Roshan Khadka

THE IMPACT OF BLOCKCHAIN TECHNOLOGY IN BANKING

How can blockchain revolutionize the banking industry?

Thesis
CENTRIA UNIVERSITY OF APPLIED SCIENCES
Business Management
October 2020

ABSTRACT

Centria University of Applied Sciences	**Date** October 2020	**Author** Roshan Khadka
Degree Programme Business Management		
Name of the thesis The impact of blockchain technology in banking: How can blockchain revolutionize the banking industry?		
Language Instructor Eija Torkinlampi		**Pages** 29 + 3
Supervisor Paula Tornikoski		

A blockchain is an ordered, decentralized, immutable ledger that allows a recording of transactions in a network. Over the recent years, blockchain has emerged to be a technology that can be applied in various sectors. It has promised to be the technology that will allow transactions simply, effectively, safely, and cheaply. The main aim of this thesis was to study the possible impacts of blockchain in banking industry along with its challenges and limitations. The outcome would include a good explanation of blockchain technology, how it works, future bank implementation and its challenges.

To answer the research questions, a literature review was conducted. The articles were selected from evidence based scientific databases such as ABI Inform, Academic Search Elite, Emerald, Sage Premier, ScienceDirect, Springer Open, and Google Scholar. Six scholarly articles were selected by using inclusion and exclusion criteria and screening the relevant articles. Data were systematically extracted and grouped into five main categories.

The result shows that the blockchain technology could enhance the efficiency of various sectors of banking industry. It has the potential to upgrade and transform the cross-border payment, trade finance, capital markets, and financial reporting and compliance. It also makes the process of knowing your customer straightforward. So, the implementation of blockchain is projected to disrupt banking and finance system by facilitating a new way of payment, faster trade execution, secured ledger, smart contracts, and many other innovations. However, there are some obstacles such as regulation and technological challenges to be solved for the efficient implementation in banking sector.

CONCEPT DEFINITIONS

CBDC	Central Bank Digital Currency
DLT	Distributed Ledger Technology
ECB	European Central Bank
KYC	Know Your Customer
NASDAQ	National Association of Securities Dealers Automated Quotations
SCIs	SEPA Credit Identifiers
SEPA	Single Euro Payment Area
SWIFT	Society for Worldwide Interbank Financial Telecommunications
WTO	World Trade Organization

ABSTRACT
CONCEPT DEFINITIONS
CONTENTS

PICTURES

TABLES

FIGURES

1 INTRODUCTION

From the early history, banking industry has been acting as an intermediary to conduct financial transactions. They have been providing the trust required for flow of funds. Technology has always had an impact on banking system. With the advancement in information and technology, banks have consistently adapted their working style. Today, banks are connected with the technological networks such as SWIFT for information flow. So, banking industry is fully dependent on technologies to perform their day to day operations. Thus, blockchain could be the significant catalyst to help banking industry.

Banks are often criticized as inefficient, expensive, and non-transparent. Fintech and neo-banks such as PayPal, Revolut, N26, are disrupting traditional banks with their innovative solution. Blockchain proposes solution for these criticism as well as provides competitive advantage over the Fintech industry. Overtime, the interest in blockchain has grown intensely, and lately central banks and governments have also started exploring its use cases. With many banks around the world exploring the potential of blockchain, the future certainly looks promising.

This exploratory thesis aims to study the possible impacts of blockchain in banking industry along with its limitations and challenges. This thesis provides a good explanation of blockchain technology, the mechanism of blockchain and the use of blockchain technology in banking industry. It introduces Bitcoin as the first application of blockchain technology along with its history and characteristics. Additionally, the research looks into the problem's banks are facing nowadays and the roles blockchain might play to solve them. Last but not the least, the thesis shows how banks are researching and implementing blockchain in their work. More specifically, this thesis proposes to answer the following questions:

i.   What are the possible impacts of blockchain technology in the banking industry?

ii.   What are the challenges for the implementation of blockchain technology?

2 BLOCKCHAIN

A Blockchain is an ordered, decentralized, immutable ledger that allows a recording of transactions in a network. The transactions are recorded in a block that is unchangeable and contains all the information of the transaction. Any transaction or information of value can be recorded and shared within the network. The traditional ways of recording transactions are centralized, inefficient, expensive, redundant and this is where blockchain comes in use. One popular example of blockchain is bitcoin- a decentralized peer to peer digital currency. Blockchain is the technology behind bitcoin. Blockchain provides the foundation and means for recording bitcoin transactions – which can be used to record anything. (Gupta 2018, 3-6.)

Blockchain possesses many characteristics that can solve problems in different fields. The two main characteristics of blockchain are decentralization and immutability. Blockchain is decentralized, meaning that the records are distributed to all the parties rather than in a central ledger. It facilitates a peer to peer communication network and eliminates the need for third parties. Since the third party is eliminated, the operation is faster and cheaper. Another interesting feature is immutability, meaning that once the transaction is recorded, it cannot be changed. In case the transaction needs to be updated, a new transaction is created and updated to all the networks. Transactions are verified by other computers in the network, and once verified they cannot be tampered. Thus, it provides high security and trust. (Attaran & Gunasekaran 2019, 13.)

PICTURE 1. Illustration of Centralized ledger and Distributed ledger (adapted from Krause, Velamuri, Burghardt, Nack, Schmidt, & Treder 2016.)

2.1 Working mechanism

Blockchain, the name is adapted from the way it works – blocks connected to form a chain. The transaction recorded in a block contains a hash (digital signature), hash of previous block and the ledger of all valid transactions. The hash links the block one after another and strengthens the verification of previous block. Thus, an immutable blockchain is formed. (Gupta 2018, 13-14.)

It is important to understand five concepts to know how blockchain works: a network of nodes, tokens, a structure, a consensus mechanism, and rules. Firstly, the network of nodes refers to each participant(computer) in a network. The nodes are connected to each other and checks

the validity of transactions. The higher the nodes connection, the stronger the network. Secondly, tokens also called digital currency or cryptocurrencies represents an ownership of value. It can represent money or any kind of assets and can be used to exchange value. Next the structure of blockchain is ordered series of transactions. Each block connects to form a blockchain. (Krause et al. 2016.)

Then, the consensus mechanism works as a collective decision-making process, where each node in a network participates to determine the correct version of ledger. The nodes prevent double payment and manipulation of transaction. There are two kinds of mechanism: proof-of-work and proof-of-stake. Under proof-of-work mechanism, network of nodes must solve complex problems to add new blocks to the blockchain. This is the reason; it is impossible to change the transactions as the third party must outperform the whole network. It is used in bitcoin. Proof-of-stake works based on the ownership of token. The network with highest token can create more blocks. Finally, rules are set of protocol for communication between the parties. It defines the character of ledger systems. All five concepts pool together to form a blockchain. (Krause et al. 2016.)

