DOKUZ EYLÜL UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
DEPARTMENT OF INTERNATIONAL BUSINESS AND TRADE
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MASTER'S THESIS

USING BLOCKCHAIN IN INTERNATIONAL TRADE: ANALYSIS ON CASE STUDIES

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DECLARATION

I hereby declare that this master's thesis titled as "Using Blockchain In International Trade: Analysis On Case Studies" has been written by myself in accordance with the academic rules and ethical conduct. I also declare that all materials benefited in this thesis consist of the mentioned resources in the reference list. I verify all these with my honor.

24/01/2022

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ABSTRACT

Master's Thesis

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In the world where the challenges of time and place differences are realized, digitalization is a technological development which piece people and institutions together. Thanks to this innovation, people from different places of the world can provide dataflow to each other. These flows are usually conducted through an intermediary. With Blockchain technology, these dataflows have been achieved without intermediaries in decentralized networks.

This study works on using Blockchain technology in international trade transactions. In the study, digitalization of money and accounting issues is examined primarily. Then, the background of data communication is explained by examining Blockchain's technical structure. In order to highlight transparent and reliable aspects of this technology; Blockchain based e-money and digital signatures examined.

In addition, provided innovations by this technology are evaluated with perspective of trade finance, logistics and government policy issues. The recent case studies regarding the innovations, which the thesis aims to explain, are examined and the effects of these projects were analyzed. According to the analysis, it has been found that blockchain technology solves excessive time consumption, tax avoidance, letter of credit costs and physical archiving problems in international trade.

Keywords: Blockchain, Electronic Money, Foreign Trade, Cryptology, Smart Contracts.

ÖZET

Yüksek Lisans Tezi

Uluslararası Ticarette Blockchain Kullanımı: Vaka Çalışmaları Üzerine Analiz

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Zaman ve yer farklılığının zorluklarının anlaşıldığı dünyada, dijitalleşme insanları ve kurumları bir araya getiren teknolojik bir yeniliktir. Bu yenilik sayesinde dünyanın farklı yerlerindeki kişiler birbirlerine veri akışını sağlamaktadır. Bu akışlar genellikle bir aracı tarafından gerçekleştirilmektedir. Blockchain teknolojisi ile bu dijital akışlara yeni soluk getirilmiş, merkeziyetsiz ve aracısız ağ ortamında veri akışı sağlanması başarılmıştır.

Bu çalışmada Blockchain teknolojisinin uluslararası ticaret işlemlerinde kullanımına yer verilmiştir. Çalışmada öncelikle para ve muhasebe konularının dijitalleşmesine yer verilmiştir. Daha sonra Blockchain teknolojisinin teknik detayları incelenerek veri iletişiminin arka planı incelenmiştir. İlgili teknolojinin, şeffaf ve güvenilir yanlarını öne çıkarmak için, otoritelerce tanımlanan Blockchain tabanlı e-paralara ve dijital imzalara yer verilmiştir.

Bunlara ilave olarak, ticaretin finansmanı, lojistik, ve resmi kurumlar perspektifinden bu teknolojinin sağladığı yenilikler açıklanmıştır. Tezin amaç edindiği yenilikler konusunda son dönemde gerçekleştirilen projeler incelenerek bu projelerin etkileri analiz edilmiştir. Yapılan analizlere göre blockchain teknolojisinin uluslararası ticarette, aşırı zaman harcanması, vergi kaçırma, akreditif maliyetleri ve fiziksel arşivleme sorunlarını iyileştirdiği bulgularına ulaşılmıştır.

Anahtar kelimeler: Blockchain, Elektronik Para, Dış Ticaret, Kriptoloji, Akıllı Sözleşmeler.

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INTERNATIONAL TRADE AND BLOCKCHAIN: ANALYSIS ON CASE STUDIES

ABBREVIATIONS

P2P	Peer to Peer
BTC	Bitcoin
XRP	Ripple
Mt CO2	Carbon Dioxide
TWh	TeraWattHour(s)
Kt	Carbon Dioxide Emission
PoW	Proof-of-Work
CPU	Central Processing Unit
PoS	Proof-of-Stake
PoET	Proof of Elapsed Time
FOB	Free On Board
PsPu	Permissionless-Public
PdPu	Permissioned-Public
PsPr	Permissionless-Private
PdPr	Permissioned-Private
TCMB	Central Bank of the Republic of Turkey
B2B	Business to Business
bBFT	Practical Byzantine Fault Tolerance
SCP	Stellar Consensus Protocol
FBA	Federated Byzantine Agreement
ECB	European Central Bank
EC	European Commission
FME	Financial Supervisory Authority of Iceland

EMI	Electronic Money Institution
CBDC	Central Bank Digital Currencies
ECOO	Electronic Certificates of Origin
L/C	Letter of Credit
UCP 600	Uniform Customs and Practice for Documentary Credits
MLETR	Model Law on Electronic Transferable Records
e-B/L	Electronic Bill of Lading
TLS	Transport Layer Security
BPO	Bank Payment Obligation
IPU	Irrevocable Payment Commitment
ICC	International Chamber of Commerce
ACID	Advance Cargo Information Declaration

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INTRODUCTION

Trade phenomenon is as old as humankind's history. People are inclined to trade in order to meet their demands for their needs. Homoeconomicus, always has sought a solution for their needs. Initially, they began the barter economy. When they have a product, they exchange them with someone who needs that. In this way, they achieve to establish trade cycles in their small fragmented societies.

While the time passes by, the small cycles have merged with each other, and they became one giant cycle, which is called international trade. Throughout history, product and service diversity has been increased as the production level is augmented. In addition to this augmentation, consumption level has also increased. People have been starting produce and consume more day by day. These new habits push people to find more effective ways for production and consumption. People in a country have developed mutual trade relations with other countries in order to supply and demand more economically. As these relations develop, people encounter more complex and riskier incidents. That is why, they are seeking solutions to make these transactions easier and more transparent.

In international trade, transactions are still prepared manually even though they are conducted in digital environment. As the amount of trade increases, trade financing and logistics transactions increase as a matter of course. Despite this, the lack of significant digitalization and automation in these transactions causes transaction burden and the risk of making mistakes. Correction of the mistakes also causes both cost and time losses, and decreases efficiency since the transactions contain various parties and documents.

In recent years, there occurred a new technology for a promising solution on digitalization: Blockchain. Even though it is just known as Bitcoin, which is launched by Satoshi Nakamoto in 2008, this technology paves a way for transmission of information thanks to its structure. As Bitcoin is only information-based data which represents a monetary value, the developers have launched new projects to transmit other information-based data with similar principle. This projects aim facilitation in several fields such as elections, bill payments, cross border trades. The technology pledges secure transaction chance without any intermediary. In this

framework, this study is conducted for exploring the technology in cross border trades.

Many projects have been started upon usage of this technology lately. Some of the projects aim to adapt the technology into international trade's own norms by initiating with finance, logistics etc. It is considered that Blockchain is able to eliminate many hurdles in cross border trading. In this study, the relationship between Blockchain and cross border trading is examined. These projects are carried out by including either a particular part of the whole process or as a whole.

The aim of this study is to examine how Blockchain technology is used in international trade and what it can bring. In the study, different networks types and consensus structures will be analyzed and answers will be sought for questions such as what kind of network type should be used by considering the general norms of international trade, how to ensure transaction security and confidentiality of the parties. In this technology, which is commonly known as crypto currencies' technology, how to send documents of international trade will be examined.

Even though this study includes the definition of Blockchain technology and its components, the main focus is on its functionality. By analysing some projects (case studies), this study is about how the components adapt into cross border trading rather than what the components are.

First chapter aims to explain the evolution in payment methods and how wide meaning it has according to the method. Additionally, the functions of money are evaluated and it is discovered whether the same functions are feasible with Blockchain structure. Chapter two gives technical insights into the network and technical principle of the network is expressed. Additionally, there are some classification methods in order to clarify the usage fields of the network. With chapter three, digital signatures and electronic money are explained and their legal aspects are assessed. Finally, chapter four reveals problems in international trade with trade finance, logistics and official perspectives and states how Blockchain solves these problems. Problems regarding payments, documents are disclosed and solutions are explained with a new technological aspect. Additionally, the legal aspects of electronic information transfer are handled briefly. In order to fortify the

asserted solution, four ventures are analyzed. Lastly the study comes up with a conclusion regarding using of Blockchain in international trade.

The reason for choosing this study is that while the transactions made in domestic trade are easy, these transactions are much more difficult in foreign trade. In this context, it has been researched whether the facilitation of trade and payments can be provided with blockchain technology.

The current reason for choosing these pilot projects is that the studies focus on the most fundamental negativities in international trade. For example, Corda and the Irrevocable Payment Commitment have worked on the long duration of payments in international trade. Nafeza, on the other hand, has been a project on the prolongation of the paperwork processes in the seaports and the late processing of transactions such as handling and clearing the shipment.

CHAPTER ONE
DIGITAL PAYMENTS AND CONVENTIONAL PAYMENTS

1.1. HISTORICAL DEVELOPMENT

1.1.1. Precious Metals

The mechanism of humankind's behavior is coded upon surviving and obtaining better from the first ages to the present days. These coded instincts have emerged inventions naturally in order to make life easier. As an example, the purpose of writing was not writing poetry or letter in the invention time by Sumerians in between B.C 3000-3500. The main purposes of the invention are data processing tool, writing, are financial transactions such as trade transactions, tax payments, property rights (Harari, 2015: 190-191).

The history of money is as far as the old ages. For instance, the founded tablet in Mesopotamia before 2500 years represents a person named "Tupsikka" who has bought 22.000-liter barley, 7 kilograms' wool, and 15-liter oil. This tablet is both practically a kind of money and a formal document (Eagleton & Williams, 2011: 142).

Besides the explored tablet, it can be expected that just certain types of products are distributed to laborers for their wages. Consequently, this payment method caused to restriction of expenditure on their incomes. Similar difficulties have occurred in trade transactions, too. When a person wants to buy wheat, he should have owned what wheat owners need. Even if he has the owners' needs, which products should have based on for determining the value.

"Why are you supposed to be dead, asked. My death is written by skies to my destiny, but I am deceived by Lu Jin. Before that, we were bargaining on ox's price and discussing that we determine price in terms of silk or silver, he responses." The cited poetry of Chinese poet Yuan Haowen stated the importance of money and problems with its lack because it creates mutual trust. In order not to encounter these problems, money phenomenon is launched by the authorization. In 7. Century each civilization produces its money and their values were almost same (gold, silver…).

This money, which was produced by coinage method imposed additional costs on civilizations with high volume trade capacity because the resource of those coins was precious minerals (Dedeoğlu, 2019: 5).

On the other hand, money represents triumphs, patriotism consciousness. In the aspect of authorities, they were able to demonstrate their power to the folks by engraving their pictures and names.

1.1.2. Banknotes

In the East, banknotes were started to be printed in China in 6. Century. Actually the banknotes were bills rather than money. In 11. Century, money was floated and cycled in China. This affordable method has spreaded from Asia to Europe and from there to America with time (Dedeoğlu, 2019: 5).

In Europe, on the other hand, first floated banknotes were created by Johan Palmstruch, founder of Stockholm Banco, in Sweden,1656. As addition to this, with authorizing by England government, Bank of England began to float the bills in 1694 as well (Eagleton & Williams, 2011: 252-256).

Change is not always a simple and self-realized process. Sometimes a disruptive change brings big questions with itself. Passing to nominal money with indicator value from precious metals which take their values by physical characteristic is changeover for human life. Also, it may have been the collapse of a country out of the unreliability reasons. As a matter of fact, some government authorities and merchants took this danger into account. In response to the apprehensive, Sweden government printed money and signed them individually (Cleveland). The precautions were similar in England. There was still confidence in gold and silver, bias to paper. That is why, there put “Promise to the Bearer on Demand the Sum of five [ten/twenty/fifty] Pounds” clause on pound. This clause means the held paper by people is protected with government guarantee (Bank of England). The clause is still written on Pound as symbol of the assurance.

1.1.3. Credit Cards

In 1914, Western Union submitted to its customers a card that could be used for postponement for their payments. These were named “metal money” since they made of thin metal (Eagleton & Williams, 2011: 352). This saying also demonstrates how money’s meaning diversified by different aspects.

In the second half of the 20. Century there took place developments in the field of technology. American banks started to first money transfer electronically which is called EFT -electronic fund transfer- (Bozkurt Yüksel,2018: 11). Frank McNamara, a businessman, by noticing that he couldn’t afford for his dinner, published “Diner’s Club” credit cards for people to pay their dinners without carrying money in 1949. Afterward, on 27 June 1967, first Automatic Teller Machine (ATM) was started to be used in London (Dedeoğlu, 2019: 6-8).

People have started to conduct their financial transactions with their bank accounts rather than their wallets thanks to these countless developments. They don’t have to carry money in their pocket as their cards have the same functions. Also, the withdrawn commission by banks and financial institutions is not a problem. In comparison with spending time and distance for cash payments, paying the commission seems to be like a more convenient way.

1.1.4. Digitalization

With those changes barter economy without money shaped today’s form by evolving. The phenomenon has become an array of numbers in our accounts instead of its physical presence. Difficulty and risk of physical carrying, convenient buying by intermediate banks are basic factors which pave the way of money’s last structure. Being an array of numbers is one of the factors for digital money[1]takes place in life.

2008 is predominantly considered the initial year when crypto money phenomenon was into question. With Bitcoin WhitePaper’s publication by Satoshi Nakamoto named writer (or writers), attentions paid to cryptocurrencies. Bitcoin is

[1] Digital means recording and storing data as number series with 1 and 0, which showing signal’s presence or absence, https://dictionary.cambridge.org/dictionary/english/digital (12.12.2019).

perceived as a massive technology. However, actual breakthrough technology is behind it: Blockchain.

Even though 2008 is accepted as the initial year, Blockchain based digital payments system had been begun in 1989 with eCash by DigiCash Inc. The payments could be realized anonymously through encryption. Chaum, the founder of DigiCash, stated the anonymity as “blind signatures” in 1983 in his article. Payments are made on a centralized network with eCash (Chuen, 2015: 9-10).

The system was collapsed without spreading not so much due to several reasons. Initially, if there is a centralized payment network, there should be a central bank in order to make it trustworthy. Otherwise, it is going to be so challenging to convince people of its safety. Also, not prevalent computers and reluctant browsers prevented its spread, too. On the other hand, 1994 European Union regulations became an obstacle for this kind of payments (Green, 2019).

2008 witnessed lots of developments which has made Blockchain reputable in time. Numerous banks and financial institutions bankrupted and non-transparent illegal transactions behind these institutions were disclosed with the mortgage crisis (Ganne, 2018: 46). With consumer’s frustrations, Bitcoin achieved drawing the attention when it was highlighted. Because there is a network without trustless? intermediaries for people. The participants are entitled to send money by encrypting them into a data cubes with peer to peer (P2P) principle.

The participants, thanks to the network, eliminate the intermediaries that are named as “middlemen”. Middlemen takes high commission from them for the transaction and they do not create a transparent trust for them. On the other hand, the impossibility of sending money at the off-duty hours, limited validation of transactions with working hours are confined them. They could be able to make transactions 7/24 without waiting for the verification anymore (Dedeoğlu, 2019: 8).

1.2. FUNCTIONS OF CONVENTIONAL MONEY AND ELECTRONIC MONEY

Money was invented and started to be used in order for human and in order to service to humanity. The most significant reason for this purpose is intricacy in the market. Supposing that a farmer who has 10 kind vegetables and fruits; and wishes buying coarse flour. The buying transactions can proceed with lots of ways and the calculation is troublesome in any case. Under the circumstances, the farmer is strained to harness from the coarse flour as medium of exchange and unit of accounts. Additionally, they are going to spoil if it is neither consumed or exchanged; they cannot have kept as value.

Money, with its four functions, it can eliminate those problems. The functions are being medium of exchange, store of value, unit of accounts and standard for deferred payments (Keyder, 2002: 181). With Blockchain network, money is able to be maintained without losing the function. Explanation of how these functions are valid with electronic money in Blockchain is crucial for insight understanding of trade in the network. It is worth to consider that below explained functions are valid electronic currencies. Virtual currencies, which are generally known as crypto currencies, cannot provide these functions as they have a low level of acceptance, high volatility (European Central Bank, 2015: 23-24).

1.2.1. Medium of Exchange

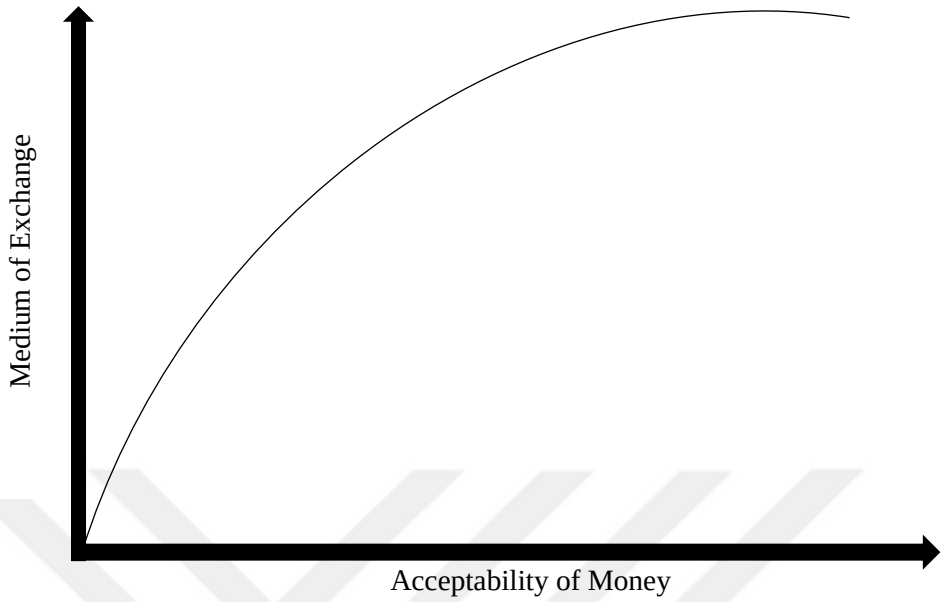
In present days, nominal currencies are not valuable physically, they take their value by written numbers on them. They also take its strength from governmental ensurance. When the developments of 21. Century and financial tools are contemplated; it is figured out that money is a subject which has so wide concepts for its mean. For instance; 100 Turkish Liras (TL) banknote in the pocket almost has same meaning with 100,00 number in the bank accounts. Furthermore, money market and capital market tools are a sort of money which is affected by economic conditions and have nominal values. With this explanation it can be defended that money doesn’t fit its conventional meaning patterns anymore.

