

A COMPARATIVE STUDY ON BLOCKCHAIN BASED BANKING SECTOR

BY

**MD. AL IMRAN
ID: 162-15-7911**

**PRITHULA GUPTA
ID: 162-15-7699
AND**

**MD. JUYEL RANA
ID: 162-15-8136**

This Report Presented in Partial Fulfillment of the Requirements for the
Degree of Bachelor of Science in Computer Science and Engineering

Supervised By

Refath Ara Hossain
Lecturer
Department of CSE
Daffodil International University

Co-Supervised By

Shah Md. Tanvir Siddiquee
Assistant Professor
Department of CSE
Daffodil International University



DAFFODIL INTERNATIONAL UNIVERSITY

DHAKA, BANGLADESH

OCTOBER 2020

APPROVAL

This Project titled “A Comparative Study On Blockchain Based Banking Sector”, submitted by Md. Al Imran, ID No: 162-15-7911, Prithula Gupta, ID No: 162-15-7699, Md. Juyel Rana, ID No: 162-15-8136 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 8 October, 2020.

BOARD OF EXAMINERS



Dr. Syed Akhter Hossain
Professor and Head

Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

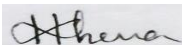
Chairman



Md. Zahid Hasan
Assistant Professor

Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

Internal Examiner



Most. Hasna Hena
Assistant Professor

Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

Internal Examiner



Dr. Mohammad Shorif Uddin
Professor

Department of Computer Science and Engineering
Jahangirnagar University

External Examiner

DECLARATION

We hereby declare that, this project “**A Comparative Study On Blockchain Based Banking Sector**” has been done by us under the supervision of **Refath Ara Hossain, Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:



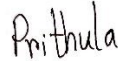
Refath Ara Hossain
Lecturer
Department of CSE
Daffodil International University

Submitted by:



Md. Al Imran
ID: 162-15-7911
Department of CSE
Daffodil International University

Submitted by:



Prithula Gupta
ID: 162-15-7699
Department of CSE
Daffodil International University

Submitted by:



Md. Juyel Rana
ID: 162-15-8136
Department of CSE
Daffodil International University

ACKNOWLEDGEMENT

First we express our heartiest thanks and gratefulness to almighty God for His divine blessing makes us possible to complete the final year project/internship successfully.

We really grateful and wish our profound our indebtedness to **Ms. Refath Ara Hossain, Lecturer**, Department of CSE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of “*Blockchain Technology*” to carry out this project. Her endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

We would like to express our heartiest gratitude to **Dr. Syed Akhter Hossain, Head**, Department of CSE, for his kind help to finish our project and also to other faculty member and the staff of CSE department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

Banking sector is arguably the most important sector of any country. While all other losses from different sectors can be compensated, normally the losses in the banking sector is so high that it devastates the country's economy. Now, there are many reasons behind the losses of banking sector, ranging from transparency issues, inefficiency issues to the maintenance issues. All these issues make the banking sector vulnerable to the attacks of criminals. As a result, we have seen different crimes happening in banking sector such as money laundering, cyber-attacks etc. The biggest worry is that these crimes make really big losses in the country's economy. As a result, to make the banking sector resilient against such things, blockchain technology is a potential solution. Blockchain technology offers a very secure method for transaction. The combined use of smart contract & blockchain makes it really hard for cyber attackers to penetrate into the system. It also allows a better monitoring system for the banking authority. As a result, the total maintenance system becomes easy. It also provides the system with other benefits like cost reduction & time waste reduction. In this writing, We will try to build such a blockchain based banking sector which will have all the tools to replace the current banking sector.

Keywords: blockchain, cyber-attack, smart contract, cost reduction, time waste reduction, transparency

TABLE OF CONTENTS

CONTENTS	PAGE
Board of examiners	i
Declaration	ii
Acknowledgements	iii
Abstract	iv
CHAPTER	
CHAPTER 1: INTRODUCTION	1-5
1.1 Introduction	1
1.2 Motivation	1
1.3 Rational of the Study	3
1.4 Research Questions	3
1.5 Expected Outcome	4
1.6 Report layout	5
CHAPTER 2: BACKGROUND STUDY	6-11
2.1 Introduction	6
2.2 Related Works	8
2.3 Research Summary	10
2.4 Scope of the Problem	10
2.5 Challenges	11

CHAPTER 3: DESCRIPTION	12-35
3.1 Introduction	12
3.2 Problems in Banking Sector	12
3.2.1 Money Laundering & Unwanted Malpractices	12
3.2.2 Absence of Micropayment System	14
3.2.3 Lack of Quality Governance, Maintenance & Transparency	14
3.2.4 Risk of IT & Weak Verification Process	15
3.2.5 Lack of Direct Connection between International Banks	16
3.2.6 High Transaction Fee & Time Delay	16
3.3 Blockchain Based Banking Sector	17
3.3.1 Peer to Peer Network	18
3.3.2 Partially Distributed Ledger	19
3.3.3 Smart Contract	20
3.3.4 Formation of Blocks	23
3.3.5 Connected Blocks of Transactions	25
3.4 Structure of Blockchain Based Banking Sector	26
3.5 Advantages of Blockchain Based Banking Sector	28
3.5.1 Preventing Money Laundering & Malpractices	28
3.5.2 Enabling Micropayment & Improved Identity System:	29
3.5.3 Enabling Quality Governance, Maintenance & Transparency	31
3.5.4 Reduced Infrastructure Cost & Instant Settlements	32
3.5.5 Improved Financial Outputs	33

3.5.6 Improved Inter-bank & International Transfers	34
CHAPTER 4: DISCUSSION	36-41
4.1 Introduction	36
4.2 Challenges in Blockchain Based Banking Sector	36
4.2.1 Problems with scalability	36
4.2.2 Policies and Regulations	37
4.2.3 Culture	38
4.2.4 Cost and efficiency	38
4.2.5 Standards	38
4.2.6 Liability	39
4.3 Result & Discussion	39
4.4 Summary	41
CHAPTER 5: IMPACT ON SOCIETY & SUSTAINABILTY	42
5.1 Impact on Society	42
5.2 Impact on Environment	42
5.3 Ethical Aspects	42
5.4 Sustainability	42
CHAPTER 6: CONCLUSION	43-44
6.1 Summary of the Study	43
6.2 Conclusion	43
6.3 Recommendations	44
Reference	45-46

List of Figures

Figures	PAGE
Figure 3.2.1 Steps of Money Laundering	13
Figure 3.3.1 Structure of Blockchain Based Banking Sector	19
Figure 3.3.5 Conceptual Illustration of the Blockchain	25

CHAPTER 1

Introduction

1.1 Introduction

Banking sector is considered to be the heart of a healthy economy. This sector is like the “lifeblood” of all economic activities. Without banks, there would have been no easy way for investors to invest & for entrepreneurs to take loans to start their start-ups.

Banks and similar financial institutions are responsible for keeping people's money safe and secure and providing it to them whenever they need it. In order to do this effectively, they need a lot of processes and mediators. This is what makes the whole banking process so slow and costly. In addition, the involvement of many manual processes and human intermediaries makes the banking industry prone to corruption and error. Moreover, there are loopholes in this sector like all other sectors. Different companies over the years have taken advantage of them & led to losses in national economy. As the banking sector is quite inefficient, it was unable to identify them & make immediate response to such crimes.

All these certainly indicate to the fact that a certain upgrade of banking sector is needed. So, We would like to restructure this banking sector through the use of “blockchain technology”. We know blockchain ensures many facilities like security of the stored information & fast transactions. All these facilities will eventually help the banking sector overcome the problems existing in the sector & make the sector a digitalized sector.

1.2 Motivation

Banking sector is one key sector for the economy of a country. But the current situation in the banking sector is not good. The sector is flooded with many problems. There is lack of quality governance & quality management existing in the sector. Moreover, the criminals around the world are taking advantage of this poor infrastructure & doing damage to the sector.

On the other hand, at the very same time, blockchain as a technology was evolving really quickly & proving to be really influential in the tech world. Already blockchain has changed the mass concept of centralized system & included decentralized system in people's thoughts. Even we go back some time to the invention of internet, for example, we can see one of the key reasons due to what internet was invented was decentralization. Decentralization is one of the more important things in the world. If we take a look around, we can see glimpse of centralized network in technology. For example, most of the websites or people's preferred websites are basically Facebook, Google, and Amazon etc. All these websites are working to make the World Wide Web centralized. As a result, one of the key targets of internet has never been met. Blockchain came as a remedy to that. Blockchain has the capability to make the sectors decentralized. Already a lot of applications of blockchain show that blockchain can finally make changes to the already existing centralized world.

As both the need of update of banking sector & the influence of blockchain in the world increased, there was another idea that came out of it. The idea is how to get these two things under the same roof. We know. Security is currently a big issue in the banking sector. Blockchain, on the other hand, makes the whole system really secure through the use of technology. Again, the whole banking system currently is a bit messy. The management of data & documents is not well governed either. Moreover, there are other problems with banking sector that make the sector hugely inefficient. Even international bank transfers sometimes take up to 7 days as well. All these add to the already existing horrible situation in banking sector.

Now, blockchain has the potential to solve these problems to a great extent. Blockchain is like internet in many ways. Both were introduced to remove centralization in the world. One of the other similarity is in the potential in these two things. When internet started its journey, nobody could imagine internet would come such a long way. But it did & surely conquered the world. Similarly, blockchain also has the potential to conquer the whole world & make a big difference in the problems.

This is why blockchain was our pick to solve the issues in the banking sector. Blockchain adds to the security issue solutions of the banking, maintenance issue solutions

of the banking sector. Moreover, it also has the potential to reduce the total cost & time waste in the sector.

1.3 Rational of the Study

Research occurs when there is a problem existing in a sector & there needs a solution of that problem. Before the start of solving of the problem, it is really necessary to identify the core objectives of the project. If we identify the working sectors of the problem, half of the work gets already done there & the wished work is implemented faster. Moreover, the work has to be distributed in small steps. This will help us keep track of where we are heading. For example, when we decide smaller steps of our target, we also imagine a desired output for each of these sub steps. As a result, whenever one of the sub step is completed, we can match our result with our guessed one & also make changes to the future working procedures.

In our research, we want to transform the banking sector with the use of smart chain based blockchain technology. Our key targets in this regard will be:

- To use smart contract technology to make a better transaction procedure in the banking sector.
- To use blockchain technology to solve governance, maintenance & transparency issues in the sector.
- To use blockchain technology to provide a better solution to the security procedure of the banking sector.
- To use peer to peer method of blockchain technology to make a better way of transactions for international transfers.
- To use blockchain technology to create a better online platform based communication system in the sector.
- To use blockchain technology to create better decision making procedures on banking activities.
- To use blockchain technology to make the sector more resilient to the unwanted malpractices.