A intents to send funds to B

1   Transaction recorded in new block

2   Block validation through network

3   Add block to existing chain
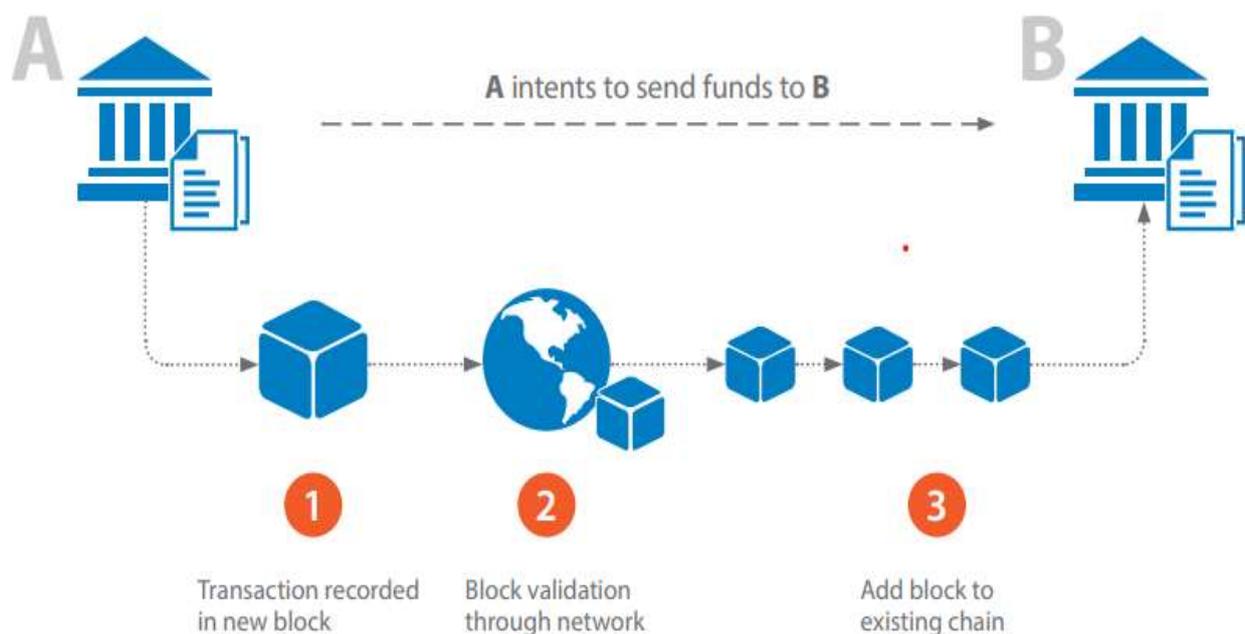
PICTURE 2. Illustration of the process of a blockchain (adapted from Krause et al. 2016)

2.2 Types of blockchain

It is important for businesses to understand the different types of blockchain, before implementing it. The differences can be significant, and businesses should adapt the system that is best suitable for their business model. (Thompson 2016.) The three main types of blockchain are discussed below:

A public blockchain is a fully decentralized blockchain which can be used by anyone with a minimum resource. The main purpose of public blockchain is to remove the intermediaries and facilitate peer to peer transactions. The common example of public blockchains are Bitcoin, Ethereum, and other cryptocurrencies, which are openly available for anyone. Each transaction is verified by the network before it is recorded, so they are highly secured. Public blockchain is expensive and slow compared to private blockchain, but it still outperforms the current systems used for recording. (Thompson 2016.)

A Private blockchain is a permissioned based type, meaning that participants need permission from central authority (to some level) to perform the task. It is not fully decentralized and is controlled by the intermediary. Each transaction is verified by authority before it is recorded. Private blockchain is faster and cheaper compared to public blockchain. It is mostly suitable for corporate business and governance models. It has huge potential to increase the efficiency and decrease the operation costs. The use case of private blockchain can be online voting system. (Thompson 2016.) A sub-category of private blockchain is consortium blockchain which has same characteristics as private blockchain, except that it is owned by a group of entity (Dragonchain 2019).

As name suggests, a hybrid blockchain is a combination of private and public blockchain. It provides decentralized environment in a private network. It offers great flexibility and control over the data. It is mostly suitable for highly regulated companies. XinFin is an example of hybrid blockchain built by combining Ethereum(public) and Quorum(private). It provides solution for global trade, finance, and supply-chain. (Freuden 2018.)

2.3 Bitcoin: The first blockchain

A bitcoin is a peer to peer digital currency that allows online payment from one party to another without a need for third party. It was proposed to solve the shortcomings of fiat money and banks. A bitcoin uses blockchain to record the transaction. (Nakamoto 2008.) The bitcoin protocol was introduced in 2008 by pseudonym Satoshi Nakamoto in a white paper named, "Bitcoin: A Peer-to-Peer Electronic Cash System" (Nakamoto 2008). The bitcoin is the first and the most popular cryptocurrency. The current market capitalization of bitcoin is $177.81 billion (Statista 2020). Blockchain is the technology behind the bitcoin. Blockchain can be supposed as an operating system and bitcoin as one of the many applications. Blockchain provides distributed ledger to record bitcoin transactions and has many uses beyond bitcoin. (Gupta 2018, 6.)