By having a wide diversity, money is fundamentally being used for means of exchange throughout the history. Unlike bartering economy, it is so simple and it facilitates daily life.

As a result of wide modern definition, money is heavily expressed an array of number in bank accounts anymore It can be used as medium of exchange despite the digital identity. If it is explained with a basic international trade relationship; by hypothetical export sale from Turkey to the United States America (USA) with 50.000 $. Even though the importer pays the price via Blockchain network, the fact doesn't change that importer will give 50.000 $ in exchange for the goods.

The point, which should be considered with above sample, is the elasticity of using this digital money by the exporter. Usage of the money as desired is dependent on acceptability of money which is one of the external features of money. The money earned through Blockchain network has no internal flaw in order to being used as a medium of exchange. However, it is supposed to be recognized as a money completely. Therefore, it could be suggested that, the degree of Blockchain-based electronic money's medium of exchange function has a positive correlation with acceptability of money (Bank for International Settlements & International Monetary Fund, 1997: 5). As seen on the figure 1, as acceptability of money grows, medium of exchange function increase. After it accepted by everyone this function lasts with infinite elasticity.

Figure 1: Medium of Exchange And Acceptability of Money Relationship



Source: Author

1.2.2. Store of Value

People save some of their earnings in order to have a fortune. With this saving they both conserve a value physically and they keep adding value to their fortunes. This function stems from characteristic durability of money. People cannot have a fortune by saving their vegetables in habitat since they are going to decay as a matter of course. Instead of it, they sell them to people who are in the need of them and obtain money as store of value.

Electronic money can be stored like conventional money in houses or bank accounts. With its durable characteristic they can be conserved (archived) digitally. Digital durability provides it’s store of value function.

1.2.3. Unit of Accounts

It expresses that money can be used for appraisal of goods and services. This function, as stated before, save people from millions of prices with $(n(n-1)/2)$[2] formulation.

Electronically programmed currencies in Blockchain network fulfill this function completely, too. Cryptocurrencies provide the function even if it is partly (mediated) since crypto currencies' worth is integrated with nominal official currencies. As an example; If a cup of coffee is 10 $ and 1 Ripple (XRP) is equivalent to 0.25 $, it can be said 40 XRP should been spent to buy a cup of coffee. On the other hand, programmed nominal currency meets this function notably.

1.2.4. Standard of Deferred Payments

This function refers to payment function in the future on trading and purchasing contracts. For example, if a person buys a good by signing a contract with three months-term, the payment will start after three months. The function's power increases as the stability of money increases. This means that as prices fall (money is more valued) borrowers are going to lose; as prices rise (money is less valued) creditors are going to lose. In other words, it fulfills the function according to the severity of inflation (Guru). As electronic money on Blockchain network is used programmed according to fiat currency, it is subjected to this function.

As it can be seen, money on Blockchain network system is able to perform the identical functions as nominal currencies. The fulfillment of these functions proves that digital money has a potential to be perceived money among people.

[2] See https://www.nctm.org/Publications/Teaching-Children-Mathematics/Blog/The-Story-of-Gauss/

1.3. ACCOUNTING IN INTERNATIONAL TRADE AND BLOCKCHAIN

Accounting history is as old as economic history. Necessity of booking and summarizing for the purpose of recording has revealed accounting for humans and governments. With this recording method, people can see their transactions, evaluate them and deduce periodically. In accounting history, there is a similar process like money which is shaped according to human needs.

In our present day, Luca Pacioli is known as “father of accounting”. He handled bookkeeping issues for 27 pages in his book “The Collected Knowledge of Arithmetic, Geometry, Proportion and Proportionality” in 1494. He approached to recording and double-entry bookkeeping on “Particularis de Computis et Scripturis” section. Even accounting is quite old system; he puts his name in history since he handled systematic double-entry bookkeeping as the first time (Bellis, 2019). By stating the sense of “if there is a creditor side in a transaction, there should be a debtor side, too.”, he emphasized necessity of double-entry bookkeeping (Kılıç, 2017: 4).

Accounting took place in the center of financial transactions with industrial revolution for developing economies. As institutions and companies grow, being examined and utilizing as a control tool functions took part besides bookkeeping and summarizing functions (Kılıç, 2017: 5)

The important point of this improvement is why double-entry bookkeeping was needed while the transactions could be bookkept by single-entry bookkeeping way. The explanation of this question is hidden in unwritten rule of the trade; trust. If a transaction is bilateral, the record also should be kept by both sides. Otherwise, disagreements might be inevitable.

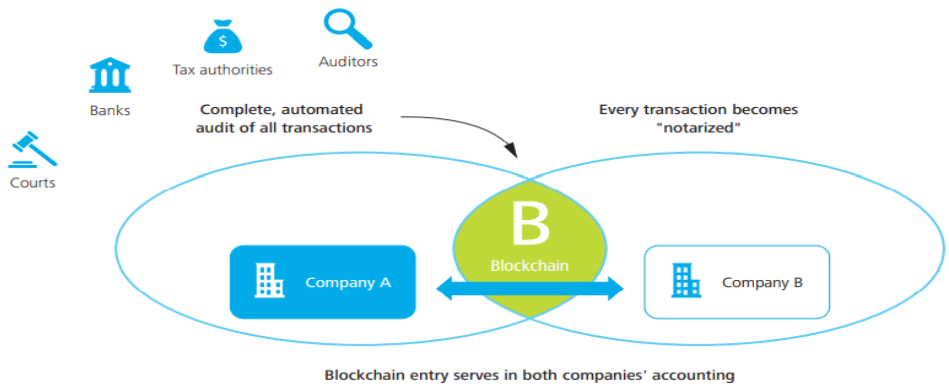
In the modern world, the exchange of goods and services is usually provided by money. This exchange also must be subject to a legal registration. The registration is realized by accounting. It is also possible to register these records with Blockchain technology. Thanks to similarity between double-entry bookkeeping and P2P mechanism makes Blockchain enable to registration of the digital transactions. Additionally, it should be emphasized that “ledger” word is used both for DLT and accountant in same manner (Dogan&Ertugay, 2019: 1664).

With Blockchain's P2P system, it is ensured a transaction can be transmitted from one peer to the another and double-spending is prevented (Richard, 2018). This means details of the transactions are bookkept by both side's accounts. Thanks to cryptography system, the parties can not alter the transaction or erase in line with their own interests. These features demonstrate the presence of double-entry bookkeeping essence (or more than double) in Blockchain network similar to accounting system. Therefore, accounting transaction can be kept, classified and examined, too.

The basic functions of Blockchain could be a breakthrough in accounting system. Businesses can realize the transaction on a common platform instead of recording the transactions in their separate systems. The transactions cannot be altered since they are encrypted and it provides more transparent recording. When a transaction is realized between two companies in Blockchain network, it is also recorded in their related authorities with an integrity. That is why, this bookeeping is named as "triple-entry bookeeping" (Deloitte Consulting GmbH, 2016: 2-3).

Triple-entry bookeeping refers to more than two-entries in which the blocks is included as a third party. The parties in the same transaction are included in Blockchain as a set of linked accounting records with the same ledger. This same ledger creates the third party of the records. This ledger structure makes World Wide Ledger (WWL) concept come into question. The concept provides recording and hiding of international transactions in the ledger and access of these transactions to the permitted authorities (Uysal&Kurt, 2018: 472-474).

Figure 2: Recording and Audit Of Transactions In Blockchain



Source: Deloitte Consulting GmbH, 2016

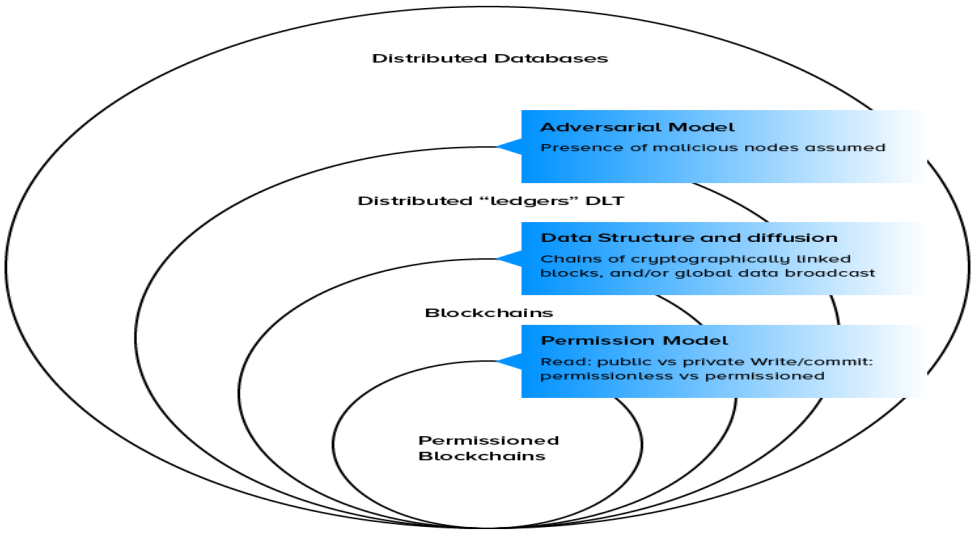
CHAPTER TWO
STRUCTURE OF BLOCKCHAIN

2.1. WHAT IS BLOCKCHAIN?

Blockchain, as a new term, is sub-technology of Distributed Ledger Technology (DLT). DLT is an open ledger network which transactions are replicated in multiple machines (nodes) on the Internet or virtual private network (Accenture, 2017: 7).

As a digital ledger, Blockchain allows reaching a secure consensus between connected devices (nodes) over shared data. This device could be any internet-connected device such as computer or smartphone. According to how Blockchain is set up, some of the participants may have authorization to add information while the rest of the participants are permitted only monitoring (McDaniel and Norberg, 2019: 4-5).

Figure 3: Blockchain And DLT Relation



Source: Bhardwaj, 2021

Blockchain is consisted of chain of blocks in which contain an encrypted data. The data is hidden into the block and this makes the block immutable and anonymous. Blockchain has wide range of usage fields; the blocks and data can be involving payment transactions, agreements, votes (Fahmy,2018). In a popular sense, misinformation of Blockchain makes Blockchain constraint as a transmitter of cryptocurrencies. However, what Blockchain provides is transmission of any information-based asset.

Blockchain is a network in which contains different degree of centralization and provides participants data transmission. Frequently "database" word is used when Blockchain is defined. Nevertheless, this word makes the definition deficient since data can be deleted or altered in database. On the other hand, users can do neither of them in Blockchain network (Dedeoğlu,2019:).

The network is often confused with Bitcoin or it is explained as though they both have same meaning. However, Bitcoin (BTC) is a simple cryptocurrency which based on Blockchain network (Lucas, 2017). It is programmed for 21 million coins restriction. By the time it reaches to the number, mining will halt. In the second biggest crypto coin, Ethereum, all coins are launched in advance (Coin Market Cap). According to cryptocurrency type and consensus, total coin amount may be limited, launched in advance or infinitive increase constantly.

Blockchain can be used for various transactions. In a political election case, each voter can turn their votes into a data with a peculiar private key and send the votes to the center of the network. The center can monitorize each participant's vote with the private key. The significant point in the case is usage of "center" word. Because when former researches are examined, Blockchain always has been defined as a decentralized network out of interchangeable usage of Blockchain-Bitcoin. As a fact, the centralization of the network could be different according to purpose of usage.

2.2. PEER TO PEER

Peer to peer (P2P) means storage a data from a peer to the another one. For understanding of data storage, aim of distributed data system should be known. In 2000's, there launched two applications: Bittorent and eDonkeydata. These applications provide hiding of any media data in millions of machines in distributed or shared way instead of single user. The participants which want to receive the data can obtain them from network by being source for other machines at the same time (Dedeoğlu, 2019: 20).

There are four key elements in this system (Üzer, 2017: 22).

1) Digital records
2) Distributions of transactions
3) Consensus
4) Encryption

Digital records reveal with executed transactions. These transactions are distributed to the other participants. The distributed data are validated by other participants automatically. The automatic validation is a consensus algorithm in the network which is compromised prior to the using of the network. The validation is realized according to the consensus algorithm.

P2P system eliminates double-spending deficiency for digital currencies. Digital or programmed currencies can be copied due to the digital structure and money may be spent twice or more. Thanks to P2P, the validated spending transactions are encrypted by the validators and linked to the chain. By this process double-spending can be prevented. The method of encryption can change according to the consensus.

This system also is the basic of smart contracts which can be utilized for international trade. Smart contracts are self-enforced agreements by digital signatures when certain conditions are met. There can be designed smart contracts with international trade's inherent rules. Smart contracts can be validated by other participants (nodes) in the system. If parties agree on Cash in Advance payment, the arranged smart contract comes into force and gives obligation to the exporter for the

shipment subsequent to the payment. The payment is recorded to the network automatically and processed it as data into a block.

After P2P network-smart contract developments were discovered and associated in terms of their purpose, its compelling and efficient structure has made it attractive. There have been launched ventures with this association. Circle P2P system provides international payment with low cost with nominal currencies. On the other hand, Traypax, is built for supply chain payments simultaneously. These different networks for different usage fields can be gathered, there may be full comprehensive P2P network for international trade. According to Accenture, p2p based Blockchain system saves 80% labor and time in bill of lading (Ganne, 2018: 44).

2.3. CRYPTOGRAPHY

Even if the word evokes a newly and contemporary meaning, cryptology roots dates back to ancient times It has derived from an old Greek word “kryptos” The word which means “science of confidentiality” has been used by people in order to hide their data throughout ages. Telling a password for entrance into a place is one of the most typical and the oldest sample for this science. Any dataset can be evolved into a random dataset with a certain rule by cryptography. Only and only, it is valid as a meaningful data for a person or people who have the key of the password (Dedeoğlu, 2017:).

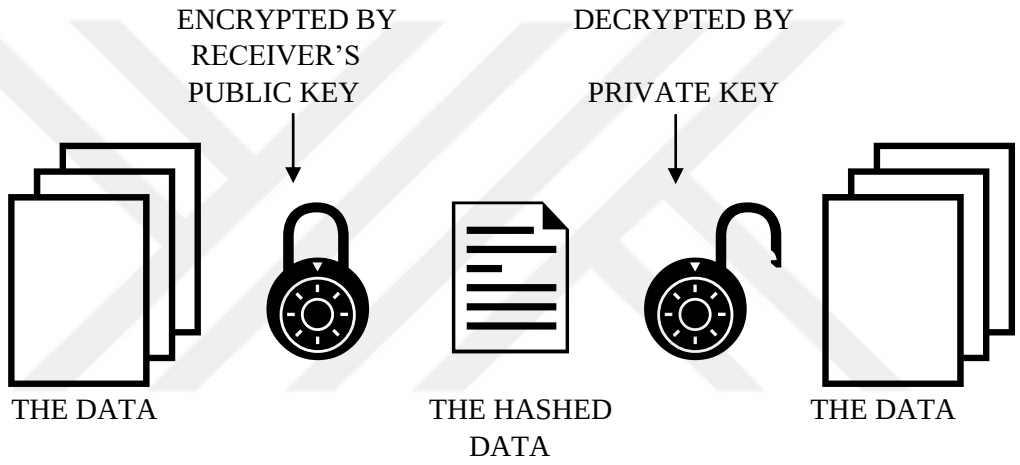
The data in Blockchain system are made secure and durable against cyber-attacks and it provides much more security opportunities than traditional methods. However, some dangers cannot be eliminated with this encryption regardless. Simply, if a wallet owner keeps record his private key on his computer, the key may be captured by malicious parties with any traditional way.

Cryptograph is regarded as synonym with encryption generally. However, encryption is one of the sub-field of cryptography like hashing or digital signature (Ganne, 2018: 121).

There are two ways for encryption: Asymmetric encryption and symmetric encryption. The former includes both private and public keys whereas the latter just

includes private key (Durbilmez, 2018: 32). With symmetric encryption both encryption and decryption can be made by one key (private key). On the other hand, there used two different keys for encryption and decryption in asymmetric encryption. Asymmetric encryption makes digital signatures possible and the security is on the highest level. Asymmetric encryption also provides integrity and non-repudiation (no deniability from signature's owner) (Kumar & others, 2011: 60-64). In Blockchain network, asymmetric encryption is used.

Figure 4: Asymmetric Cryptography



Source: Author

Asymmetric encryption process is convenient and understandable for users as it is seen in Figure 4. Firstly, sender generates a hash value for a message. This massage might be invitation, invoice or purchasing order. The sender requests a copy of the recipient's public key. After receiving the public key, the sender encrypts the massage and the hash value. The sender sends the message, the hash value and its public key. The recipient decrypts the message by only using its private key (Usta&Doğantekin, 2018: 67).

Public key and private key should not be considered as two completely independent concepts. These can be visualized as IBAN-account password or home address-house key. Since the other party knows your IBAN or home address, it can transfer money to the bank account or send things to the home. However, it cannot

make any transaction on behalf of the owner as it doesn't have the account password or house key.

