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Abstract

Bitcoin developed a trustless monetary system, without the need of intermediaries. Bitcoin has been expected to threaten banks traditional monetary systems. The underlying technology, blockchain, is a profound technology that presents a decentralized database technology. The technology is suitable for exchanging value in an untrusted environment. Instead of threatening traditional monetary systems, Bitcoin has introduced a new technology that might benefit banks and other financial institutions.

In recent years, banks have been threatened within the cross border payment segment. Companies such as PayPal, Western Union and Transferwise are gaining market share as they provide customers with enhanced value propositions. There is little standardization between banks in a global perspective as they struggle with variations in messaging systems and account systems. Therefore, banks are studying the blockchain technology as a possible innovative solution to their cross border payment systems.

In this explorative study, I aim to investigate how blockchain technology may benefit banks position in the cross border payment segment. First, an explanation of the technology is provided, followed by how a transaction with bitcoins is completed. Then, a comparative analysis of several money transfer operator will be presented to better understand banks lack of valued customer experience domains. Lastly, a method of utilizing blockchain within the cross border payment segment, and its benefits and challenges, will be presented.

Preface

This thesis concludes my master within the field of Industrial Economy. Through my education I have acquired a balanced set of knowledge within economics and technology.

The combination of knowledge has been useful throughout this thesis as I got to combine technology and economics into one subject.

The work completed in this thesis has been challenging, interesting and comprehensive. My goal was to gain a deeper understanding of how a complex technology may benefit banks in the cross border payment segment.

I would like to thank my supervisor Atle Øglend for valuable feedback and encouragement. I would also like to thank my brother, Simon, for providing me with useful input. Lastly, I would like to thank my parents for an endless amount of support.

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1. Introduction

Banks have had the upper hand within the payment industry for the most part of the monetary history. While revenue margins for domestic payments has declined as regulation and competition has increased in the last decades, making banks improve efficiency of their products and systems. Revenue margins for cross-border payments have remained high over time due to banks not experiencing the same pressure to innovate. Therefore, banks have had little incentive to increase efficiency within cross-border payments. This has now changed. It's in the last decade that banks have been affected by other players that has entered the payment industry. Mainly, within cross-border payments. Players such as Western Union, PayPal and Transferwise has caused banks to come under pressure from customers. Customers are now expecting fast, cheap, secure, convenient and transparent payments methods. Evidently, digital players have been better suited to fulfill customer expectations as these players has gained market share within the cross-border payments industry. Consequently, banks are experiencing looser ties with end customers with payment related activities.

As Bitcoin was developed in 2009, the underlying technology, blockchain, came to its existence. Bitcoin and were predicted to have an immense impact on the financial industry. However, there has not yet been much development in the applications areas predicted. The underlying technology is believed to have more application areas. Today, as the gap between consumer's expectations and banks' ability to fulfill these expectations are widening. Banks are considering how, if feasible, blockchain can improve cross-border payment activities.

In this thesis, a presentation of blockchain technology will be provided to better understand its implications and possibilities for banks within the cross-border payment industry. An analysis of Bitcoin, Western Union, PayPal and Transferwise transaction process will be given. The purpose of analyzing

these money transfer operators is to evaluate what aspects within the cross-border payment industry banks must improve, and how consumers want to transfer money in the near future. This thesis looks at a consumer to consumer (C2C) money transfer perspective.

This thesis intends to answer the following:

- How will the implementation of blockchain technology benefit banks in the cross border payment segment?

2. Blockchain Technology:

The success of cryptocurrencies comes from the underlying technology called blockchain. The blockchain technology has been argued to be revolutionary and is now considered to have several application areas. The blockchain technology was created by the pseudonym Satoshi Nakamoto when developing Bitcoin in 2009 (Nakamoto, 2008).

The blockchain technology allows digital information to be distributed, but not copied which means there is only one owner to each individual piece of data. The information is reconciled into the database constantly, which is updated instantly and stored in several locations. That gives the blockchain the ability to be public and verifiable. There is no central location, so it's nearly impossible to hack due to the information potentially existing simultaneously in millions of places (Blockgeeks, 2018). In other words, blockchain is a distributed ledger technology (DLT) that acts as a shared database. Today, banks keep track of all parties' balances in a ledger closed off to the public. The banks are responsible for confirming and rejecting transactions. Checking the balances of the trading parties in their ledger and updates it whenever a transaction has been completed. This system is referred to as a centralized authority. Blockchain is essentially the opposite. Blockchain is a system with distributed authority amongst users that enables them to trade digital assets peer-to-peer. The authority is distributed due to the public ledger that users of the system can check and verify. The system is a growing list of records of transactions, from the first to last transaction. When a trade is engaged, the parties involved check if the transacting party has the balance to complete the trade. After the criterions are met, the public ledger is updated and will be impossible to retract (Nolan Bauerle, 2018).

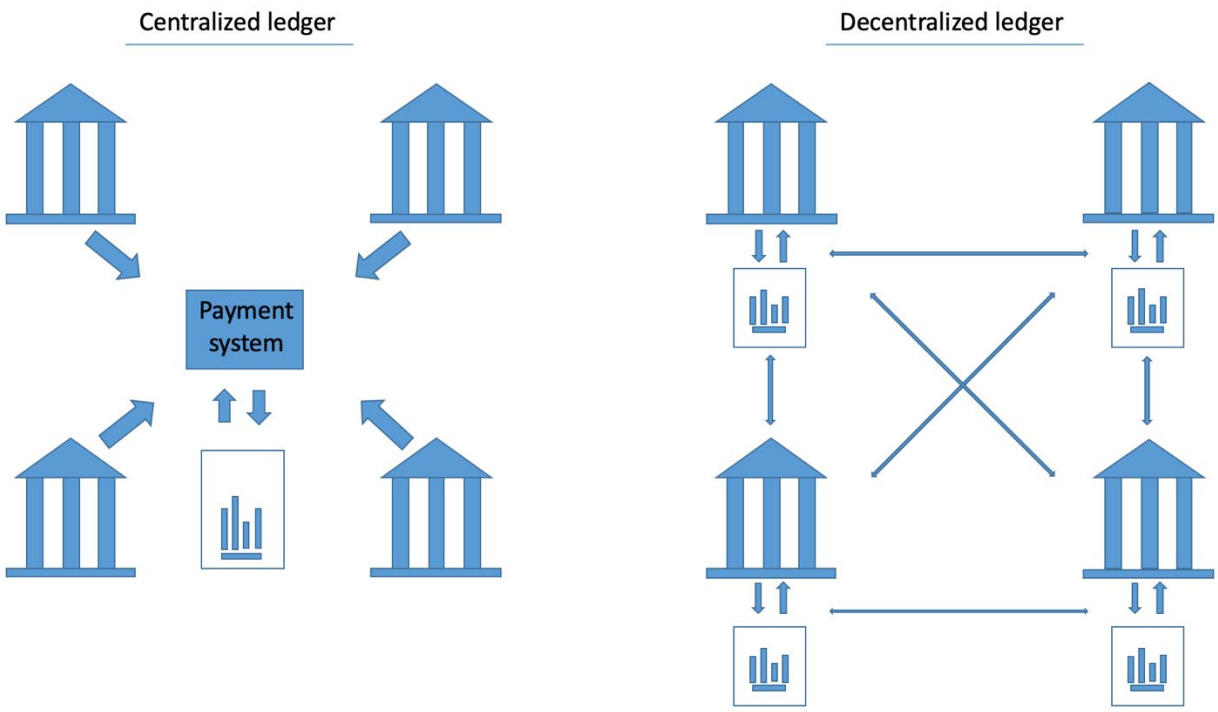

Figure 2.1: An illustration of a centralized and decentralized ledger.

2.1 Blockchains Designs

There are two criteria's of classifications of blockchains.

The verification criterion:

Permissionless: Everyone willing to take part in the verification process is able to. This is done by acting as a node in the network. The network is therefore unrestricted meaning anyone are able gain rewards by providing computational power that maintains the network. The Bitcoin blockchain is a permissionless system. The system allows anyone at any time to download all client software's to run the blockchain protocol and to continuously maintain and append new transactions data "blocks" (Tasca et al., 2016). This type of system is useful when trading value in untrusted environments. Trust is not based on anyone but encryption.

Permissioned: To be able to act as a node in the network, one must be chosen by one or several central authorities. Permissioned systems are regularly applied within an organizations. They allow a specified nodes to act as miner and observe transaction data. This systems offer possibilities of connection between existing software solutions (Tasca et al., 2016).

The access criterion:

Public: Submitting transactions and reading blockchain data is not restricted by any means.

Private: Only a predefined list of participants are given access to submitting transactions and blockchain data.

2.2 Blockchains Security

Blockchain is intrinsically a secure technology. Due to its cryptographic algorithm and decentralized nature the blockchain is immune to attacks. The core of the technology is that it's a decentralized digital ledger of any transaction of value. These transactions are verified by a "proof of work" process. Bunches of verified transactions are put together and cryptographically sealed in a data "block" (Miles, 2017). This is done by hashing, which is a method to convert data into a string of symbols of a specific length. The transactions are immutable due to the hash being almost impossible to reverse engineer. The new transactions contains a "stamp" of each block from the previous history of the blockchain. This is required to to be able to verify the new owner of an asset (Miles, 2017). So, assets are transferred when authentications of the transactions history leading up to the present ownership are verified.

If someone want to change the transactions history held by the blockchain ledger, they would have to reverse engineer the hash of a sealed bock. This is possible. However, the new block that was released would have a different hash output. The system would be alerted and reject the resealed block because the new hash would be out of sync with the "stamps" running through the rest of the chain.

Another hurdle for potential hackers is the decentralized system of the blockchain. Since the transaction ledgers are decentralized, transaction copies exist on several "nodes". Nodes are all the computes participating in a specific blockchain applications. In regards to cryptocurrencies, which is a public blockchain, there can be millions of nodes. In order successfully change the blockchain, at least 51% of the participating nodes must verify it. This means that at least 51%

of the copies of the ledger held on different nodes must be changed simultaneously (Miles, 2017).