2.3.1 The rise and fall of bitcoin

The bitcoin emerged as a cryptocurrency in 2009 to solve the inefficient, expensive, and vulnerable drawbacks of cash and banking system. The bitcoin is the first cryptocurrency in the world and the most popular one. The bitcoin uses blockchain technology to record the transactions. (Gupta 2018, 4-5.)
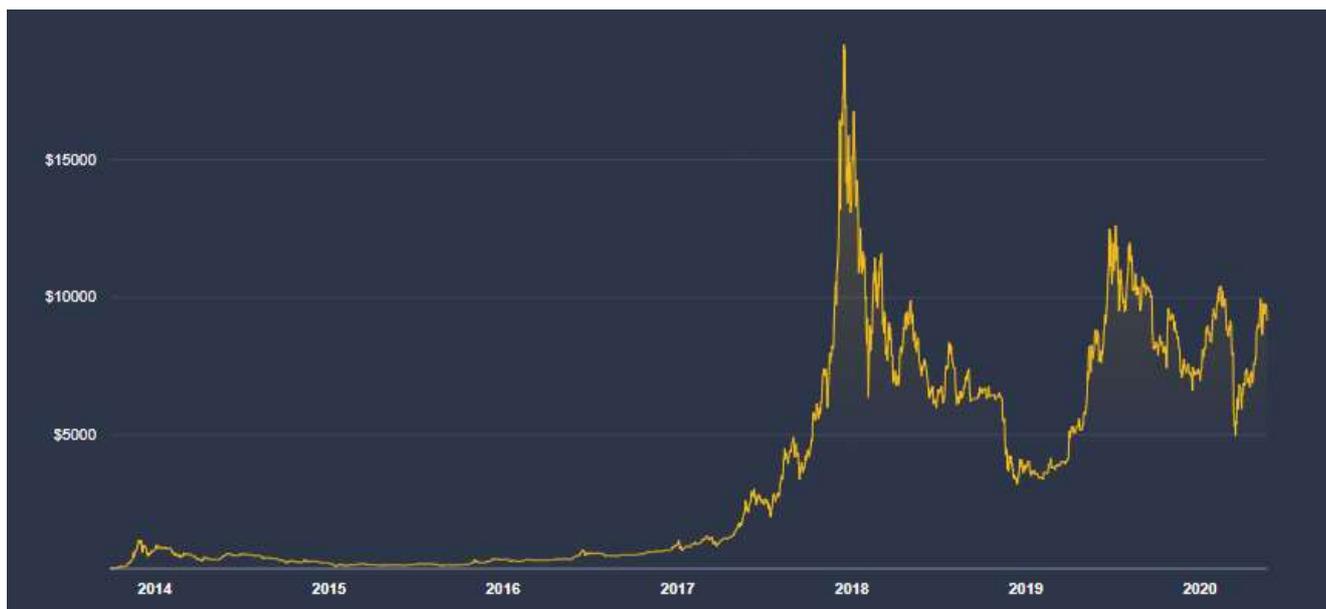
PICTURE 3. Price history of bitcoin (adapted from CoinDesk, 2020.)

The value of bitcoin for first two years was near to nothing. The first significant change came in July 2010, when the value increased from around $0.0008 to $0.08 for 1bitcoin. From 2010, the market exposed slowly, and the currency started gaining retailers and users. It stayed slow until 2013 and it is when the price started to explode. In 2013, bitcoin was trading for around $13.5 per bitcoin. The price went to record high $220 in April, before coming back to $70 in same month. During October-November period, the price rallied from around $100 to $1,075, an increase of 975%. The primary cause of the rally was the bitcoin gaining popularity and miners from China entering the market. (Edwards 2020.)

Throughout the history of bitcoin, the price has seen dramatic rise and fall. In February 2014, Mt. Gox, the largest bitcoin exchange filed for bankruptcy. This led Bitcoin to crash below $580 and resulted in slow decline in the price. The price fell to around $315 in early 2015. After that it rose gradually and settled around $ 1,000 in early 2017. The biggest moves came in 2017. The price reached $5,000 in October, $10,000 in November, and $19,783 in December, an increase of more than 1800% in a year. Shortly, the market crashed and reached below $7,000 and continued till November 2018 when the price fell around $3,500. Since then the price has been fluctuating around $5,000 - $10,000. (Edwards 2020.)

2.3.2 Why is bitcoin highly volatile?

The price of bitcoin has been quiet volatile over the period. For example, during October 2017 – January 2018, the volatility of bitcoin was around 8 %, meaning that the price could rise or fall 8% from the average price. There are many factors that drives the bitcoin price in the market. One of the primary reasons is the uncertainty of the future value of bitcoin. Since, bitcoin is just a transfer of value, and nobody knows what the value holds, the price fluctuates a lot even with a small news. The second reason is unregulated market. Bitcoin is not governed by a single authority and it is always considered a home for illegal activities. This makes adopters always fear and speculate the market. As a result, investors are only moving the price. (Reiff 2020.)

Another reason is the limited number of bitcoins. Unlike the fiat currency, Bitcoin has a fixed supply of 21million and whenever the economy rises or shrinks, investors will be interested to invest in bitcoin. Due to this reason, it is often compared with gold. Users are also often worried about the thefts and digital issues. The fall of Mt. Gox, the largest bitcoin exchange is the example of the market uncertainty. (Reiff 2020.)

3 DO BANKS NEED BLOCKCHAIN TECHNOLOGY?

Banking industry represents the major part of global economy. Banks are the biggest and oldest financial intermediaries around the world. Digitalization has shaped the banking industry and radically changed the banking system. The barter system was eradicated by commodity money which was then replaced by fiat money and now digital currency and digital payment are in place. Overtime, the technology facilitated Automated Teller Machine (ATM), electronic fund transfer, electronic clearing service, real-time gross settlement, online banking, debit-credit cards and mobile banking to the customers. Today, banking industry is reliant on the technology and therefore, blockchain could prove to be the game-changer in the industry. Blockchain technology allows recording of transaction in a block which are unchangeable. It removes third parties. Blockchain in a theory promises a big transformation in banking and finance sectors. It has the potential to disrupt the banking industry and bring a significant change. (Gupta & Gupta 2018.)

The last two decade has seen the rapid advancement and innovation in technology sector. Almost every industry has been disrupted by advancement in technology. Banking sector was hard to break through due to the regulation and compliance but now, banks are facing a serious competition from Fintech. Fintech, a word made from Finance and Technology are companies which applies the latest technologies to provide financial services. They provide services such as payments, clearing and settlements, trading and investment, digital currencies, and other services. Fintech are rising and innovating a new way of delivering high quality financial services. Fintech focuses on a niche service so; they provide better solution than the banks. Fintech are a potential threat to banks because they are fast, cheap, reliable, and transparent. For a long time, banks have been at the forefront of the payment industry, but now Fintech companies are gaining significant share of payment industry. The cross-border payment with bank takes 1-5 days and average cost of $40- $50 (TransferWise). The payment is faster, cheaper, and easier with Fintech. Fintech also provides faster clearing and settlement

services than banks. Digital wallet and currencies are gaining in popularity. Moreover, companies like Apple provide its customer with a virtual wallet that can be used for any payment and loans. Facebook has proposed to launch Libra- a digital currency to facilitate payment in 2021. With growing interest and trust in Fintech, banks are likely to face high competition. (Thakor 2020.)