1.4 Research Questions

In our proposed idea of “Blockchain Bases Banking Sector”, some questions may arise here:

1. Is it really possible to have a decentralized or partially decentralized network in banking sector?
2. Is smart contract a better structured & efficient method than the existing one
3. How come blockchain will be applied in the larger scenario among the countries & how will the rules of the system be set?
4. How easy will it be to reinforce the blockchain technology, which is a new technology in banking sector?

All these questions are really valid & it is quite a tricky scenario. But if the whole process of blockchain can be upheld before the necessary authorities & they can be convinced how effective this new technology can be, it will make the adoption of blockchain in the banking sector quite possible. In our further writing, we will talk about all the question in details & try to answer all of them with the possible scenarios.

1.5 Expected Outcome:

Blockchain is a very vast technology with lots of different types of it available. Blockchain has the technical solidity in itself that it needs to take charge of an important sector like banking sector. Blockchain might be in its new phase & it may not be widely known. But its application have already impressed critics all over the world in different sectors. Similarly, it can change the scenario here in banking as well.

From the application of blockchain in the banking sector, we expect to see a changed banking sector. In this changed scenario, all the transactions will be completed through smart contracts. Smart contracts are basically digital contracts where all the parties have to sign the documents digitally. Moreover, the terms in the smart contract can never be changed. As a result, it adds another additional layer of security to the transaction method. Moreover, all the information in this will be stored in blocks where all the blocks will be connected in a one dimensional way. If anybody wants to conquer some contract & make changes to it, at first, he will have to hack 51% of the network & then change it. This makes all the information on the blockchain more secure.

Again, we want to see a faster way of transaction in this changed system. In this system, all the deals will be completed in an electrical & digital way. As a result, the transactions will be faster. Moreover, the transaction cost will also decrease in this new system of banking with blockchain technology. As a whole, we want a highly efficient & better banking sector with the use of blockchain in it.

1.6 Report Layout

There are five chapters in this research paper. They are: “Introduction”, “Background Study”, “Description”, “Discussion”, “Conclusion”.

Chapter One: Introduction, Motivation, Rational of the Study, Research Questions, Expected Outcome, Report layout.

Chapter Two: Introduction, Related works, Research Summary, Scope of the Problem, challenges.

Chapter Three: Introduction, Problems in Banking Sector, Blockchain Based Banking Sector, Structure of Blockchain Based Banking Sector, Advantages of Blockchain Based Banking Sector, Challenges in Blockchain Based Banking Sector.

Chapter Four: Introduction, Result & Discussion, Summery.

Chapter Five: Summery of the Study, Conclusion, Recommendations.

CHAPTER 2

Background Study

2.1 Introduction

Blockchain has started its journey in 2008 with Satoshi Nakamoto who proposed a public transaction ledger. So, blockchain technology is in its earlier stage. But it has already made a mark. Now, a common misconception that lies in the minds of people is that blockchain & bitcoin are two same things. This conception is due to the fact that the latest version of blockchain & bitcoin both were introduced by the same person, Satoshi Nakamoto. Sending their white paperwork on blockchain in 2008 and introducing the first code in 2009, Nakamoto made bitcoin, a currency, which could be sent to peers without the need for a central bank or other authority to use and adjust the ledger, much like real money. That's why, the misconception arose among people. But these two things are a lot different from each other. Blockchain is more of a vast sector & bitcoin is a part of it. There are different types of blockchain available in the world. They can be primarily classified as public blockchain, private blockchain, consortium blockchain & hybrid blockchain. Now, bitcoin is an example of a public blockchain. So, blockchain is a vast concept & bitcoin is more of a subset of this.

Now, surprisingly, bitcoin is not the first ever crypto currency or digital currency in the market. In year 1998, Nick Szabo, a computer scientist worked on digital currency & invented one named "bit gold" which is a digital crypto currency. In year 2000, Stefan Konst, another scientist, invented a way for decentralized cryptographic chain. He also provided with the procedure of implementation. Even before all of them, in year 1991, Stuart Haber and W Scott Stornetta provided the definition of a cryptographically secured chain of block.

In year 2008, Satoshi Nakamoto brought a revolution in the sector of blockchain. In that year, he established a model for blockchain & showed it to the world. In year 2009, he also built the first ever implementation of blockchain. He used a public ledger for

transactions where all the information will be accessible to everyone & named the blockchain “bitcoin”. After that, blockchain revolutionized with years & different types of blockchain were established. One key fact here is that in initially bitcoin & blockchain were a single entity. Later, the scientist understood that keeping blockchain within just bitcoin was a complete waste of the potential of the blockchain technology. As a result, it is now used in different sectors with or without the use of crypto currencies. Such a blockchain application is the Ethereum blockchain technology.

Ethereum is a technology which used the concept of including the computer programs into it. Such computer programs are called “smart contracts”. Smart contract can be used in different sectors because of its widespread potential. Wherever there is need for documentation of some property or other stuffs, this smart contract concept can be helpful. The biggest benefit of smart contract is that it is an immutable feature of blockchain. Whenever a smart contract is introduced by two companies, it becomes a permanent part of the distributed ledger. As a result, it runs automatically without the need of someone to maintain it. The other benefit is that nobody can change it easily due to the high security system of blockchain. As a result, uses of smart contract is increasing with every new day. This provides us with a highly potent alternative to the traditional documentation of necessary files. Even smart contract has the potential to run big auction ceremonies. Ethereum used this very feature of smart contract to get the best output from the blockchain technology.

In year 2014, another revolution occurred in the arena of blockchain and we got the new version of blockchain “Blockchain 2.0” which gave us technologies like Ethereum, ripple etc. Blockchain 2.0 provided us with some quality materials like:

- ✓ Decentralized exchange of stuffs other than money
- ✓ Getting & transferring digital assets
- ✓ Micro transactions
- ✓ Smart Contracts

All these features made blockchain technology quite popular among people. After that, blockchain technology is improving with every passing day & newer applications of blockchain technology are invented. As a result, blockchain technology is being used in many sectors like financial institutions, garments industry etc. today.

2.2 Related Works

Blockchain is in its quite early days. Its applications, as a result, are quite limited in today's perspectives. Similarly, blockchain hasn't been used that much in banking sector yet. But many analysts have already highlighted the future of blockchain technology in banking sector.

In 1992, researcher Ye Guo & Chen Liang at el. [1] highlighted the bright prospect of blockchain in banking sector. They focused on the China economy & highlighted that their banking sector was at risk due to interest rate liberalization & profit decline. In such situation, blockchain could open a new door & innovate the financial terms. Blockchain also supplies "multi-center, weekly-intermediate scenarios" which may enhance the efficiency of the banking activity.

Again, Hossein Hassani, Xu Huang & Emmanuel Silva at el. [2] brought up the fact, in an article in year 2018, how limited our knowledge on blockchain is. They said that blockchain can have a serious impact in banking in the "big-data" thing & our limited knowledge is a big barrier in this. They also suggested an extensive research & development of blockchain technology in banking sector.

Moreover, in year 2017, researcher Luisanna Cocco, Andrea Pinna & Michele Marchesi at el. [3] showed the challenges & potential of blockchain technology in banking sector. They highlighted in their article that only bitcoin technology has some big disadvantages & they can be overcome with the widespread use of blockchain technology. According to them, there are three quantities than can truly uphold the efficiency of the banking sector. These are:

- ❖ Economic efficiency
- ❖ Operational efficiency
- ❖ Efficient Service

Another researcher I. Eyal at el. [4], in 2017, in one of his articles, stated that he saw huge potential in distributed ledger technology (DLT) or cryptocurrency blockchain protocols. He also showed that blockchain research beyond bitcoin was reducing the gap between blockchain & its applications in banking sector. Again, in 2017, Q. K. Nguyen at el. [5], focused on the fact that how different people & the banks authorities are in terms of their regulations. After the financial crisis in, the banks made stricter rules when it comes

to the banking activities. But the general public wanted more flexibility in all the regulations in banking. They wanted direct involvement in policy making. Q. K. Nguyen then presented the possibility of blockchain in banking sector & how it can turn the sector around & meet everyone's demand.

Blockchain has the potential to make the supply chains efficient as well through its application in banking sector. Sebastian Schuetz & Viswanath Venkatesh at el. [6], in June of year 2020, highlighted how Indian economy can be benefitted from the planned use blockchain in banking sector.

In year 2016, Peters G.W. & Panayi E. at el. [7], also upheld the great relationship between blockchain & banking sector in one of their articles. They showed a complete model of different possibilities of this technology in banking sector & later also showed the potential challenges in its execution. Again, in year 2019, an article by N. A. Popova and N. G. Butakova at el. [8], highlighted how blockchain technology without its tokens can be used in the banking sector to enhance the security in the banking sector. Blockchain has the potential to give maximum security to the banking sector & this article was a prime example to it. In year 2020, Hao Wang, Shenglan Ma, Hong-Ning Dai, Muhammad Imran, Tongsen Wang at el. [12], also showed the possibilities & hindrances in applying blockchain in banking sector. Reggie O'Shields at el. [13] also highlighted the advantages of smart contract in banking sector in one of his articles in year 2017. Again, in year 2016, Mark Buitenhok at el. [14] showed how this blockchain technology can boost the whole sector, not favoring any particular bank. In year 2019, Rella Ludovico at el. [15] showed the effect of this technology on financial inclusion & remittances. On the other hand, Yeoh, P. at el. [16] in 2017, upheld the problems that can be there in a blockchain based system. Harris, W.L. and Wonglimpiyarat, J. at el. [17] in one of their articles in year 2019 highlighted the new dynamics that blockchain will provide in banking sector.

In year 2020, Rajnak, V., Puschmann, T. at el. [18] did a regression test & found that blockchain can have a significant impact in banking sector. Dancho Petrov at el. [19] in year 2018, showed in which sector of finance this technology will have most impact on. Seretakakis, Alexandros L. at el. [20] in year 2017, showed the influence of blockchain in market security & central banking as well.

Blockchain technology has a lot of potential in it & all the analysts have tried to use that potential in the banking sector some extent. Banking sector is a very important in every country's perspective & making it a very well structured sector is also important. In our later part, we will try to enrich the banking sector by using blockchain technology in the proceedings.