2.3 Mining

A network of computer power is required for a peer-to-peer network to function properly. Any person with a strong enough computer and stable internet connection is able to "rent" their computer power to the network. When mining for Bitcoin, specialized software and hardware is required to be able to sustain the massive flow of information connected to all the transactions processed on the network (Cosset, 2018). Miners do not mine transactions. However, they mine blocks which are collections of transactions. The computer becomes part of the infrastructure that sustains the cryptocurrency when downloading the mining program and connect to the system. All computers connected to the system receives all the transactions on the blockchain and then arrange them into "blocks" (Cosset, 2017). A block in the Bitcoin protocol cannot exceed 1 MB of data. This limit is set to prevent large blocks from clogging the system (Bitcoin.com, 2017).

3. Bitcoin: A threat to present monetary systems

In this section I will explain the technical and conceptual principles of how transactions are completed on the blockchain with regards to Bitcoin. Bitcoin is a distributed ledger that lists money and accounts as a ledger. It was created to function as a peer-to-peer electronic cash (Nakamoto, 2008). Transactions are public and decentralized, and can be found on the digital ledger known as the blockchain. Everyone connected to the Bitcoin network share the same ledger and the history of each transactions is bitcoin transaction goes back to the point where the bitcoins first were created. For simplicity reasons, an example is utilized to explain how transactions are completed.

Name	Amount (BTC)
Jack	100
Peter	200
Lars	500

Figure 3.1: Ledger.

Assume Peter wants to send Jack 10 bitcoins. Peter would broadcast a message (transaction) to the Bitcoin network that says he wants to send 10 bitcoins to Jack. This would effectively reduce Peter's balance by 10 bitcoins and increase Jack's balance by 10 bitcoins. Then, the message is

broadcasted to the entire network and awaits to be verified in order to be accepted. When the transactions is accepted, the ledger is updated and available to everyone in the network to see (Driscoll, 2013).

Name	Amount (BTC)
Jack	100
Peter	200
Lars	500

Name	Amount (BTC)
Jack	90
Peter	210
Lars	500

Figure 3: Transaction process.

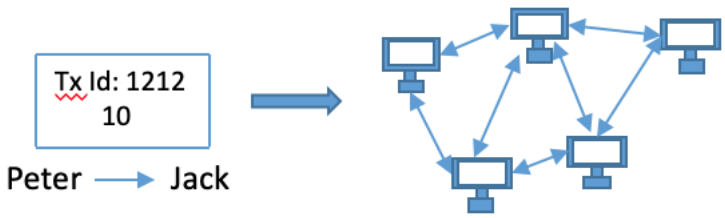

Figure 3.2: Transaction broadcasting.

Now, assume Jack want to send Lars 20 bitcoins after receiving 10 from Peter. A message containing the amount of bitcoins, previous received bitcoins and output referring to the address Jack want to send his bitcoins to, is sent. Received bitcoins, in other word, inputs must be spent in the full amount, thus Jack would send "change" back to himself if the sum of input exceeds sum of output. When Jack broadcast the message, the network verifies that Jack is the rightful owner of these bitcoins. This is completed by checking the transactions chain, examining the whole history of the bitcoins inputs to prove that jack is the owner of the bitcoins transacting, and not already have been spent (Driscoll, 2013).

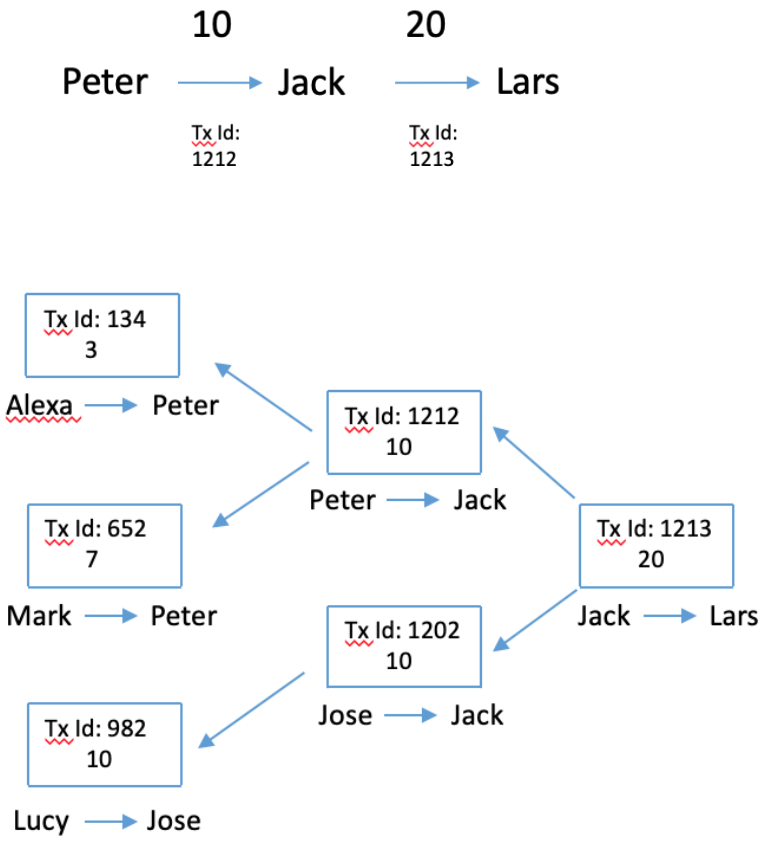

Figure 3.3: Transaction chain (Driscoll, 2013)

After a successful verification, the transactions is grouped into a block with other transactions that recently were verified as well. The blocks are created by miners. These miners compete to add the next block of transactions by solving mathematical “puzzles”. Every node receives the updated ledger whenever a new block is created, showing the changes in the user’s balance (Driscoll, 2013). The “blocks” are chained to “blocks” previously created due to the need of timestamping transactions. Hence, the name blockchain.

Before being added to a “block”, unverified transactions are polled in the memory of miner nodes. Two miners might solve the mathematical puzzle simultaneously causing there to be two “blocks”. This creates two branches in the blockchain. However, this is not a problem as it is easily fixed by the subsequent block which is added to one of them. It is protocol for every node to continue with the longest chain of “blocks”. The probability of this situation to arise is extremely low, and for it to happen twice in a row is even less likely. Also, if there is a chain that is rejected, the other transactions in that chain will be sent back to the pool of unverified transactions (Driscoll, 2013).

3.1 Cross Border Payment Evaluation of Bitcoin

In this section, an evaluation of Bitcoin will be presented in regards to cross-border payments. This evaluation is conducted in a consumer to consumer (C2C) perspective. As explained in the section xx above, it does not matter from and where bitcoins are being sent. All bitcoin transactions are borderless, allowing for frictionless and cheap international payments. There are no intermediaries, exchange rates and it is trustless. These aspects shows to an efficient, cheap, and safe method of transferring funds internationally. In regards to the customer experience domains: Price, speed, security, transparency and convenience. The purpose of this study is to have a better understanding of banks position in the cross border payment segment. Later, a similar study case will be completed with a specific bank. A score from 1 to 5 will be given. The purpose of this score is to compare experience domains with different banks and other money transfer operators. A comparison will be completed later in this thesis.

Price: 4

With a median transaction fee is 45 satoshis per byte. One Satoshi is one hundred million of a bitcoin. On November 19th the median size of an transaction is 225 bytes. The median transaction fee is therefore 0.5 USD (Earn.com, 2018). However, the transaction fees change several times each hour. The fees depend on the availability of miners verifying transactions. One is able to pay 0 satoshis, but then, no miners is willing to complete the transfer. Evidently, completing a transaction is cheap. However, transaction fees depend on the amount being sent among other factors. This leads to high fees when transferring high sums.

Speed: 5

Transactions are completed on average within an hour. However, depending on how much one is willing pay in transaction fees, the faster a transaction is completed. One must wait about an hour for a transaction to be confirmed when paying the median fee of 45 Satoshis. By paying less, the longer one must wait. And by paying more, a transaction may be completed within a few minutes (Buchko, 2017).

Security: 3

The blockchain technology behind Bitcoin is tamperproof. Therefore, it is considered to be the most secure method of transferring funds. However, some owners of cryptocurrencies have been unfortunate to have their "coins" stolen. This is not due the blockchain of Bitcoin being hacked. Bitcoins blockchain has remained secure and will stay secure considering the qualities explained previously. The reason why Bitcoin owners have got their coins stolen is due to hackers being successful hacking exchanges or wallets. If a hacker gains access to bitcoins held on an exchange or wallet, and also possesses the key necessary to facilitate a transactions, they can steal them. Then proceeding by transferring the stolen coins into offline wallet to avoid being traced, and then launder the stolen funds. Another issue with bitcoin and other cryptocurrencies is the possibility to register an address that has no link to the holders identity. This is not related to blockchain technology itself, but rather how the cryptocurrency system is set up. Also, there is no insurance from Bitcoin. If one has experienced theft or fraud with legal tender, it is possible to be reimbursed in some cases, by insurance companies, banks, and other financial services. In the Bitcoin community, there is no institution to ensure retrieval of lost funds.

Transparency: 5

The decentralized ledger comes in form of creating a completely transparent payment system. A complete transaction history is available, and anyone transferring funds using bitcoin are able to track their funds. The transfer fee is chosen by the sender, so there is full transparency on fees. The transaction speed is estimated with 90% certainty, giving the sender a overview of transfer speed.

Convenience: 3

Bitcoin allows anyone to join the network and transfer funds anywhere in the world. It is relatively simple to use, but difficult to have a complete understanding of how bitcoins are transacted. Due to the price being so volatile, it is not an ideal method of transferring funds. There lies an uncertainty at all times on how much the transfer is worth. The adaption of bitcoins has been low, so there are not many people one is able to transfer funds to. One must have a digital wallet, software or hardware that supports bitcoin. As for countries such as Venezuela where their fiat currency value has plummeted, bitcoin helps citizens receive funds that have value and can be utilized.