Blockchain along with AI, robotic process automation, big data etc are considered as the future technologies. Blockchain has gained huge attention from banks, private equity firms, start-ups, and other financial institution. The big banks such as J.P Morgan, The Bank of America, Merrill Lynch, HSBC, and many others have already executed a transaction with blockchain and are looking forward to implement the technology in their business model. The feature of blockchain- the decentralized, and immutability ledger could bring the revolution in the record keeping system. The blockchain technology can be used in banks and almost every business. It has the potential to transform the backend of banking system and reduce large amount of operational cost. Blockchain would be critical in solving the current problems in banks. The main advantages of blockchains are efficiency, cost reduction, transparency, and elimination of third party. Firstly, blockchain improves the efficiency of a transaction as it eliminates the decision-making time. Record keeping and managing can be automated and be completed faster than the manpower. Secondly, it saves the transaction and operation cost. The payment and settlement can be done without the need of third party and hefty broker fees. Blockchain uses cryptography to provide the trust of third party. Finally, blockchains are distributed which allows both parties with the real time information of the transaction and thus leads to transparency. (Gupta & Gupta 2018.)

4 RESEARCH METHODOLOGY

A literature review of scholarly research was conducted. A literature review is the foundation of all kinds of research. A literature review as a research method in business is more significant than ever due to the increasing number of interdisciplinary researches and the lack of collective evidence in a specific area (Snyder 2019).

4.1 Literature review

A literature review is a systematic way of collecting and processing information from existing research to achieve the research goals. It is a useful and widely accepted methodology in all research disciplines. A literature review conducted systematically provides a complete overview of an area and the progress over time. A result achieved by combining different conclusions can effectively justify the research questions. There are different ways of conducting a literature review, the three popular methods are systematic, semi- systematic, and integrative approach. A researcher should choose the right methodologies depending on the research goals and objectives. A literature review can be quantitative, qualitative, or mixed based on research questions and methodologies used. (Snyder 2019.)

The result of a literature review is based on the conclusion of the original work. That is the reason a researcher should be careful while selecting the existing research and follow the literature review guidelines strictly. A literature review can be broadly divided into two parts: data collection and data analysis. Data are collected by using keywords and search strings. The boolean expression "OR", "AND" is used to get the best results. Also, searches are performed using the inclusion and exclusion criteria to find relevant topics. Then, the research papers are evaluated individually, and the most relevant articles are selected. Lastly, the conclusions are analyzed, synthesized, and the research questions are answered. (Fink 2014.)

4.2 Data collection

Data collection is the first part of a literature review. Choosing the proper keyword and data-base defines the quality of the result. So, a researcher should try different combinations and evaluate the relevancy of articles obtained (Fink 2014.) The databases used in this thesis are provided by Centria University of Applied Sciences. The author tried different keywords and search strings and evaluated the result. The same search string was used in all databases. Table 1 presents the keywords, databases, and strings used.

TABLE 1. Keywords, databases, and search string.

Keywords	"blockchain", "blockchain technology", "banks", "banking", "financial institu-tion", "banking sector", "impacts", "applications", "outcome", "blockchain and banking", "blockchain technology application", "impact of blockchain".
Databases	ABI Inform, Academic Search Elite, Emerald, Sage Premier, ScienceDirect, Springer Open, Google Scholar
Search string	("impact" OR "effect" OR "application") AND ("blockchain" OR "blockchain technology") AND ("banking industry" OR "banks" OR "financial institutions")

4.2.1 Inclusion and exclusion criteria

Inclusion and exclusion criteria are important to find specific information. The results from basic search operations are usually large and wide. So, it is important to eliminate unrelated papers. (Fink 2014.) The papers were analyzed based on different criteria. The searches were performed on April 10, 2020. The author processed all the articles produced from 2015 till the date. The inclusion and exclusion criteria are presented in the table below.

TABLE 2. Inclusion and exclusion criteria

Criteria for Inclusion	Criteria for Exclusion
Peer-reviewed and scientific research.	Unscientific literature such as google articles and blogs.
The papers must be related to blockchain in banking, finance, or financial sectors.	Papers focusing on the technical part of blockchain and bitcoin.
The full text of the paper is available.	The full text is not available.
English papers.	Non-English papers.
Free access or unpaid.	Purchased access.
Time frame (2015 – 2020)	Before 2015.

4.2.2 Searching and selection of related articles

This is the last step in data collection. The articles obtained after applying inclusion and exclusion criteria were evaluated individually. At this stage, the selection was done by reading the abstract and content of the articles. A total of 4,033 articles were screened and 6 of them were selected. The same articles were found in Springer Open and Google scholar, and the duplicate was removed. Table 3 shows the process involved in screening and selecting papers.

TABLE 3. Illustration of the searching and selection process

Criteria	ABI Inform	Academic Search Elite	Emerald	Sage Premier	Science Direct	Springer Open	Google Scholar
Using search string and Inclusion and Exclusion Criteria	↓	↓	↓	↓	↓	↓	↓
First draft	1,390	428	16	55	113	31	2,000
Screening and selecting relevant papers	↓	↓	↓	↓	↓	↓	↓
Final Selection	2	0	0	0	0	1	3

4.3 Data Analysis

Data analysis is the final step in the literature review. At this stage, the six selected articles were studied thoroughly, and the data were extracted systematically. The impacts discussed in all articles were grouped as shown in the table. While going through each article, 15 different impacts were found. The main 5 impacts related to banking industry were further selected and

discussed in the next heading. Table 4 represents the information of selected articles, authors, published date, and the findings.

TABLE 4. Analysis of selected papers

Author(s)	Published year	Title	Impact
Petrov, D.	2019	The impact of blockchain and distributed ledger technology on financial services	Know your customer, Smart contracts, Trade finance, Global payments, Capital market, Insurance, Regulations and compliance
Gupta, A.; Gupta, S.	2018	Blockchain technology: Application in the Indian banking sector	Digital currency, Trade finance, Cross border payment, Capital markets, Supply chain finance, Consortium accounts, Know your customer
Casey, M.; Crane, J.; Gensler, G.; Johnson, S.; Narula, N.	2018	The impact of Blockchain Technology on Finance: A Catalyst for change	Cross border payment, know your customer, primary securities issuance, securities clearing and settlement, trade finance, post trade reporting
Collomb, A.; Sok, K.	2016	Blockchain / Distributed Ledger Technology (DLT): What Impact on the Financial Sector?	Cross border payment, corporate finance, and governance, Financial accounting, Trade finance, Supply chain management, Fi-

			nancial reporting and compli- ance, Crowdfunding and peer to peer lending
Isaksen, E.M.	2018	The future of cross border payment	Cross border payment, Digital currency
Guo, Y.; Liang, C.	2016	Blockchain Application and outlook in the banking industry	Cross border payment, Information system, Know your customer, Supply chain finance, Smart contracts

