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Blockchain - Transforming the Future of Trade Finance

International Business
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ABSTRACT

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Trade finance systems can be the most beneficial from the Blockchain technology. The time-consuming and costly traditional trade finance process has led to the global trade finance gap reaching $1.7 trillion. Blockchain allows digital records and information to be shared in a secure, transparent, and immutable manner without relying on a single trusted third party, and offers interesting promises that can transform the future of trade finance. Through a literature review, this thesis will examine the barriers and opportunities of blockchain uses in trade finance, suggest the ways that blockchain technology could transform the trade finance system, and discuss the future of Blockchain Trade Finance.

Blockchain is shaking up the sector and requiring established financial institutions to adapt. If the recently developed applications are successful and interoperability issues are resolved, allowing for the connecting of various payment platforms, blockchain may end up being the infrastructure for financial services in the future. Blockchain has the potential to transform international trade finance, but smart trade requires smart standardization, which can only be accomplished through cooperation. If we are successful in creating an ecosystem that promotes the ongoing development of Blockchain, international trade, particularly trade financing, will go through a significant transformation in the next ten years.

Keywords blockchain technology, trade finance

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Glossary

Cryptography

Cryptography is the process of communicating securely in an insecure environment. It is the science that constructs and analyses the protocols used to implement information security, such as data privacy and integrity, and authentication.

Ethereum

Ethereum is the second largest public blockchain after Bitcoin. Ethereum's quantum leap lies in the concept of smart contracts, i.e., computer programmes that self-execute the terms of a contract when specific conditions are met.

Fintech

Fintech refers to the integration of technology into offerings by financial services companies in order to improve their use and delivery to consumers.

Hyperledger Fabric

Hyperledger is an open-source collaborative effort created to act as a foundation for developing blockchain-based products, solutions, and applications for use by private enterprises. It is a global collaboration, hosted by The Linux Foundation, including leaders in finance, banking, IoT, supply chains, manufacturing, and technology.

Letter of credit

A letter of credit, also known as a documentary credit or bankers' commercial credit, or letter of undertaking, is a payment mechanism used in international trade to provide an economic guarantee from a creditworthy bank to an exporter of goods

Node

A node is a computer connected to the network. Each node keeps a copy of the data added to the blockchain.

Open account transaction

An open account transaction is a sale where the goods are shipped and delivered before payment is due. Obviously, this option is the most advantageous for the importer in terms of cash flow and cost, but it is consequently the highest risk option for an exporter.

Single point of failure

An element or part of a system that, if it fails, will disable the entire system.

Smart contracts

Smart contracts are computer programmes that self-execute when certain conditions are met (based on the if… then... logic – i.e., if the goods are unloaded at port of X, then the funds are transferred). They state the obligations of each party to the "contract", as well as the benefits and penalties that may be due to either party in different circumstances.

Abbreviations

ADB	Asian Development Bank
AML	Anti-money laundering
DAO	Decentralized autonomous organization
KYC	Know your customer
L/C	Letter of credit
MSMEs	micro, small and medium-sized enterprises
P2P	Peer-to-peer
PoS	Proof of Stake
PoW	Proof of Work
SWIFT	Society for Worldwide Interbank Financial Telecommunication
TWh	Terawatt hour
WTO	World Trade Organization

1 Introduction

1.1 Choice of topic and preunderstanding

I have known about cryptocurrencies since 2018 and have always been curious about the technology behind them, which is blockchain. My first experience with blockchain was when I wrote about it for future trends in the International Supply Chain Management course final project during my second year at Vaasa University of Applied Sciences. I knew I wanted to write about blockchain when I decided to write my thesis because of its advantages in almost every area, but especially in business. The idea about trade finance came from the Financing in Foreign Trade course. In this course, I discovered the complexity of the financing process, which is lengthy, time-consuming and requires a significant amount of paperwork with multiple participants in different authorities. Therefore, I decided to write my thesis on the subject since I think blockchain technology can contribute to improving the efficiency of the trade financing process.

Although I have learned about blockchain my knowledge about it was very limited. I read a lot of blockchain research for this paper, but I decided to leave out the most advanced technical information because my general knowledge of technology is not broad enough to ensure that I interpret the advanced technical aspects accurately. Since my focus is on applications and perceptions rather than the technology itself, the most technical aspects of blockchain technology are not examined in this study. My limited technological knowledge has motivated me to approach this project with an open mind and unbiased viewpoint.

1.2 Background

The coronavirus (COVID-19) pandemic disrupted and destroyed the world economy in 2020, resulting in a 3.2% decline in global GDP and a 7.5% decline in global trade (Asian Development Bank, 2021). “Covid-19 has forced trade finance organisations to consider alternative solutions for conducting their business,” says Contour chief executive, Carl Wegner. (“Blockchain platforms see Covid-19…,” 2020). Moreover, the economy is struggling with a significant supply-demand gap

in supply chain finance. According to the Asian Development Bank (ADB), the global trade finance gap has reached $1.7 trillion currently. In addition, the global trade finance gap was already high prior to the pandemic with $1.4 trillion in 2014, and in some economies, the rapid spread of COVID-19 aggravated the trade finance access issue due to the panic and uncertainty (Asian Development Bank, 2021). Moreover, the global trade finance gap is expected to rise to more than $2.4 trillion by 2025 if left unsolved (World Economic Forum, 2018).

