, the currency itself is being perceived as potential tools for

illegal activities. Consequently, merchants will not risk their image to use such currency in their store.

In short, regardless of the low transaction fees and the free-of-charge installations, Bitcoin still need to resolve many addressed issues which prevent such innovation to achieve its potential growth of being a common currency between both users and merchants.

As the end of the thesis, it has delivered a clear yet fundamental concept of Bitcoin towards unfamiliar readers, as well as propose a broad knowledge for merchants who are looking forward to adopting Bitcoin. Also, by addressing the fundamentals as well as the benefits and challenges of accepting Bitcoin, the paper urges to pave ways for merchants to welcome such innovation into their store, which will ensure a brighter future for one of the most important discoveries of financial technology.

REFERENCES

ABA. (2016). Contact-Free and Easy: A Closer Look at In-Store Mobile Payments. *ABA Banking Journal.*

Abra. (2017). *Abra.com.* Retrieved from Abra.com: https://www.abra.com/

Antonopoulos, A. M. (2015). *Mastering Bitcoin.* O'Reilly Media, Inc.

Aventus. (2017). *Aventus.io.* Retrieved from Aventus.io: https://aventus.io/

Back, A. (2002). *Hashcash - A Denial of Service Counter-Measure.*

Bitcoin Mining. (2017). Bitcoin Mining Pools. Retrieved November 21, 2017, from https://www.bitcoinmining.com/bitcoin-mining-pools/

Bitcoin Wiki. (2017a). Bitcoin Wiki - Block. Retrieved November 15, 2017, from https://en.bitcoin.it/wiki/Block

Bitcoin Wiki. (2017b). Bitcoin Wiki - Difficulty. Retrieved November 21, 2017, from https://en.bitcoin.it/wiki/Difficulty

Bitcoin Wiki. (2017c). Bitcoin Wiki - Mining. Retrieved November 2017, from https://en.bitcoin.it/wiki/Mining

Bitcoin Wiki. (2017d). Bitcoin Wiki - Genesis Block. Retrieved November 19, 2017, from https://en.bitcoin.it/wiki/Genesis_block

Bitcoin Wiki. (2017e, August 12). *Bitcoin Wiki - Miners, Full Node, and Lightweight Node.* Retrieved November 12, 2017, from https://en.bitcoin.it/wiki/Full_node

Bitcoin Wisdom. (2017). Bitcoin Hash Rate vs Difficulty (9 Months). Retrieved November 16, 2017, from https://bitcoinwisdom.com/bitcoin/difficulty

Bitcoin.org. (2017a). *Bitcoin is an innovative payment network and a new kind of money.* Retrieved from Bitcoin.org: https://bitcoin.org/en/

Bitcoin.org. (2017b). Bitcoin.org - Running a full node. Retrieved from https://bitcoin.org/en/full-node

Bitcoinblockhalf.com. (2017). Bitcoin Block Reward Halving Countdown. Retrieved November 25, 2017, from Bitcoin Block Reward Halving Countdown

Bitcoinmining.com. (2017). What is Bitcoin mining? Retrieved November 21, 2017, from https://www.bitcoinmining.com/

Bitfinex'ed. (2017, August 4). Meet 'Spoofy'. How a Single entity dominates the price of Bitcoin. Retrieved from https://hackernoon.com/meet-spoofy-how-a-single-entity-dominates-the-price-of-bitcoin-39c711d28eb4

Bitnodes. (2017). GLOBAL BITCOIN NODES DISTRIBUTION. Retrieved October 18, 2017, from https://bitnodes.earn.com/

Bitspark. (2017). *Project Zephyr - A reward token for a pegged cryptocurrency remittance network*. Retrieved from https://zephyr.bitspark.io/

Block Explorer. (2017). *blockexplorer.com*. Retrieved from https://blockexplorer.com/

Blockchain. (2017a). Blockchain.info - Market Price. Luxembourg S.A. Retrieved October 19, 2017, from https://blockchain.info/charts/market-price

Blockchain. (2017b). Total Bitcoins in circulation. Luxembourg S.A. Retrieved November 11, 2017, from https://blockchain.info/charts/total-bitcoins

Blockchain. (2017c, October 16). Bitcoin Unique Address. Retrieved November 13, 2017, from Blockchain.info: https://blockchain.info/charts/n-unique-addresses

Blockgeeks. (2017). What is Hashing. Retrieved from https://blockgeeks.com/guides/what-is-hashing/

Bread. (2017). Bread Bitcoin Mobile Wallet. Retrieved from https://breadapp.com/

Cline, A. (2015, July 9). Is QR Code On The Verge of Extinction in the Mobile Arena? Retrieved November 16, 2017, from https://onextrapixel.com/is-qr-code-on-the-verge-of-extinction-in-the-mobile-arena/

Coin ATM Radar. (2017). *Bitcoin ATM map*. Retrieved from Coin ATM Radar: https://coinatmradar.com/

Coin Map. (2017). *Coin Map*. Retrieved from http://coinmap.org/

Coinatmradar.com. (2017). *Bitcoin to cash and cash to bitcoin service providers*. Retrieved from Coin ATM Radar: https://coinatmradar.com/manufacturers/#cash-services

Coindesk.com. (2015, October 14). How to Accept Bitcoin Payments for Your Store. Retrieved from How to Accept Bitcoin Payments for Your Store: https://www.coindesk.com/information/bitcoin-retail-pos-systems/