2.4. HASH

Hash function is harnessed in field of cryptology-based applications. In other words, this function converts a readable data into an unreadable one in the network. Hash system works with mathematical algorithms and today there used algorithms such as MD2, MD5, SHA, SHA-1 (Dedeoğlu, 2019: 22).

Hashing allows readability of a message just by receiver providing that the private key is entered. That is why, it can be said, hashed and encrypted have identical meaning in Blockchain networks.

Hashing has six properties which half of them are general and the rest of them are peculiar to hashing (Narayanan & others, 2016: 2):

1. The Input Can Has Any String of Size
2. The Output Is Fixed-Sized
3. It Efficiently Computable
4. Collision Resistance
5. Hiding
6. Puzzle Friendliness

If the first two properties are assessed together, they indicate that the size of output is always stable irrespective of size of input. Even if the input is consisted of 3 Mb sales contract, it is placed into the block 256 bit (32 byte) when there used SHA 256 hashing algorithm. The third means that time of hashing can be computed as long as the input string is known.

Collision resistance means there is no feasibility for two different inputs have the same hash value. With strong hashing algorithm, hashes don't collide with each other. In addition to this, also the receiver doesn't see the input thanks to hiding property. What it sees is just the output. At last, puzzle friendliness commits not to being solved the block with using the hash value.

Addition to these, “avalanche effect” term should be stated. With this effect, hashing information will alter totally even with the smallest change and generate much different hash value (Usta&Doğantekin, 2018: 115). This effect stems from randomized hashing function which is independent from the data.

Table 1: Hash Values Table

Original Text	SHA-256 Hash Value
KadirSayın	6a569c4eac6befc79ea851011eed3602db5865c7e2092ece419dad0150dab53c
KadirSayin	ec034690b15385272b8124989a5bda99d635f475e1edaed44d913251699a0dd0

Source: Author via https://www.fileformat.info/tool/hash.htm

As it is seen with Table 1, all hash value is utterly changed when just one word is entered differently due to its independency from the data and randomization.

2.5. BLOCKS

Blocks include validated data in its structure. If the network is imagined as a data room with full of boxes, each block is one of the boxes. The network is a digital version of the room and each block contains data of transaction.

There are pre-determined set of rules for Blockchain networks and they must be complied with. In Blockchain network, maximum bytes must not exceed. It must involve more value than maximum number of transaction. A block must refer to the previous block (Sadaouskaya, 2017: 9). The first block is called “genesis block” and each block links to each other with chronological sequence. Encrypted data is sent to the network and submitted to request on validation of the validator nodes. The block is connected to other blocks and added in the network when the nodes validate data (Ganne, 2018: 113).

Each block may involve more than one transaction. Each block has timestamp, previous hash, merkle root and nonce (just in public Blockchain).

2.6. TYPES OF BLOCKCHAIN

The advent of the network has raised questions. One of them is what type network it should be. There are four type of Blockchain; permissioned, permissionless, public and private. All the types are established for different purposes.

2.6.1 Permissionless Blockchain

There is no restriction for attendance to the network and validation process. Each computer can be a participant in the network and validate data transmissions (Ganne, 2018: 8).

The biggest problem for this type of Blockchain is network's energy consumption. When the nodes are encouraged to participate in the network, there should be an interest for them. The interest is provided through a competition. As each node is entitled to be validator node and can solve the algorithm, competition for solving algorithm increases for the reward among the miners. This competition escalates cost of adding a block to the chain day by day. Non-permissionless and authorized Blockchain network is more likely to be healthy and economical, when huge amount of international trade is taken into consideration in the world. Below table demonstrates annual energy consumption of Bitcoin, the biggest permissionless network, and countries which have the equivalent annual consumption.

Table 2: Bitcoin Energy Consumption

Bitcoin Annual Consumption	Energy Type	Same annual consumption with
Carbon Footprint	87.28 Mt CO2	Bangladesh
Electrical Energy	183.74 TWh	Thailand
Electronic Waste	26.26 kt	The Netherlands.

Source: Digiconomist, 2021

2.6.2 Permissioned Blockchain

The basic feature of these networks is being subject to a permission totally or partly. Degree of the subjection can change according to structure of the network. There is a closed consortium of nodes tasked with creating new blocks. These permissions may be dependent on validation of a block or adding data or another aspect. On the contrary to permissionless, they don't spend huge amount of energy, give a chance to control participants against money laundering or other illegal issues (Sousa & others, 2017).

2.6.3 Public Blockchain

In this type of networks, everybody can participant to the network, validate transactions and add new blocks. In brief, each participant has equal management rights. As participant number grows, nodes grow in the network and provides more security possibility with more decentralized structure. Much of permissionless networks has public structure. On the contrary, there are permissioned networks which have public structure, too. In spite of their high level of security, they encounter scalability (Ganne, 2018: 9-10).

2.6.4 Private Blockchain

These networks are used by some institutions such as companies and governments which find public networks objectionable in terms of their securities. Much as public Blockchain supplies an infinitive security, it is not sufficient for these institutions. All security measurements are going to be futile with a leak from one person whose information of the key. That is why these institutions prefer to use private networks instead of public networks (Usta&Doğantekin, 2018: 32-36). In this network type, the access to both the network and the transactions are restricted. For example, an international banking system establishes private Blockchain network in which banks, exporters, importers. If an importer sends a remittance, no other nodes can see the data block except that sender bank, receiver bank and exporter.

Addition to the distinctions above there are some other distinction methods. For Niall Ferguson (2018), Blockchain varies in three different aspects; the nature of the consensus algorithm, the number of transactions per block and fees and miners' rewards.

With the two classifications according to the permission degree (permissionless-permissioned) and according to the participation degree (public-private), there can be a new classification in which cover both classification. Four network types as Permissionless-Public (PsPu), Permissioned Public (PdPu), and Permissioned Private (PdPr) and their usage fields make provide more abstract imagination and differences among them is going to be more understandable (Table 3).

Table 3: Types Of Blockchain And Used Fields

Network Type	Who Can Attend Network?	Who Are Authorized To Add New Block ?	Who Can Read The Data?	Example
PsPu	Everyone	Everyone	Everyone	Social Media
PdPu	Everyone	Approved Participants	Everyone	Central Bank of the Republic of Turkey, General Elections
PdPr	Approved Participants	Approved Participants	Approved Participants	B2B Trade

Source: Author

As a first, social media could be exemplified as PsPu network. Everyone[3] who meets consensus conditions (having a non-used mail address) can participate in the network and entitle sharing thoughts or medias in the frame of the consensus.

Secondly, as PdPu Blockchain network, Central Bank of the Republic of Turkey (TCMB) is a good sample. TCMB publishes specific types of reports concerning Turkey's economy in certain dates. These reports are open to all participants in order to be read. If monthly inflation report is handled, it is data and wishing everyone can attend to the network and read it. However, the authorization of new data creation just belongs to TCMB.

With an another example, general elections can be given as a PdPu network. For this consensus mechanism, there stipulates being over 18 years old and being Republic of Turkey citizen; all people who meet these stipulations have right to get the permission and vote. In order to create one block (one vote) the automatic validation of the consensus algorithm by which is accepted is necessary. On the other hand, right for tracking or reading the votes belong just to the authorized party. As one citizen has one equal vote right, it meets public Blockchain's "*equal management*" principle.

PdPr network can be used for Business to Business (B2B) trade. In order to be exporter, being member of the exporters' association is required. The firms which meet this consensus can be able to a participant. However, data regarding a firm's export is accessible by the participants which are assigned by the exporter (importer, freight forwarder, customs consultancy…) and a party needs another parties' validation in order to create a new block (for proforma invoice: by importer's validation; custom declaration: by exporter's validation).

[3]Before explaining the examples in detail, "everyone" term is need to be explained. All Blockchain networks have a certain consensus mechanism and the participants have to meet with consensus conditions. That is why the term does not refer to every natural person and legal entities, it does just people who meet the requirements.

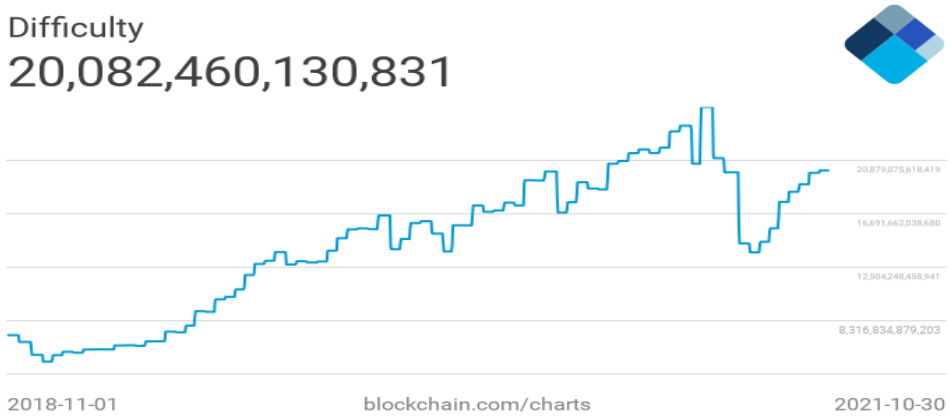
2.7. Consensus Types

2.7.1 Proof-of-Work

This system is based on proof of miner's work which means solving mathematical problem and finding the hash. The nodes in the network create a new hash value in order to turn data into a new block with reference of the previous hash value. It is impossible to generate a hash value by calculating mathematically. Because hash value is not dependent on content of the data; it is random and independent random from the data. Therefore, miners prove their works with trial and error method. Each miner has equal chance for creating a block as data reach to the all nodes. On the other hand, trial and error method process needs energy consumption and it is supplied by central processing unit (CPU). The higher CPU miner has, the higher chance to find out hash value. A miner announces to prove the work to the other miners and with the validation of the nodes a new block is added to the chain. If more than one miner finds out hash value, the first one is accepted and the others recorded in case there is a possibility of creating longer chain. Afterwards, with the subsequent block, it is continued with longer chain and forked block stays as "orphan block" (Nakamoto, 2008).

This consensus is likely to be attacked by malicious software developers. This attack is called "%51 attack", which refers majority of the network. There is a possibility that the malicious attackers who hold the majority of CPU are able to decline adding block of honest nodes and just validate their PoW. Also, it makes malicious attackers eligible for double-spending issue. However, such an attack would be futile to the network thanks to mining difficulty level, which increases and decreases difficulty of finding hash value in the network according to the average of the difficulty of finding value and makes it more difficult and requires more CPU power (Okazaki, 2018: 8-9). Below figure 5 demonstrates mining difficulty level for Bitcoin which is worked by PoW consensus and the danger of escalating energy consumption.

Figure 5: Mining Difficulty on Bitcoin



Source: Blockchain.com, 2021

2.7.2 Proof of Stake

For this algorithm, incentive payments are determined by how many coins a machine has; not by CPU. The participant nodes are required have some coins so as to have right to create a new block. The least amount is determined by network's structure and difficulty level. With stipulation of having coin, it submits more decentralized network structure than PoW consensus and much more energy-saving process. Because, the participant nodes invest in their wallets in the network not in their machines unlike PoW. The block-producer machine is selected randomly according to its stake. Higher stake owner node has higher possibility of being selected. If the node cannot produce a new block, the next machine has to right producing the new block and producer block win a reward in proportion to its stake. On the other hand, coin age of the winner node, is reset by the network and coin age is going to be 0 (zero). The node is supposed to wait at least 30 days for block producing possibility. Thus, as the coins in the wallets with low share get older, the probability of adding blocks will increase (BitFury Group, 2015; Siim, 2017). From this aspect, it offers a democratic hash generation structure.

2.7.3 Proof of Elapsed Time

This consensus algorithm was designed by Intel in 2016. With usage of this consensus, each node has to wait before creating a new block. The time is determined random and the node which completes the determined time is entitled to be the block leader. Each node which has Intel's Software Guard Extension (SGX) can register to the network with public and private keys. After registration, nodes choose random timers. There are two significant factors for the algorithm. First, whether winner node choose or not amount of a random time is important for a fair chance. Secondly, whether winner node completes or not its waiting time properly (Chen & others, 2017).

Unlike PoW, this algorithm prevents a huge amount of CPU consumption by being based on waiting time rather than mining-intensive structure (Rilee, 2018).

2.7.4 Practical Byzantine Fault Tolerance

Lamport, Shostak and Pease (1982) evaluated computer-network communication flaws by abstracting them with Byzantine Generals sample in the paper:

> *We imagine that several divisions of the Byzantine army are camped outside an enemy city, each division commanded by its own general. The generals can communicate with one another only by messenger. After observing the enemy, they must decide upon a common plan of action. However, some of the generals may be traitors, trying to prevent the loyal generals from reaching agreement. The generals must have an algorithm to guarantee that.*

This abstraction and possible scenarios in the paper recalls arbitrary network faults: Traitorous generals (malicious attackers), lost messengers (fail in network), killed generals (erroneous or damaged hardware). As generals must trust each other when they attack to the city or retreat from there, it should be an inspection mechanism.

In order to solve the trust problem, the emperor used to send more than one messenger to the generals, also generals used to send to the others to share the

message. If generals' messages are verified by the messengers, it is accepted true message (Özer, 2018).

With Practical Byzantine Fault Tolerance (pBFT) is an algorithm to tolerate byzantine faults (malicious nodes). It is an asynchronous system and corporates important optimization. The algorithm's fault replicas are at most (f=(n-1)/3) of all nodes. Thanks to its asynchronous structure it is resilient against malicious attacks. It consists of four stages; sending request from a client to the primary node, multicasting of the request to backup nodes, executing the request and sending a reply to the client, the client waits for f+1 replies (f is the maximum number of faulty nodes) (Casto&Liskov, 1999).

2.7.5 Federated Byzantine Agreement

Federated Byzantine Agreement (FBA) is consensus type in which each general (node) is responsible for determining the validator of their transactions. FBA is designed for Stellar currency, also known as Stellar Consensus Protocol (SCP), this protocol provides low latency, decentralized control, flexible trust and asymptotic security[4]. Unlike pBFT, SCP is decentralized network with quorum slices (subset of quorum) which nodes choose whom they trust for validation. With this consensus, flaws of PoW and FBA –in figure 6- repaired and designed more inclined system for cross-border payments (Mazieres, 2016).

[4]Furthermore, https://www.youtube.com/watch?v=X3Gj2nQZCNM linked video can be watch for more insight.

Figure 6: Properties of Different Consensus Mechanisms

MECHANISM	DECENTRALIZED CONTROL	LOW LATENCY	FLEXIBLE TRUST	ASYMPTOTIC SECURITY
Proof of work	✓			
Proof of stake	✓	maybe		maybe
Byzantine agreement		✓	✓	✓
Tendermint	✓	✓		✓
Stellar Consensus Protocol	✓	✓	✓	✓

Source: SDF Blog, 2015

CHAPTER THREE

ELECTRONIC MONEY AND DIGITAL SIGNATURES

3.1. ELECTRONIC MONEY

Electronic money (e-money) is electronic payment product which involves a monetary value. In short, e-money is equivalent of cash in terms of carried value. A monetary value is held electronically and represents a right such as purchasing or entrance (Financial Conduct Authority, 2018).

USA, as a pioneer for electronic money, took the first step with passing Electronic Fund Transaction Act (EFTA) in 1978 in order to protect the consumers. Actually, it is not a hasty and redundant step when The National Automated Clearing House Association's report is evaluated. According to the report, in 1995, $533 trillion is transferred via wire, $11 trillion is transferred by Automated Clearing House and $800 billion is transferred by credit cards, whereas the amounts are just $73 billion by check and $2.2 trillion in cash (Muller).

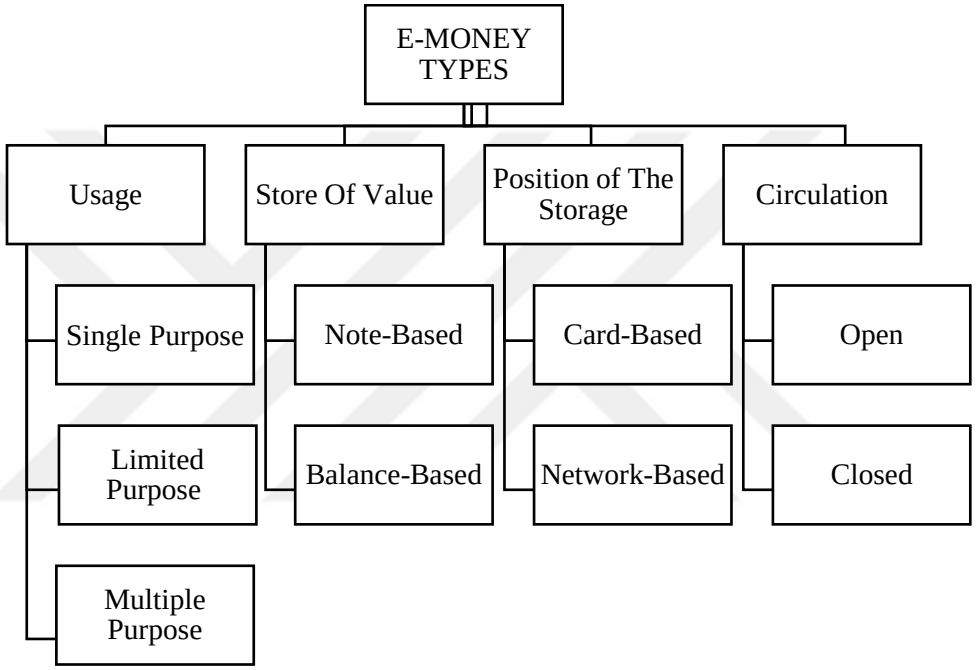
Afterwards, there have been several amendments concerning e-money as digital technology develops in the world. The subject came into question in 1993 by European Central Bank (ECB) and it was analyzed by the central banks of the member states. ECB released a report and responded e-money promising. E-money is defined as a monetary value which stored on a technical device. It can be card-based and software-based and divided into two types: limited purpose and single purpose (European Central Bank, 1998).