2.3 Research Summary:

Blockchain is a very new technology & it can very much contribute to all the sectors in the business world. Blockchain has the ability to contribute in the banking sector. By scrutinizing all the research works, it is really clear blockchain can make a big positive change in the banking sector. These articles show a lot of positive sides of blockchain's use in banking. They are:

- Blockchain can contribute to banking sector by adding an extra layer of security to it.
- Blockchain tech can make the transactions in the banking very effortless, less time consuming & less costly.
- Blockchain can make the maintenance of the banking sector effective & easy.
- Blockchain, as a whole, can make the whole sector really efficient.
- Blockchain can stop all the ongoing widespread malpractices in the banking sector.

2.4 Scope of the Problem:

Banking sector & the problems related with this sector comprise a burning issue of today's world. A lot of research & calculations are going on currently to solve this issue. A lot of technologies have already been used in this sector to make the sector less prone to the cyber-attacks & malpractices. But still there is much scope of improvement in this sector.

Similarly, blockchain hasn't been able to solve all the problems as well. There are certain issues associated with blockchain that hinder blockchain to fully flourish as a technology & improve the banking sector. However, lots of researches & practices are being done regularly nowadays so that blockchain can fully flourish & it can solve all the related problems in banking sector.

2.5 Challenges:

There are quite some challenges in the way of properly executing blockchain technology in banking sector. Blockchain technology has some problems with scalability. Moreover, all the banks & financial institutions are too reluctant to change its infrastructure. As a result, they won't make any change to the banking sector straight away.

Moreover, even if the blockchain technology is adopted in the banking sector, there is really low chance that all the banks around the world will have similar sets of policies. As a result, in the inter-bank blockchain, there will be problems to fix the regulations to control the blockchain.

Instead of all these challenges, it is quite clear that blockchain has the tools to provide the banking sector with the highest efficiency & quality governance. It is high time blockchain technology was applied in the banking sector.

CHAPTER 3

Description

3.1 Introduction

Banking sectors in all countries are facing problems at the moment. A newer technology & update of the current banking sector is quite a crying need in present time. Blockchain technology has the potential to be that sector.

3.2 Problems in Banking Sector

Banking sector is undoubtedly one of the most important sectors of any country. Nevertheless we often get to know that there has been some serious controversial incidents in this sector. This is because there are some great issues with this sector which make the sector vulnerable to such incidents.

3.2.1 Money Laundering & Unwanted Malpractices

Money laundering is an illegal process. It works as a way of concealing the origins of illegal money by circulating it through a complex set of bank transfers or commercial transactions. This overall process returns “clean” money to the launderer in the end. The following figure 3.2.1 shows steps of money laundering.

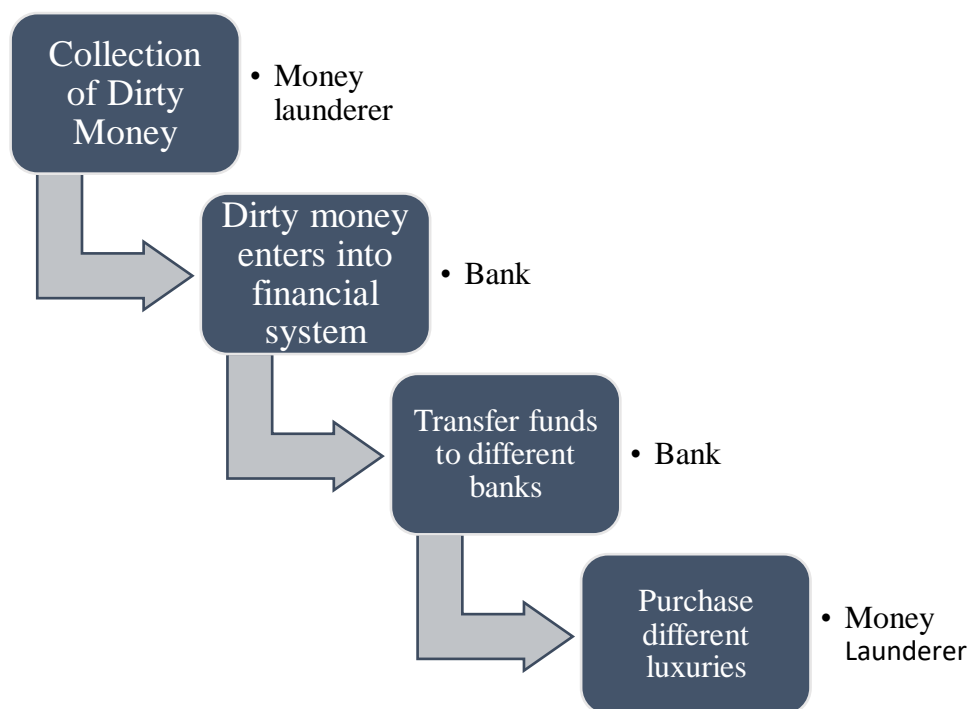


Figure 3.2.1 Steps of Money Laundering

Money laundering is one of the newer headaches created by globalization. The loss due to money laundering is estimated around \$2 trillion dollar per year, which is nearly equivalent to the total GDP of Brazil, the eighth economy in the world.

Money launderers actually take advantage of the banking system. There is a part named “layering” in the money laundering process. In this part, money launderers transfer their money from a bank to different banks within the country or across different countries. Here the job of bank is to identify suspicious transactions & react to them. But the current banking system is really slow & not well-digitalized. As a result, whenever money laundering or such incidents occur, banking sector doesn’t get enough time or opportunity to react.

Moreover, lately the banking sector of Bangladesh has been tarnished by several unwanted malpractices like Crescent Group incident, the Hallmark scandal, Bangladesh Bank cyber heist, AnonTex Group loan etc. This has damaged the image of this sector both within & outside the country.

This actually highlights a very significant issue of the ongoing world. It also shows that the banking system is very vulnerable to the modern crimes & proves that the sector desperately requires some serious improvements.

3.2.2 Absence of Micropayment System

Micropayments are basically payments or transactions worth less than a dollar (in some cases) or less than \$10 (in other cases). Any system which takes payment or allows the transactions within this range can be termed a micropayment system. The first generation of micropayment system was proposed in mid-to-late 1990s, whereas the second generation was introduced in 2010s.

Micropayment system allows the users to engage in the system more effectively. But as the transfer charge is quite high in the classical banking system, it is quite hard for the sector to adopt this micropayment methodology. As a result, we are not getting the best output from this sector.

3.2.3 Lack of Quality Governance, Maintenance & Transparency

Quality governance & transparency are two fundamental pillars of banking sector. Proper governance allows the bank to flourish & transparency in the sector makes it less vulnerable to errors.

Unfortunately, our current banking is not a well-governed one. A report by Enamul Hoque Chowdhury [9] of Daily Sun on 31 July 2020 says, “*Analysts think that the banks are losing their capacity to extend credit support to the entrepreneurs in the given circumstances keeping pace with the country’s development thrust.*” They also think that the bank should be more strict in scrutinizing all the loan applications so that the more deserving people get the loans. Analysts also suggested that each individual bank authority should monitor their own activities more carefully & central bank should synthesize all those banks’ proceedings.

Moreover, proper maintenance is also missing in the current banking sector. If someone loses his documents & wants to take a copy from the bank, he will have to spend a lot of his time in this regard. This is simply due to the poor maintenance of all the documents in the banking sector. This poor maintenance also eventually allows the online & offline attacks to succeed.

Transparency is another key component in this sector. Many banks now have wide-scale international operations & security or insurance businesses alongside traditional banking activities. As a result, they require highly complex transactions. Moreover, their

managerial structure are also getting more & more complex. Consequently these banks are at risk of malpractices & corruption. One of the things that can save the banking sector from all these risks is transparency.

Transparency means that the banks provide all their customers with detailed information on their strategies, actions & policy decisions as well as provide justification for all their decisions. Ensuring transparency means bank authority & all their employees have to answer for their activities which in a consequent manner reduces corruption. If transparency could be ensured in this sector to the fullest, there would hardly have been any corruption in this sector.

All these three things are basic needs in banking sector. According to the England Bank, A transparent, accountable and well-governed central bank is essential not only for effective policy, but also for democratic legitimacy.

But unfortunately our current banking system is not well-governed & well-maintained. Moreover, there is less scope for transparency in this sector than there should be. These points indicate that improvement & upgradation in this sector should be made as soon as possible.

3.2.4 Risk of IT & Weak Verification Process

With advancement of technology, banks have also adopted some of the technology materials with time. Nowadays, use of information technology is quite common in many banks. In fact, all the private banks and their branches are nearly 100% equipped with information technology where all the state-owned banks are also trying their best to equip themselves with this technology.

Though the banking sector has quite embraced information technology, this sector is yet far away from ensuring cyber security & risk management measures. A report by Md. Naimul Hossen [10] of The Financial Express on April 27, 2019 says, “According to a research on cyber security of the banks in Bangladesh by Bangladesh Institute of Bank Management (BIBM), nearly 52 per cent of all the banks are facing a high risk of cyber-attacks.”

Again, another research has revealed that 80% banks in Bangladesh are not capable of withstanding the possible cyber-attacks. All these highlight the risk of information

technology in this sector & it is really a must to develop system, servers in a way that all the information in this sector are safe and they cannot be easily tampered by the cyber-attacks.

Financial frauds cases in the banking sector have increased rapidly in last few years as the criminals are using newer technologies to penetrate the information. Lack of digitalization & lack of multiple layer security are two main reasons behind these criminals' success.

A much stronger verification process & a very secured interface seem to be a must to avoid these cases. The authorities should introduce such technology which will not only eradicate both these problems but also will add to the proper maintaining of the stored data in the banks.

3.2.5 Lack of Direct Connection between International Banks

Lack of peer to peer connection among international banks is also a major issue in banking sector. Currently, a huge number of international bank transfers must be routed via New York.

For example, let's assume, a company from Argentina wants to make a transaction with its partner in Mexico. Surprisingly the funds must pass from Argentina to Mexico through New York.

This shows that current banking sector desperately needs an update of peer to peer network. Without it, the funds have to go through a long way to complete the transaction. As a result, it kills much of our valuable time & also the transfer cost gets increased because of the third party.

3.2.6 High Transaction Fee & Time Delay

There is a third party involved whenever an international transaction is made. As the transaction goes via a third party, the transaction takes a lot of time, ranging from 1 day to 4 days. Moreover, because of the 3rd party, the transaction fee also gets higher. As a result, this whole sector is quite inefficient.