3.2 Properties and Characteristics of Money

This section will give a better understanding of how money is understood by economist today. To be able to compare Bitcoin, a cryptocurrency with fiat currency, we need to lay out the properties and characteristics of fiat currency as well as cryptocurrencies.

3.2.1 Store of value:

For money to be considered a medium of exchange, it must hold its value over time. Meaning it must be a store of value (Lumen, 2018). In the case that money could not store value for a period of time and still remain valuable in exchange, it would not be considered to solve the coincidence of exchange problem. However, money is not the only store of value available. Gold, silver, land, stamps etc. are also considered to be stores of value (Lumen, 2018). Money has the problem of depreciation with inflation, so it might not be the best method of storing value. All though, money is more liquid than most other stores of value due be being accepted everywhere by anyone. Also, money is easily transported store of value that is available in many convenient denominations.

Cryptocurrencies represent a store of value in the same way that fiat currencies do. Both are worth something because the parties agree that they do, just as 1 USD bill is worthless if it cannot be redeemed for any goods or services.

3.2.2 Medium of exchange:

Considered to be the most important function is the medium of exchange to enable transactions. Without money, all transactions would have to be conducted by direct exchange of one good to another (Lumen, 2018). This occurrence is called barter in which an exchange can take place only if there is a double coincidence of wants concerning two parties. So, the problem with the barter system, is that one is only able to obtain a particular good or service from a supplier, if the buyer has a good or service of equal value which the supplier also desires. The likelihood of a double coincidence of wants is therefore small and makes the exchange of goods and services challenging. Money removes the double coincidence of wants issue, by serving as a medium of exchange that is recognized in all transactions and by all parties, unrelatedly of what goods and services they offer and desire (Lumen, 2018).

Cryptocurrencies are also considered to be a medium of exchange as it enables transactions of different goods and services.

3.2.3 Unit of account:

Money provides a common measure of the value of goods and services being exchanged. Knowing the value in terms of money, of a good or service, enables suppliers and purchaser of that good or service to decide how much of it to supply and how much to purchase (Lumen, 2018). This means that money must be able to serve the function of accounting. One dollar worth can be measured in the form of another currency or by the acquisitive power of that unit of account in either goods or services (Lumen, 2018).

Cryptocurrencies represent a unit of account in the form of 1 bitcoin or 1 ether, in the same form that fiat currencies do in the form of 1 USD or 1 NOK.

3.2.4 Evolution of Money and Payment Techniques:

A quick look into the evolution of money and payment techniques will show a clear trend. Today, financial transactions are possible almost at any time and place. We use credit cards, debit cards, e-commerce transactions and mobile payments etc. We have many options to enable a simple method for transactions. However, it was not always so simple. Exchanging goods and services was the only method of transactions for several thousands of years. If someone wanted to purchase a goat from a farmer, that someone had to offer the farmer something of interest in return. If that someone had nothing the farmer wanted, there was no transaction in place. Bartering and livestock was not easily portable as one can imagine. However, it was a accepted by anyone, anywhere. Ancient civilization would use beads and shells as coins, and eventually began using precious metals to make coins. This currency was not only valuable, but also easily portable. In 1816 England established gold as its standard of value (Square, Inc, 2018). They issued bank notes that was backed by gold. Meaning that all notes that were issued had an equal value as the gold being stored in banks (commodity backed currency). This system was in place for a while until fiat currency became the norm.

3.3.5 Money and Trust:

Looking at money's function and the evolution of money and payment techniques, it is evident that a major trend is the increasing of efficiency when facilitating transactions. All three roles of money are related to transactions costs. The development of money is clearly related to reducing transactions cost in a globalized and integrated economy. This trend has boosted trade and increased economic activity. The function of money as a medium of exchange has had an major impact reducing transactions cost when considering availability. There is always others willing to engage in an exchange of goods and services. When considering commodity backed money compared to fiat currency, it is clear that there has been an substantial reduction in storage cost. From storing commodities such as gold in inventories to recording money as electronic deposits and bank loans. The risk of robbery has also been substantially reduced.

Trust between counterparts has always been necessary to facilitate a transactions. In a barter economy, when exchanging goods and services trust was established by social interactions. One had to trust that the people exchanging good or service between them exchanged legitimate goods or services.

Fiat currency is money not backed up by any commodity, but rather declared legal tender by a government. The value of fiat currencies are derived from the supply and demand relationship rather than the value of the material the money is made from (Chen, 2018). Since fiat currency is not linked to any physical reserve, it has the risk of becoming worthless due to hyperinflation. In theory, the government can print endless amounts of money. In doing so, the currency becomes worthless. People can lose faith in a nation's currency and thereby affecting the money's value.

Fiat money systems is advantageous over commodity money as it allows banks to adjust money supply in response to changes in money demand (Hall, 2015). The demand for money is considered to be impossible to control, monetary policies are conducted by central banks. Aiming to ensure price stability and a robust financial system. Commodity money has in theory a fixed supply and thereby changes in demand will result in large fluctuations of price levels.

3.4 The rise and fall of Bitcoin

In this section, about 1700 cryptocurrencies has been developed since Bitcoin introduced the first in early 2009. The reason is quite simple. From late 2016 to the end of 2017 there was a huge rise in consumer interest in cryptocurrencies. Also, several players wanted to join the action to be a part of a new era regarding payments which is moving away from fiat currency. However, only a few players would be considered direct competitors of Bitcoin. Cryptocurrencies such as Ripple, Ethereum and Litecoin to mention a few. But why has Bitcoin prices both drastically increased and later decreased? This section will give an analysis from a consumer's perspective on to why bitcoin prices has been so volatile.

Bitcoin are global tokens are unregulated, which means they are not controlled by any government. This leaves the power to the users. The users decide its market value similar to a barter system. So when people started to understand the underlying technology and its possibilities the value of several cryptocurrencies exploded during 2017. People that were unsure about the technology started to gain knowledge around key aspects of a decentralized currency. As more people invested, price obviously increased. Although it is speculated that a handful of large investors significantly impacted the price of bitcoin in the start of 2017, the immense price increase in throughout 2017 is due to bitcoin gaining about 20 million users around the world (McCann, 2018).

3.4.1 Key aspects of Bitcoins Potential

1) Peer to peer transactions: Cost efficient and fast due to there being no need for a third party intervention.
2) Borderless payments: All bitcoins transactions are borderless, allowing for frictionless and cheap international payments.
3) Trustless: There is no need to trust the counterpart of any transaction. The reason is Bitcoin's underlying technology blockchain store data using sophisticated math and innovative software that is extremely difficult for attackers to tamper with.
4) Bank-less currency: Bitcoin is free from monetary policies. For instance, bitcoin has served as an alternative currency for residents of countries with a destabilized fiat currency. Bitcoin is also immune to inflation and deflation due to bank-less interventions.
5) Bank threats: Bitcoins are insulated from banks failing or collapsing, as well as high bank fees and unpleasant policies.
6) Unbanked and underbanked user benefits: Bitcoin enables users with little to none access to banks to have the ability to obtain and use a wallet, which is the only requirement for using bitcoin.
7) Exchange rates: Bitcoins is not subjected to exchange rates, meaning that any good or service purchased with bitcoins will not be devalued by unfavorable changes in monetary values or tariffs.
8) Blockchain technology: In regards to the underlying technology that is considered to have immense potential. Bitcoin created the technology, which shows a futuristic vision.

These reasons for why Bitcoin and other cryptocurrencies gathered extreme hype are clear. The crypto fanatics believe the potential of bitcoin as an independent currency is extreme. Therefore, it is not surprising that the price of bitcoin skyrocketed during 2017. In January 2017, the price of one bitcoin was about $980 and by December 2017, the price of one bitcoin hit its peak at about $19800 (Bitcoin, 2018). There were several players in the crypto market that hyped the potential and consequently a handful of crypto-exchanges emerged making it simple to invest in any cryptocurrency. There is a clear difference between the potential of the underlying technology blockchain and the potential of cryptocurrencies. Blockchain technology has several application areas in several industries. While cryptocurrencies has a handful of applications areas in the payment industry. This might also be a reason for the extreme increase in users of bitcoin, causing the price to increase drastically. Since blockchain became such a known term and was projected to have an incredible potential. Companies such as Maersk Line, Microsoft, IBM started to experiment with and advocate the applications of blockchain. This might have had an indirect effect on the crypto-market as most cryptocurrencies are based on the blockchain technology. Nevertheless, the key aspects of bitcoin are definitely impressive and idealistic. Several people would consider the development of cryptocurrencies to be revolutionary. However, there are just as many people that have been critical of the potential of cryptocurrencies.

After a sensational year for bitcoin owners in 2017, the price of bitcoins together with other legitimate cryptocurrencies, started to drop drastically. From bitcoins peak price at about $19800 in late December 2017, the price has dropped by 75% to just below $5000 dollars by 20th of November (Bitcoin, 2018). Simple supply and demand is the reason for the drastic price decrease. There has been an decrease in the crypto market interest. In late December during the

peak price of bitcoins, there was simultaneously a peak in google searches of bitcoin. The google searches has decreased by 90% from December 2017 to November 2018 (Google, 2018).

3.4.2 Key Aspects of Bitcoin's Downfall

1) Increasing transactions time: Bitcoin transaction times were suggested to be instant, but that is not the case. As more and more joined the Bitcoin community, transactions became slower. This is due to their blockchain network being public and permissionless. Every transaction is reviewed of full transaction history. This is relatively time consuming, as a transaction may take up to 1200 minutes (there has been reports of even longer transactions times). A transaction might also only take about 70 minutes (BitInfoCharts, 2018). This is due to the how long the transaction history is and how many transactions are being processed at that time. Consequently, there lies an uncertainty on how long it take to complete a transfer. Bitcoin can only handle on average 10678 transactions per hour. This is not feasible in regards to a universal payment system.
2) Increasing transactions fee: Miners work out complex cryptographic puzzles to add transactions to the blockchain. They are paid in bitcoin in return for their services and it's the users that carry this cost. The cost is relatively low at an average of $0.7 per transaction (BitInfoCharts, 2018). Compared to banks and MTO's it is low. However, it is speculated that transactions cost will rise as mining becomes more time consuming.
3) Energy consumption: Due to the powerful computer power that is needed for mining, the energy consumption is high. In fact, it is much higher than traditional financial

institutions. Bitcoin estimated annual energy consumption is 64.37 TWh (Digiconomist, 2018). This is close to the same amount of energy Switzerland uses annually (Jordheim, 2018). The cost of mining is about the same as the cost of energy. Meaning that miners are no longer cost effective.