Subsequently, the importance of e-money is comprehended and European Parliament released Directive/2009/110/EC on 16 September 2009 with amending Directive 2005/60/EC and Directive 2006/48/EC also with repealing Directive 2000/46/EC and prevalent usage of e-money is paved a way. European Commission (EC), in response to the legislation, studied on e-money between 2009-2014 regarding legal conformity assessment and the economic impact of e-money and overall results are positive (European Commission, 2018).

3.1.1. Electronic Money Types

Electronic money systems are classified with four different types; according to value's usage purpose, how to store the value, where to store the value and degree of value's circulation (Bozkurt Yüksel,2018: 40-44):

Figure 7: Electronic Money Systems



Source: Author

3.1.1.1. Usage Fields

Single Purpose: In single-purposed e-money, the issuer and the acceptor are identical. The customer is supposed to make an advance payment in order to utilize from this e-money type. As there is a limited usage, the customer store just limited amounts and will not consider it as an electronic form of money. Telephone cards are good sample for this type of money. An issuer issues a card and accepts its usage, also a consumer of the card doesn't see the value as money and uses it just for a single purpose (European Central Bank, 1998: 31).

Limited Purpose: As the previous electronic money type, the parties (the issuer and the acceptor) are same and prepaid is precondition so as to use. The limited purpose can be stored in the computer memories or on the cards. Company cards and university cards are good example for this type as they used in restricted purposes such as entrance and having launch (European Central Bank, 1998: 31-32).

Multi Purpose: Beyond single purpose and limited purpose, the issuer and the acceptor are different which means any party apart from the issuer accepts this type electronic money. That is why, using of this kind of e-money is dependent on regulations of Central Banks and their monetary policy views (Shroff, 2007: 18). In Turkey there are adaptation developments to EC Directives for electronic money issues With respect to the legal definition of electronic money[5], Blockchain based electronic currencies can be regarded as legal and multi-purpose electronic money in both Europe Union and Turkey.

3.1.1.2. Store of Value

Note-Based: This type involves electronic notes which each of them has a fixed value with a serial number. They can be transferred from one device to the another electronically. With other words, they are electronic representation of traditional money (Bank for International Settlements & International Monetary Fund, 1997: 3-4).

Balance-Based: Single balance is stored in the device thanks to system and the balance is updated as transactions are realized (Bank for International Settlements & International Monetary Fund, 1997: 3). In this system, the devices can be perceived as a ledger book's digital type.

[5]Electronic money definition in Article 3(1)(ç) with 27.06.2013 dated 6493. law which regulated by TCMB:
"Monetary value which is issued on the receipt of funds by an electronic money issuer, stored electronically, used to make payment transactions defined in this Law and accepted as a payment instrument also by natural and legal persons other than the electronic money issuer."

3.1.1.3. Position of The Storage

Card-Based: Monetary value is stored on electronic money cards in this electronic money type. This card may be debit card, credit card or ATM card (Adityarani, 2016).

Network-Based: This type of e-money does not require any private device since the transactions conducted via online platform like Internet. Computers have monetary values and these values transferred to other computers thanks to the network (Adityarani, 2016).

3.1.1.4. Circulation

Open: Electronic Money can circulate freely in the system and also saved for saving purpose (Bozkurt Yüksel, 2018: 44). Blockchain network provides open system for users.

Closed: In closed systems, users participate in the network just with purpose of paying to the sellers. They don't send money one another (Bozkurt Yüksel,2018: 44). Shopping websites are proper sample for this network type.

According to the e-money classification, Blockchain network-based e-money could be classified as;

1) Multi-purpose
2) Note-based value
3) Network-based system
4) Open-circulated

It is multi-purpose since the issuer (trust centers) and the acceptors are different. Also, it doesn't provide only one purpose. On the other hand, it is note-based rather than balance based, because e-money could be transferred from one device to another as a banking transaction. At last, there should be a network to use the system and money flow should work seamlessly. That is why, it can be classified as network-based and open-circulated system.

3.1.2. Electronic Money in Blockchain

Despite the well-known currencies are Bitcoin, Ripple, Etherium etc., these currencies are classified as cryptocurrency. In this case, making distinctions between crypto currencies and electronic money is important in order to grasp electronic money. Electronic money is digital form of fiat currencies and they are subjected to regulations. On the contrary to crypto currencies, electronic money must be recognized legally by the authorities. However, crypto currencies are unregulated, decentralized currencies. Transactions and identities cannot be tracked by the authorities (Source Essay). Below two projects are designed for fiat currency based electronic money.

3.1.2.1 ioCash

IoCash is an electronic money platform which works integrated and Blockchain based. Payments are carried out on Blockchain platform under Electronic Money European License regulation. It provides various payments such as individual payments, cross-border payments, e-commerce payments. Any user can create e-money account through their IBAN. ioCash supports smart contracts interaction. Businesses can perform transactions with configuration of business logic (ioCash).

3.1.2.2 Monerium

Monerium is the first project receiving a license for issuance of e-money. Monerium co-founder and CEO Sueinn Valfells defines monerium wih three aspects: “fully asset-backed, redeemable and supervised”. The payments are transferred digitally. The project aims to hold clients’ deposits with their IBAN and allows them to make the payments in digital forms. This electronic money is licenced in the European Economic Area and there is no restriction to redeem digital money to conventional money. The critical point is that the payments are sent within 10 seconds even on holidays (Monerium, 2020).

Monerium, programmable digital coin, was licensed by the Financial Supervisory Authority of Iceland (FME). As being licensed Electronic Money Institution (EMI), Monerium was utilized and there issued an e-invoice using Monerium's tokenized Icelandic Krona. Up to date, as a regulated & programmable e-money Monerium, is used with license in seven countries (Denmark, France, Germany, Lithuania, Sweden, and the United Kingdom) with US Dollars, Euros, British Pounds, and Icelandic Krona (Monerium, 2020).

3.1.2.3 Central Bank Digital Currencies and Digital Turkish Lira

In the digitalized world, governments and central banks are launching their own currencies in the blockchain-based digital networks. It is important to underline that %86 of the central banks is under R&D process in 2020, whereas this rate was % %66 in 2017. On the other hand, more than %60 of the research are passed the pilot phase and they are under experimental stage (Codruta & Wehrli, 2021: 6).[6] There are two types of Central Bank Digital Currencies (CBDC); retail and wholesale. Retail CBDC is issued for private transactions among citizens and private companies whereas wholesale CBDSs are used for financial institutions. Most of the CBDC developments are based on retail CBDC to manage monetary policies and track the transactions more effectively. Retail CBDCs are mainly to control liabilities of balance sheets (Olive, 2020).

European Union consulted to the citizens of the union for their opions and expectations for digital currency. The Union concluded the research in May 2021 with more than 8000 replies. According to the replies, the citizens mostly expect privacy, integration with current payment methods and security for e-payments (Panetta, 2021: 2-4). In July 2021, the European Union announced that they are going to launch a project for digital Euro, called e-Euro. This project lasts about two years, and the aim of the project is giving the citizens and merchandises. The project is going to be handled by considering the expectation of the citizens (European Central Bank, 2021).

[6] Current developments can be followed on https://www.atlanticcouncil.org/cbdctracker/

China established digital currency research institute in 2017. After the research of the institute, e-CNY is launched in April 2020. This digital currency system is integrated into fiat currency with 1:1 ratio, which is central bank fully backed. E-CNY is not a different currency, it is a substitute for cash in circulation (M0) and coexist with physical RMB. After the test trials, more than 20 million personal wallets and 3.51 million corporate wallets opened as of June 30, 2021. The transaction value has reached RMB34.5 billion. The four cities where the pilot was conducted are Shenzhen, Suzhou, Xiong'an and Chengdu. Account holders can open a Digital Currency Electronic Payment wallet on the apps, and use it to pay at Starbucks, McDonalds and participating restaurants and grocery stores. The main plan is to use this currency for 2022 Beijing Winter Olympics for foreign visitors (People's Bank of China, 2021).

In September 2021, TCMB published that Digital Turkish Lira is going to launched in 2022. This digital currency is used in “Digital Turkish Lira Network” as closed-circulated network as the first phase. According to results of the test, this electronic currency puts into broader networks. The aim is to implement this currency into blockchain technology for instant payment systems (Central Bank of the Republic of Turkey, 2021).

3.2. DIGITAL SIGNATURES

Electronic signature is a superior concept including digital signatures created by key cryptography, PIN codes used on credit cards, scanned hand-signed to the electronic environment, people’s biometric characteristics like eye retina scanning, and fingerprint scanning (Erturgut, 2004: 68).

Digital signatures are method which provides equivalent functions as much as normal signatures. These signatures involve both the most reliable solution and complex preparation for electronic document issues (Keser, 2002:126-127).

Technology renews itself every day. In the light of developments in information technology, cross border trades are arranged electronically anymore. The point is whether normal signatures cater reliability and legal binding. In order to sign electronically for electronic documents, scanning wet signatures are prevalent way.

However, this simple way makes being imitated easily. On the other hand, with cryptography system, identification that the document is issued by electronic signature's owner is so simple.

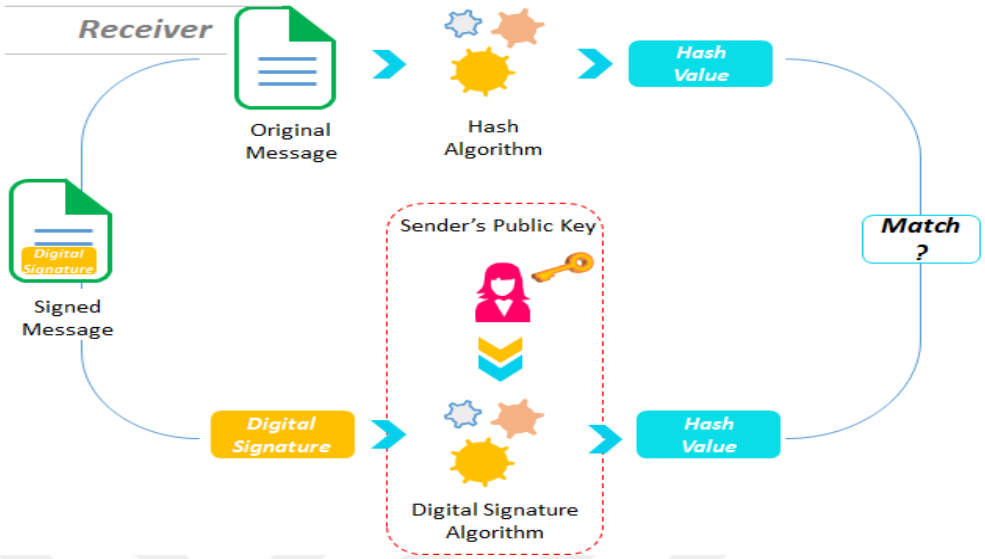
Legal results of the contract and performing the condition in the contract which digitally signed are as important as drawing up the contract. Ultimately, contract parties might agree verbally. However, they are always inclined to protect themselves in case the counter party does not abide by the conditions. That is why, results of the contract should provide same binding results even if it is issued contract with appropriate digital signatures.

3.2.1. Digital Signature Process in Blockchain

Digital signature is realized through cryptography science in Blockchain and it services two main purpose; verification of signed data's owner and non-alteration of signed asset in transition process. Initially, in order to be entitled to sign, digital certification must be received from Trust Centers. In Turkey, Trust Centers, which are legally named as "electronic certificate service providers" assign public and private key to the participant. How secure the private key is associated with hiding the key. The private key either can be hold in computer application or can be hold as a chip card. Chip card is more secure way since it is easy to carry and convenient (Sarıakçalı, 2008: 66-69).

As encryption method is explained in this study in chapter 2 and it is relevant with digital signature, Figure 8 is simple to be understandable. When the sender encrypts data with the recipient's public key, there occurs a hash function. Afterwards, the sender can sign the data digitally by using the hash value and the private key if the data is required to be signed. The recipient feeds the sender's public key and the signature into the algorithm, and there release another hash value. As long as this hash value matches the original data's hash value, the digital signature accepted valid (Sharmak-D 2019).

Figure 8: Digital Signature Process With Blockchain



Source: Sharmak-D, 2019

3.2.2. Advantages of Digital Signature

In order to sign an electronic document and send them to the receiver, either the vendor should print the document and sign it with hand or add the signature onto the document (generally the second method is implemented by cutting the signature from the previous documents with any office program). The first way is time and money consuming due to courier and printing costs. When cross border trade is taken into account, the process will be longer and more expensive. The second way is fast and practical method for electronic documents. However, the missing point is that even the vendor imitates its own signature and brings them legal binding. From this view, the malicious parties exploit from this imitation, and they might imitate the documents, as well. On the other hand, there might be some additions to the document without other parties' permission or consent for abuse to the third party.

With digital signatures these problems are eliminated. Initially, electronic documents which are prepared in electronic platform obtain electronic binding. Signing electronic document digitally is more consistent approach for binding and proof. These signatures save businesses from time and money consuming issues with

its simultaneously signable structure. On the other hand, the parties are notified when digitally signed document is being tried to alter without permission as the digital signature is placed into the document.

Another benefit shows itself with time stamp concept. In order to sign digitally, constitutions need to have digital certificates and they are given by "Trust Centers". Trust Centers are third parties authorized by official institutions in order to deliver digital certificates. Via Trust Centers, time stamp verifies that digital data is submitted with a digital signature in a certain time. It prevents documents from manual arrangement of time and manipulation risks, (Olenski, 2015; Keser 2002: 152).

3.2.3. Legal Binding

In European Union, EU 910/2014 electronic Identification, Authentication and trust Services, known as eIDAS regulation came into force in 2014 in order to simplify and standardize electronic signatures and electronic identifications in the frame of law. On the other hand, trust service provider is defined as "a natural or legal person who provides one or more trust services either as a qualified or as a non-qualified trust service provider". Under this regulation, electronic signatures have same binding effect and acceptability for legal processes as written signatures. Also a e-signature with qualified certificate which is issued in one member shall be recognized in other member states.[7]

USA government passed electronic signature law in 2000. With ESIGN Act (Electronic Signatures in Global and National Commerce) electronic signatures obtained legally identical binding status. Additionally, UETA (Uniform Electronic Transactions Act) drafted for legal framework of electronic signatures. There are five factors that makes e-signature legally binding (Girish);

1) Intent to sign
2) Consent to do business electronically
3) Clear attribution
4) Association of the signature with the record

[7]See Article 25

5) Record retention

In Turkey, certificated electronic signature is determined legally binding with 5070 electronic signature law. According to Article 5 of the law, e-signatures shall have identical effect with wet signatures. Also Article 6 states that the signed data cannot be altered by third parties. In 2012, with Turkish Code of Obligation's 6098. Law, electronic signature became one of the written forms (Article 14) and it's legal binding is assured.

As it is pointed out, electronic signatures are legally binding under the certain circumstances such as having a digital certification. On the other hand, registrability of the signatures are more comprehensive as a matter of course.

CHAPTER FOUR
INTERNATIONAL TRADE AND BLOCKCHAIN

International trade is one of the fundamentals for both countries and firms for the development. Firms always find global market more alluring for the purpose of more income acquaintance, penetrating to other markets, obtaining global reputation, leveraging and utilizing from lower costs. Governments also support their firms in order to endorse their developments with tax advantages, incentives.

On the other hand, international trade is far more complex than domestic trade. Participation of many parties and hesitation of exporters and importers for managing cross border transaction are the main hindering reasons. International trade entails proper documentation and rigorous process with a high coordination. The fragmented process undermines high coordination and it needs to be gathered in one piece. Thanks to Blockchain technology there is an opportunity to gather all parties into one platform with a one digital document (Civelek&Ozalp; 2017: 4-5). This document is expressed as “full-integrated trade document”.

Main purpose of implementing Blockchain network into international trade process is uploading and tracking of the necessary documents in the digital platform. The breakthrough technology eliminates documentation-based delays and trust concerns. Facilitated trade paves a way for growth of international trade volume.

4.1. PAPERLESS TRADE

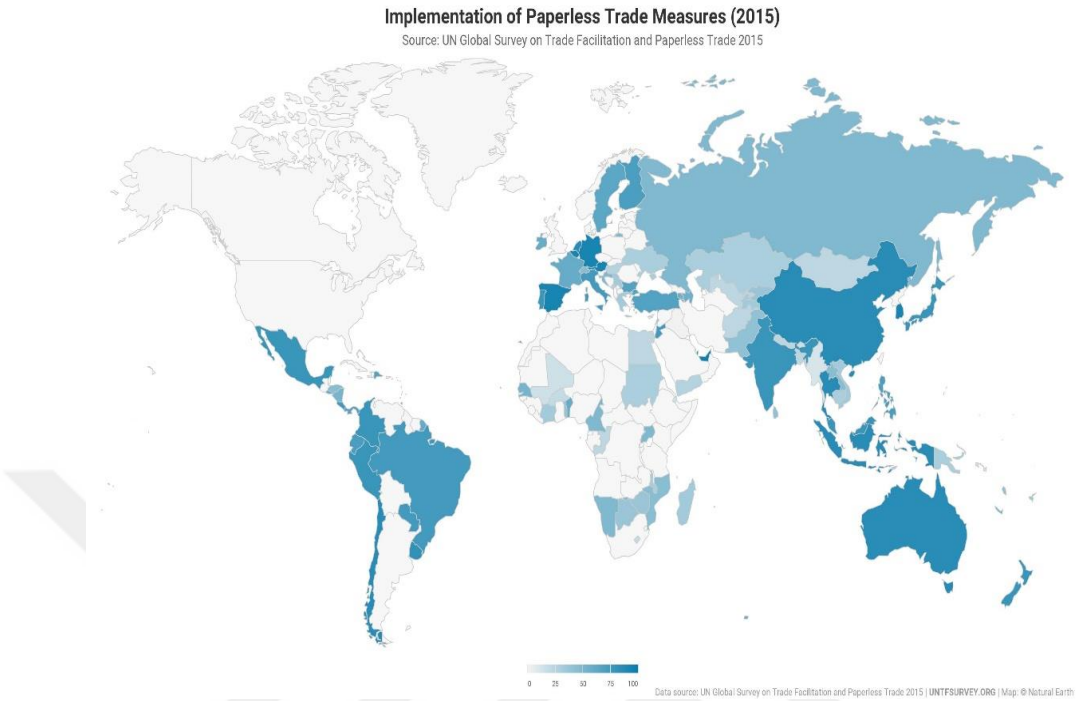
Despite the efforts, international trade is still dependent on papers. Additionally, this paper process takes much time from parties and reduces efficiency. As an example, Maersk tracked the export transaction from Kenya to the Netherlands and results are considerably crucial to emphasize the importance of the paperless trade. Around 30 actors and more than 100 people were involved into the shipment process. The shipment lasted 34 days from the farm in Kenya to the retailers in the Netherlands. The critical point is that 10 days of the shipment is spent by waiting documentation processes (Ganne, 2018: 17).