Now, for example, let's replace this whole system with a peer to peer system, where every international bank will be connected in a common platform & they will have no

intermediaries between themselves to complete any transfer. Because of absence of the intermediary, the transaction cost will be really less than the current method & the time delay will also be minimized to a large extent. This clearly shows that the banking sector must be upgraded to improve the efficiency of the sector.

3.3 Blockchain Based Banking Sector

Though our current banking sector has adopted some technology materials, it's still quite inefficient. The sector needs to be made more secured and more transparent. Moreover, there should be inclusion of a peer to peer network between banks so that international transfers can be time efficient & less costly. As a whole, the whole sector needs to be made well-governed.

Blockchain can be the exact solution to these problems. A blockchain is mainly a connected group of blocks where each block contains set of transactions. These blocks are connected with each other through their hashes. "Hash" is like an identity of a block. Two blocks in a blockchain can't have the same hash.

Now, there are four types of blockchain. They are:

- 1) **Public Blockchain:** A public blockchain is basically open for all. It is a non-restrictive, permission-less distributed ledger. Anyone with access to the internet can be a part of a public blockchain. As a result, he will have access to all previous records, make transactions & do mining. Bitcoin, Ethereum, Litecoin are familiar examples of public blockchain.
- 2) **Private Blockchain:** Unlike public blockchain, a private blockchain is not open for all. It is a restrictive, permission blockchain. This type of blockchain is normally visible in organizations or enterprises where selected people participate in the blockchain. All the rules & regulations, accessibility, authorization are controlled by the controlling organization or enterprise. Multichain & Hyperledger projects are examples of private blockchain.
- 3) **Consortium Blockchain:** Consortium blockchain is quite similar to private blockchain. The slight difference is that in consortium blockchain, more than one organization control the level of security, authorizations, permissions & accessibility.

This is more of a semi-decentralized type of blockchain. Energy Web Foundation is an example of a consortium blockchain.

4) Hybrid Blockchain: A hybrid blockchain is a combination of characteristics of both public & private blockchain. So, this type of blockchain may seem a non-restrictive, permission-less blockchain according to some features whereas a restrictive, permission blockchain according to other features. Similarly. Some of the information of this blockchain is public and some are confidential & kept private. In such a blockchain, users can choose which user can have access to which data. This blockchain is really flexible. It sets such a combination of public & private blockchain characteristics that the users get the best service out of this blockchain. Dragonchain is an example of a hybrid blockchain.

If we take a close look at the characteristics of all the blockchain types, we can say, private blockchain will be the best choice for intra-bank activities. This is because, the bank authority deserves the right to set the specific rules & accessibility of the blockchain. Moreover, all the information of a bank should not be made public. Again, the authority should have complete control over who can enter the blockchain. So, private blockchain methodology is the best for intra-bank activities.

On the other hand, consortium blockchain is the better choice for inter-banks activities. The rules of the blockchain should be set with the opinion of all the banks. Similarly, all the banks will be a node in this system. So, consortium blockchain will be the basis of inter-bank activities.

Private & consortium blockchain have some unique components. These are:

- ❖ Peer to peer network
- ❖ Partially distributed ledger
- ❖ Smart Contract
- ❖ Formation of Blocks
- ❖ Connected blocks of transaction

All these features as a whole can reform the banking sector to be a very efficient sector.

3.3.1 Peer to Peer Network

Peer to peer network is an IT infrastructure in which two or more computers connect with each other to share resources. The setup of such network specialized algorithms & specialized software.

Blockchain provides us with a platform where peer to peer network is ensured. Anybody can join the platform. Here, all the customers will be directly linked to their corresponding banks electronically. Again, the banks will be mutually connected to each other as well.

The following figure 3.3.1 shows structure of blockchain based banking sector.

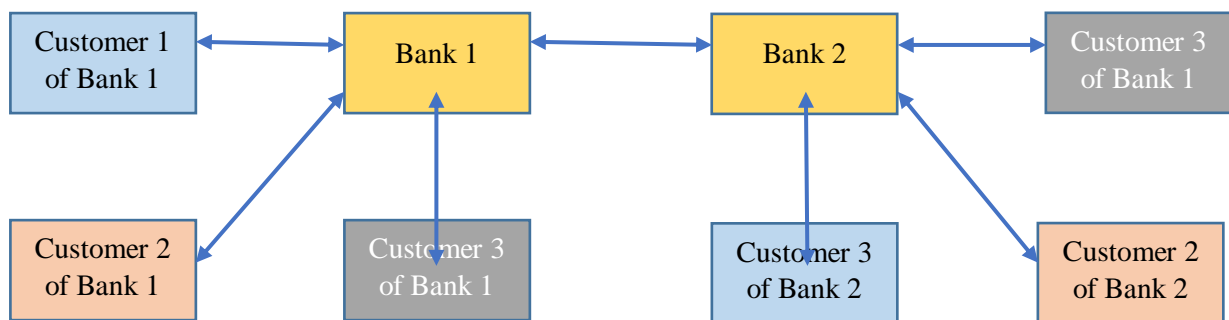


Figure 3.3.1 Structure of Blockchain Based Banking Sector

The main advantage of this peer to peer network is in international transfers. We know, in the traditional international banking transfers, the transaction requires a third party which acts as an intermediary and makes the transaction successful. But the problem in this method is that quite some time delay breaks into the system. Moreover, transaction fee also gets high in this manner. But in the blockchain based banking system, all the banks will be connected to each other directly. As a result, this would make this extra cost go away & as the transaction is made by an electronic way, the consumed time will also be minimum.

Again, in this private/consortium blockchain, both the bank & the customer get to have all the details of the transaction. As a result, even if something controversial happens, they can easily get to any conclusions based on the information.

Moreover, as the banks are connected by a secured electronic platform, it will be easier for the central bank to control all the proceedings. Moreover, it will be easy for all

the banks to connect with their customers. As a result, better maintenance will be achieved in this sector.

3.3.2 Partially Distributed Ledger

A partially distributed ledger is simply a database. In a distributed ledger, the database is consensually shared & synchronized by multiple entities. In this method, there is no central authority. All the entities save a copy of the transactions in their own server. As a result, if someone makes a mistake, it can be easily identified & solved. Here, the entities don't belong to a single organization.

On the other hand, in a private or consortium blockchain, the ledger is mainly controlled by one or two organizations. As a result, the ledger is not fully distributed. Hence, it is termed as a partially distributed ledger.

There is a lot of controversies regarding private blockchain company. Basically, many believe that the controlling company may tamper a transaction if they wish. But it's too unlikely to happen. Again, if we use smart contract to record the transaction, this transaction will be really secured & if the authority makes some changes, the customer can complain against this according to law.

A partially distributed ledger is not as safe as a completely distributed ledger. But the smart contract application & hashing of the blocks make this ledger safer than the classical banking database. Moreover, this ledger makes the banking activities more organized. In classical banking, all the documents are stored in a scattered way & it's tough to find the needed document quickly. On the contrary, if we use this partially distributed ledger & filter the data in the database, we can find the desired data with just few clicks within a short time.

3.3.3 Smart Contract

Transaction is the basis of the banking sector. Smart Contract in blockchain allows us to do these transactions more efficiently & offers a more secure platform for the dealings. Smart contract can be termed as the heart of a secured blockchain system.

A smart contract is a computer program or legal system that aims to automatically perform, manage or document relevant events and actions in accordance with the terms of

the agreement. The objectives of smart contracts are to reduce the need for reliable mediators, mediation and enforcement costs, fraudulent losses, and to reduce risk and risk differences.

Nowadays, security is the most important thing everywhere. Whenever, some company would like to invest in some banks, they would like to have a secured base. Though it is quite unlikely that banks would try to do something harmful to the deals or tamper the deals, there is always risk of outside attacks. They might try to change or tamper the data. As a result, security becomes a significant issue in the banking sector just like any other sector.

Here, smart contract along with the concept of blockchain may come to rescue. There are many advantages that smart contract provides. Some of them are:

1. **Accuracy:** One of the most important features of a smart contract is to clearly record all the terms and conditions. This is necessary because leaving any of the specifications out of the smart contract may result in any loophole of the transaction which may later be taken advantage of by a group. So, whenever a smart contract is prepared, accuracy checking is one of the first things that are done. As a result, automated smart contracts avoid the pitfalls of fraud.
2. **Openness & Transparency:** The terms and conditions of these contracts are fully transparent and available to all parties involved. There is not a single way to challenge the terms in the contract once the contract has been established. As a result, if all the specifications are specified correctly, because of transparency & the stability of smart contract, this transaction becomes more reliable than ever. This facilitates the complete transparency of transactions across all parties involved.
3. **Clear Connection:** The need for accuracy in all the contract conditions results in everything being explicit. There can be no space for misinterpretation or misinterpretation. Therefore, smart contracts can significantly reduce lost performance because of communication gaps.
4. **Speed:** These contracts basically consist of the software code and they normally reside online. As a result, they are able to make transactions much faster. This speed can cut down wasting hours in many traditional business processes. As a result, there is no need to process documents manually.

5. **Security:** Automated contracts use the highest amount of data encryption currently, which is the same method used by modern crypto-currencies. This level of protection makes them one of the most secure features on the World Wide Web. Smart contracts in blockchain system normally use public key cryptography encryption method.
6. **Efficiency:** As all the smart contracts are made online & they remain in digital server, the natural result of this is the efficient operation of smart contracts. High efficiency results in a more profitable performance generated by each unit of time.
7. **Paper free:** Businesses around the world are increasingly remembering their impact on the environment. Nowadays, it's a burning issue to save the environment. All the business authorities around the world are gradually participating in "go-green" travel because they now understand that they are alive and breathing on earth. Smart contracts promote "go-green" movement. This removes the need to redo large sheets of paper.
8. **Storage & Backup:** These contracts record important details for each purchase. Therefore, whenever your information is used in a contract, they are kept permanently in future records. In the event of a data loss, these attributes are readily available.
9. **Savings:** Perhaps one of the most important advantages of automated contracts is that they eliminate the need for a large monkey chain. There is no need for lawyers, witnesses, banks and other lawyers. As a result, the cost of transaction also reduces.
10. **Immutability:** Immutability is another major characteristic of smart contract. Once the smart contract is complete & signed by both the parties, there is no way to change anything of this. As a result, smart contract seems very unlikely to any change & it enables a very secured way of transaction.
11. **Hope:** Smart contracts generate complete confidence in their performance. The transparent, independent, and secure nature of the agreement removes any fraud, preferences or errors. Moreover, once the smart contract is accepted in the blockchain, the network automatically runs the contract. As a result, the trust between the bank & all their customers gets better & investment in banks improve.
12. **Guaranteed Results (Bonus):** One of the advantages of these contracts is that they can significantly reduce or even eliminate the need for litigation and courts. Through the implementation contract, the parties commit themselves to adhere to the rules and decisions of the code.