5 THE IMPACT OF BLOCKCHAIN IN BANKING INDUSTRY

The banking industry has been providing people with the service of trust since the establishment. Every financial transaction- bank deposit, trading, custody, insurance, clearing & settlement etc is dependent on the trust. Customers pay for the trust and wants their transaction to be handled safely and fairly. Banks maintain the ledger and accounting systems and charge customers for that. The work system in banking industry is repetitive, time consuming and costly. To solve these problems, major banks including central banks are exploring the uses of blockchain in their existing model. Banks are aiming to significantly reduce the back-office operational cost. Fintech start-ups with the use of latest technologies and blockchain are challenging banks with their faster, transparent, and cheaper services. They have already managed to capture the significant shares of the market in the payment industry. With the growing competitive market, blockchain is very important topic for the banks around the world. (Casey, Crane, Gensler, Johnson & Narula 2018.)

Banks play a vital role in the global economy and they have faced many problems and challenges in past. Financial crisis in 2008 showed that, economy is highly sensitive to the participant's action and it can repeat again. So, there is a need to examine both merits and demerits of blockchain. The question is how can blockchain technology be used to build a better financial model without causing any financial meltdown. (Casey et al. 2018.)

The analysis shows that the blockchain technology can be used in various functions in financial sectors. Financial sectors typically bank, and financial markets are fully dependent on technologies. So, blockchain technology has unlimited prospects to change the whole financial industry. Among the various impacts analyzed from the data analysis, the five major impacts related to the banking industry are discussed.

5.1 Cross-border payments

Banks have been playing a key role in cross-border payment since the establishment of monetary transactions. With the rise in Fintech companies such as PayPal, TransferWise, banks have lost significant market share in a payment business. They exceed the bank's performance in terms of speed, cost, flexibility, and transparency and possess a great threat to a bank's payment service. Banks use the SWIFT (Society for Worldwide Interbank Financial Telecommunications) network to send and receive international payments. The SWIFT is a messaging network that allows banks and other financial institutions to send and receive financial information through secured codes. (Isaksen 2018.) SWIFT is the most secure and reliable way of cross-border payments. However, it is a lengthy and costly process. (Isaksen 2018; Guo & Liang 2016.) The average transfer time is 1-5 business day and the average cost is $40- $50 (TransferWise). To solve these problems, banks are testing blockchain technology for a faster and better solution (Isaksen 2018).

Blockchain technology can facilitate banks to make direct international payments economical and efficient (Isaksen 2018; Guo & Liang 2016). First, banks need to have blockchain networks of their own allowing them to transfer funds directly to another bank's network. All the transactions are recorded in the block and are unchangeable. The ledger will be available to the parties involved and no middleman is required. This way blockchain technology has the potential to reduce the time and cost associated which is required with SWIFT. (Isaksen 2018.)

Blockchain technology can help solve current problems in global payments by bringing new solutions. A third party will not be required to make an international payment. Payment records and bookkeeping are self-initiated which reduces operational cost. The transactions will be performed in faster time. It will make payment easy and transparent for the customer. (Petrov 2019.)
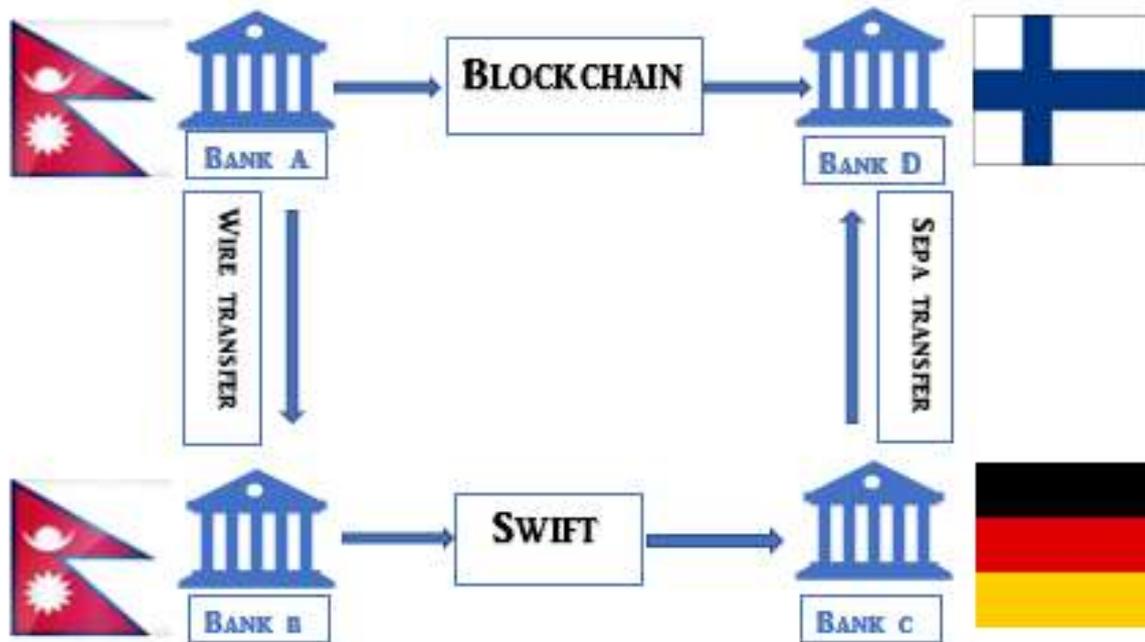
FIGURE 4. Illustration of cross-border payment using blockchain technology.

The figure shows the process involved in cross-border payment from Nepal to Finland. Normally with SWIFT, there is a need of third party (and sometimes fourth party), which is Bank B and C based on the bank's connection. But, blockchain network connects two parties directly and facilitates direct transaction. Blockchain transaction can be completed in hours compared to 1-5 business days in case of SWIFT.

5.2 Trade finance

Banks play an important role in financing the global flow of goods. World Trade Organization (WTO) estimates that around 80 - 90% of global trade is supported by trade finance. Trade finance is a credit support and payment guarantee provided by financial intermediaries to satisfy the trade transaction. One of the common forms of trade finance is Letter of Credit. Letter

of Credit is a written document produced by the bank on behalf of buyer promising to the seller that the purchase amount will be paid on due date, if not banks will be liable to pay the amount. (WTO). Like the cross-border payment, drafting a Letter of Credit is a complex and lengthy process (Gupta & Gupta 2018). It still involves lots of paperwork and manual inspection which increases the cost and time. Blockchain technology could help increase the efficiency and cut the operation cost with smart contracts. (Gupta & Gupta 2018; Guo & Liang 2016; Collomb & Sok 2016 ; Petrov 2019.)