When a basic international transaction is taken into account at least ten parties emerge: Exporter, importer, exporter's bank, importer's bank, departure port, arrival port, forwarder, carrier, customs for both export and imports. This is the simplest cross-border trade case actors. There are other involved various factors for trade parties in particular countries. For example, the trade requires a consular invoice when a firm exports a good to some countries (Yılmazer&Onay, 2015: 106).

Paper-based international trade predominantly remains its presence and its negative impacts on international trade could be observed or experienced every day. Fast moving consumer goods (FMCG) industry is a good sample in order to see the deficiency of paper based trade. When dairy products are taken into account, one erroneous paper or delay has a potential to impede or interrupt the supply chain. With the prospect of having a mistake or delay pertaining to bill of lading during the shipment of dairies and the products are kept waited several days at the discharge port. Although some days are counted as free time, this time might exceed. Thanks to the refrigerated container, the dairies can be hold without a spoilage. However, the importer is obliged to pay demurrage cost of the exceeded days. On the other hand, there arises other impediments such as not meeting the demand perfectly, approaching expiry date for the last consumer. When this sample is considered, how paper based transactions impose on international trade is seen clearly. Therefore, the world is seeking a solution to pass paperless trade.

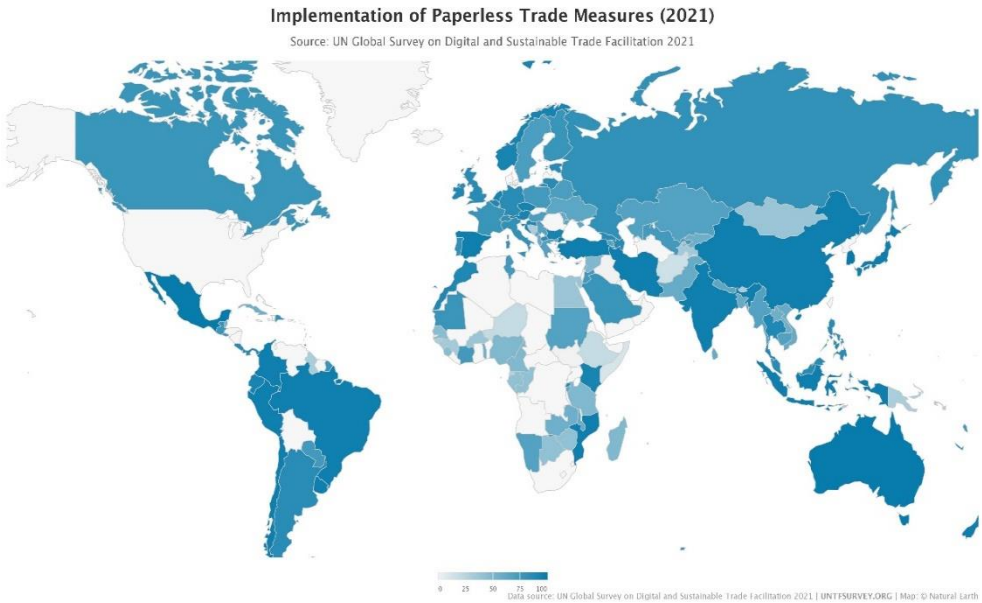
United Nations conducts a survey on 128 countries with 53 measures which are regarding WTO Trade Facilitation Agreement since 2015.

Figure 9: Paperless Domestic Trade Implements in 2015



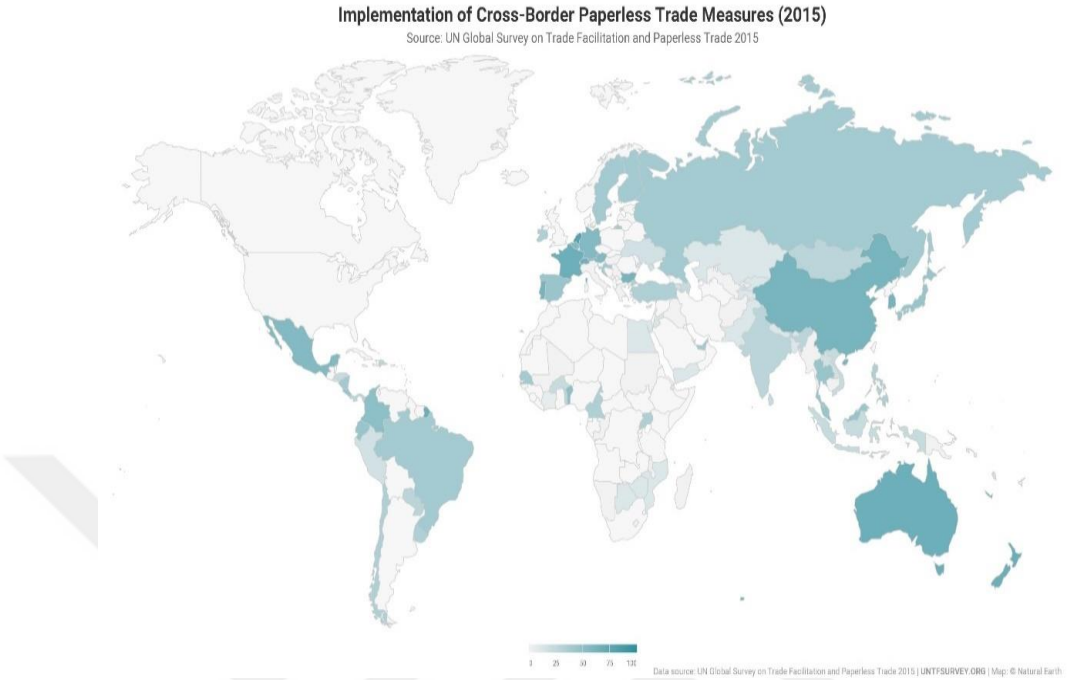
Source: UN Global Survey on Digital and Sustainable Trade Facilitation

Figure 10: Paperless Domestic Trade Implements in 2021



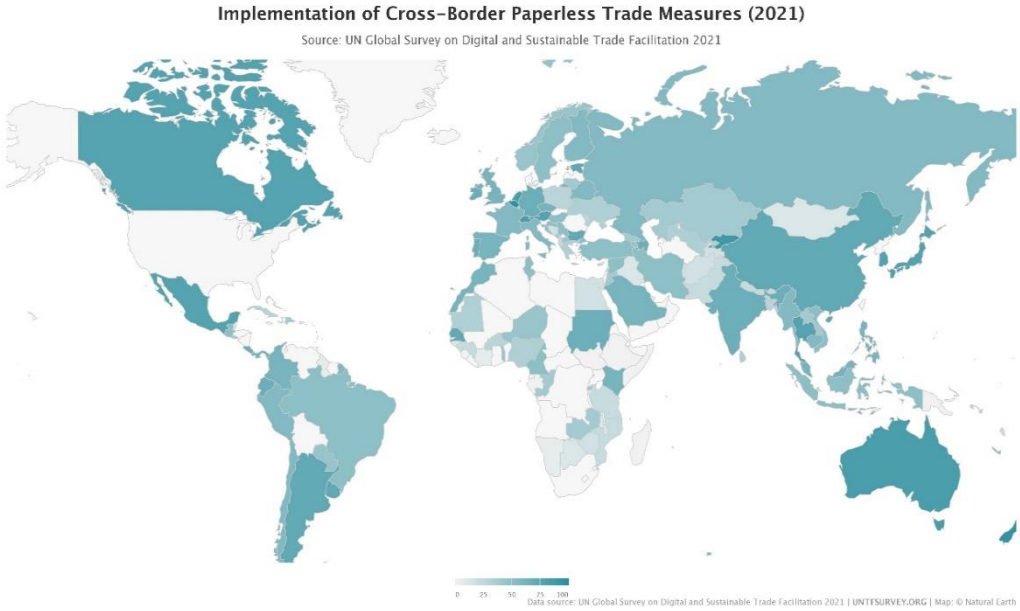
Source: UN Global Survey on Digital and Sustainable Trade Facilitation

Figure 11: Paperless Cross-Border Trade Implements in 2015



Source: UN Global Survey on Digital and Sustainable Trade Facilitation

Figure 12: Paperless Cross-Border Trade Implements in 2021



Source: UN Global Survey on Digital and Sustainable Trade Facilitation

When above figures are examined the results are striking but not surprising. The world is approaching to the peak stage on domestic scale for usage of paperless trade and with recent developments it can be estimated that full paperless domestic trade implementation is likely to be applied. However, the process is much slower in terms of cross-border trade. As international trade's more complex structure and not having law and regulations on paperless trade in much countries, the results seem not extraordinary. On the other hand, this results demonstrate that today's technology can surpass paperless trade with required amendments. The requirements are common international standards and harmonization of legal issues.

4.2. SMART CONTRACTS

Nick Szabo, the founder of smart contract concept, describes smarts contracts as "set of promises, specified in digital form, including protocols within which the parties perform on these promises" (Szabo, 1996).

Smart contracts can be expressed self-enforced computed programs which are executed automatically when certain conditions are met. By the time smart contract was explored, Blockchain technology hadn't existed yet. They are different technologies in terms of usage. Smart contracts are utilized for self-execution on agreements whereas Blockchain's purpose is transferring digital assets without intermediaries. Nevertheless, smart contracts have been applied and coded for creating blocks thanks to a parallel purpose: Trust. Piecing together of these two technologies, cross-border trade risks can be minimized.

The humble vending machines are primitive ancestor of the smart contracts. These machines provide automatic dispense; providing a sufficient amount of coins are inserted. When a person presses the button the machine dispenses what that person is willing to get thanks to self-executed coding. However, it doesn't dispense anything unless certain conditions are met (Szabo, 1996). Smart contracts are the main principle of the applicability of international trade into Blockchain with the trust. With consideration of humble vending machines and comparison with international trade, the idea is simple. The parties are supposed to agree on the conditions and smart contracts are supposed to deliver their rights. Supposing that

there is a cross-border trade contract and importer commits to the exporter paying contract value when bill of lading is released. This creates trust for the exporter. The exporter has confidence as it knows that the payment is ensured if the products are released. On the other hand, the importer has confidence as it knows that the products are under insurance by the smart contract as well. This transaction can be applied without Blockchain as well. However, the process realizes in the shadow of ambiguity and unreliability. Blockchain network contributes smart contracts to being binding under the supervision of the network.

Table 4: Aspects Of Smart Contracts

TECHNICAL ASPECTS	LEGAL ASPECTS	ECONOMIC ASPECTS
✓ Self-Verifying ✓ Self-Executing ✓ Tamper Resistant	✓ Legal Obligation with Automated Process ✓ Contractual Security	✓ Higher Transparency ✓ Less Intermediaries ✓ Lower Transaction Costs

Source: Blockchainhub.net

When the aspects of smart contracts (Table 4) are associated with international trade, it can be figured out that technical aspects and economic aspects facilitate time-consuming and costly processes such as Letter of Credit and bill of lading. They also provide minimization in mistakes out of its automated structure. Additionally, digital identity ensures the parties in terms of non-deniability and immutability. As legal aspect, legal binding of Blockchain network based transactions has been assured as well with the last enactments in the last two decades. If there is a trade agreement, there must be a written evidence of the agreement so that the agreement is legally binding for the parties. With modernized world, not only paper based writings but also digital based writings are considered binding. Hence, any smart contract could be asserted as legally binding. The experts are consulted for digital based evidences during the cases.

4.3. THE ROLE OF BLOCKCHAIN IN CROSS BORDER TRADE

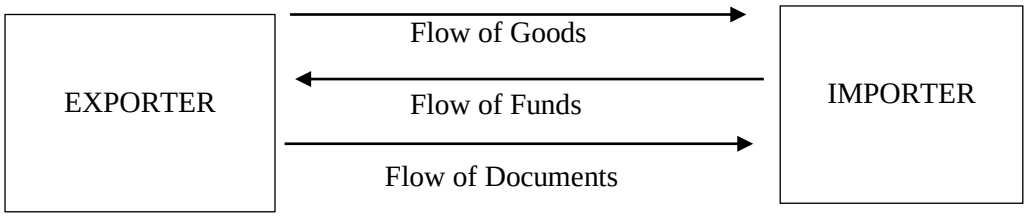
International trade contains many transactions and all of them are interdependent. In order to understand the insight of Blockchain technology on international trade, international trade processes should be simplified with classification of three different flows as follows:

1. Flow of Documents: There are wide range of documents in international trade. Bill of lading, invoice, certificate of origin and packing list are the basic documents. These documents prove the possession of the goods, legal evidence of the process. Flow of documents are carried out by physical delivery. The delivery causes both slowdown of the process and has risks such as missing documentation and correction of the mistakes.

2. Flow of Fund: The main purpose of the flow is obtaining ownership of the shipment. The importer sends the payment to the exporter for acquiring proof of possession. According to the agreed contract term, the exporter sends the documents. The importer obtains a proof against third parties pertaining to the possession.

3. Flow of Goods: It is the consignment of the goods. Optionally, this flow can be carried out along with flow of documents together. Nevertheless, preference of this option is not common due to the security concerns of the shipper and liability concerns of the agents. The documents are sent via an international courier frequently. That is why, segregation between flow of goods and flow of documents is more likely to be applicable for international trade realities.

Figure 13: International Trade Flows



Source: Author

Those flows are carried out in coordination, and they are complement for integrity of the transactions. The interdependent structure of the flows gives responsibilities to the parties for careful managing process for avoidance of delays, unpredictable financial burdens and reputation loses. There encounter erroneous transactions frequently in global trade, even though firms operate rigorously not to make a mistake. The mistakes arise from general lack of coordination and communication. The main reason for the lack is fragmented communication and network structures which always exclude one or more parties. On the other hand, the documentation process is carried out manually, without any automatic inspection. Management of the transactions in one network which gives parties a simultaneous information is essential.

One of the driving factors for Blockchain is integration between transaction parties and documentation. For example, when an exporter and an importer agree on letter of credit, the documentation is carried out by international courier whereas the issuing and inspecting parties are the exporter, the importer and the banks. This causes a fragmentation between issuance and transportation. If Blockchain based letter of credit is issued, there wouldn't need any courier and both sides have an inspection control on the documents simultaneously.

Blockchain network offers countless opportunities to international trade regarding mentioned flows such as (Belu, 2019: 6):

✓ Documents can be verified in real-time: Operational documents for export-import can be uploaded to the network and verified automatically thanks to the self-executed structure.

✓ Disintermediation: None of the extra parties are involved in the transaction. As an example, courier companies will be excluded from the transaction since the documents are digitalized.

✓ Reduction of transaction costs: International trade transactions are dependent on paperwork documentation, and this is both costly and time consuming. With the digital network, paperwork's costs are eliminated and the process is faster than paper-work's.

✓ Proof of Ownership: Legal provability of the ownership gives parties some advantages. The importer doesn't have to wait the documents in order to assert the

ownership of the shipment to the domestic buyers (this is so frequent situation for the retailers and the wholesalers). In addition to this, the exporter can prove its finance for future investments without waiting for approval of letter of credit so long.