All these advantages of smart contracts make smart contract based blockchain a very effective solution to the existing bank sector. In our proposed plan, whenever some party will agree on the terms and conditions of a deal with the bank, blockchain will run a smart contract. Since it is immutable, that means a smart contract can never be changed and no one can tamper with or break a contract.

In our blockchain based banking system, there will be a profile for all the companies. Providing security for all the profiles is as important as keeping the deals secured. We will use private key cryptography to provide a two-layer security in this regard.

Each recipient in the system will receive two keys - a public key and a private key. Public keys are available to everyone, while private keys are kept private. The profile address is an example of a public key. Using the public key, it is possible to encrypt the message so that only the private key can translate and read it. Both keys are connected in some way, but it is not possible to predict the private key using only the public key. Private key & public key work collaboratively so that one can use a private key to sign any message. This is known as a digital signature. From this, you can know without a doubt that the sender is the one who created that message and that no one else can claim to be the one sending it. On the other hand, using public key, one can send a particular offer to another. In our banking sector, banks & all the customers will be able to connect with each other using this keys.

So, using this methodology, all the customers will be able to contact with bank easily, perform their wanted task more easily & efficiently. As a result, efficiency & maintenance will be improved of this sector.

3.3.4 Formation of Blocks

Blocks are files where blockchain network data is permanently recorded. The block records some or all of the latest blockchain transactions that have not yet entered the previous blocks. Therefore, a block is like a ledger page or a record book. Each time a block is 'completed', it enters the next block in the block. The block then behaves like a permanent record store, once it is registered, cannot be changed or removed.

A block has some unique characteristics. They are:

1. The block can be thought of as a metal link. It contains portions or records of all previous purchases.
2. The blockchain network is made up of millions of blocks that are constantly in a state of flux.
3. The block is almost impossible to break. If it were possible, it would have had the same effect as the bank robber arrived over the counter and took not only the money but also all the bank records as well.

In our proposed system, there will be miners appointed by the bank authority. The job of miners is to record all the transactions into blocks. The miners are basically nodes of the blockchain.

The purpose of the miner's network is as follows: Each new block can be understood as an integrated decision of history of a past few minutes. The network reaches an agreement for the current activity or activity for a certain period of time. This time is 2.5 minutes on average for Horizen whereas it is 10 minutes for Bitcoin.

Each miner has a very different block than the other miners. The difference is that it takes time for new activities to spread across the network, and different miners may find that some transfers are different. Miners have to solve a cryptographic puzzle to add a block to the blockchain. Later, miners start working newer blocks - hence the new puzzle - soon after the previous block had been inserted into the chain. They start collecting all the transactions on the network that are not currently blocked and include them in their next block version.

The miner who solves the puzzle first gets to add the next block that writes history at the last minute. They spread their block with a puzzle solution on the blog network. All nodes, no matter whether they are mining or not, make sure the puzzle solution is correct, and if so, add a new block to their blockchain copy. After that the cycle repeats again.

Now, there are some elements associated with every blocks in a blockchain. They are hash of previous block, hash of current block, the goal of the current difficulty, the time that was required to create the block, the nonce etc. Among them, one of the most important elements of a block if not the most, is its hash function.

Hashing is an algorithm that calculates a string from a fixed file values. The file basically contains data blocks. Hashing converts this data into a string of short lengths or

a key representing a real string. The hash value can be assumed as a reduced summary of everything in that file.

A good hashing algorithm will display an asset called the avalanche effect, in which a variable hash output can change drastically or completely even if slightest of data in the data block is altered. Hash number that does not do this is assumed to have randomization, which is likely to be broken by hackers.

A hash is usually a hexadecimal code with several characters. Doing Hashing is also a one-way process so you can never work back to get the original data from hash.

A good hash algorithm should be complex enough not to produce the same hash value for two different entries. When this happens, this is known as hash collision. The hash algorithm can be considered as good and acceptable if it provides a very low chance of collision. Several algorithmic techniques are available in order to orchestrate hashing, bitcoin, for example, uses SHA-256.

Hashing offers a more flexible and reliable data recovery method than all other data structures. It's faster than list-to-list search. In the same space, it can return 1.5 processors anything stored in the tree that will otherwise take $\log n$ probes. As a result, you can find any of your documents searching for the hash function more quickly than ever. This will improve the efficiency of the system also.

You can't determine the speed you will get with hashing unlike other data structures. Rather you can choose the time-space tradeoff here. You can control the space by selecting the return speed. Similarly, you can control the speed by selecting the hash table space value.

3.3.5 Connected Blocks of Transactions

A single block is never safe from hackers or other malpractices. If there is only one block of data, then it is easy to change or tamper the data. That's why, it's really important to connect all this blocks together so that no one can break into the system & tamper anything.

Whenever, a new block enters into the blockchain, in the header part, the hash of the previous block is attached. Suppose, the previous block is block no.171109 & new block is 171110. Then the header part of block 171110 will contain the hash function of

block 171109. Similarly, block 171109 will bear the hash function of block 171108. As a result, a connection between the blocks is created.

The following figure 3.3.5 conceptual illustration of the blockchain.

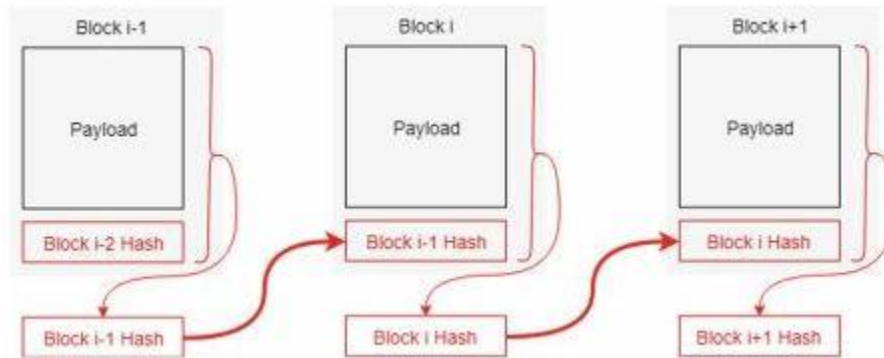


Figure 3.3.5 Conceptual Illustration of the Blockchain

All information processed on the blockchain is automatically hashed. New hashing of incoming (generated) data sets is created by combining the original hash of the genesis block (the first block of the blockchain), all the previous hashes, and the data of incoming payments. This results in a continuous line of continuity between all verified network transactions recorded in the blockchain.

As a result, any attempt to change even the smallest detail in a single component or block of 'series' results in the alternation of complete hash signature of all hashes of the network. Since all nodes in the network make a copy of the blockchain in the devices, the deviation from this hash (as will be the case if a node modified a blockchain segment) is immediately rejected by the broader network consensus and discarded. Only data (generated) that syncs the hash signature are used for integration.

This is the system of permanent connectivity and integration of everything that is done in the blockchain, however, all these create a complex list of details that need to be handled properly if blockchain functionality is to be achieved. To do this, blockchain uses data structures.

3.4 Structure of Blockchain Based Banking Sector

Our proposed idea of blockchain based banking sector will make the use of smart contract & chaining of blocks to build the reformed sector. Here, all the processes will

use some digital features of blockchain, smart contract & other digital technology materials.

Here, transaction will take place in some steps. These are:

1. Bank/customer will send a transaction offer to the other entity. This transaction offer may include any banking activity like opening deposit account, asking for loan, confirming loan.
2. Bank will provide the necessary regulations & stuffs to the customer. As a result, the customer will be sure whether he should go for the transaction or not.
3. After both party agreeing to the transaction offer, a smart contract will be run. The bank will initialize the smart contract & digitally sign it. As the offer or smart contract document will be sent from the blockchain account of the bank, the customer will have no doubt on the fact that from whom this is coming.
4. Now, the customer will digitally sign the contract paper by using his own private key. As the private key of the customer only belongs to him, there will be hardly any scope for the cyber attackers to tamper the transaction.
5. After the transaction is done, it will be out in the blockchain for the miners to grab. There will be thousands of transactions in the field which the miners will gradually grab. Here, all the miners will get some transactions on a block & will try to verify it.

Here one thing is important to notice, one transaction can only be accepted in only one block. Now, there may be more than one miner who might have included the same transaction in their blocks. In such case, only one of the blocks will be accepted. This will depend on the time of the verification. The miner who verifies the block first will get to add his block to the blockchain. All other blocks that have a same transaction as in the verified block will not be accepted by the blockchain.

6. The verification will be done with the solving of a puzzle. Validation of any block requires a puzzle to be solved. Any miner who gets to solve the puzzle first gets to add the block.

7. After the block is added, according to the information of the transactions, the block gets a hash number of its own. It also holds a copy of the hash function of the previous block.

Now, in this procedure, all the information including transactions & other stuffs will be recorded in the blockchain. Now, for any outside hacker, if he wants to do a change to any contract, the hash of that block will automatically change. Now, all the nodes of the blockchain have the original copy of the contracts. So, the consensus will identify the change & refuse it. As a result, the blockchain will be safe.

In our system, the maintenance & everything related to the blockchain will be done by the banking authority. They will monitor all the transactions. They will see if something is fishy & will according to that.

When it comes to the inter-bank blockchain, all the banks around the world will set the rules together. Moreover, all the monitoring will also be done by all the banks together. Together they will verify all the transactions & make sure that the maintenance is done perfectly.

This whole blockchain based managerial process will make the bank management easier. Moreover, the efficiency in the blockchain based banking sector will be higher than the traditional banking sector.

3.5 Advantages of Blockchain Based Banking Sector

Blockchain is a newer technology. It is like the internet in many ways, when internet started its journey, nobody knew it would come so far. Blockchain is in its early stage & already its impact shows it can go a long way. Similarly, like other sectors, using blockchain in banking sector might bring in a lot of advantages. Some of them are:

3.5.1 Preventing Money Laundering & Malpractices

Money laundering is one of the biggest problems that modern banking sector faces. In the recent years, number of money laundering incidents & the losses due to this have increased highly. As a result, solving this money laundering issue is a burning issue for today's world. Here, smart contract based blockchain technology has the potential to turn the whole scenario around.

The question of how to identify illegal money using blockchain technology is a complex one. In fact, any execution of an AML solution to Blockchain will require the use or integration of smart contracts. A blockchain-supported AML platform that uses smart contracts will be able to use random algorithms to create a deceptive AML detection process.