Blockchain can be used to simplify the large process of drafting the Letter of Credit. Once the parties involved in the trade have their own blockchain network, the information can be shared on a private distributed ledger and the agreement can be done with the smart contracts. (Gupta & Gupta 2018.) Different concepts have been initiated to solve the problems of trade finance such as Skuchain10. Skuchain10 facilitates B2B commerce and its financing, by providing smart contract solution and tracking all phases of trade deal from order, shipment to final payments. (Collomb & Sok 2016.)

5.3 Know your customer

Know your customer (KYC) is considered as another important use of blockchain in banking. The average time banks take to complete the KYC process is around 26 days. (Petrov 2019.) It is the bank's responsibility and mandatory task to record the details of the customer and ensure that the details are verified before establishing any financial transactions. KYC is governed by a legal framework to avoid money-laundering and terrorism financing. (ECB 2018.) At present, customers are required to submit the details to each bank to open an account. The data are stored in bank's centralized system and are only accessible for them. With blockchain technology, a customer data can be stored in a block and the block can be shared between the banks. (Gupta & Gupta 2018.) It increases the efficiency of operation and removes the repetitive works (Gupta & Gupta 2018; Guo & Liang 2016). The data stored in blocks are immutable

and ensures the information is correct. This way once the data is stored, it can be used by other banks. (Guo & Liang 2016.)

5.4 Capital markets

Blockchain technology has a great potential to transform the capital market trading system. Capital market involves a heavy procedure and it often takes a long time to settle the accounts. There are many intermediaries in capital markets such as banks (mostly investment), brokers, investors, credit agencies and others who actively participates in the market. At present, these participants keep their ledger themselves and make the changes. This process is time and money consuming. (Gupta & Gupta 2018.) The current problem with the capital market is that there are different clearing and settlement systems. Since, there are many parties involved, it has a high counterparty risk. The defaulting in one party can impact the whole market. The procedure is often slow and inefficient. (Petrov 2019.)

Blockchain can be used to increase the efficiency of trade and custody securities services. If the participating companies has a common blockchain platform, the transaction can be performed in a real time with the greater efficiency and transparency. It can be used to maintain the KYC process and removes the third person. It can also be used in Initial Public Offering (I.P.O). National Association of Securities Dealers Automated Quotations (NASDAQ) has successfully tested blockchain named "Linq" to facilitate the trading and transparency concerns with regulators and customers. (Gupta & Gupta). The research conducted by Goldman Sachs Investment bank shows that blockchain can save $ 6 billion every year in the capital market. The study was done on four instruments only. So, the real saving is expected to be more. Blockchain has the potential to change the way of issuing activity, recording the balances, clearing and settlement and reporting with the use of smart contracts. (Petrov 2019.)

5.5 Financial reporting and compliance

Finally, blockchain also has the potential to transform the financial reporting and compliance. Banks and other financial institution must perform reporting such as tax reports, audit, and other financial reports on a regular basis. It is mandatory for every bank to submit the reports timely and is specifically important to control the fraud and anti-money laundering activities. Preparing the reports regularly based on the regulation, consumes time and manpower. Blockchain could be helpful in automating the reporting and saving a lot of time and money. With blockchain, all the paper works can be eliminated. The transactions could be recorded and updated automatically. This would ease the work of both banks and regulation board. The transactions can be monitored which can help in activities related with anti-money laundering. (Petrov 2019.)

Blockchain ability to record the transaction and track the history will facilitate auditor's and regulator's work. This could help banks automate financial reporting and compliance. Many banks and regulators are testing the ways to implement blockchain. (Collomb & Sok 2016.)

6 CURRENT PROGRESS AND USE CASES IN BANKS

Cross-border payment is one of the most important use cases in banks. Ripple is currently being tested or used in more than 300 financial institutions across over 40 countries (Ripple 2020). Banks such as Santander, Bank of America, Mitsubishi UFJ Financial Group, Barclays PLC, Royal Bank of Canada, and others have already partnered with Ripple for cross border payment. (Brown 2020.) The function of Ripple is similar to SWIFT. Ripple provides banks and financial institutions with its online service called RippleNet, which allows participants to transfer the message. With ripple payment can be settled within minutes unlike SWIF which usually takes 1-5 days. Ripple uses private, non-distributed blockchain technology. The transaction can be made by fiat currency or its own ripple-XRP currency. As per McKinsey, banks are estimated to save around $ 4 billion a year in cross border payment. (Higginson, Hilal & Yugac 2019.)

Various blockchains are being tested to maintain KYC and other customer data regulations. In 2017, Bluzelle – a start-up providing database for decentralized application collaborated with group of 3 banks HSBC, Mitsubishi UFJ Financial Group and OCBC bank to test the platform for KYC. The result showed that the cost can be reduced by 25 – 50 % and fraud and money-laundering activities can be strictly monitored. Similarly, SecureKey a Canadian Fintech start-up developed a digital identity and verification service in collaboration with IBM, National Bank of Canada, Scotiabank, and TD. Mastercard is testing blockchain to record, identify, and verify the ownership of transaction. Other companies bringing innovation in KYC are Norbloc, Cambridge Blockchain, Spring Labs, and Blockstack. (Higginson, Hilal & Yugac 2019.)

In trade finance, companies like R3 and We.trade are testing and implementing various solutions. R3 provides Corda – an open source blockchain platform which can be used for different purposes including trade finance, identity, supply chain, insurance and more. (R3 2020.) Voltron -application run by R3 has been tested by more than 50 banks including Standard

Chartered, ABN Amro, ING. As per R3, 96% of trial participants reported that Voltron would reduce cost and make trade finance easier. (Khatri 2019.) Elsewhere, we.trade is bringing together banks and SMEs across Europe to make trade easy, secure, and transparent. At the moment, we.trade consists of 13 banks such as Caixa, HSBC, Nordea, Santander, UBS, UniCredit, etc. We.trade provides platform to make communication easier. It helps in KYC process, real time settlement, bank financing, invoice financing, and record keeping. (we.trade 2020.)