4) Illegal activities: As cash's availability is decreasing, bitcoin is a perfect substitute. As well as being a peer to peer transaction and anonymous, it is also much simpler to move. Bitcoin has been affiliated with several criminal activities such as terror funding, drugs and laundering. This has led to government official to advocate against Bitcoin.
5) Volatility: Lastly, the purchasing power of most fiat currencies are extremely predictable. The same cannot be said about bitcoins. Within 2017 the value of one bitcoin increased by almost 1300% and within 2018 the value has decreased by almost 75%. The value can fluctuate by thousands of dollars within a day.

In hindsight it is not surprising that the price of bitcoins has dropped. The idea of a public and permissionless decentralized currency is hardly feasible. With no government interaction, there is too much room for problems in regards to fraud, volatility and illegal funding. Bitcoin is speculative, and has acted more as a stock than a currency. Fiat currency has value because the government in charge of that specific fiat currency says so and the users believe as well. Bitcoin has value because users and speculators believe it has value. Believing Bitcoin will be an integrated part of how the payment system will evolve in the future. Bitcoins are considered to a store of value, medium of exchange and unit of account. What sets bitcoins apart from fiat currencies is the government backing. Governments have declared their fiat currency legal tender. Therefore, users will have central authorities (i.e central banks) that provide a stable and predictable currency. As for bitcoins, there is ultimately a maximum of 21 million bitcoins that

will be available. However, even though this design prevents inflation, bitcoins value is highly unpredictable. There is no central authorities to govern the currency. As a result, Bitcoin and other cryptocurrencies has not threatened conventional fiat currency as expected by many. Banks and other financial institutions are comfortable with the use of fiat currency and believe that the entry of cryptocurrencies will have little effect on their conventional monetary system.

4. Money Transfer Operators

In this section, available alternative methods to transfer money internationally will be evaluated and discussed. Today, there are several Money-transfer operators (MTOs) around the world that assists businesses and consumers with their money transfers. Banks have not been able to satisfy customers in regards to international money transfers. The high cost and low efficiency of correspondent banking have attracted a market for MTOs. In the past, MTOs such as Western Union targeted consumers with little access to banks (under-banked and unbanked). MTOs differentiated their service by speed, predictability and convenience rather than price. As banks targeted banked customers and businesses, MTOs targeted the unbanked customers segment. However, MTOs has been relatively successful in both segments as MTOs command about 40% of global revenues for international transfer for C2C, but has also 5% of global revenues in the B2C and B2B segments (Denecker et al. 2016). In recent years, digital innovators have threatened cut banks out of their correspondent banking relationships as customers are offered new solutions and enhanced propositions. Leading transaction banks are no longer able to afford maintaining large international correspondent bank networks, and therefore has been closing less profitable locations continuously (Denecker et al. 2016).

PayPal is considered the first successful digital player to threaten banks payment business. More digital players have entered the market, intensifying by changing the ways payments are completed. Transferwise is gaining tractions with both banked and unbanked customers by offering value propositions for C2C international transfers. These digital players are now outperforming correspondent banks in key dimensions such as speed, convenience, transparency and price (Denecker et al. 2016).

4.1 Methodology

To better understand Western Union, PayPal and Transferwise position in the cross-border payment market, a short description of their business will be presented. Also, an explanation of how to complete a transfer with bank account will be given. Then there will be a case where transferring money from Norway to USA via customers bank accounts. This case mostly looks at the price and speed at each company of transferring money of different amounts. A further evaluation of transparency, security and convenience will be completed as well. This evaluation will have supporting evidence from articles and published papers that evaluate such domains. The purpose of this study is to have a better understanding of banks position in the cross border payment segment. Later, a similar study case will be completed with a specific bank.
Exchange rates are calculated in regards to mid-market exchange rate. The mid-market exchange rate was 1 NOK= 0.1157 USD on November 18th.

4.2 Western Union

Western Union is a well-known financial service and communications company that primarily helps customers around the world with international money transfers. Western Union provide a simple and reliable way to transfer money between consumers and companies, offering services in more than 200 countries and territories. Also, approximately 90 % of these territories are outside the US (Finder.com, 2018). A large portion of WU's money transfers customers are migrants that has immigrated to countries with more financial opportunities. These immigrants will then use WU's services to send money back home to their family. Western union offers to send money online, by phone or in person in one of their several locations worldwide. A transfer is completed in a few simple steps:

4.2.1 Case: Transferring funds from Norway to USA

Information is gathered from (Western Union, 2018) and (Finder.com, 2018).

How to complete a transfer:

1. Create a Westerns Union account: Personal information such as name, country of residence, date of birth and ID.
2. Sending money: Enter the amount, currency and destination.
3. Choose method of payment: Cash (at retail agent location), debit or credit card, or bank account.
4. Fill in the receiver's information: Name, destination, bank account number. A receiver may also pick up cash at a WU agent location.

Data:

Transfer fee	Tiered
Flat fee	0
Exchange rate	6,5% above mid-market rate

Table 4.1: Fees included in transfer.

Sender			
Amount (NOK)	Transfer fee (NOK)	Flat fee (NOK)	Total transfer fee (NOK)
100	25.00	0	25.00
1000	100.00	0	100.00
10000	405.00	0	405.00
100000	-	-	-

Table 4.2: Total transfer fee with each amount.

Receiver		
Transfer amount (NOK)	Exchange rate	Amount received (USD)
75.00	1 NOK= 0,1103	8.27
900.00	1 NOK= 0,1103	99.27
9595.00	1 NOK= 0,1103	1058.33

Table 4.3: Amount received in USD.

4.2.2 Evaluation

Price: 3

Table 4.2 shows the different fees incurred depending on what amount is being sent. Western Union has tiered fee structure. The fees depend on the amount being sent and where the funds are sent. The fees are quite high when considering the amounts being sent.

WU's exchange rates are high, and can be nearly 7% more than the mid-market rate. This leads to a substantial amount is lost between the sender and receiver.

Speed: 3

Transactions from your own bank account online is estimated to take 2-5 business days. This is not very quick, and is also not their fastest option. But this case is only looking at bank account transfers through Western Union. One is able to send funds within minutes when utilizing WU's cash pick-up option.

Security: 5

The entire process of sending money with Western Union is considered to be secure. The right person receives the money due to WU's strict ID policy. The sender also receives a transaction number (MTCN) which is shared with the recipient to disclose the number it to WU. WU's platform uses encryption technology to keep bank account and identifying information safe along every step of the transfer.

Transparency: 3

Western Union makes it a bit difficult to estimate transfer price as they don't show any price table on their online platform. They have a price calculator that estimates total fee, but there is no explanation behind that given fee. It is possible to track payments through the whole transfer chain.

Convenience: 4

Western Union has a humongous network. With more than 500,000 agent locations worldwide, one is able to send fund practically anywhere. Since the case only looks at transfers with bank accounts it is not considered to be very convenient. Sending money to United States was not possible with bank account to bank account. Transferring money from a bank account in Norway would only be able to be received as cash at one of their several agent locations. Meaning that the recipient must pick-up cash at one of WU's locations. Western Union is a a great option for under-banked and unbanked customers as cash pick-up is possible at their 500,000 agent locations worldwide.

4.3 PayPal:

PayPal is a technology platform providing several types of payments services such as online payments, domestic money transfers, but also international money transfers. PayPal was the first successful digital player to threaten banks payments business. They offer services for business and consumers including: B2B, B2C and C2C. In this thesis, C2C international transfers being evaluated. Today, PayPal has 254 million active consumer accounts, which makes them the largest internet payment company in the world.

4.3.1 Case: Transferring funds from Norway to USA

Information is gathered from (PayPal, 2018) and (Finder.com, 2018):

How to complete a transfer:

1. Sign up for a PayPal account: Personal information such as name, date of birth, email address, phone number, residential address and details of your linked bank account or debit/credit card.
2. Click send money tab: Enter your recipient's phone number or email address, the amount being sent and a description of the transfer.
3. PayPal shows an overview of transfer fee and currency exchange rates
4. Review and information and complete transfer

Data:

Transfer fee	3.40%
Flat fee	15 NOK
Exchange fee	3.00%
Exchange rate	2,5 % above mid-market rate

Table 4.4: Fees included in transfer.

Sender				
Amount (NOK)	Transfer fee (NOK)	Flat fee (NOK)	Currency exchange fee (NOK)	Total transfer fee (NOK)
100	3.40	15.00	3.00	21.40
1000	34.00	15.00	30.00	79.00
10000	340.00	15.00	300.00	655.00
100000	-	-		-

Table 4.5: Total transfer fee with each amount.

Receiver		
Transfer amount (NOK)	Exchange rate	Amount received (USD)
78.60	1 NOK= 0,1128	8.87
921.00	1 NOK= 0,1128	103.89
9345.00	1 NOK= 0,1128	1054.12

Table 4.6: Amount received in USD.

4.3.2 Evaluation

Speed: 4

PayPal states that with transfer through PayPal account linked to bank account it will take up to 2-4 days. This depends on where the transfer is being sent from and to. If one has a PayPal account with funds on it, sending money to a recipient with a PayPal account will be completed immediately.

Price: 3

PayPal's have structured their fees to be calculated based on the amount being sent. As one can see from table 4.5, large transfers are not ideal with PayPal. The fees are based on percentages of transfer amount. As amount increases the cost of transfers' increases at the same rate. However, PayPal's fees are ideal for small transfers. Fees are also based on where money is transferred. Exchange rates are relatively high as PayPal exchange rates start at 2.5% above mid-market rate. This leads to a small amount is lost between the sender and receiver.Also, PayPal charges customers for currency exchange. At 3% of total amount, the fees are become steep as amount sent increases.