By installing a set of requirements, such as the need for a verified ID, this technology will be able to automatically block or flag any suspicious transactions. In this way, the authority can oversee all transactions through participating financial institutions without hiring large groups of accountants to audit the transfers or transactions.

Governments will be able to apply such a law, which means that all financial institutions and crypto currencies will have to use such a system in order to operate. Any blockchain-based database that incorporates money or assets can include the feature of recording each group's guaranteed identification. This means that these people have to account for their deeds if they do something wrong.

Such a solution could work by allowing each participating financial institution to operate as a member of blockchain platform. Whenever transaction is made, the network will scrutiny if the transaction is suspicious or not and if found suspicious, the case could be marked as suspicious and required for investigation.

It can be argued that the integrated blockchain solution, in which all participants are usually financial institutions, does not support the real concept of segregation imposed by Satoshi Nakamoto. However, preventing money laundering, which last year cost different governments billions of dollars in lost taxes should be paramount.

Moreover, due to high maintenance & security setup by blockchain, it would be quite difficult for the criminals to repeat any malpractice they used to do on traditional banking system.

3.5.2 Enabling Micropayment & Improved Identity System:

Several times now, micropayments systems have tried and failed to take the market due to high fees or impractical digital finance. However, with the advent of blockchain and the better construction of digital payments, real financial micropayments are now happening.

Blockchain offers the first effective solution for low cost (or zero) properties and fast speeds in micropayment system. Systematic networks can create reliable systems that support trading for very low cost.

This effectively lowers the barriers to allow micropayments to flow - and they already exist. According to a report by Stacey Schneider [11] of “Provide” published on December 17, 2019, *“At EthDenver this year, we saw the creation of the BuffiDai, a conference coin built on MakerDao’s Dai stablecoin. This localcoin digital asset ran on an Ethereum xDai sidechain to purchase food, beverage, and swag all weekend. With transaction volumes almost exclusively below \$10, the entire experiment consisted of micropayments. From the food trucks alone, vendors doled out 4,405 meals for a total of \$38,432.56. The cost to process all of these transactions amounted to only \$0.20. To put it in perspective, if those vendors accepted credit cards, the cost would have been around \$2400.”*

So, it’s quite clear that blockchain has a bright future in micropayment system & it has already started to prove that. If properly utilized, blockchain may turn into the next big thing. Moreover, it may turn the banking sector into an altogether new one & make this sector an efficient one.

Financial fraud and money laundering are on the rise as criminals resort to new technologies. As the criminals are taking advantage of technology, the only way to stop them is the use of technology itself. KYC is an effective way to combat such crimes.

KYC means Know your customer. Sometimes it also means Know your Client. KYC or KYC testing is a fundamental process to find & verify client identity when creating an account and from time to time. In other words, bank authorities need to make sure who their real customers are.

Bank-defined KYC procedures incorporate all necessary steps to ensure that their customers are realistic and they can monitor risk. These processes help protect and identify money laundering, terrorist money, and other illegal activities. The KYC procedure includes face verification, ID card verification, document verification as billing for use as address proof, and biometric verification.

As a result, blockchain stores all the information of the customers & can easily monitor their activities. So, whenever something suspicious takes place, the authority can

red-flag this & ask that particular customer to account for that unusual deed. As a result, the blockchain based banking system becomes highly reliable.

With KYC, banks can work on improving banking and intra-bank authentication processes, facilitating secure transactions. All of this also eliminates the need to provide customer information to various banks more frequently and reduces re-processing costs. As a result, the whole banking sector upgrades itself & makes the sector even more efficient & reliable.

3.5.3 Enabling Quality Governance, Maintenance & Transparency

Banking sector is definitely the backbone of a country's economy & proper governance of this sector must be ensured if a country wants to develop its economy. Nowadays, many questions have arisen about the proper governance of the bank. Many analysts think that there has been mismanagement in loan acceptance. They claim that bank authority is not properly scrutinizing the loan applications before accepting it. Here, smart contract based blockchain technology can help to some extent. Using this technology, bank authority can easily compare different loan applications & accept the deserving ones.

Moreover, due to lack of proper governance, different institutions are taking advantage of the whole banking system. If proper governance by the use of blockchain technology can be ensured, these type of misuse by different institutions can be fully stopped.

Quality maintenance is another burning issue of today's banking sector. Due to lack of quality management of data & documents of clients & bank itself, this sector becomes very inefficient & it is really hard for general people to retrieve data really quickly. Here, blockchain looks like a real solution to this problem. In blockchain technology, all data are reserved in blockchain system. Moreover, all the agreed deals are documented using smart contracts & they are also reserved in the blockchain system. As all the data stay on the blockchain system in an electronic way, it becomes really easy to retrieve any data. Moreover, searching or filtering in blockchain is also quicker than searching in normal array or collection. As a result, total management of this system

improves due to blockchain. So, using blockchain in banking sector is a key to enable quality management.

Blockchain has the potential to make great changes to the banking sector & make it more powerful. One of the most important things that blockchain provides the banking with is transparency. We know, smart contracts are electric documents which can never be tampered or broken once it is documented. So, whenever, someone agrees a deal with the banking authority & digitally signs the smart contract, they know for sure that this will last & this brings more transparency to the system. Moreover, the banking authority can also monitor all the activities of the stuffs & the customers. If someone is found to do something wrong, they can easily detect them & make sure that right judgment is achieved. As a result, transparency can be achieved in the blockchain by dint of blockchain technology.

Quality governance, management & transparency are three key things in the banking sector. If we use smart contracts based blockchain technology in the banking sector, we can go a long way in achieving these three major things. So, blockchain in banking sector is no more an imaginary concept. Rather it is more of a practical approach to create a better banking sector.

3.5.4 Reduced Infrastructure Cost & Instant Settlements

One of the benefits of blockchain in banks is reduced infrastructure costs. Banks have recently learned that the blockchain based system could allow them to reduce infrastructure costs by up to \$20 billion by 2022. By doing things like good communication within the platform, banks can reduce counter-parties & intermediaries with partners and mediators. They can also reduce the cost of maintaining and contracting again. Banks can also reduce transaction costs within the bank to a bank transfer. As a whole, blockchain has the ability to minimize the overall cost.

One another big advantage that blockchain provides is that transfers or transactions can be made in minutes or seconds in this method, while at present, transaction by classical method can take up to 1-4 days. With Blockchain, all the processes are user-optimized, which will save time and money for both parties involved. Blockchain will eliminate the need for more central and back office staff in banks, as transactions are

resolved immediately. Besides that, blockchain will remove the need for a lot of middle offices.

Moreover, in this method, even the bank can arrange for a blockchain based app which may be accessible by any digital device with internet connection, like smartphones, computers etc. As a result, the payments can be done even sitting at home with great ease. Thus, banks have an important motive to test blockchain for residential development. Some banks now test internal options first. On the other hand, others test options between banks first.

3.5.5 Improved Financial Outputs

Creating fundraising circles using blockchain technology offers many solutions to many common problems, from availability to visibility, and cost. With the advent of blockchain technology and its inclusion in the financial sector, we have found many different types of fundraising.

One interesting example is the development of financial circles, also called "rotation savings and credit relationships" (ROSCA) where a bunch of people keep and borrow money in a single platform. This is done with repeated donations and regular cash withdrawals from a regular fund. It operates as an informal financial institution that often includes a lot of mistrust. Blockchain has the potential and power to add credibility and resilience to these highly expensive money circles.

A project like AZ FundChain makes use of blockchain technology to better transparency and trust issue among fundraising members. AZ Fundchain uses social badges to improve trust and reputation on-chain because members can leave reviews on the platform. The project concentrates on adding positive impact & vibe to existing social media circles that this can improve local communities and provide a non-conflict environment.

AZ FundChain enables one to trace for a fundraiser outside one's local community and sort through fixed prices, objectives or reputation levels. This enables one to find the right financial circle for one's needs.

All money circle parameters are documented in a secured smart contract that manages the transaction. The transfers are completed using the AZ token which is also known as the fuel of FundChain.

Blockchain has the capability to transform the regular crowdfunding activity of banks into a more efficient & effective activity. Again, it has the potential to get the best out of the money circles.

There are extended options for financial solutions in times of crisis due to crypto or digital currency. When Bitfinex Hack happened, the solution they were building was to compensate consumers, and all who shared equally in the loss, with the Treasure Right Token (RRT) trademark. One token was valued at a loss of \$ 1 and each token was identified as an IOU. Customers can sell the token at market price (if they do not believe in the return of Bitfinex or if they do and want to make a profit), they can exchange it for ownership (which happened to be about half of all tokens) or they can buy it again with Bitfinex for \$ 1 some time in the future. After the initial RRT price drop to \$ 0.30, it is now selling for about \$ 0.80 and Bitfinex is back to normal. A lovely example of a new financial solution, thanks to Blockchain. Without it, Bitfinex would have collapsed and all customers would have lost all their money.

So, blockchain technology based banking sector can contribute much in the times of disasters as well. It is high time all the banks gave a deep thought about this amazing technology.

3.5.6 Improved Inter-bank & International Transfers

One of the fascinating things about blockchain is that it has the power to eliminate the need for a reliable mediator and makes peer-to-peer transactions possible. When blockchain is used in the financial services industry, it can replace charging entities such as custodian banks (those that transfer money between different banks) or clearers (those that vouch for counterparties credit positions). Thus, Blockchain offers better performance due to a major decrease in operational cost for banks. In addition, when banks share a blockchain, the total cost of that blockchain and the surrounding process may be higher than the costs of classical bank management. However, costs are allocated

& shared between all participating banks and as a result, there is a significant reduction in cost for each bank.

Moreover, we know, traditionally, majority of the international bank transfers have to go through via New York. This causes two big problems. One is increase of transaction fee because of third party. Another is time delay due to a longer route. Blockchain has the capability to solve this problem.

In blockchain, we can bring all the banks within or outside the country in a single platform & establish a peer to peer network between them. As a result, all the banks will be able to contact with each other directly no matter the circumstances. As the blockchain between the banks will be a consortium blockchain, all the rules & regulations of the blockchain will be set based on the consensus of all the banks. Consequently no bank will be able to take any extra advantage from the system.

So, we can see, if we use blockchain in banking sector, international transfers will no longer need a third party in the route. This will significantly improve the efficiency of the international transfers & both money & time will be saved during the procedure. So, blockchain can be the ultimate solution to the inter-bank transfers & it is a crying need to adopt blockchain in banking.