According to the report by the Bank for International Settlements, around 40 central banks across the world are currently or soon will be, exploring blockchain for central bank digital currency. A central bank digital currency (CBDC) is a government issued digital currency which is being tested by several central banks around the world to remove the domestic currency equivalent to the money supply. It may be issued for general payment purpose or for use by banks and financial institutions. Bank of England was the first central bank to explore distributed ledger technology (DLT) in 2014. After that, Bank of Canada, the Monetary Authority of Singapore, Bank of Japan, the Swedish Central Bank, the German Central Bank, and more others joined and are actively testing different blockchain and distributed ledger technology. The Bank of France started testing from 2016 and now is using blockchain to process the SEPA(single euro payment area) Credit Identifiers (SCIs). They are able to automate and share information with smart contracts faster and easier. The National Bank of Cambodia is in the final stage to use blockchain technology for payments within the country. It will be one of the first countries to implement blockchain technology. The people and banks face large problems in payments and the bank estimates blockchain to solve that problem. (World economic forum 2019.)

7 CHALLENGES IN IMPLEMENTATION

Though, future looks bright for blockchain in banks, there are many challenges associated with it. Without accessing these challenges, blockchain technology cannot be used in practice. Some of the challenges in implementing blockchain are described below:

7.1 Regulation

Regulation is one of the main problems with the blockchain. Since blockchain is based on concept of decentralization, how to regulate the blockchain has been the big topic of discussion among the regulators. Fully decentralized system is almost not possible to achieve and there must be authority (to some extent) to control the financial institution. (Guo & Liang 2016.) Blockchain does not have any national or international rules. Although, governments are looking for the way to control blockchain, legal aspect of blockchain is still not clear. (Gupta & Gupta 2018.)

It also raises the question that who will act as an authority during the time of crisis. Having no authority, means that there are no one to act as a shock absorber during a bad period. This can lead to an economic problem. That is why regulators must understand the overall picture before implementing it. (Deloitte 2016.) Also, without regulation, it is unclear how the dispute between two financial institution will be solved and thus it creates problem for rapid adoption. (Petrov 2019.)

7.2 Security and privacy

Although blockchain technology is considered to be the most secured technology till date, there are still questions about security and privacy of data. In public blockchains, the data is accessible to all the parties involved and it increases the risk of data misuse. The private blockchain provides the better solution for security and privacy. (Gupta & Gupta 2018.) Security and privacy concerns are high among the institutions. The technology should be tested thoroughly before implementing it. (Guo & Liang 2016.)

MIT (Massachusetts Institute of Technology) technology review reported that around $2 billion of cryptocurrency has been stolen since 2017. More and more security problems are appearing, and the popular exchanges are frequently under attack. To control a network, a hacker should possess majority of mining power, also known as 51% attack rule. This can lead to a fatal vulnerability and therefore should be considered beforehand. (Orcutt 2019.)

7.3 Energy consumption

Another problem with blockchain technology is that, it uses a large amount of energy and leaves a massive carbon footprint (Gupta & Gupta 2018). A new online tool from the University of Cambridge estimates that bitcoin uses same amount of energy as the whole of Switzerland. A new online tool from the University of Cambridge estimates that bitcoin uses same amount of energy as the whole of Switzerland. A study in the scientific journal joule estimates that bitcoin produces around 22 megatons of Carbon dioxide (CO_2) annually. (Baraniuk 2019.)

7.4 Lack of understanding and trust in technology

Though, it possesses huge potential, there is a lack of proper understanding of what it is and how it works. Unless, people and organization are aware of blockchain and its' significance,

new ideas and investments cannot be explored. This is one of the hurdles to pass before implementing blockchain. (Deloitte 2016.)

7.5 Cost and efficiency

Lastly, there is a high cost and efficiency problem with the blockchain technology. The cost and efficiency largely depend upon the type of the blockchain used and the participants in the network. The inefficiency problem arises since all the nodes in a network has to perform the validation of each transactions. As the nodes increases, the security increases but transaction speed decreases. (Guo & Liang 2016.) The total cost for recording the transaction in bitcoin is estimated to be more than $600 million a year and rising based on users. So, the companies should properly evaluate the costs before implementing the technology. (Deloitte 2016.)

8 CONCLUSION AND RECOMMENDATION

The result shows that the blockchain technology is about to cause a big transformation in banking industry. The technology seems promising to solve the inefficiency problems of banks by removing third parties, increasing efficiency, and decreasing cost. The five promising area where blockchain is going to impact are cross border payment, trade finance, knowing your customer, capital market, and regulation & compliance. Banks can perform cross-border transaction faster and economical with blockchain than the current services such as Swift. The reduction of third party makes the transaction efficient and transparent to customers. Trade finance could be done efficiently and economically by drafting agreements with the help of smart contracts. Moreover, it can also help in tracking the trade delivery and reducing the risk. Similarly, smart contract can be used to record, verify, and distribute the identity of customers within the banks in a blockchain network. This will save a lot of time and money for banks and will help regulation authorities to control the money laundering and other terrorism activities. In capital market, trade settlement can be done in a real time with great efficiency and transparency. Furthermore, blockchain could help banks to automate the financial reporting and compliance activities. The data recorded in blocks are immutable and hence trusted by the regulators. Besides all these advantages, blockchain also has some limitations. Blockchain at core concept is hard to implement and is time extensive. Big banks have been exploring blockchain since 2015 and are still not ready. Before adapting blockchain technology, banks should find the solution to obstacles such as regulatory, technology, trust, energy, and cost.

The main purpose of this research was to find out the impacts of blockchain in banking industry and the research finding shows that the impact is going to be huge on cross border payment, trade finance, know your customer, capital market, and regulation. To conclude, blockchain technology has great potential to transform the banking system.

8.1 Limitations of the study

Although the purpose of the thesis was to present trustworthy research there are some limitations of the study. During the collection of data, the inclusion and exclusion criteria were set based on the author knowledge of data collection. The articles published between 2015 to 2020 were included so, there is a possibility that some significant scientific papers published before 2015 may have been missed which could have adverse impact on the result of the thesis. Also, the Final screening of more than 4,000 articles was done by single author and the papers may have been missed or may have been selected in a biased way.

8.2 Recommendation for further research

Based on the findings, there are still lots of research to be done in this topic since the technology is still in its early stage. During the research, I found that some important topics were uncovered. So, I understand that researching on these topics would be critical. The thesis has three recommendation for further research. The first topic idea is related to Central Banks and blockchain so, the research question can be "How could Central banks implement blockchain technology?". Secondly, I found that banks and Fintech should collaborate for fast implementation of blockchain technology so, any idea related to this can be a good research topic. Lastly, research on regulation of blockchain would be an interesting topic.