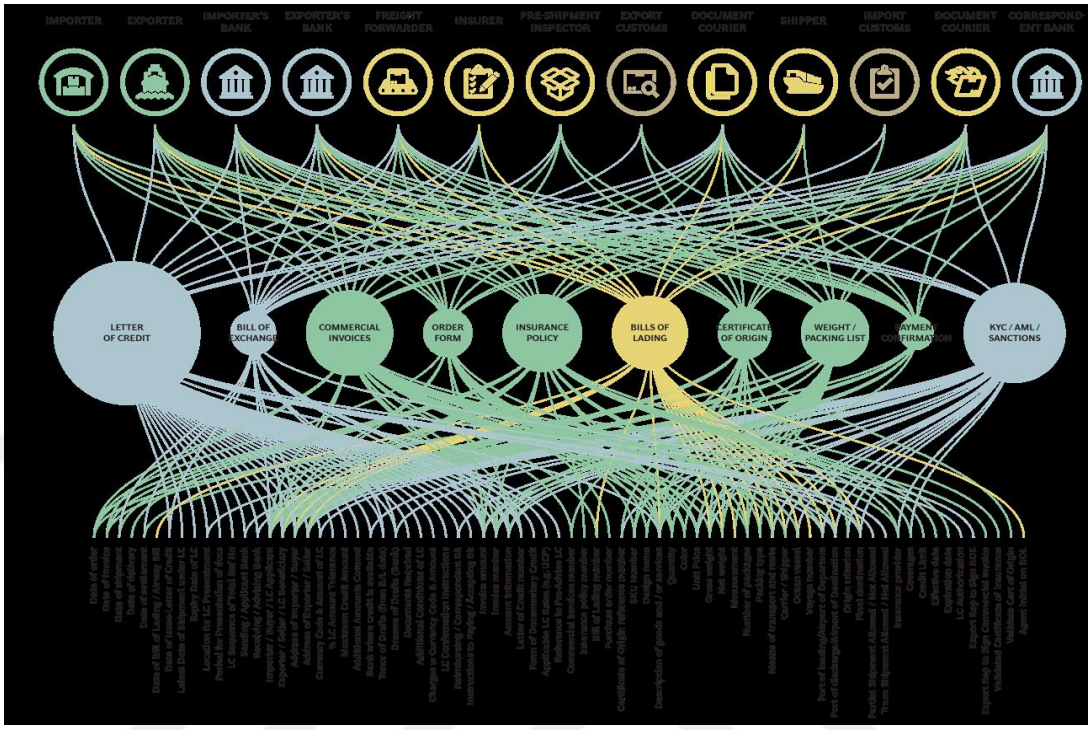
4.3.1. Trade Finance:

Trade finance is critical part of the transactions. According to preferred payment term, parties are subject to take responsibilities and risks. As one of international trade payment terms, Letter of Credit is commonly used in global trade because it is the safest term for both parties. The safety brings an expense as a matter of course. Besides, letter of credit is cumbersome term in terms of efficiency. There are other terms which are faster and less complicated such as cash in advance, cash against documents. However, they can't offer risk free transaction for trust issues.

Boston Consulting Group conducted a comprehensive research on trade financing systems for international trade and figured out that more than 20 entities are involve in a trade financing for letter of credit process and most of time is consumed by cumbersome procedures. There is approximately 5.000 transactions and only %1 of them make value. The rest of them are only unnecessary procedures. Moreover, more than 100 pages are used and archived for the transactions.

According to United Nations study, there are 8 main steps for letter of credit process, however the number of the steps is 20 on average in practice. Those steps are dependent the previous steps and most of them are consisted of back and forth verification steps. Those processes impose great burden to companies, especially to SMEs (McDaniel and Norberg, 2019: 7-8).

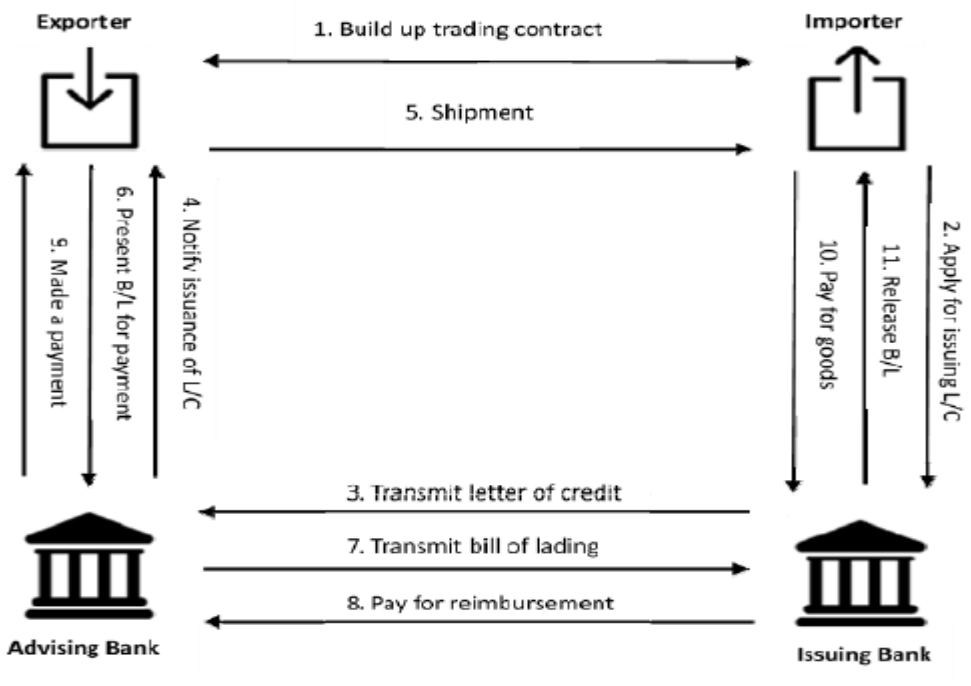
Figure 14: Interaction With The Data Documents for LC Transactions



Source: Ramachandran and Others, 2017: 4

Letter of Credit is still preferred because of elimination of imposed risks of the other payment terms. However, tedious and intricate process seems intimidating for some parties. Especially Small and medium enterprises(SME's) are deprived of experience and knowledge, and they hesitate to operates with LC. As their payment term experience tools are limited, growing and making the enterprise international is limited, too.

Figure 15: Traditional Letter of Credit Steps



Source: Chang, S. E., Chen, Y.-C., &Wu, T.-C. 2019: 6

Even though there are various payment methods, none of them meets global trust conditions' necessities for some countries. As an illustration, direct foreign exchange payment is forbidden in Tunisia for prevention of money laundries. Importers are only permitted to pay the amount of shipment by the time the shipment is in Tunisian customs (International Trade Administration, 2019). This regulation means that either exporters and importers suffer from LC costs or exporters take a high risk by accepting cash against documents term. Exporter could be compelled to cope with high expenses in case of giving up on receiving the shipment. On the other hand, there might be low amounted import order which isn't worth to agree on letter of credit costs. This situation forces importer to a costlier purchasing which actually exceeds both its needs and its budged. This type of specific amendment hinders companies from growing and constrain to being a competitor for both domestic and international competition.

When the matter is global trade, the payment terms must be global and demonstrates coordination with countries' regulation differentiations. Blockchain network promises to carry out of LC process with fast and affordable conditions. Smart contracts and decentralized paperless network provides a quicker solution with lower costs. Contrary to the popular myth, payment doesn't have to be cryptocurrency. As stated before, what seen in the bank accounts are representatives of the physical currencies. The same fundamental is valid in Blockchain network as well. The payment is just an equivalent digital amount of the fiat currency; only digital representative numbers are transferred to other accounts.

4.3.2.Logistics:

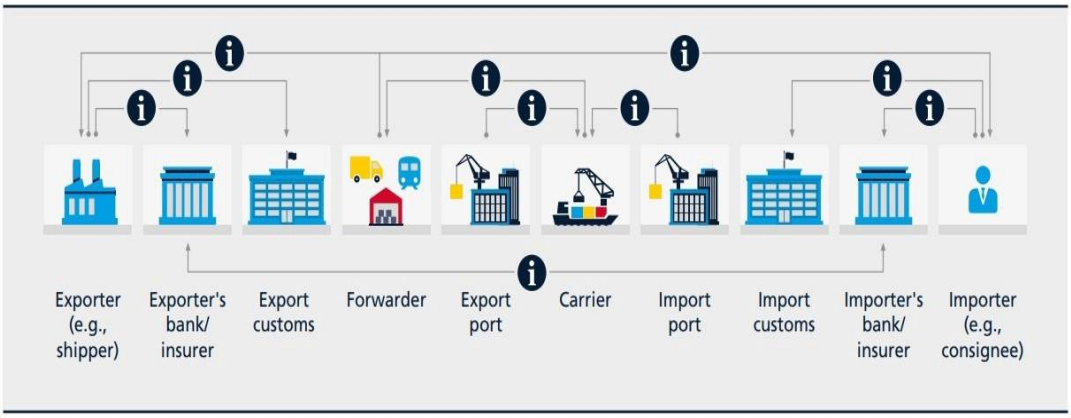
The logistics process is long and fragmented operations. It involves the thorough movement of the goods from packaging phase to delivery to the last consumer. There might be accidents during the shipment such as fraud or damage. The crucial point is which party is responsible for those accidents. The goods are in neither exporter's factory nor importer's store throughout the shipment. As a solution, parties agree on a term of the INCOTERMS and allocate the liabilities and risks with certain rules. Nonetheless, they are not able to track the shipment simultaneously and determination of damage location and cause is notified after a prolonged investigation. Furthermore, the result might be deceptive as logistics parties hesitate to admit the responsibility. Simultaneously track of shipments is indispensable for determining of damage location faster. Thanks to Blockchain, the process can easily integrate to the goods via IoT (Internet of Things). The last undamaged loading place and, where and when the damage place is can be tracked. Thus, both exporter and importer can be notified regarding the responsibility by this transparent tracking system (Georgiou, 2019).

The flow of information and documentation is as important as the flow of goods. These two flows are interdependent. The information flow is conducted manually without making an added value. A mistake of the flow of information imposes a hinder to the flow of goods. As international trade logistics consists of

multimodal shipments, fast and automated information flow is vital for the safety of the shipment.

Nowadays, the main impediments pertaining to logistics are stemmed from lack of communication. The lack causes expensive mistakes on important documents such as bill of lading. Logistics companies consider bill of lading as the most precious document of shipments. It gives responsibility to all parties and the change of a small mistake usually brings unexpected costs and diminishes the efficiency of international trade. For example, if there occurs a mistake on B/L out of lack of communication and the mistake is realized after completion of the manifest, there arise extra expenses for the new bill of lading and delivery of it. On the other hand, logistics firms demand two documents as "application of modification" and "disclaimer" from both exporter and importer. These documents are also time-consuming factors.

Figure 16: Traditional Logistics Flow



Source: Zebi, 2018

The above concerns reveal the importance of a digital network in logistics. With the Blockchain network, every party is accessible to documents simultaneously and communication-based concerns are eliminated. If there is a mistake, all parties are aware of it simultaneously. Inefficient correction methods are obsolete and logistics companies are seeking digital solutions. Blockchain technology is

promising for them. The four factors below explain why Blockchain is so important for logistics (Hackius & Peterson, 2017: 7-10):

1. The paperwork process is eliminated: International shipping process consists of a pile of paperwork and some malicious parties are prone to frauds, especially bill of lading.

2. Counterfeit products are identified: The pharmaceutical market is also prone to fraud issues with counterfeit medicines. Blockchain's transparent network gives information to the consumer where the products' origin and what is the process until the last consumption.

3. Origin tracking is simple in the food industry.

4. Internet of Things provides accessibility for tracking of the shipment by sensors, and they are recorded into the blocks.

In the pharmaceutical industry, Blockchain has proved its effect in terms of international shipments. The pharmaceutical medicines, vaccines are so sensitive and World Health Organization (WHO) estimates that %40 of the vaccines degraded during the shipment because of temperature differences. Also, %8.5 pharmaceutical products encounter temperature deviation throughout the shipment and the rate escalates to %15-20 in the Middle East. In 2017, Swiss Tech Firm SkyCell launched Blockchain enabled refrigerated containers and temperature-deviated rates down to less than 0.1%. With this technology, containers have sensors with Internet of Things. The documents are recorded into Blockchain ledger, and the network provides remote control of the temperature safety. Thanks to the innovation, Blockchain network shows its potential for saving the market from the waste which is stemmed from temperature differentiation (Hampstead, 2018).

In November 2019, a new virus, Covid-19 is erupted and it turned into a pandemic crisis. Proper transportation is one of the expert's discussion in case a vaccine explores. How does a vaccine is distributed to the world is as crucial as finding a vaccine in terms of efficacy. Hence, Blockchain based logistics could open a new era for transportation.

4.3.3. Governmental Issues:

In this century, there are countless flaws in cross border trades. These flaws don't damage only trade partners, but also governments. Governments impose restrictions (taxes, countervailing duties, amount quotes etc.). The main purpose of the restrictions is protecting domestic market unless there is a political conflict. Nevertheless, these restrictions are so fragile to document amendments. As a simple sample, European Union imposes countervailing duties on certain woven and/or stitched glass fibre fabrics originating in the People's Republic of China and Egypt (GIDE, 2020). Trade sides might be inclined to break cross border trade rules since it is not traceable. For example, any importer which is not willing to pay the duty could ask the exporter to issue the invoice value less. In this kind of cases cause both money lost and authorization lost for the government. Below there are two separate examples which are most common violation methods and how they can be solved by Blockchain.

Table 5: Violations in International Trade

INVOICE	*Sometimes, importer requests an invoice with less value to avoid tax payment.
COUNTRY OF ORIGIN	*This certificate is subject to manipulation by exporters. They are filled out manually by not looking at the background of the product. In this sense, importers are not confident about their imported good's origin.

Source: Author

At first, when an exporter issues a Blockchain-based invoice for the importer, it cannot issue the document with requested amount since the invoice is integrated with the domestic invoice. Thanks to the integrated structure, it protects governments from tax avoidances. On the contrary, traditional binary invoice system doesn't give this ensurance since domestic invoice-customs clearance and commercial invoice are

independent papers. In a cross-border trade, exporters prepare a domestic invoice and customs clearance to submit officials. However, the invoice which is sent to the importer doesn't have any connection with the exporter's local official. That is why it is able to avoid paying taxes with the original value.

Secondly, there are some concerns about violation of country of origin. Any government imposes a restriction in a particular product group. However, any exporter might certify their products from other countries to violate the restrictions. As a result, restriction attempts are likely to be futile. Also, exporter has a potential to produce products in a cheaper neighbor country and stamp its own label. This labeling falls the market prices, since the brand country has a quality reputation whereas the production country has a cheaper production process. The domestic manufacturers can't compete with cheap price and high-quality label in the market. However, if Blockchain system operates the trade it allows the importer to track background of the imported product. For instance, the USA companies are skeptical about the origin of their importing footwear from Europe. They are concerns that they are produced in neighbor countries and labeled as "Made in the EU". These illegal transactions decrease the footwear market value for domestic manufacturers (European Parliament, 2020: 95-96). As second example, a company director was fined 434.000,00 USD for falsified certificate of origin. In this case, Chinese zippers are exported to Europe by issuing a certificate to show that the zippers are produced in Indonesia (Camarda).

In this sense, the Singapore International Chamber of Commerce (SICC) and Singapore-based international trade facilitator vCargo Cloud (VCC) launched Blockchain based platform for electronic certificates of origin (eCOO). Thanks to the platform, all stages of a trade are inspected electronically to prevent fraud and the certificates are encrypted. The encrypted data can't be altered by any third parties. Thanks to the network it is possible to minimize fraud and falsified certificates (Camarda).

4.4. LEGAL ASPECTS OF BLOCKCHAIN ON INTERNATIONAL TRADE

With the recent developments, Blockchain-based transactions have shown themselves as a breakthrough. International trade facilitation is one of those breakthroughs. There are increasing pilot projects, however, negligence of the law aspects still remains. Not having a legal infrastructure is one of the key reasons why there hasn't taken a step at a global scale. The absence of a legal basis should be regarded as a critical obstacle as the law provides safety to parties. Legal aspect of Blockchain is subject to controversy as its legal validity still is not evident in some law systems. This circumstance makes assessment of Blockchain indispensable with legal framework.

With regards to international trade contract, the law is applicable as the parties and type of the contract are known. Even though, smart contracts' structure is different from paper contracts, their presence should be seen as a legal presence. Hence, being applicable to Blockchain and smart contracts as important as being used for expansion of the network. Otherwise, ambiguous identification and jurisdiction of the parties makes exporter-importer reluctant. These problems arise when permissionless Blockchain is preferred.

Initially, legal systems expect authenticity, immutability, and auditability at a certain degree in order to being regarded as admissible evidence. When permissionless and permissioned networks are compared, it is obvious that there is a legal discrepancy over legal identification. Thus, it is an obstacle to assess the legal identity of the users (Unece, 2019: 39-40).

In the case of permissioned ledgers, authorized parties are entitled to realize transactions with immutability, auditability and authenticity. As a result of full satisfaction to those three aspects, detection of legal identity is feasible.

Secondly, the party of the transaction might deny the contract and legal systems also expect prevention of the denials. With regard to non-repudiation of signatures, electronic signatures on Blockchain network cannot be repudiated. When the party confirms the contract by signing electronically:

1. The electronic authorization in the transaction is unique to that party and it can be identified easily.

2. The electronic authorization is given to that person along with ensurance of the exclusive control.

3. The causality principal clarifies the association between the transaction and the signature (Unece, 2019: 40).

Those three functions of the electronic signatures provide non-repudiation by submitting integrity, consent and acknowledge in terms of legal framework.

At this point, privacy and confidentiality issues emerge. The former refers to being accessible by only authorized third parties. The latter refers to a user's right to control and to access to its transactions. Since digital records have intangible structure, the records' control and accessibility always has been discussion. The parties would rather to be invisible in the network over being tracked. In order to solve this concern, Blockchain developers have developed diverse network types. Permissioned networks are among them by providing privacy and confidentiality rights. Thanks to this network type, the users realize the transaction without being public. These networks have potential to be harnessed for trade facilitation. Non-authorized third parties are not eligible to access to the transactions; only the authorized parties are entitled to track transaction with the restrictions (Unece,2019: 37-39).

In spite of the strong infrastructure of the network, law aspect should be considered along with technological aspect. International trade is subject to common legal jurisdiction even though parties are subject to different jurisdictions. For example, when L/C is applied, the applicant refers to UCP 600 (Uniform Customs and Practice for Documentary Credits) in order to prevent legal differentiations and establish a common sense of law. If the parties establish a business, prepare an agreement, they would rather be sure that they are both are protected by the legal institutions. In the previous chapter, it is seen that digital signatures have legal binding. Nevertheless, Blockchain-based international trades are still deprived of a certain international legal rules. They are still unsure that how the documents and transactions are evaluated by legal institutions. That is why, a legal assurance is essential to thrive this networks. Guidelines for application of Blockchain on cross-border transaction are necessary to overcome the disputes. Enactment of a comprehensive and appropriate law is a prolonged process which is developed along

with new prospects, new precedent cases. Law aspect should be regarded as inseparable part of the network; shouldn't be regarded as a different part.