CHAPTER 4

Discussion

4.1 Introduction

Blockchain in banking sector is not a mere possibility now. Rather it has already set its feet in the banking sector. It offers many benefits to the banking sector that the banking sector can altogether be transformed with the help of blockchain. It is just a matter of time & proper patronizing so that blockchain gets to flourish in the banking sector.

4.2 Challenges in Blockchain Based Banking Sector

There are numerous advantages of blockchain based banking sector. Blockchain can transform the whole banking sector & make it resilient to all the problems current banking sector faces. But there are some obstacles in proper adoption of blockchain in current banking sector. They are:

4.2.1 Problems with scalability

Since blockchain is a distributed system, its integration capabilities are directly dependent on the integration capacity of the devices involved. In comparison with 1,700 Visa transactions per second, blockchain can only process 4,6 transactions per second on average. This gap represents a major challenge to the global adoption of the blockchain.

With the growing popularity of blockchain, only the problem of scalability becomes vague. Although several measures are proposed, each has its own limitations. One of the most important limitations is known as 'sharding'.

In the context of blockchain development, sharding is basically a method of distributing computational load and partial storage (shards) into a P2P network so that every node gets to process only the transaction associated with its shard. The objective of this process is to free each node of the need to process the blockchain completely, which greatly improves the transactions rate.

Major physical challenges of sharding are related to safety and communication. When a blockchain is divided into many small pieces, each behaves like a network with a single blockchain. This affixes an extra layer of perplexity for the designers because it requires a special communication process.

Another challenge is safety. As a result of the split, the hash power of each blockchain node decreases. This makes it much easier for cyber hackers to get into any single shard, which may lead to irrecoverable data loss.

Although brilliant minds work on to find solutions to these problems, only time can say if it is possible for the blockchain to reach a very fast transaction rate such as Visa.

4.2.2 Policies and Regulations

Banks also face a lack of clarification about policies. In the current situation, there are no rules or regulations when it comes to transactions made with cryptocurrencies and smart contracts. Until the right regulatory framework is established, it will be really difficult for all financial institutions to use the blockchain.

For example, last year the EU enacted a law called the "General Data Protection Regulation" (GDPR) to ensure the confidentiality of data for EU citizens. New EU legislation has quickly garnered the attention of blockchain advocates for two specific reasons:

1. One of the key requirements of the GDPR is that personal data must be modifiable and displayed, which is in direct conflict with the blockchain data blocking policy. Violating this arrangement will result in a huge loss to any bank - a fine of \$ 20 million or 4% of the organization's money.

2. The GDPR requires a clear unit of responsibility for EU citizens against those who do not exercise their rights under EU data protection law. Because blockchains do not have a central control, it is hardly possible to distribute the responsibility. This alone makes it difficult for blockchain technology to comply with EU law.

While the purpose of the blockchain and GDPR is to protect data, the law in place can severely limit blockchain recognition in the international bank. The European Parliament has released a study on the blockchain and the GDPR, which aims to resolve

the dispute. While it discusses a number of ways to deal with ongoing interest conflicts, it is highly likely that major changes in blockchain technology will be needed to address all of these concerns.

4.2.3 Culture

Blockchain technology is a modern concept of asset marketing. It is by experience in the 'new earth' that one can experience. Anyone will experience a cultural shock when they are introduced to a whole new world. Moreover, all the institutions normally tend to stick their old methodology. As a result, they usually don't react to newer technology & their applications well. Also, it is not easy even for the digitized institutions to adapt to the new technology right now.

It takes time, effort and proper knowledge to get used to the newer technology which makes instant application of this technology challenged.

4.2.4 Cost and efficiency

Blockchain technology is very effective in reducing costs. However, it still faces some challenges during legacy planning. Setting up the primary blockchain infrastructure is expensive. Small financial companies or Banks will not choose to invest in something that does not have a promising future. As we have discussed, such as scalability, many other factors contribute to higher repair costs.

This will need to be addressed in order to ensure that any company performs the next process.

Although the future of Blockchain has great potential, very little is possible if the challenges described above are not improved. For the foreseeable future, solidarity between all countries and a common set of goals will be crucial in using these technologies to their great potential.

4.2.5 Standards

Various blockchains organize information in a variety of ways. This implies that feeding necessary information from one blockchain to another blockchain is not always easy.

There is no consistent universal structure for trading data structure. In a cash payment, the block will hold the person or company name, account details, payment, location address, transaction times and other relevant details. But cryptocurrencies all do this differently, so it will be harder to move from one currency to another. They need to create levels of information that they contain and how it is presented.

There will be a need of a leading body in this who will make all the rules & regulations, as does the Internet Force Task Force (IETF) online. Here, one another key fact is that there should be balance in all the rules so that any fixed institution doesn't get extra benefit from the rules & all the banks get to improve their efficiency.

4.2.6 Liability

There is no obligation or proper reactions on the platforms when things are not going well yet. When banks reserve money & information, it's more important to keep them safe because it's other people's money information & money. So, when things go wrong, they will have to react urgently & effectively. But the current scenario shows a lack of reactions in this regard. For example, in 2017, CanadrigaCX, Canadian digital currency exchange announced that an error by a computer had resulted in the loss of ether worth US \$ 14m.

Ether was trapped in the Ethereum system, but the Ethereum community decided not to take action to reclaim that and therefore QuadrigaCX had to take its losses so that no client's power could be affected.

Of course, liability will need to be clarified before so that the public can rely on blockchains for their money. In this case, we need more control over the crypto space and blockchain in general.

4.3 Result & Discussion

Banking sector is one of the fundamental sectors of any country's economy. All the businesses of any country largely depends on the activity of the banks of that country.

But it's a matter of great sorrow that the banking sector is not in a very good shape. There are problems with the infrastructure & the working method. There are also problems with the transaction process of the banking sector.

All these problems highlight the need of an alternative method in banking sector activities. Blockchain might be the exact solution to all these problems. In the blockchain, all the transactions are added in blocks. A smart contract based application will be executed in our proposed system. Smart contracts dynamically store all the necessary documents. The most important benefit of smart contract is that it is immutable. So, it is quite impossible for anybody to get into the smart contract & change it.

All the transactions in our system will be done through the use of smart contracts. The smart contract will be initialized by the bank. The customer will be notified all the necessary rules as well by the bank. The customer will then digitally sign the smart contract if they want to go ahead with the transaction. If they don't want it, they can refuse it. After the signing of the smart contract by the customer, it will then be digitally signed by the bank. As both parties have digitally signed the smart contract, the contract will be a valid contract then & it will go to the ocean of transactions.

Blockchain works with a partially distributed ledger in our proposed banking system. This partial distributed ledger allows many nodes to have the same information in their device. Information here includes all the information related to the bank & customers activities like bank deposit information, personal account information etc. The distributed ledger adds a whole lot security to the sector. If someone comes to change the slightest of information in the blockchain, all the nodes will be notified of this & they will be able to repel any possible tampering incident. As a result, it becomes pretty hard for the hackers to change any data.

Blockchain also adds a lot to the proper maintaining of data. In our classical banking system, getting any document or transaction information from the bank requires a lot of precious time. Blockchain based banking solves this problem. As all the transactions are saved electrically, it is really quick to get access the data. Just a filtering of the blocks will eventually get people to their desired document. This will make the maintenance better than ever in the banking system.

Blockchain will also make international transfer easy. We know, currently there are a lot of problems available in the international transactions. As a result, there is also some time delay & increased cost in the traditional banking system. Blockchain, in this case, reduces both transaction cost & wasted time by providing the sector with a peer to peer connection.

Blockchain also enables transparency & quality governance in the system. As all the transfers are secured & visible for the customer, he knows what is in the contract paper & what are the terms & conditions. Moreover, it's easy to maintain monitoring in the sector with the use of blockchain in it.

Apart from all the advantages blockchain provides, there are some challenges as well in its way that need to be solved by the authority. Only proper flourishing of the blockchain technology in the banking sector can help to solve all the challenges & issues existing in this sector.

4.4 Summary

Blockchain is one of those technologies which have much potential in it, but they don't get enough chances to prove the worth. But recently, many have understood the possibilities of blockchain in the banking sector. As a result, some financial institutions are using the technology in their own private farm as a test case. Blockchain provides security, quality governance & maintenance all at once. Moreover, it also reduces the cost in the transactions significantly & reduces the time waste of the transactions as well. This technology can be the perfect technology to take over sectors like garments industry, banking sector etc.

CHAPTER 5

Impact on Society, Environment & Sustainability

5.1 Impact on Society

Blockchain mainly offers us a more secured way of doing transactions... Moreover, it has can reduce the time delay in transactions & reduce costs as well which have the ability to significantly impact the society positively.

5.2 Impact on Environment

Blockchain based technology is basically a technology that uses cloud storage where there is no use of any dangerous material that could endanger the environment. Moreover, blockchain technology saves a lot of paperwork which is good for the environment.

5.3 Ethical Aspects

Blockchain offers a secured, fast way of transaction which can hardly be ever broken. Moreover, smart contracts also are nearly impossible to break. As a result, if some company wants to be in the business with an ethical medium & secured process, blockchain can come handy for them.

5.4 Sustainability Plan

Blockchain records all the data electrically. As it uses cloud storage, it can easily record data of many years & if someone wants, he can go up & check the records. Again, all the information are hard to manipulate. As a result, this technology is a sustainable one.

CHAPTER 6

Conclusion

6.1 Summary of the Study

Since the innovation of blockchain technology in year 2008, it has grown enough to be applied in the banking sector. But still it needs some improvements regarding various issues. But apart from them, blockchain has all the characteristics to go all the way. It just needs proper support & work on blockchain technology to make this possible.

Blockchain can ensure transparency, quality governance, and proper maintenance in the banking sector. It also reduces transaction cost when it comes to foreign transfers & also reduces the transaction time by a great amount. Moreover, it also opens the door for fair & transparent crowd fundraising. As a whole, blockchain can transform the current classical banking into an efficient one.

6.2 Conclusion

In the project, our key target was to build a blockchain based banking sector where all the transactions will be done through the use of smart contracts. Here, smart contract is basically a code which contains all the conditions & terms of the transaction between the bank & the customer. All the transactions will be inserted into blocks & many blocks together will create the blockchain. Here all the blocks are connected through the hashes. A hash is a hexadecimal code which can be assumed as a summary of the whole block. This code is a unique code. IF a single digit or character of the block changes, the hash of the block changes & it informs all the nodes of the change. As a result, the change is refused by the consensus of the nodes. My target was to build a similar platform for the bank transactions. Here, all the bank transfers will be completed electrically & all of them will be added to the blockchain. As the bank will be in charge of the blockchain, they will also be able to monitor the activities of the suspicious people. As a result, unwanted malpractices can be stopped.