Security: 5

PayPal is a company with long term public trust. They have a 2-step login and verification procedure. PayPal's security team monitors every transaction at all times. Preventing identity theft and fraud. All private information and transactions are secured with complex encryption and security measures. PayPal also utilizes artificial intelligence to maintain high resistance to

fraud. However, security breaches are possible, but extremely unlikely. There are several reports of fraud, but often it would be considered to be the consumers own fault.

Transparency: 4

PayPal is very transparent considering it terms of use and prices. When transferring from Norway to United States it clear on how PayPal calculated exchange rate as well. However, transferring with credit card or debit card will add some fees that PayPal is not able to determine. They state that most banks charge an additional fee, and therefore consumers must ask their banks about these additional fees.

Convenience: 4

PayPal is simple to use. Sending money overseas is intuitive and easy. There are clear steps to follow when completing a transfer. PayPal is a worldwide payment network. One can transfer money from 161 countries to PayPal accounts in 78 countries. However, there are only 26 currencies available for money transfer purposes. The recipient needs a PayPal account to be able to receive money from the sender. This makes it impossible for underbanked and unbanked customers to use their services.

4.4 Transferwise

TransferWise is a money transfer service launched by Kristo Käärmann and Taavet Hinrikus in 2011. Transferwise does not route payments by transferring the sender's money directly to the recipient, but rather by redirecting payments to the recipient of an equivalent transfer proceeding in the opposite direction. This process of money transfer avoids currency conversion and international transfers. Transferwise state "Pay into our bank account in your country. We pay your recipient from our account in their country using the real exchange rate." (Transferwise, 2018). Transferwise aims to make the international transfer process as cheap and easy as possible. Using peer-to-peer technology, which they call "Member Matching".

4.4.1 Case: Transferring funds from Norway to USA

Information gathered from (Transferwise, 2018) and (Finder.com, 2018)

How to complete a transfer:

1. Sign up to a Transferwise account: Name, age, phone number, address and email address.
2. Set up transfer: Amount being sent and recipient's bank details (full name, address and IBAN)
3. Select bank transfer at payment step: this will bring up TransferWise's bank account details and reference, which are needed to pay with bank transfer through your bank.
4. Pay by bank transfer directly through your bank: Then pay by bank transfer, directly through the bank. Leaving your Transferwise account, and setting up your bank transfer directly with your bank.

5. Confirmation: Transferwise sends an email as soon as senders money arrives in Transferwise's bank account. Then, they'll convert it and pay it out to the recipient.

Data:

Transfer fee	0.35%
Flat fee	7 NOK
Exchange rate	Mid-market rate

Table 4.7: Fees included in transfer.

Sender			
Amount (NOK)	Transfer fee (NOK)	Flat fee (NOK)	Total transfer fee (NOK)
100	0.35	7.00	7.35
1000	3.50	7.00	10.50
10000	35.00	7.00	42.00
100000	350.00	7.00	357.00

Table 4.8: Total transfer fee with each amount.

Receiver		
Transfer amount (NOK)	Exchange rate	Amount received (USD)
92.65	1 NOK= 0,1157	10.72
989.50	1 NOK= 0,1157	114.49
9958.00	1 NOK= 0,1157	1152.14
99643.00	1 NOK= 0,1157	11528.70

Table 4.9: Amount received in USD.

4.4.2 Evaluation

Price: 5

TransferWise is clearly a cheap option. Table xx shows fees included in the transfer. As one can see, Transferwise is the cheapest option when transferring funds. With a percentage rate of 0,35% and a flat rate of 7 NOK, most of the funds being sent will arrive in receiver's bank account.

Exchange rate: With a competitive exchange rates within 0,02% of mid-market rate, Transferwise gives customers the most fair exchange rate.

Speed: 4

1-3 business days (depending on from and where a transfer is directed). Since one must pay through bank account, it may take some time before Transferwise receives funds that are being transferred via their platform.

Security: 5

TransferWise states that they maintain bank level security. Meaning that it is continuously tested and audited independently. They have preventive measure such as a 2-step login and verification procedures. Safeguards and teams monitoring consumers profile for any unusual activity.

Transparency: 4

TransferWise provides full upfront transparency on fees. Their website shows all fees regarding a transfer. However, transferring with credit card or debit card will add some fees that Transferwise is not able to determine. They state that most banks charge an additional fee, and therefore consumers must ask their banks about these additional fees.

Convenience: 4

TransferWise off several options as method of payments (bank account, swift, credit and debit), but funds are only sent to recipient to bank account. Also, when paying with debit and credit card, additional fees are likely to be added to the transfer. There is no option for cash pick up, so Transferwise is not a possible option for unbanked customers. Individuals are able to transfer 301160 NOK.

The process was a bit tedious, as one must first pay via bank account to TransferWise and then wait for TransferWise to receive the payment before they are able to transfer the funds to recipient. TransferWise is able to send and receive 21 currencies and are also able to send an additional 27 currencies, but not receive.

5 Cross Border Payments with Banks:

International money transfers are similar to domestic inter-bank transfers. In this case, the banks are in different countries. This makes the transfers a bit more complex. The correspondent banking principle still applies, as the banks need to have an established relationship to complete a transfer between one another.

SWIFT (The Society of Worldwide Interbank Financial Telecommunications) is a financial messaging system with tens of thousands of financial institution around the world participating in the network. The system enables all institutions involved to securely send and receive standardized information on transactions. The SWIFT system allows money to be sent from one bank to another anywhere in the world in several different currencies.
SWIFT does not send money, it simply a messaging system between banks. This causes banks to use more human intervened systems to transfer actual funds. Consequently, this makes international transfers slow. First a message has to be sent (Swift), then banks must utilize employees to do the actual transfer of money. These transfers are seen as complex and therefore contains a fee (Revacademy, 2018). A SWIFT transactions would proceed as such:

Lars wants to send $100 from his bank account based in the Norway (DNB) to Jack's account held in a bank in the US (Chase Bank). In this case there are 2 scenarios:

The banks have a direct relationship: Both banks have a commercial account at one another's banks.

Lars's bank (DNB) will send a SWIFT message to Jack's bank (Chase Bank). This will inform Chase Bank of the transfer. The message is received within minutes, then the funds can be transferred directly between the banks. Due to the banks having a direct relationship, they can easily move the funds across. This keeps the fees to a minimum and enables a fast transfer.

1. DNB will debit Lars's personal bank account by $100.-
2. DNB will credit Chase Bank commercial bank account held with DNB by $100.+
3. Chase will credit Jack's personal bank account by $100-+

Banks do not have a direct relationship:

In this case, an intermediary bank must participate in the facilitation of the transfer. So, DNB will send a SWIFT message to Chase bank that informs them of the incoming transfer. Since neither bank hold accounts with each other, SWIFT will find an intermediate where both banks hold commercial accounts. In this case there are more operations happening behind the scenes. The transfer is also more expensive and takes between 3-5 working days to complete. Also, some transfers will require two or more intermediaries, which would include more fees and longer time to complete. In this case, the transfer would proceed as such (Revacademy, 2018):

1. DNB will debit Lars's personal account by $100.-
2. DNB will request intermediate bank to debit their commercial account by $100-, and to credit Chase's commercial account by $100.+
3. The intermediate bank deducts a fee (e.g $0.50) for acting as an intermediary from the amount being transferred. And credits Chase's commercial account by $99.50.+
4. Chase will credit Jack's personal account by $99.50.+

5.1 Case: Transferring funds from Norway to USA

In this section, a case will be conducted to get a better understanding of how transferring money internationally from consumers to consumer with regards to time, price, transparency, convenience and security. As intra-banks transfers are both fast and cheap, only inter-banks transfer will be evaluated in the case. With inter-bank transfers, an intermediate bank is needed to complete the transfer. Consequently, friction arises, causing transfers to be inefficient.

Case: Cross border transfer from Norway to USA. The bank utilized in this case is DNB. DNB correspondent bank in USA is The Bank of New York Mellon.

Transfer steps from DNB online platform: Assuming the person transfering funds already has an bank account with DNB (DNB, 2018).

1. Transfer details: Chose international payment and what currency to send. Choosing the receivers currency (USD) to have information of exchange rates available.
2. Receiver details: Enter country, account number, BIC/SWIFT number, name and address of the receiver
3. Completing transfer: Send payments require a 2 step identification process.

Data:

Intermederies transfer fee	Tiered
Flat fee	60 kr
Exchange rate	4,5% above mid-market rate

Table 5.1: Fee table.

Sender (DNB)	
Amount (NOK)	Flat fee (NOK)
100	60.00
1000	60.00
10000	60.00
100000	60.00

Table 5.2: Fee incurred on sender.

Currency exchange		
Amount exchanged (NOK)	Exchange rate	Amount sent (USD)
40.00	1 NOK= 0,1116	4.46
940.00	1 NOK= 0,1116	104.90
9940.00	1 NOK= 0,1116	1109.30
99940.00	1 NOK= 0,1116	11153.30

Table 5.3: Exchange rate calculations.

Correspondant (The Bank of New York Mellon)		Additional intermederies	
Amount (USD)	Correspondent fee (USD)	2nd Intermediary fee* (USD)	3rd Intermediary fee** (USD)
4.46	0	0	0
104.90	15	10	10
1109.30	25	20	20
11153.30	50	40	40

Table 5.4: Fees added by intermediaries, depending on number of intermediaries needed.

Chase bank		
Amount received (USD)	Amount received* (USD)	Amount received** (USD)
4.46	4.46	4.46
89.90	79.90	69.90
1084.30	1064.30	1044.30
11103.30	11063.30	11023.30

Table 5.5: total amount received by beneficiary depending on number of intermediaries utilized.