REFERENCES

Attaran, M. & Gunasekaran, A. 2019. Applications of Blockchain Technology in Business: Challenges and Opportunities. Cham, Switzerland: Springer International Publishing.

Baraniuk, C. 2019. Bitcoin' s energy consumption equals that of Switzerland. Available: https://www.bbc.com/news/technology-48853230 . Accessed on July 6, 2020.

Brown, C. 2020. More than a third of the world's largest banks use Ripple. Available: https://www.crypto-news-flash.com/mehr-als-ein-drittel-der-groessten-banken-der-welt-nutzen-ripple/. Accessed on July 5, 2020.

Casey, M., Crane, J., Gensler, G., Johnson, S. & Narula, N. 2019. The Impact of Blockchain Technology on Finance: A Catalyst for Change. London: Centre for Economic Policy Research.

CoinDesk, 2020. Figure showing the price of bitcoin. Available: https://www.coindesk.com/price/bitcoin. Accessed on June 2, 2020.

Collomb, A. & Sok, K. 2016. Blockchain / distributed ledger technology (DLT): What impact on the financial sector? Communications & Strategies, no. 103, pp. 93-111,212,214. Retrieved from https://search.proquest.com/docview/1841718518?accountid=10007. Accessed on May 6, 2020.

Deloitte. 2016. Blockchain, Enigma. Paradox. Opportunity. Available: https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/Innovation/deloitte-uk-blockchain-full-report.pdf. Accessed on May 15, 2020.

Dragonchain. 2019. What different types of blockchains are there? Available: https://dragon-chain.com/blog/differences-between-public-private-blockchains/. Accessed on July 15, 2020.

Edwards, J. 2020. Bitcoin's Price History. Investopedia. Available: https://www.in-vestopedia.com/articles/forex/121815/bitcoins-price-history.asp. Accessed on July 16, 2020.

European Central Bank. 2018. The ECB and anti-money laundering. Available: https://www.bankingsupervision.europa.eu/press/publications/newsletter/2018/html/ssm.nl180516_2.en.html. Accessed on June 20, 2020.

Fink, A. 2014. Conducting Research Literature Reviews: From the Internet to Paper. Fourth edition. Thousand Oaks, CA: SAGE.

Freuden, D. 2018. Hybrid blockchains: the best of both public and private. Bravenewcoin. Available: https://bravenewcoin.com/insights/hybrid-blockchains-the-best-of-both-public-and-private. Accessed on July 15, 2020.

Guo, Y. & Liang, C. 2016. Blockchain application and outlook in the banking industry. Financial Innovation 2, 24. Available: https://doi.org/10.1186/s40854-016-0034-9. Accessed on April 10, 2020.

Gupta, A. & Gupta, S. 2018. Blockchain technology: Application in Indian banking sector. Delhi Business Review, 19(2), 75-84. Available: https://search.proquest.com/docview/2247499893?accountid=10007. Accessed on April 12, 2020.

Gupta, M. 2018. Blockchain for dummies (3rd ed.). Hoboken, NJ: John Wiley & Sons.

Higginson, M., Hilal, A. & Yugac, E. 2019. Blockchain and retail banking: Making the connection. Available: https://www.mckinsey.com/industries/financial-services/our-insights/blockchain-and-retail-banking-making-the-connection. Accessed on April 18, 2020.

Isaksen, E.M. 2018. The Future of Cross Border Payments. Stavanger. University of Stavanger. Master of Sciences Thesis.

Khatri, Y. 2019. Over 50 Banks, Firms trial Trade Finance App built with R3's Corda Blockchain. Available: https://www.coindesk.com/over-50-banks-firms-trial-trade-finance-app-built-with-r3s-corda-blockchain. Accessed on June 18,2020.

Krause, E.G., Velamuri, V.K., Burghardt, T., Nack, D., Schmidt, M. & Treder, T.M. 2016. Blockchain Technology and the Financial Services Market State-of-the-Art Analysis. Infosys Consulting. Available :https://www.infosysconsultinginsights.com/wp-content/uploads/2016/10/InfosysConsulting_HHL_Blockchain.pdf. Accessed on April 22, 2020.

Nakamoto, S. 2008. Bitcoin: A peer-to-peer Electronic Cash System. Available: https://bitcoin.org/bitcoin.pdf. Accessed on May 20, 2020.

Orcutt, M. 2019. Once hailed as unhackable, Blockchains are now getting hacked. MIT Technology Review. Available: https://www.technologyreview.com/2019/02/19/239592/once-hailed-as-unhackable-blockchains-are-now-getting-hacked/. Accessed on July 20, 2020.

Petrov, D. 2019. The impact of blockchain and distributed ledger technology on financial services. International Scientific Journal "Industry 4.0", Issue 2.

R3. 2020. https://www.r3.com/corda-platform/. Accessed on July 22, 2020.

Reiff, N. 2020. Why Bitcoin has a volatile value. Investopedia. Available: https://www.investopedia.com/articles/investing/052014/why-bitcoins-value-so-volatile.asp. Accessed on June 15, 2020.

Snyder, H. 2019. Literature review as a research methodology: An overview and guidelines. Journal of Financial Intermediation, volume 104, pages 333-339.Available: https://www.sciencedirect.com/science/article/pii/S0148296319304564#bb0105. Accessed on April 4, 2020.

Statista.2020. Bitcoin market capitalization. Available: https://www.statista.com/statistics/377382/bitcoin-market-capitalization/. Accessed on June 15, 2020.

Thakor, A.V.2020. Fintech and banking: What do we know? Journal of Financial Intermediation, volume 41. Available: (http://www.sciencedirect.com/science/article/pii/S104295731930049X). Accessed on May 18, 2020.

Thompson, C. 2016. What's The differences between a private, public, and consortium blockchain? Available: https://medium.com/blockchain-review/the-difference-between-a-private-public-consortium-blockchain-799ae7f022bc. Accessed on July 15, 2020.

TransferWise. 2018. How long does an international wire transfer take? Available: https://transferwise.com/us/blog/international-wire-transfer-time. Accessed on June 7, 2020.

We.trade. 2020. Available: https://we-trade.com/. Accessed on July 12, 2020.

World economic forum. 2019. Central Banks and Distributed Ledger Technology: How are Central Banks Exploring Blockchain Today? Available: http://www3.weforum.org/docs/WEF_Central_Bank_Activity_in_Blockchain_DLT.pdf. Accessed on July 22, 2020.

World Trade Organization. 2016. Trade finance and SMEs. Available: https://www.wto.org/english/res_e/booksp_e/tradefinsme_e.pdf. Accessed on June 27, 2020.