Under this chapter, legal aspects of Blockchain on international trade are examined with UNCITRAL Model Law on Electronic Transferable Records (MLETR). UNCITRAL prepared the law with the purpose of determining equivalence conditions between transferable documents and electronic transferable records. This Model Law is significant to give inspiration to law makers to prepare Blockchain-based commercial regulations.

MLETR suggests that dematerialized documents don't have to be managed in separate systems, all if them could be gathered into one system. It allows managing and tracking of different documents with one digital record. Therefore, entire documents (invoice, packing list, bill of lading, etc.) could be recorded as a single electronic document irrespective of issued parties.

MLETR consists of four chapters; general provisions, provisions on functional equivalence, use of electronic transferable records and cross-border recognition of electronic transferable records.

General Provisions:

The chapter begins the scope of the law and it is indicated the law applies to the electronic transferable records. The law does not apply to securities (shares, bonds, other investment instruments). The law doesn't affect any other law application which requires disclosure of a person's identity, business address, or relieves a person from legal consequences of uncertain, false statements. With this law, no electronic transferable record which includes information of the transferable document is prevented. In Article 7, legal recognition of electronic transferable records is expressed that legal effects, enforceability, and validity cannot be denied just because based on their form. In addition to this, the law doesn't require a person's use of electronic transferable records without that persons' consent.

Provisions On Functional Equivalence:

With the purpose of subsequent reference, electronic transferable records require accessibility to information. The function is met if the contained information is used as a reference such as paper-based information with Article 8.

Article 9 shows that as long as a reliable method is used and it identifies signatory's identity and its intention, the law requirements can be met by the electronic transferable records.

Both above the two articles could be enabled by authorities as long as parties use approved methods such as trust centers. Since the trust centers are approved centers by official institutions, the transactions attain legal binding.

According to Article 10, electronic transferable records are regarded equivalent with transferable documents if the records contain all information which transferable records contain and reliable method is applied. The reliable method shall identify the electronic records as a transferable electronic records and retain the integrity of that electronic record.

If a reliable method is used, electronic transferable record meets with possession of transferable document when the law requires. The reliable method also should establish exclusive control over electronic transferable records by a person and identify that person as the owner of the possession. The conditions are valid for the transfer of electronically transferable record in Article 11.

Both Articles 10 and 11 indicate the singularity of electronic transferable documents. When paper-based documents are a matter of issue, they give the right to claim performance from other parties with original papers. In the digital world, on the other hand, there is a possibility of multiple claims by copying documents. These indicate the importance of the consortium network type for exclusive control. In addition to this, encryption of a block protects parties from copying prospects.

When a Blockchain network is taken into account for detection of its compliance in terms of functional equivalences, it is obvious that a standard Blockchain network complies with all provisions. Initially, a Blockchain network has a capacity to archive its documentations for a prolonged time for retroactive searches. Additionally, its retroactive searches are simpler than paperwork since the

documentation and gathering field is one.

Use of Electronic Transferable Records:

Article 12 refers that certain circumstances render electronic transferable records appropriate for reliability. The circumstances are the assessment of reliability, the assurance of data integrity, the prevention of unauthorized access, the security of software or hardware, the regularity and extent of an audit by an independent body, a declaration of existence by a supervisory body, an accreditation body.

13. Article emphasizes that if time and place are required for the transferable documents, they could be stated by electronic transferable records in case of using reliable methods.

Any transaction can be saved on Blockchain by the time stamp which indicates exact date of the transaction. Also, the time stamped transaction is hashed and digitally signed by the signatory. Thus, the signatory adds its approval to the time and it can be asserted if it is necessary (Unece,2019: 36).

The place where equipment and technology information is accessed does not give the location of the business. The electronic address doesn't give the assumption that that address is the business address according to Article 14.

Article 15 explains endorsement of the transferable document could be carried out by electronic transferable records if the law permits and the record contains information of transferable records. When Blockchain networks are examined, it can be figured out that all the networks enable endorsing by encryption.

When a transferable document is permitted being amended in case of amendment, electronic transferable records meet this requirement if a reliable method is used under Article 16.

This article is the most critical among them on account of it is the single conflicting regulation between the structural features of Blockchain and the law. As a result of immutability of the Blockchain transactions, it is infeasible to amend the data. The immutability doesn't give the right to retreat to the parties even if they are inclined to agree on giving up. On the other hand, they cannot alter any erroneous

information in the data. That is why, the immutability is not compatible in terms of commercial contracts. The developers should put a logic enables for new transaction, which disregards the impact or the presence of inaccurate entries. This logic can be carried out by the forking without causing any amendment for accurate parts of the transaction (Unece,2019: 36-37). The logic is similar to reversing entry in an accounting ledger and can be named as “on purpose forking”.

Article 17 and 18, make enable for the replacement of transferable documents and electronic transferable records mutually. Providing reliable methods is used and a statement of replacement is stated, the replacement is may be applied. The medium of change doesn’t affect the obligation of parties or doesn’t lose validity.

When the model law and Blockchain infrastructure are evaluated, it is obvious that Blockchain is able to key network for international trade. For example, the electronic bill of lading (e-B/L) is launched in Korea based on MLETR. This network is conducted by the carriers and also amendments, transfers, cargo release issues are managed by the carriers. Also the carriers encrypt the e- B/L in order to strengthen security. The records are preserved for 10 years in the network.

Figure 17: Differences Between e-B/L And Traditional B/L

Classification	Electronic bill of lading (e-B/L)	Paper bill of lading
Issuance	The shipping company obtains the approval of the consigner as to its issuance and registers it with the registration authority.	The Internet or fax is used to request shipping and receive the actual bill of lading.
Keeping	It is stored in the electronic archive.	The holder keeps it.
Ownership	The entire lifecycle of ownership is managed by the Title Registry.	Ownership is transferred by endorsement, and only the holder exercises ownership.
Export bill purchasing	As it is attached during electronic purchase, the actual bill of lading does not need to be presented.	The actual bill of lading must be submitted to the bank along with other shipping documents.

Source: e-B/L Korea

Cross-Border Recognition of Electronic Transferable Records:

Based on that an electronic transferable record is issued abroad; legal effect, validity and enforcement of the record cannot be denied with Article 19.

In addition to MLETR, Rotterdam Rules adapted electronic transferable records as well. The rules' basic purposes are harmonization of international sea shipment laws, reducing transaction costs, promoting confidence in international maritime with comprehensive provisions (Yang, 2019: 121).

The rules enable issuance of transport documents in the form of electronic record with the consent of the carrier and the shipper. According to the rules, electronic transport records have the same legal effects with respect to issuance possession and transfer. Besides, use procedures, replacement provisions are similar to MLETR (United Nations Commission On International Trade Law, 2009: 11-12).

4.5. BLOCKCHAIN CASES IN INTERNATIONAL TRADE

4.5.1 Literature Review

Blockchain technology is seen as a significant step for digitalization process. However, many researches are stuck in focusing on cryptocurrencies (Zheng, Dai, Xie, 2018). Fahmy (2018) describes Blockchain as a chain of blocks in which contains data, and the blocks are cryptographically verified. This network protects data since its distributed structure replicates data in multiple nodes. According to Belu (2019), this technology has a potential to be applied into cross-border transactions. Reduction in costs, more transparency, time saving might be feasible and flaws of the traditional process could be eliminated. Ekinci (2020) has reached similar findings, and with this study, the concept of "scalability" is emphasized. Open network structures such as Bitcoin and Etherium create a scaling problem in foreign trade transactions. Therefore, consortium networks should be used for cross border trades.

European Central Bank (2012) claims that using of cryptocurrencies might cause risks of tracking and supervision the transactions. That is why, a legal form of money for blockchain is indispensable. Regulators and initiatives should work on e-money topic and its implementation. E-money is subject to supervision while cryptocurrencies are not.

According to Kemiksiz (2020), the problem of financing illegal activities is result of the anonymous and untraceable structure of crypto currencies. The financing of these illegal activities affects the perspective on cryptocurrencies. Even if the transactions are generally well-intentioned, the reality of the existence of financing of illegal transactions always keeps the distance between the crypto currencies and the authorities.

Blockchain has the potential to reduce trade costs significantly, including verification, networking, processing, coordination, transportation and logistics, as well as financial intermediation and exchange rate costs (Ganne, 2018). Blockchain is regarded as a possible breakthrough to digitalize and automate trade process. There are ongoing projects to adopt this technology for utilizing in cross border trades.

Even though there are many unfinished aspects, functionality of blockchain is promising for the future. Mclagan analysis (2017) suggests that, on average, blockchain has the potential to save 38 percent of the costs of investing banks (Accenture: 6).

Thanks to blockchain technology, one smart contract could involve multiple documents such as invoice, packing list, bill of lading, etc. This saves businesses from pile of documents and pledges full integration between the parties. Smart contracts are self-execution codes which carry out cross-border trade process (Civelek & Özalp, 2018).

Various efforts by banks and other market participants are under way to investigate the possibilities of the DLT technology for financial transactions. If adopted, DLT will influence banking and commerce at large (Peter and Moser, 2017) In the digital money world, security is only possible by verifying transactions with digital signatures. That is, when A transferring money to person B, person A signs the transaction with his / her digital signature and makes it secure (Ünsal and Kocaoğlu,2018).

After the parties agree on the obligations, smart contracts are prepared, signed cryptographically and uploaded to Blockchain. When the contractual situation occurs, smart contracts automatically ensure that the contractual conditions defined in it are met. The main purpose of smart contracts is to provide superior security and reduce transaction costs compared to traditional contracts (Kınacı, 2019).

Blockchain could add much value for international finance. According to Asian Development Bank; the global trade finance gap between demand and supply of trade finance has reached 1.6 trillion USD. Given that global trade finance volume is 2.8 trillion USD, the gap indicates that there is so waste for this market. This gap generally stems from the complex risky nature of traditional trade finance (McDaniel & Norberg, 2019).

Blockchain offers a large potential for logistics and supply chain management. However, this potential has been discovered only by a few experts. A survey is conducted with logistics experts who take place and observe the projects. When four main topics (ease paperwork process, identify counterfeit products, facilitate origin tracking, operate the Internet of Things) are evaluated with benefits

of blockchain and likeliness of adaptation, the results are promising. Both of the scale are ranked from 1 to 7. For the benefits; 1 is very small and 7 is very large, for the likeliness 1 is very unlikely and 7 is very likely. According to results, the benefits are ranked 5.44 and the likeliness are ranked 4.79 on average. For this research, %56 of the experts see regulatory uncertainty is a biggest obstacle (Hackius & Peterson, 2017).

The World Trade Organization considers blockchain's impacts on global trade as a revolution. Storage of transaction, no need for third parties, fast and secure process get countries closer. This technology is expected to create over 3 trillion USD by the end of 2030 according to Gartner's report (Ganne, 2018).

Despite these advantages which are associated with blockchain, it encounters challenges. Mainly inadequate regulation is a big obstacle to expand this technology. On the other hand, Browne (2018) sees unstandardized network is as a handicap. In traditional ways, it is possible to interact the participants each other. Most of the projects have focused on a particular part of the process by excluding the other parts.

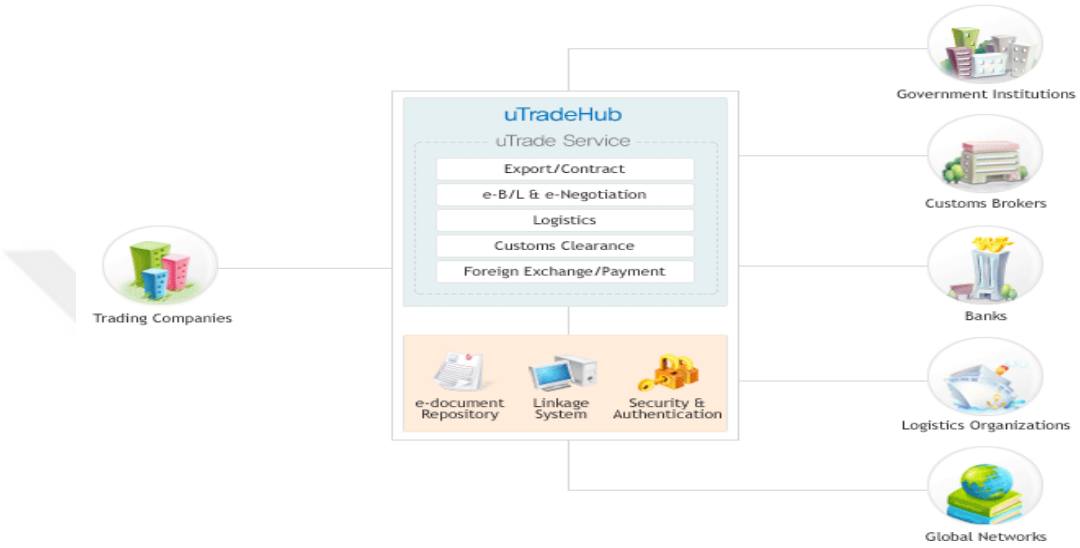
4.5.2. Blockchain Case: uTradeHub

In 2007 Blockchain based cross-border platform "uTradeHub" was launched as a result of "e-trade services" project of The Minister of Knowledge Economy and The Korea International Trade Association (KITA). Trading companies are able to use this platform in various areas such as customs clearance, logistics, banking etc. Thanks to this platform export process is managed automatically. This portal enables working with different workspaces with integration. There are various in trade process and all should be in interaction. Utradehub aims to build different blockchain networks and gather them under a hub network. For example, e-customs is provided by Korea Customs Brokers Association and Utrade gives an integration via N:N linkage. N:N linkage gives an opportunity to link scattered networks under a main network (uTradehub).

Main purpose of the platform is saving exporters from being overwhelmed by paperwork issues. Exporters are able to submit or receive documents such as bill of lading, certificate of origin, bill of exchange without visiting related authorities. This

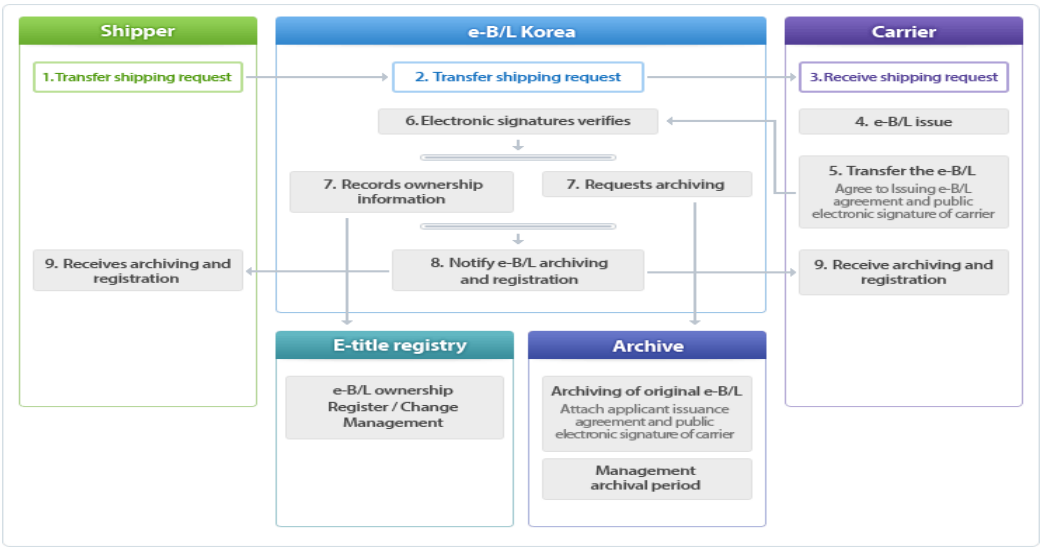
platform gaining importance year by year. From 2016 to 2018, the number of total traders which use the network are 79.353 in 2016, 86.272 in 2017, 94.207 in 2018 (Heun).

Figure 18: uTradeHub Platform



Source: uTradehub

Figure 19: e-B/L With uTradeHub



Source: e-B/L Korea

As it is seen in Figure 20, when an exporter needs shipment its request is transferred through uTradeHub to the carrier. The carrier issues the e-B/L and signs it electronic signature. Its issuance is verified in the platform to ensure that is not-repudiation. Additionally, the carrier can choose encrypting the e-B/L to strengthen the security.

An example of this is as follows. For example, the exporter agrees with the carrier for shipment. On the request of the exporter, the carrier prepares the bill of lading and signs it with a digital signature. It sends the bill of lading to the exporter on the Blockchain by encryption. Normally, it is essential to send the original of the paper bill of lading and this takes 2-3 days via courier. With this process, the document preserves its authenticity and reaches the exporter within seconds. If the export is agreed on the letter of credit, the original bill of lading must be presented to the bank. The exporter has the possession of the document with decryption and it can encrypt this signed bill of lading with cryptology in order to submit it to his bank in the financial network. Since the document is encrypted with cryptology, no party other than the exporter's bank can see this document.

This is one of the uTradeHub's different electronically issued document. When an e-B/L is issued, it can be tracked by the other parties. However, the amendment right only belongs to the carrier. It can be classified as permissioned private (PdPr) type Blockchain from the thesis's classification.

4.5.3. Blockchain Case: Corda

In 2016, Corda Blockchain platform was launched by R3. This platform is developed in accordance with needs of financial service, insurance companies and business environment. It was launched with permissioned Blockchain architecture. The purpose of the architecture is to provide data secrecy and scalability (Ünal, 2020).