5.1.2 Evaluation

Speed: 1

2-8 business days, depending on how many intermediary banks the transfer must through. The correspondent bank in the US would receive the funds from DNB the same day it was sent. Normally, they would forward it to the next bank in the chain quickly. Depending on how many banks there are in the chain and the final bank's policy, the funds could be credited to the final customer relatively quickly, or it could take a few of days. No difference for different amounts.

Fees: 2

First, DNB will take a fee from the customer in Norway of 60 NOK (deducted from the amount). Then the correspondent bank in the US will deduct a fee from the amount before the amount is credited to the receiver of funds in its books. The fee will vary from bank to bank and for the size of the amount. Typically, there will be no fees deducted for amounts below USD 100 – USD 150. Then there will be a tiered fee schedule with the fee being deducted increasing with the size of the amount. The fee typically varies between USD 15 and USD 40 (below USD 100,000) depending on the size of the amount.

If the payment is forwarded to one or more banks in the US before it reaches the receiver, other banks in the chain could also deduct a fee. Typically these fees would also be tiered and vary from bank to bank with fees from.

Exchange rate: Most customers would send USD to the US, so the exchange from NOK to USD would be made in DNB according to the current list of exchange rates. However, the rates given are not good.

Security: 5

They have preventive measure such as a 2-step login and verification procedures. Payments are sent via Swift which is a very secure means of transferring money. In addition both sending and receiving banks are screening the payments against a lot of international filters in order to prevent terror financing and money laundering.

Transparency: 3

DNB now sends all international payments via Swift GPI (Global Payments Initiative) where there is great transparency and possible to track payments all the way. Whether the transparency continues beyond the correspondent bank would depend on whether the next bank(s) in the chain are also GPI banks. However, one does not know which intermediaries and how many intermediaries there are in the transfer chain until after the funds has arrived at the intermediaries. Therefore, it is hard to estimate all fees included in the transfer. As shown in table xx, one can see that each intermediaries will add a fee for their services. The fees will become very high as more steps are needed to complete transfer.

The exchange rate for NOK to USD is available online, making it easy to calculate the amount being sent from NOK to USD.

Convenience: 4

To be able to make any transfer with DNB, one must have an account with the bank. Making a transfer online is simple and fast, but one may also call or enter a bank to complete transfers. Also, there is no limitation to amount allowed to be transferred. Banks service.

5.2 Banks vs Money Transfer Operators

Table 5.6 below, shows how banks score on each experience dimension compared to its competitors within cross-border payments. These scores are based literature study and the cases completed in the previous section.

Experience Dimensions	Money Transfer Operator: Score (1-5)				
	Bank (DNB)	Bitcoin	Western Union	PayPal	Transferwise
Price	2	4	3	3	5
Speed	1	5	3	4	4
Security	5	3	4	5	5
Transperancy	2	5	3	3	4
Convenience	4	3	4	4	4
Average Score	2.8	4	3.4	3.8	4.4

Table 5.6. Quantified evaluation of experience dimension.

Having evaluated each money transfer operator, it is clear that banks have fallen behind in every experience dimension expect for security and convenience. Banks have better customer service in regards to convenience and there is a high level of security The shortcomings experience dimension of banks cross-border payment services are substantial. Cross-border transfers are costly as transfers are routed through several banks that all charge a fee. The long transfer chain

is also responsible for the slow handling of transfers. There are also higher risk of delays as more intermediaries are involved in a transfer. Banks cross-border payments also lack transparency as the final fee incurred on the customer is not known until the transfer has been completed. Banks struggle with variations in messaging systems and banks systems. There is little standardization between banks in a global perspective. Swift messaging system is utilized cross-borders, but domestically, other messaging systems are utilized (i.e Fedwire and NICS). An estimated 90 percent of the resulting costs are incurred on banks in efforts to manage bank relationships between one another. The cost must be shifted towards the technologies and networks that handle the value transfers between banks. Having a standardized system would with minimal human intervention is possible to develop. As a result, the cost of handling international payments would decrease.

5.2.1 Drivers of change

There are essentially three forces that can explain banks necessity for a new and improved cross-border payment system. First, the non-bank offer, companies such as PayPal, TransferWise, Western Union and Bitcoin entering the market and thereby directly competing with banks. These companies are outperforming banks offerings in key dimensions such as speed, price, transparency and convenience (Denecker et al. 2016). Second, banks are not operating alone like the non-bank competitors. They are dependent on not only other banks to complete a transfer, but also regulatory framework that are structured differently in most countries. With a world getting more and more connected, banks have fallen behind due to lack of standardization. Effectively causing banks to be much less efficient than their competitors (Denecker et al. 2016).

Lastly, in regards to how domestic payments have evolved (i.e Vipps), customers are expecting more from banks in international transfers as well. Their competitors are offering digitally enabled products and services that provide customers with greater experience in regards to the domains evaluated previously (Denecker et al. 2016).

6. The Implementation of Blockchain

After studying several money transfer operators including Bitcoin, PayPal, Western Union and Transferwise from a C2C perspective, it is clear that banks have room for improvement. In this section, the implementation of blockchain technology will be discussed and evaluated.

Blockchain is a universal ledger in a distributed network. It is accessible to anyone in the network, giving each node a complete copy of the entire ledgers database. Blockchain restricts any modification completed in the ledger to be verified by other nodes in the network. Meaning for the ledger to be valid, all nodes must agree on the state of the ledger at all times. This short and simple summary of the blockchain technology is presented to better understand its benefits for banks in the cross border transfer segment.

Blockchain technology will give banks the opportunity to have transparent, bilateral and unchangeable money transfers. Consequently, blockchain technology will assist banks to directly transfer funds between each other, faster and cheaper without the risk of theft or fraud.

6.1 Payment Process with Blockchain

In section xx, the technical aspects of a bitcoin transfer was presented. A transaction between banks will be similar. The design of the blockchains are different, as Bitcoin blockchain network is public and permissionless, while banks would have a private and permissioned blockchain. This leads to the blockchain network for banks to only have banks acting as nodes in the network. No single customer will have its own ledger, as it is each individual bank that will have ledger on the network. In regards to mining, the most likely scenario would be large data centers that are able to comprehend all transaction processed on the network. These data centers would be a part of the blockchain network infrastructure and would be run by the banks involved or more central authorities.

With the implementation of blockchain technology, the payment would be transferred directly from Bank A to Bank D. A transaction between to banks utilizing the blockchain network would proceed as follows (Ravishankar, 2018)

How a transaction would be completed:

1. Transaction posted at Bank A: Debit the customer and credit the settlement account at Bank B, which is maintained with Bank A
2. Transaction posted on blockchain network: Debit the ledger account of Bank A exposed on the network. Credit the ledger account of Bank B exposed on the network. These accounts will act as a mirror account for the settlements accounts maintained at the banks.
3. Transaction posted at Bank B: Debit settlement account at Bank A, which is maintained with bank B. Then, credit the beneficiary customers account.

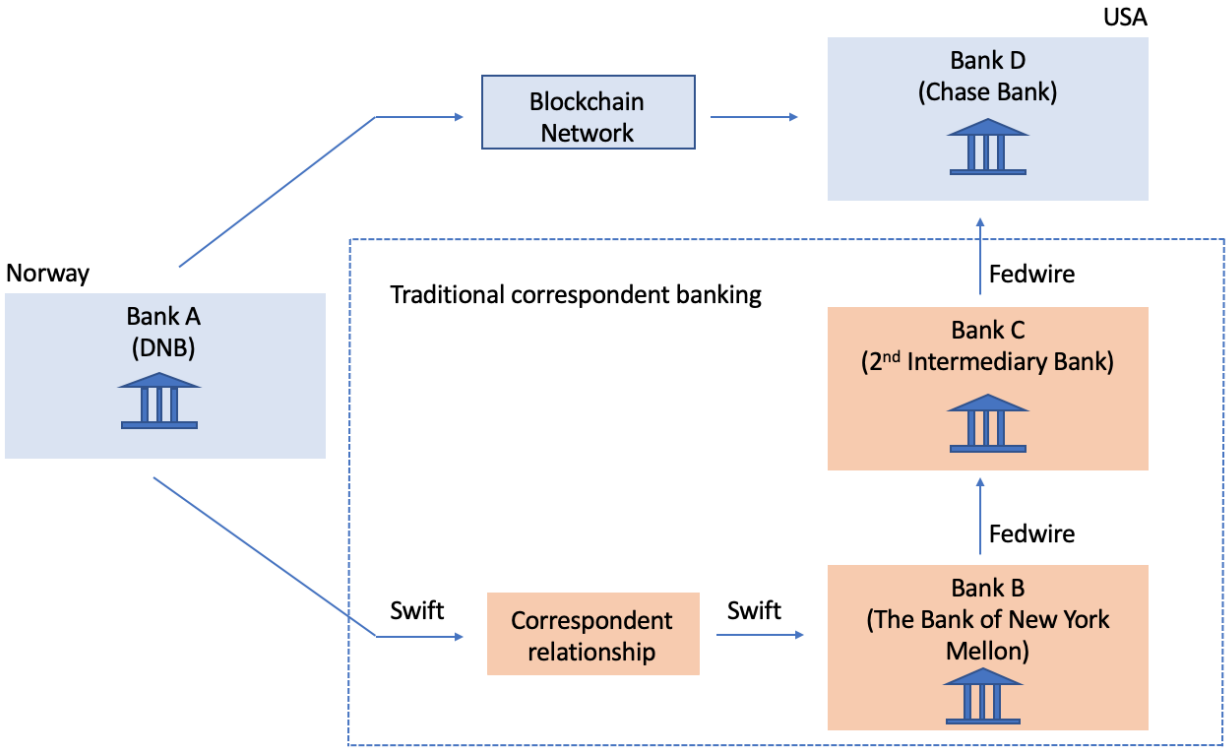

Figure 6.1: Money transfer from Bank A to Bank D through utilization of blockchain, eliminating the third party.