Coingate. (2017). *Coingate Website*. Retrieved from https://coingate.com/

Coingate. (2017). How it Works - Accept Bitcoin Payments on Any Store. Retrieved November 22, 2017, from https://coingate.com/accept-bitcoin

Coinify. (2017). *Coinify Website*. Retrieved from https://coinify.com/

CoinMarketCap. (2017). Bitcoin Market Capitalization. Retrieved October 18, 2017, from https://coinmarketcap.com/currencies/bitcoin/#charts

Crypto Watch. (2017). Cryptowat.ch - Price of Bitcoin on Bitfinex exchange. Retrieved October 20, 2017, from https://cryptowat.ch/bitfinex/btcusd

Dictionary.com. (2017). Dictionary.com - Definition of Immutable. Retrieved from http://www.dictionary.com/browse/immutable

Digiconomist. (2017). Bitcoin Energy Consumption. Retrieved from https://digiconomist.net/bitcoin-energy-consumption

Edureka! (2017). Blockchain Technology – Everything you need to know about Blockchain and Bitcoin. Retrieved from https://www.edureka.co/blog/blockchain-technology/

Eyal, I., & Sirer, E. G. (2013). *Majority is not Enough: Bitcoin Mining is Vulnerable.* Cornell University, Department of Computer Science. Retrieved from https://www.cs.cornell.edu/~ie53/publications/btcprocfc.pdf

Graham, A. (2017). How to Measure Success for Mobile Point of Sale Systems. Retrieved from https://www.paymentssource.com/opinion/how-to-measure-success-for-mobile-point-of-sale-systems

History of Bitcoin. (2017). Retrieved from History of Bitcoin: http://historyofbitcoin.org/

Intel. (2015). 50 Years of Moore's Law. Retrieved from https://www.intel.com/content/www/us/en/silicon-innovations/moores-law-technology.html

Investopedia. (2017a). Definition of Convertible Virtual Currency. Retrieved December 15, 2017, from https://www.investopedia.com/terms/c/convertible-virtual-currency.asp

Investopedia. (2017b). Definition of Point of Sale. Retrieved November 23, 2017, from https://www.investopedia.com/terms/p/point-of-sale.asp

Investopedia. (2017c). Definition of Remittance. Retrieved November 1, 2017, from https://www.investopedia.com/terms/r/remittance.asp

Investopedia. (2017d). *Definition of Automated Teller Machine - ATM.* Retrieved from Investopedia: https://www.investopedia.com/terms/a/atm.asp

Mamudi, S. (2008, September 15). *Lehman folds with record $613 billion debt.* Retrieved from Market Watch: https://www.marketwatch.com/story/lehman-folds-with-record-613-billion-debt

Nakamoto, S. (2008). *Bitcoin: A Peer-to-Peer Electronic Cash System.* Retrieved from Bitcoin.org: https://bitcoin.org/bitcoin.pdf

Redman, J. (2015, October 8). *BitPay unveils Ingenico Bitcoin terminal.* Retrieved from Bitcoin.com: https://news.bitcoin.com/bitpay-unveils-ingenico-bitcoin-terminal/

Rogers, E. M. (1971). Chapter 6: Attributes of Innovations and Their Rate of Adoption. In E. M. Rogers, *Diffusion Of Innovation* (pp. 213-232).

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students - fifth edition.* Pearson Education Limited.

Statista. (2016). *Total number of POS terminals in Finland from 2009 to 2015 (in 1,000).* Retrieved from Statista: https://www.statista.com/statistics/444558/number-of-pos-terminals-finland/

Statistics Finland. (2017, March 23). Statistics Finland - Total energy consumption rose by 2 per cent in 2016. Retrieved November 20, 2017, from http://www.stat.fi/til/ehk/2016/04/ehk_2016_04_2017-03-23_tie_001_en.html

Streng, M. (2017). How I built a bitcoin empire | Marco Streng | TEDxTrinityCollegeDublin. Retrieved November 20, 2017, from https://www.youtube.com/watch?v=cVxi2CQcXZo

Tapscott, D. (2017). SXSW Preview: What's the Next Generation Internet? Surprise: It's all about the Blockchain! Retrieved from https://www.linkedin.com/pulse/whats-next-generation-internet-surprise-its-all-don-tapscott

Techopedia.com. (2017a). Techopedia - Mobile Wallet. Retrieved November 21, 2017, from https://www.techopedia.com/definition/31599/mobile-wallet

Techopedia.com. (2017b). Techopedia.com - Definition of Node. Retrieved November 10, 2017, from https://www.techopedia.com/definition/5307/node

The Bitcoin Gospel (2015). [Motion Picture]. Retrieved from https://www.youtube.com/watch?v=8zKuoqZLyKg&t=2171s

Vey, A., & Annika, M. (2017). *Aventus - A blockchain-Based Event Ticketing Protocol.* Retrieved from https://aventus.io/doc/whitepaper.pdf

White, J. (2008, September 15). *Market plummets after Lehman Brothers collapse.* Retrieved from Express: https://www.express.co.uk/finance/city/61552/Market-plummets-after-Lehman-Brothers-collapse

Wonderopolis. (2017). How Do QR Codes Work? Retrieved November 2017, from https://wonderopolis.org/wonder/how-do-qr-codes-work

Yle. (2016, February 21). *Bank of Finland predicts country will be cash-free by 2029.* Retrieved from Yle Uutiset: https://yle.fi/uutiset/osasto/news/bank_of_finland_predicts_country_will_be_cash-free_by_2029/8689417