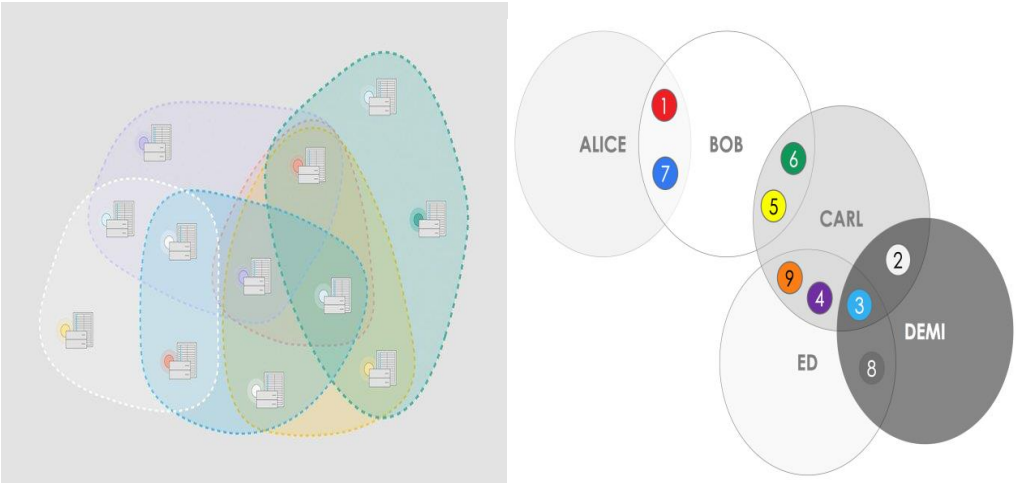
The access to the platform is provided by doorman services. A person who wants to participate in the platform should connect to the service and submit all required information appropriately. After the access permission application is approved, that person is given a signed Transport Layer Security (TLS) certificate by

the service. The certificate enables that person to communicate securely. In this platform, users don't hold the data in distributed manner. Profoundly, each user holds data which are related to its transaction. In other words, all the users see the data from their own perspective (Ünal, 2020).

The consensus structure of this platform is similar with FBA consensus. As it is stated on page 28, each node has right to determine their own validators (transaction sides). With FBA consensus, Blockchain is consisted of small slices and each slice node is able to track their slice transactions. The nodes are not confined with only one slice. For example, if an exporter has two different export transactions, it is possible to be in two slices. On the other hand, both of the importer are only able to track their own slices. The identical function is valid for Corda platform. The transaction is only can be tracked by the transaction parties.

With Figure 21, the similarity can be seen between FBA and Corda consensus types. In the first picture, there are different nodes and each node are in more than one slice. Despite those overlapped slices, a node only can track its own slices. In the second picture, the same principle is observed. There are nine transactions among 5 nodes. However, all the nodes only can track and issue their own transaction. For example, Alice can track her transaction with Bob (1, 7) while she can't access Bob's transaction with Carl (5, 6).

Figure 20: Data Storage Comparison Between FBA And Corda

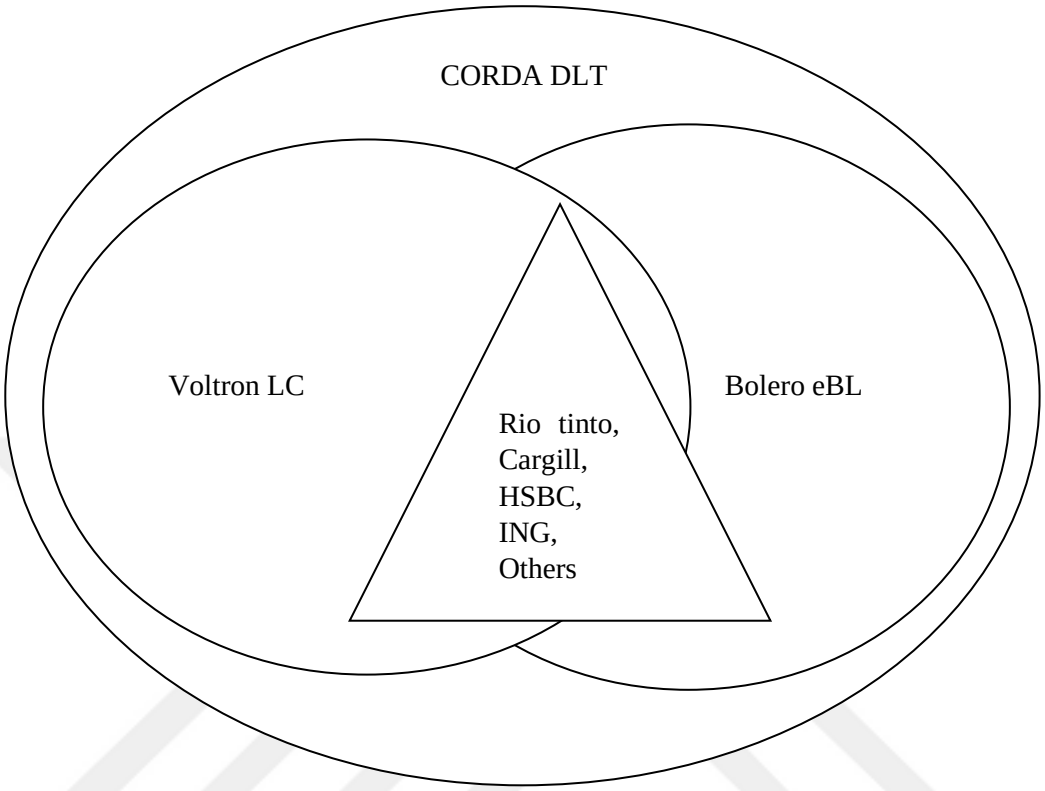


Sources: Stellar Consensus Protocol in GIFs Corda Documentation. The Ledger

HSBC realized the first digital international trade transaction with R3's Corda technology. In November 2018, Corda's The Voltron L/C application was integrated to Bolero eBL. The Voltron LC involves all letter of credit stages and cases such as issuance, advising, amendment requests. Thanks to the pilot project, all documentation process was issued and transferred less than 24 hours. In this transaction, exporter firm (Rio Tinto) sends the shipment to the importer (Cargill) by seaway and entire documentation process was managed in Corda network. HSBC and BNP banks took part in the transaction as the advising bank and issuing bank (HSBC; 2018). With the integration of these two applications, the identification and matching of the shipment documents with money transfer was processed. The requirement for matching the shipment documents with the smart contract is provided.

Below diagram (Figure 22) is so important for this study to exemplify Blockchain descriptions until this page. With this case, the entire concept would be grasped There is using of PdPr Blockchain structure since there are participation conditions and permission stipulation for adding block. Also, the consensus type has the same functionality and purpose with FBA. On the other hand, it is a remarkable example to understand the distinction between DLT-blockhain. It is seen that DLT technology (Corda) enables integration between different Blockchain networks (Voltron LC & Bolero eBL) and solves the divergence of different networks.

Figure 21: Corda DLT Diagram With The First Transaction



Source: Author

4.5.4. Blockchain Case: Irrevocable Payment Commitment

On 27 May 2020, Sisecam and Kuraray Europe GmbH realized the first Blockchain based pilot transaction. Thanks to the project, the payment process is completed in a couple of hours. İs Bankası and Commerzbank took part in this project as the supplier's and buyer's banks (Türkiye İş Bankası, 2020).

In this project, Marco Polo's payment commitment instrument was used. Payment commitment is an irrevocable and independent undertaking on importer's remittance. This platform gives to the parties faster, more secure and transparent transaction opportunities. The data of the transaction are not being distributed to all the platform users, only the transaction sides are eligible for accessing to the data. This platform works with matching of three information based asset: purchase order from the importer, invoice from the exporter, shipment papers from the carrier. When

these three assets match, buyer's bank provides IPU in favor of the supplier (Marco Polo, 6).

It draws attention for three major problems and brings solutions for these problems:

1. %60-%70 rejection rate on the first presentation in LC evaluation process.
2. High unit costs of Bank Payment Obligation (BPO) for small banks.
3. 7-10 days average time for LC issuance.

Marco Polo's solution, which is called IPU (Irrevocable Payment Commitment), ensures more secure, easier transaction. The whole commitment and payment process are realized on digital platform.

In order to get technical information, an interview has been made with Ms. Meral Sengoz, trade finance products unit manager at Is Bankasi. The objection of the interview is dispelling some of the questions regarding the transaction.

1.Could you explain the privacy aspect of the transaction? Which parties are eligible for accessing to the data?

> *The transaction is encrypted and private. This Project contains only financial part of the transaction. That is why, only authorized banks, the exporter and the importer are eligible for seeing the data. For example, if any two banks make a transaction, we definitely can't see the transaction even if we are the user of the platform.*

2.Is the seller able to spend the received amount any other way except Blockchain?

"Payments are made by SWIFT. The service provided here is that the importer's bank undertaking to make the payment, provided that the data on the trade of the importer and exporter comply with the smart contract."

3. If this transaction just involves the financial side of the transaction, how do the users integrate themselves to the Blockchain for logistics and customs process?

"Invoice, order and logistics information are recorded by the nodes (exporter and importer) manually. In the short term, the objection is providing integration with the firms' ERP systems. As a long term, logistics and insurance parties are being involved and take part in the transaction as nodes."

4.In case of any reserve or changes in the letter of credit, how are the changes provided on the network?

Reserve's counterpart is data mismatch on this platform. If no data is entered in accordance with the terms of the smart contract, the data will not match. However, if the parties accept this incompatibility, a payment commitment occurs. So it is possible to accept mismatch data. If the data is not accepted by the mismatched parties, the Bank will not be liable for payment because the terms of the payment commitment are not fulfilled.

5.The data on the Blockchain are generally referred to as immutable in the literature. What solution can the network promise us in such a problem?

"Unfortunately, the data cannot be changed for now. Therefore, the transaction has to be canceled and the data is entered again."

6. What impression did the transaction make compared to a standard letter of credit transaction? I would be glad if you open it with its positive or negative sides.

It is positive. The process, which could take days, took place in a very short time. Trusting the parties, knowing your customer, customer identity problems have been resolved. There is no question of document review which is finalized in days. Trade data are instantly matched. This will have mitigating effects in the financial sector. Most importantly, it will speed up the financing of trade.

4.5.5. Blockchain Case: Nafeza Platform-CargoX

The Egyptian government has made it mandatory to use the CargoX platform for all seaway imports to Egypt as of October 1, 2021. In all seaway exports to Egypt, the exporter must first register on the Cargox platform. The process is carried out through Egyptian customs platform (NAFEZA). Egyptian importers are supposed to register NAFEZA platform. On this platform importers generate an Advance Cargo Information Declaration (ACID) number by entering exporter's and their Tax IDs. The importers send these ACID numbers to the exporters. The exporters must put the ACID number to the required documents prior to enrollment of the documents. This platform provides up to %85 of savings compared to the traditional methods (Kukman, 2021).

According to Ehab Abu Eish, Deputy Minister of Finance for the Public Treasury, more than 60.000 foreign exporters have been registered on CargoX platform. So far, 164.000 ACIDs have been generated by 26.000 Egyptian importers. With this procedure, Egypt aims to enhance global competitiveness, doing business and decrease congestion in the sea ports (Daily News Egypt, 2021).

Addition to above cases, blockchain technology is being harnessed for stock markets. For example, Nasdaq collaborates with R3 to implement Corda blockchain to the market. The projects aim to build a consortium network in which broker, shareholders are involved. However, these projects are in infancy period and their technical structures haven’t been published yet. That is why, they are not convenient to be analyzed for this study.

As it is seen international trade has a fragmented structure and this structure proceeds independently. Each part of international trade is an utterly different organization. As an example, when freight forwarders undertake the shipment of the goods, they don't give attention if the payment is made. So far, blockchain projects have been based on fragmented solutions which concentrate only one part of the trade process. For the above cases, it can be figured out that blockchain technology promises facilitation for a particular part of international trade. For example, IPC gives the companies an alternative payment method, whereas Cargo-X solves the slowness and tracking problems of seaports. The technological concentration might be more beneficial in the long term since each part of international trade requires different professionalization. In the future, these fragmented solutions which are created by different professionalization are likely to be integrated into each other with barcodes or other technologies.

CONCLUSION

The world is witness for lots of technological developments. Blockchain is one of these developments. Even though it obtains the reputation with Bitcoin, the technology promises opportunities in numerous fields such voting, trading etc. This thesis investigates the technology regarding international trade transactions.

Cross-border trade is one of these opportunities in the digitalized world. Initiatives are seeking new services or methods for cross border transactions. It is considered that traders are capable of carrying out the process without intermediaries through Blockchain. They can send the digital papers by protecting their original status via P2P technology. Additionally, the networks are designed with consideration of privacy and security. Thanks to private participation and permissioned data adding, Blockchain can provide a convenient management mechanism for these considerations.

In terms of payments, e-money should be utilized in these transactions instead of crypto currencies. E-money is more secure, traceable and legitimate for international trade transactions. Therefore, most of the developed countries have already started projects to launch their own currencies. On the contrary to electronic money, cryptocurrencies cannot give these security factors as they cannot be tracked by the authorities. The main function of cryptology should be encrypting the documents. When a party encrypts the documents, these documents are in secure in the network. Only the designated parties have a key to decrypt the documents.

There are a great number of obstacles during cross border trading. These obstacles cause time lost and extra cost for the businesses. Furthermore, a small mistake could cause a big lost for the transaction. The underlying reason is that cross border trade transactions are both interdependent and scattered. Any discrepancy on document means misleading for other documents.

Blockchain technology aims to bring this scattered parties together under one digital paper. No party can enter a misinformation since it needs to be validated for all information with a high interaction. Also, this interaction gives more supervision opportunities for government institutions. With the integrated process, governments

can track if there is a tax avoidance etc. Thanks to this supervision, governments control their economies and domestic market more effectively.

Blockchain demonstrates itself in trade finance as well. Exporters and importers can handle financial part of the process in hours. Addition to this, the technology is more cost effective compared to the traditional ways. It also gives the opportunity to prevent banking days and hour restriction and time zone differences. These opportunities save financial institutions from transaction procedure burden and gives traders fast financial flow for their businesses.

From a logistics perspective, Blockchain technology minimizes human-made errors in logistics transactions. It also saves logistics companies from shipping costs. Thanks to IoT technology, products in shipment can be tracked and information about their status updated simultaneously. IoT technology enables sensor system which accesses via Blockhain to the goods and their conditions can be identified. With Blockchain technology, saving time, reduction in costs, transparent shipment are possible.

Besides above benefits, there is a contradiction between the immutability principle of Blockchain and international trade. The analyzed projects in the thesis are prepared in advance and they are at pilot stages. Practically, international trades and agreements are open to changes during the process. Simply, parties might agree on a change the conditions among themselves during the transaction. For example, importer might request an increase in their purchase order and exporter might agree with that. Some changes don’t even require the consent of other parties. As an illustration, the importer may want to change the port of discharge in an international trade case which the parties agree on EXW shipment term. As smart contracts are used in these transaction, port of discharge information should be added to the invoice and it is automatically uploaded for the bill of lading when the order is shipped. In this case, there will be no chance for the change because of the immutability principle. In order to solve these type of obstacles, the projects should be implemented by adding a logic which enables to change the information. This logic can be created by using a forking function that disenables the former information.

Additionally, there are still unfinished points for cross border trades. Law is lagging behind the technology and still remains unclear. Since there is some hesitation to utilize from this network, there needs an international regulation bodies like ICC (International Chamber of Commerce). With ICC rules, legal differences between countries are handled and companies' rights in 140 countries are ensured by the arbitration committee. This regulation should deliver rights on supervision, amendment, endorsement, singularity, replacement with paper records, possession issues. With the regulation, it should give a legal binding for transaction parties. Also, these transaction's legal aspects should be investigated by the experts who acknowledge technical aspect of the technology.

When the four cases are examined, it is evident a high technical knowledge of the technology is not indispensable for the implementation. UTrade, Corda, CargoX and IPC projects are carried out by the employees with the help of the experts. Since even the ERP systems used in companies are easily integrated into this technology, Blockchain seems applicable to today's transactions easily. Giving that lack of regulation aspects, world-wide implementation might be inconvenient for near future. A negotiation between countries is more convenient and initial step instead. For example, United Kingdom and Turkey signed Free Trade Agreement after Brexit process. Having that United Kingdom is 2nd biggest import market for Turkey; Blockchain based trade agreement might be a key to expand the technology. A government endorsed project between some logistics and banks facilitate cross border trade between these two countries. This kind of facilitation provides companies a bigger trade volume with faster trade transaction process over their competitors. Also, the companies might be supported through some incentives such as being exempted from the association charges. Blockchain based cost reduction and the exemption are so encouraging and economical for the companies. In long term, it will increase trade volume and the associations will be paid more proportional dues according to trade volume. Briefly, it creates win-win situation for every part of trade. This kind of projects may provide comprehensive network to the world for international trade. Beyond this, Blockchain may develop new services possible in international trade related with space economy.

These projects were chosen because they eliminate the most common disruptions in international trade. With these projects, it is aimed to solve problems such as payment delays, customs problems, etc.

With this study, it has been determined that blockchain and p2p technology facilitate transactions in foreign trade. However, the pilot projects in this study are limited as they only provide solutions to some of them. In future studies, a more comprehensive analysis can be obtained by working on the integration of the projects.

In this study, electronic currencies were examined with CBDC perspective. According to this concept, electronic currencies have 1:1 parity with their fiat currencies. The aim here is to convert the payment into digital format and complete the international transfer easily. How the payments will be affected by the emergence of a different digital parity is a different subject of study.

Lastly, this thesis aims to evaluate using blockchain technology in international trade organizations which have so fragmented structure. In this regard, international trade flows are explained, and selected four blockchain cases are evaluated. According to findings, blockchain projects take the fragmented structure of international trade into consideration. The projects are carried out for particular parts of the trade process and this gives more detailed process management for companies. If these projects are implemented successfully, integration of the projects seems inevitable for the second stage. This integration may be realized by platforms that enable network-to-network data transfer. With the integration, companies are going to be capable of managing all parts of the transactions in different networks but on the same platform.

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