Looking at the figure 6.1 above, it is evident that with the implementation of the blockchain technology, the payment chain is reduced with several steps. The figure is an example of a payment from Bank A to Bank D. Since the payment is transferred from Norway to USA, Bank A must utilize Swift to send a message to their correspondent bank (Bank B). Then, Bank B must utilize Fedwire to transfer funds to Bank C, which is an intermediary between Bank B and Bank

D. As discussed previously, this is time consuming and costly. With the utilization of blockchain technology, there is a direct transfer between Bank A and Bank D.

6.1.1 User Experience Improvements

A closer look into what benefits blockchain technology will bring:

1. **Transfer time reduction:** There is no need for intermediates and messaging systems (SWIFT). These aspects of a cross border transfer are the reasons for a slow transfer process. Eliminating these steps will enable a nearly instant transfer between all banks participating in the network. And of course, eliminating intermediaries banks will reduce transfer time.
2. **Transfer cost reduction:** Blockchain technology will eliminate transfer steps such as SWIFT messaging system and intermediate bank payment processes. These processes are charged and by eliminating these steps, the cost will be reduced drastically as most of the cost of cross border transfers stems from these steps.
3. **Eliminating trust:** By excluding middlemen, correspondents and central agencies from the transfer process, transactions are only between the banks that have a bilateral agreement.
4. **Security:** Blockchain technology is considered to be groundbreaking secure. All details of a transaction is encrypted and hashed. This means that tampering with any data in the network is impossible.

5. **Balance overview:** Due to being a distributed ledger, each node of the network have a copy of the balances. The balances are maintained in settlement accounts with the other banks. Meaning that balances are constantly updated and maintained.
6. **Transparency:** Since sender and receiver are nodes of the network, full transparency is possible with a distributed ledger. It is important to note that it depends on if the blockchain network is set up to be public or private and permissionless or permissioned.

6.2 Critical Factor to Be Addressed Prior to the Implementation of Blockchain

There are clear benefits of the blockchain technology. However, for there to be an industry-wide open adoption of the technology, some critical factors must be addressed for it to be feasible (Ravishankar, 2018) and (Shah et al., 2017):

1. **Data protection and privacy:** There has to be a clear and strict guideline to ensure that there is no modification of data and external data breaches. It is important that the institution(s) that will implement the technology, has a clear understanding of its possibilities and threats.
2. **Standardization:** In regards to globalization, there has been a lack of standardization in formats between banks. SWIFT is a globalized system that connects all banks directly or indirectly. However, banks are more standardized domestically. It is important for the blockchain technology to be implemented in a standardized manner on a globalized perspective.
3. **Collaboration:** Banks must cooperate to create a inter-operable blockchain system. A standardized blockchain network is not possible of banks create their own networks domestically.
4. **Transparency:** Cross border transfers are expensive and time consuming due to the charges and steps incurred through several correspondent banks. Full transparency is not

given, as sender and receivers are not informed about all the steps the transfer went through. With the blockchain network, sender and receiver must be informed of transfer route and costs incurred.

5. **Regulatory factor:** Money laundering and illegal financing will still be possible if there is no regulatory reporting to keep tab on suspicious transfers.
6. **Adaption:** With the implementation of blockchain technology will only be successful if everyone adopts it. This is a crucial element of the cross-border transfer/payment segment.

6.3 Design of the blockchain network:

When deciding on how the blockchain network should be designed, it is important for banks to understand how permissionless and permissioned verification criteria differ. In section xx there is a description of both verification criteria. Moreover, having a public permissionless blockchain design such as Bitcoin would not be feasible. Banks need to have control over the transactions processed. With a public permissionless design, anyone can act as a node in the network and thereby submit transactions. This would lead to there being very little control over transactions completed and consequently enabling several illegal transactions. A much more reliable design is the private permissioned design. This design will have banks acting as nodes in the network. The customers will not be provided with an individual address connected to a node, as it would lead to exposure of copies of all customer ledgers. The volume of customers and the data privacy as a user is key. Therefore, only banks' ledger accounts should be a part of the networks nodes.

6.3.1 Regulators and Compliance

Today, regulatory and compliance reporting such as Electronic Data Interchange (EDI), Anti-Money Laundering (AML), and Financial Action Task Force (FATF) ensures sufficient payment transparency and keeps high-risk payments under surveillance. Regulation has four main objectives: Securing financial stability, conduct and fairness, prudential regulation, and competition and market development (Arner et al., 2015). Combining blockchain technology and data analytics, could facilitate real-time screening in suspicious transaction activities. By changing the whole payment infrastructure, there will be challenges maintaining compliance

with regulators. A solution will be to include data analytics (big data) as an additional data layer of the blockchain network. In this data layer, details of the transactions within the blockchain will be registered. This big data environment with all the details of transactions will be available for compliance and regulation. For it to be possible, the registered details of the banks within the blockchain network must also be available. Figure 6.2 below, shows how transparency will be achieved.

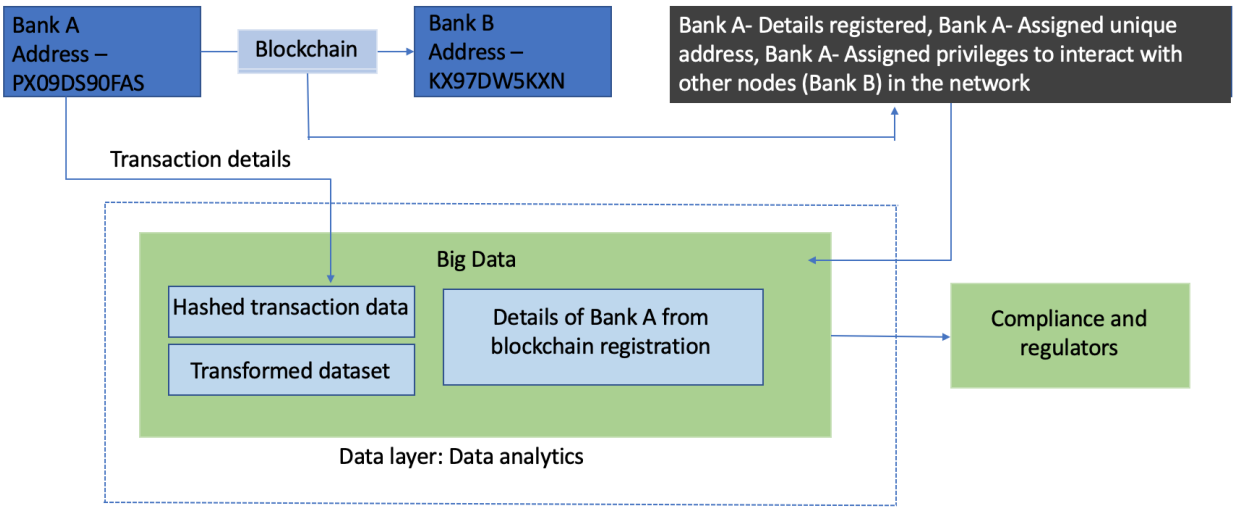

Figure 6.2: Framework for a collaborative approach to regulatory reporting (Ravishankar, 2018).

6.3.2 Key benefits of a data layer

1. **Organized:** Data can be easily be subdivided by country, region, bank and date making it simple to have a complete overview of all data. Consequently, compliance and regulatory measures will be simple to conduct. This data environment will serve as a crucial source of information for compliance, regulatory and investigation purposes.
2. **Efficient:** Information such as customer, registration, transaction and bank details can automatically be placed in the big data environment. Unhashing the transaction details from the "blocks" will also be possible. This will make a much more efficient distribution of information and (Shah et al., 2017):
3. **Business Intelligence (BI):** Access to data for compliance, regulators and other departments will give them the ability to conduct analysis with a more transparent approach. Much more data will be available, as most data will be available on the added data layer (Ravishankar, 2018).

6.4 Challenges and Risks

There are several challenges and risks to consider if the implementation of blockchain technology should completed. Having stated that for blockchain to be implemented, there must be collaboration between banks. Moreover, implementation can only be as efficient as the slowest member (Fintech Futures, 2018). Delays are bound to occur as more banks are responsible for a correct method of the implementation of blockchain. Banks must also accept higher operational cost in the beginning. As the motivation of the system is to reduce cost for both banks and customers, banks run the risk of being responsible for most of the cost affiliated with implementation and operational costs. Considering overall cost of maintenance, using bitcoin as an example, where computing power and electricity cost has increased dramatically. Banks must design the blockchain network to where it will bring economics of scale.

The implementation of blockchain must be considered an investment. Moreover, banks must have a clear overview of what cost are affiliated with the implementation and operation of the system. Banks run the risk of having long payback periods. A full understanding of what costs they will be subjected to must be determined (Shah et al., 2017). Also, as the application of blockchain will require significant overhaul of existing systems in place. Banks must carefully strategize the transition. There needs to be a consortium based approach as all stakeholders agree on the same system designs (Shah et al., 2017). There needs to be thorough education to minimize the risk of ineffective implementation of the blockchain technology.

There will also a substation risk concerning cyber security. Managing security within a private technological infrastructure is a lot easier than what a shared technological infrastructure (Fintech Futures, 2018). Blockchain technology is a shared infrastructure. The extent of exposure

to cyber-attacks are unknown. The risk of external and internal cyber-attacks must be determined.

There are also questioned about how the concept of reversing mistakes on the blockchain. There might be an incident where there are mistakes made, either a transaction or identity information etc. Blockchain is set up to be tamper proof. This means that it is impossible to reverse if there already was a consensus about the new information being valid. A new block is created and theoretically irreversible (Fintech Futures, 2018). Will it be possible to reverse if the information provided is wrong?

Lastly, change management post implementation is another challenge for participating banks. As all participants need to agree on the change, implementing blockchain may be more challenging as there will be disagreements on how the operational aspects of the system will be handled (Fintech Futures, 2018).

6.5 Current standpoint of blockchain with banks today

There is obviously a long way to go before utilization of blockchain within transfer will be implemented. To better understand the standpoint of banks of the technologies today, a short presentation of blockchain entry into the banking world will be provided.