Blockchain provides the banking sector already with many benefits. If the developers can develop the technology a bit more, this technology may take the whole world in its own hand & control every little thing.

6.3 Recommendations

Blockchain has a great future in the banking sector. If properly developed & utilized, it can change the whole scenario of the world. Already many researchers are taking interest in blockchain & doing hard-work & research on them. Moreover, many banks around the world are also testing the technology to see if it can be the perfect option for their bank. So, blockchain can be the next big thing in this world. It may just slide into the banking sector with every passing year & positively impact the banking sector.

Reference:

1. Guo, Y., Liang, C. Blockchain application and outlook in the banking industry. *Financ Innov* **2**, 24 DOI 10.1186/s40854-016-0034-9 (2016).
2. Hossein Hassani, Xu Huang & Emmanuel Silva, "Banking with blockchain-ed big data", *Journal of Management Analytics*, 5:4, 256- 275, DOI: [10.1080/23270012.2018.1528900](https://doi.org/10.1080/23270012.2018.1528900) (2018)
3. Cocco, L., Pinna, A.; Marchesi, "M. Banking on Blockchain: Costs Savings Thanks to the Blockchain Technology". *Future Internet*, 9, 25 (2017).
4. I. Eyal, "Blockchain Technology: Transforming Libertarian Cryptocurrency Dreams to Finance and Banking Realities," in *Computer*, vol. 50, no. 9, pp. 38-49, DOI: 10.1109/MC.2017.3571042 (2017).
5. Q. K. Nguyen, "Blockchain - A Financial Technology for Future Sustainable Development," 2016 3rd International Conference on Green Technology and Sustainable Development (GTSD), Kaohsiung, pp. 51-54, DOI: 10.1109/GTSD.2016.22 (2016).
6. Sebastian Schuetz, Viswanath Venkatesh, "Blockchain, adoption, and financial inclusion in India: Research opportunities", *International Journal of Information Management*, Volume 52, DOI:10.1016/j.ijinfomgt.2019.04.009(2020), 101936, ISSN 0268-4012
7. Peters G.W., Panayi E. Understanding Modern Banking Ledgers Through Blockchain Technologies: Future of Transaction Processing and Smart Contracts on the Internet of Money. In: Tasca P., Aste T., Pelizzon L., Perony N. (eds) *Banking Beyond Banks and Money*. New Economic Windows. Springer, Cham. 10.1007/978-3-319-42448-4_13 (2016)
8. N. A. Popova and N. G. Butakova, "Research of a Possibility of Using Blockchain Technology without Tokens to Protect Banking Transactions," 2019 IEEE Conference of Russian Young Researchers in Electrical and Electronic Engineering (EIConRus), Saint Petersburg and Moscow, Russia, DOI: 10.1109/EIConRus.2019.8657279. (2019), pp. 1764-1768,
9. Chowdhury, E.H. (2018, March 29). "Good governance in banking sector a must: Experts". *Daily Sun*, pp. 1
10. Hossen, M.N. (2019, April 27). "Challenges the banking sector faces". *The Financial Express*
11. Schneider, S. (2019, December 17). "How blockchain is making micropayments affordable, finally". *Provide*
12. Hao Wang, Shenglan Ma, Hong-Ning Dai, Muhammad Imran, Tongsen Wang, "Blockchain-based data privacy management with Nudge theory in open banking", *Future Generation Computer Systems*, Volume 110, 2020, Pages 812-823, DOI: 10.1016/j.future.2019.09.010.
13. Reggie O'Shields, "Smart Contracts: Legal Agreements for the Blockchain", 21 *N.C. Banking Inst.* 177 (2017).
14. Buitenhek, Mark (2016, September 1). "Understanding and applying Blockchain technology in banking: Evolution or revolution?". *Journal of Digital Banking*, Volume 1, Issue 2.

15. Rella Ludovico, "Blockchain Technologies and Remittances: From Financial Inclusion to Correspondent Banking", *Frontiers in Blockchain*, 2, 2019, 14, DOI=10.3389/fbloc.2019.00014.
16. Yeoh, P. (2017), "Regulatory issues in blockchain technology", *Journal of Financial Regulation and Compliance*, Vol. 25 No. 2, pp. 196-208. DOI: 10.1108/JFRC-08-2016-0068
17. Harris, W.L. and Wonglimpiyarat, J. (2019), "Blockchain platform and future bank competition", *Foresight*, Vol. 21 No. 6, pp. 625-639. DOI: 10.1108/FS-12-2018-0113
18. Rajnak, V., Puschmann, T. "The impact of blockchain on business models in banking. *Inf Syst E-Bus Manage*". (2020). DOI: 10.1007/s10257-020-00468-2
19. Dancho Petrov, 2018. "Application of Blockchain and Smart Contracts in the Financial Industry," *Izvestia Journal of the Union of Scientists - Varna. Economic Sciences Series*, Union of Scientists - Varna, Economic Sciences Section, vol. 7(2), pages 24-33, November.
20. Seretakis, Alexandros L., "Blockchain, Securities Markets and Central Banking (July 23, 2017). Forthcoming in: *Regulating Blockchain.*" *Techno-Social and Legal Challenges*, edited by Philipp Hacker, Ioannis Lianos, Georgios Dimitropoulos, and Stefan Eich, Oxford University Press, 2019. DOI: 10.2139/ssrn.3007402

Blockchain based Banking Sector

ORIGINALITY REPORT

10%	5%	2%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	medium.com Internet Source	1%
2	economia.icaew.com Internet Source	1%
3	Submitted to Coventry University Student Paper	1%
4	www.2brightsparks.com Internet Source	<1%
5	Submitted to Rochester Institute of Technology Student Paper	<1%
6	Submitted to University of South Florida Student Paper	<1%
7	thefinancialexpress.com.bd Internet Source	<1%
8	Submitted to Jamia Milia Islamia University Student Paper	<1%
9	"Blockchain Economics and Financial Market Innovation", Springer Science and Business	<1%

Media LLC, 2019

Publication

10	Submitted to Wawasan Open University Student Paper	<1%
11	Nikita Rajeshkumar Bagrecha, Ishaq Mustafa Polishwala, Pragma Abhai Mehrotra, Rishabh Sharma, B.S. Thakare. "Decentralised Blockchain Technology: Application in Banking Sector", 2020 International Conference for Emerging Technology (INCET), 2020 Publication	<1%
12	Submitted to King Fahd University for Petroleum and Minerals Student Paper	<1%
13	Submitted to NIT Imphal Student Paper	<1%
14	Submitted to Arab Open University Student Paper	<1%
15	Submitted to Daffodil International University Student Paper	<1%
16	Submitted to University of the Commonwealth Caribbean Student Paper	<1%
17	Mohamad Osmani, Ramzi El-Haddadeh, Nitham Hindi, Marijn Janssen, Vishanth Weerakkody. "Blockchain for next generation services in	<1%

banking and finance: cost, benefit, risk and opportunity analysis", Journal of Enterprise Information Management, 2020

Publication

18	www.europeanceo.com Internet Source	<1%
19	Submitted to City University Student Paper	<1%
20	Submitted to King's College Student Paper	<1%
21	rubygarage.org Internet Source	<1%
22	Submitted to Loughborough University Student Paper	<1%
23	Submitted to Turun yliopisto Student Paper	<1%
24	Submitted to University of Northumbria at Newcastle Student Paper	<1%
25	Submitted to Kingston University Student Paper	<1%
26	"Information Systems", Springer Science and Business Media LLC, 2019 Publication	<1%

Submitted to Central Queensland University

27	Student Paper	<1%
28	Submitted to University of Strathclyde Student Paper	<1%
29	export.arxiv.org Internet Source	<1%
30	www.answers.com Internet Source	<1%
31	Submitted to Aston University Student Paper	<1%
32	Submitted to South Bank University Student Paper	<1%
33	Submitted to Heriot-Watt University Student Paper	<1%
34	es.scribd.com Internet Source	<1%
35	Submitted to Universiteit van Amsterdam Student Paper	<1%
36	Submitted to Asia Pacific University College of Technology and Innovation (UCTI) Student Paper	<1%
37	Submitted to CSU, Long Beach Student Paper	<1%

www.nou.edu.ng

38	Internet Source	<1%
39	lutpub.lut.fi Internet Source	<1%
40	Submitted to Ain Shams University Student Paper	<1%
41	Submitted to University of Exeter Student Paper	<1%
42	www.observerbd.com Internet Source	<1%
43	"Business Information Systems", Springer Science and Business Media LLC, 2018 Publication	<1%
44	Submitted to University of Newcastle upon Tyne Student Paper	<1%
45	Submitted to Limerick Institute of Technology Student Paper	<1%
46	Submitted to University of Wales, Bangor Student Paper	<1%
47	Submitted to University of London External System Student Paper	<1%
48	Submitted to University of Northampton Student Paper	<1%

49	Submitted to The University of Manchester Student Paper	<1%
50	Submitted to University of Wales Institute, Cardiff Student Paper	<1%
51	Submitted to International Business School Student Paper	<1%
52	Submitted to Kwame Nkrumah University of Science and Technology Student Paper	<1%
53	Marcus O'Dair, Zuleika Beaven. "The networked record industry: How blockchain technology could transform the record industry", Strategic Change, 2017 Publication	<1%
54	Submitted to International Centre for Education Student Paper	<1%
55	Xin Zhang, Pengcheng Sun, Jiping Xu, Xiaoyi Wang, Jiabin Yu, Zhiyao Zhao, Yunfeng Dong. "Blockchain-Based Safety Management System for the Grain Supply Chain", IEEE Access, 2020 Publication	<1%
56	Submitted to University of Dhaka Student Paper	<1%
57	baadalsg.inflibnet.ac.in Internet Source	

		<1%
58	Submitted to South University Student Paper	<1%
59	Submitted to SUNY, Binghamton Student Paper	<1%
60	Submitted to University of Sunderland Student Paper	<1%
61	"Blockchain and Trustworthy Systems", Springer Science and Business Media LLC, 2020 Publication	<1%
62	Submitted to Oxford Brookes University Student Paper	<1%
63	Submitted to Curtin University of Technology Student Paper	<1%
64	link.springer.com Internet Source	<1%
65	hazeguitars.com Internet Source	<1%

Exclude quotes On
Exclude bibliography On

Exclude matches Off