There is about 90% of banking executives that state that they are studying the potential of blockchain technology. 40% of banks are still at the exploration phase, meaning that they are still considering where the implementation would benefit the banking industry. Approximately 30% are pursuing proof of concept (PoC). It is believed that the most likely implementation of

blockchain technology will be within intra-bank cross border payments, but also inter-bank cross border payments are regarded as a possible destination of the technology (Consultancy.UK, 2016). The banking industry is also studying several benefits of the technology. Research show banks consider lower frictional cost, lower administrative cost, shorter settlement time, error reduction and new revenue opportunities to be promising benefits.

Fintech companies are benefiting from banks interest in the blockchain technology, Companies such as Ripple and R3 are already working with banks developing blockchain based systems for cross border payments and regulatory factors that include in such payments.

Ripple, which also has their own cryptocurrency, are considered to be a fintech company. As early as May 2016, Santander bank announced they have developed an application to facilitate cross-border payments using Ripple's blockchain technology. The application is available on mobiles in Spain, UK, Brazil and Poland. Expecting to expand to more European countries. Latin America and Asia soon (Ngetich, 2018). This solution is for Santander customers only, meaning a solution for intra-bank cross border payments.

R3 is another fintech company that has partnered with 39 financial firms testing R3's Know Your Customer (KYC) application, which is based on blockchain technology. R3 completed more than 300 transaction between 19 countries. The customers could request KYC data, while clients could grant or revoke access (Partz, 2018). Their goal was to speed up process of verifying customer's identity for financial transactions both domestically and internationally.

Ripple published a paper in 2016 about potential savings for banks when implementing their blockchain technology with cross-border payments. An estimate of 33% cost reduction is presented. Moreover, Ripple estimates a one-time payment of 10 million USD for the

implementation and suggesting the payback period will be about 11 months. They also state that it will depend on a banks size (Ripple, 2018)

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Another important entrant in the blockchain world is Swift. Swift are also testing how blockchain technology might improve their current operations. They are regarded as Ripple's biggest competitor within cross border payments (Arnold, 2018). Newly, Swift implemented the use of Global payment initiative, which is used by only 165 banks worldwide. This technology, previously discussed is not based on blockchain. Even though it has reduced frictions in cross border payments, Swift are looking into how blockchain may benefit their operations. Swift have stated that they are sceptic of blockchains benefits.

Several other fintech companies are pursuing the opportunities arising in cross border payments and also other areas with banking. It is clear that some headway has been made, but in regards to intra- bank cross-border payments, there is still no definite solution being proposed. Starting with inter-bank cross border payments seems to be banks first priority as it is easier to control more factors included in the implementation.

7. Conclusion

Bitcoin, instead of treating traditional monetary systems, has developed a technology that will benefit banks and other financial institutions in the future to come. Cryptocurrencies does not have government backing, causing bitcoins to not being able to penetrate present monetary systems. However, money transfer operators such as PayPal, Western Union and Transferwise are direct threats to banks cross border payment segment, as they provide customers with enhanced value propositions.

Having presented a method and benefits for banks to utilize the blockchain technology, it is clear that it will benefit banks involvement in the cross-border payment segment. A digital ledger provided by the blockchain technology will eliminate much friction that is present in the payment chain, and thereby increasing customer value propositions. Also, a study by Ripple, suggested severe cost reduction in regards to banking operations.

The main challenge of the implementation of blockchain technology is providing a standardized system that can be utilized globally. Much of the payment chain frictions are caused by countries having different messaging and account systems. Therefore, it is crucial that when implementing blockchain, the system must be structured to suit all banks involved. Banks and other financial institution responsible for the implementation of the technology must educate themselves to have a complete overview of its risks. Security is a major risk, as no one really understand the technology implications, banks must construct proof of work before implementing blockchain.

In conclusion, I strongly believe that banks cross border payment segment will be able to provide customers and themselves, with enhanced value propositions by utilizing blockchain technology.

References:

Arner, D., Barberis, J., & Buckley, R. (2015). The Evolution of Fintech: A New Post-Crisis Paradigm? Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2676553

Arnold, M. (2018)*Ripple and Swift slug it out over cross-border payments*:Retrieved from https://www.ft.com/content/631af8cc-47cc-11e8-8c77-ff51caedcde6

Bitcoin (2017) *How Bitcoin Transaction Work.* Retrieved from https://www.bitcoin.com/info/how-bitcoin-transactions-work

Bitcoin (2018). *Bitcoin Core (BTC) Price*. Retrieved from https://charts.bitcoin.com/btc/chart/price

BitInfoCharts (2018). *Bitcoin (BTC) price stats and information.* Retrieved from https://bitinfocharts.com/bitcoin/

Blockgeeks (2018). *What is Blockchain Technology? A Step-by-Step Guide For Beginners.* Retrieved from https://blockgeeks.com/guides/what-is-blockchain-technology/

Buchko, S. (2017). *How Long do Bitcoin Transactions Take?* Retrieved from https://coincentral.com/how-long-do-bitcoin-transfers-take/

Chen, J. (2018). *Fiat Money.* Retrieved from https://www.investopedia.com/terms/f/fiatmoney.asp

Chris McCann (2018). *12 Graphs That Show Just How Early The Cryptocurrency Market Is.* Retrieved from https://medium.com/@mccannatron/12-graphs-that-show-just-how-early-the-cryptocurrency-market-is-653a4b8b2720

Consultancy.UK (2016).*The benefits and use cases for blockchain technology in banking.* Retrieved from https://www.consultancy.uk/news/12801/the-benefits-and-use-cases-for-blockchain-technology-in-banking

Cosset, D. (2018) *Blockchain: What is Mining?* Retrieved from https://dev.to/damcosset/blockchain-what-is-mining-2eod

Denecker, O., Istace, F., Masanam, P, K., & Niederkorn, M. (2016). *Rethinking correspondent banking.* Retrieved from https://www.mckinsey.com/~/media/McKinsey/Industries/Financial%20Services/Our%20Insights/Rethinking%20correspondent%20banking/Rethinking-correspondent-banking.ashx

Digiconomist (2018) *Bitcoin Energy Consumption Index.* Retrieved from https://digiconomist.net/bitcoin-energy-consumption

DNB Bank ASA. (2018) *Konto og kort.* Retrieved from https://www.dnb.no/

Driscoll, S. (2013). How Bitcoin Works Under the Hood. Retrieved from http://www.imponderablethings.com/2013/07/how-bitcoin-works-under-hood.html

Earn.com. (2018) *Predicting Bitcoin fees for transactions.* Retrieved from https://bitcoinfees.earn.com/

Finder.com, A (2018). *Review: Western Union international money transfers.* Retrieved from https://www.finder.com/western-union-international-money-transfer

Finder.com, B (2018). *Review: PayPal international money transfers – December 2018.* Retrieved from https://www.finder.com/paypal-international-money-transfers

Finder.com, C (2018). *TransferWise international money transfer review.* Retrieved from https://www.finder.com/no/transferwise

Fintech Futures (2018) *Managing the risk of blockchain.* Retrieved from **https://www.bankingtech.com/2018/03/managing-the-risks-of-blockchain/**

Google (2018). *Google Trends: Bitcoin* Retrieved from https://trends.google.com/trends/explore?q=bitcoin

Hall, J. (2015). *Fiat Currency: What It Is and Why It's Better Than a Gold Standard.* Retrieved from https://www.fool.com/investing/general/2015/12/06/fiat-currency-what-it-is-and-why-its-better-than-a.aspx

Hans Jordheim (2018). *Studie: Snart trekker bitcoin like mye strøm som Østerrike.* Retrieved from https://e24.no/digital/bitcoin/studie-bitcoin-vil-staa-for-en-halv-prosent-av-verdens-energiforbruk-foer-aaret-er-omme/24338415

Lumen (2018). *Money as a Tool*. Retrieved from https://courses.lumenlearning.com/boundless-business/chapter/money-as-a-tool/

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

Nolan Bauerle *(2018) How Does Blockchain Technology Work?* Retrieved from *https://www.coindesk.com/information/how-does-blockchain-technology-work*

Ngetich, D (2018). *$90 Billion Santander Bank Partners with Ripple Labs.* Retrieved from *https://ripplecoinnews.com/90-billion-santander-bank-to-use-xrp-after-partnering-with-ripple-labs*

Miles, C. (2017) *Blockchain security: What keeps your transaction data safe?.* Retrieved from https://www.ibm.com/blogs/blockchain/2017/12/blockchain-security-what-keeps-your-transaction-data-safe/

Partz, H. (2018) *Banks and Regulators Complete KYC App Test on R3 Blockchain Platform.* Retrieved from https://cointelegraph.com/news/banks-and-regulators-complete-kyc-app-test-on-r3-blockchain-platform

PayPal (2018). *Send Money Online*. Retrieved from https://www.paypal.com/no/webapps/mpp/send-money-online

Ravishankar, A. (2018) *Cross-Border Money Transfer using Blockchain- Enabled by Big Data.* Retrieved from https://www.infosys.com/industries/cards-and-payments/resources/Documents/cross-border-money-transfer.pdf

RevAcademy. (2018) *SWIFT & SEPA: How international money transfers actually work.* Retrieved from https://blog.revolut.com/swift-sepa-how-international-money-transfers-actually-work/

Ripple. (2018) *The Cost-Cutting Case for Banks.* Retrieved from https://ripple.com/files/xrp_cost_model_paper.pdf

Shah, M., Chatterjee, S. (2017) *Blockchain in banking.* Retrieved from https://www2.deloitte.com/content/dam/Deloitte/in/Documents/strategy/in-strategy-innovation-blockchain-in-banking-noexp.pdf

Square, Inc (2018). *History of Money and Payments.* Retrieved from https://squareup.com/townsquare/history-of-money-and-payments

Tasca, P., Aste, T., Pelizzon, L., & Perony, N. (2016). Banking Beyond Banks and Money. Cham, Switzerland: Springer.

TransferWise (2018). *Send Money.* Retrieved from https://transferwise.com/

Western Union (2018). *Send Penger via Internett*. Retrieved from https://www.westernunion.com/no/no/send-money/app/start