Digital solutions are no longer a "nice to have" but rather an essential instrument for economic viability, according to the industry consensus. Additionally, trade participants are more aware that the rate of adoption needs to improve because, if done correctly, digitalization would help unlock significant benefits for trade (“Digitalize trade,” 2020). According to Bain & Company’s modeling, new digital technologies, particularly distributed ledger technology (DLT) such as blockchain, can close a significant portion of this gap and enable around $1.1 trillion worth of new trade volumes in the next 10 years (World Economic Forum, 2018). To create a trade finance solution, numerous banks joined together to form the Digital Trade Chain consortium (Deloitte, 2018a), there were around 30 consortia are working to use DLT in trade finance as Euromoney reported (Kshetri, 2021). In May 2018, HSBC and ING applied a R3 blockchain platform to reduce the time for submitting, verifying, and authorizing an international trade transaction from five-to-10 days to just less than 24 hours. The transaction involved a bulk shipment of soybeans from Argentina to Malaysia; HSBC issued a letter of credit for U.S. food and agriculture firm Cargill using R3 platform (Browne, 2018).

Blockchain is a revolutionary technology that is seen by many as a possible game-changer. But what exactly is Blockchain, and how may this technology be used in global trade finance? A blockchain is a digital ledger that stores transactions in a highly secure, verifiable, and permanent manner using a variety of cryptographic* techniques. It is distributed (no one entity controls the network) and decentralized (records are shared with all participants) (Ganne, 2018). Blockchain has the potential to revolutionize the global banking system, speed up certain payment

types like more effective B2B transactions and reduced friction in cross-border currency exchange (Hewlett Packard Enterprise, 2016). Furthermore, blockchain has the ability to digitalize and automate trade finance processes, specifically letters of credit, as well as to simplify supply chain financing. It has the potential to be a powerful tool for increasing MSMEs' participation in international trade by enhancing access to trade finance, facilitating trade procedures, and lowering trade costs (Ganne, 2018).

This thesis seeks to describe the fundamental concepts of the technology and its primary functions in order to shed light on the Blockchain phenomenon. It addresses several barriers that must be overcome before the technology can be widely used and offers opportunities for international trade finance. It examines how this technology is presently being utilized or might be utilized in order to analyze the potential for it to transform international trade finance in the future.

1.3 Purpose and research questions

The purpose of this thesis is to assess the possibility that blockchain technology can transform trade finance in the present and future. The thesis examines the barriers to blockchain adoption in trade finance, as well as the potential benefits of blockchain adoption and the future of Blockchain Trade Finance.

The research questions are as follows:

RQ1: What are the barriers to blockchain adoption in trade finance?

RQ2: What ar the opportunities of blockchain adoption in trade finance?

RQ3: What is the future of Blockchain in Trade Finance?

1.4 Scope of research

This thesis focuses on the general impact of blockchain technology on trade finance. The public, private, consortium and hybrid blockchains will be discussed in moderation to offer context and comparison between different types of blockchain.

We will also assume the permissionless blockchains are analogous to public blockchains and permissioned blockchains are analogous to private blockchains, although they may divide the blockchain into further subtypes.

This research mainly focuses on blockchain technology and will not discuss other distributed ledger technologies such as tangle and hashgraph. Furthermore, this study does not include the legal aspects of blockchain technology.

1.5 Structure of the research

The chapters of this thesis are dispositioned as follows:

Chapter 1. Introduction; In this chapter, the background is presented prior to the research aim and research questions. Subsequently, the research methodology, scope of research and structure of the research are presented in this chapter.

Chapter 2. Blockchain in a nutshell; This chapter presents the necessary background of Blockchain technology.

Chapter 3. Barriers of blockchain technology uses in trade finance; This chapter contains the barriers of blockchain adoption in trade finance.

Chapter 4. Multifaceted opportunities of Blockchain Trade Finance; This chapter contains the opportunities of Blockchain Trade Finance.

Chapter 5. Can Blockchain transform the future of trade finance?; The future of trade finance using Blockchain has been addressed in this chapter.

Chapter 6. Conclusions and future research; The last chapter presents the conclusions made in this thesis, and future research suggestions regarding the chosen field of research.

2 Blockchain in a nutshell

Technologists have been looking for a solution for some time since double-spend has been a significant issue in developing a form of electronic cash that can be fully distributed without needing a centralized third party to validate and complete the transaction (Vyas, Beije, & Krishnamachari, 2019). Unlike traditional paper cash or metal coins, electronic cash or digital coins are simply a computer file (sequence of bits) can always be copied (Hofmann, Strewe, & Bosia, 2017). The problem of double spending remained open and unsolved for a long time until October 31st 2008, when a paper titled "Bitcoin: A peer-to-peer electronic cash system" was published under the name of Satoshi Nakomoto, which proposed a trustless payment system that removed the requirement for a reliable third party and enabled any two willing parties to transact directly with one another (Nakamoto, 2008). While Bitcoin was the first real-life and remains the most well-known application of Blockchain, Bitcoin and other cryptocurrencies are not synonymous with Blockchain (McDaniel & Norberg, 2019; Makarov & Schoar, 2022). Instead, Blockchain is the virtual infrastructure that Bitcoin uses, and its potential uses extend far beyond the world of cryptocurrencies (Ganne, 2018).

2.1 What is a blockchain and how does it work

A blockchain is a digital ledger of transactions that is shared among all participants in a network (distributed), and the network is not under the control of any single entity (decentralized) where the transactions are stored using cryptographic* methods in a permanent and nearly immutable way (Ganne, 2018). In contrast to traditional databases, which are managed by a single company, blockchains are based on a peer-to-peer network that no single party can control. For example, in Figure 1, if Alice pays Bob $10 using blockchain, it will go directly to Bob without the need for trusted third parties such as banks, brokers, or other financial institutions (Singhal, Dhameja, & Panda, 2018).

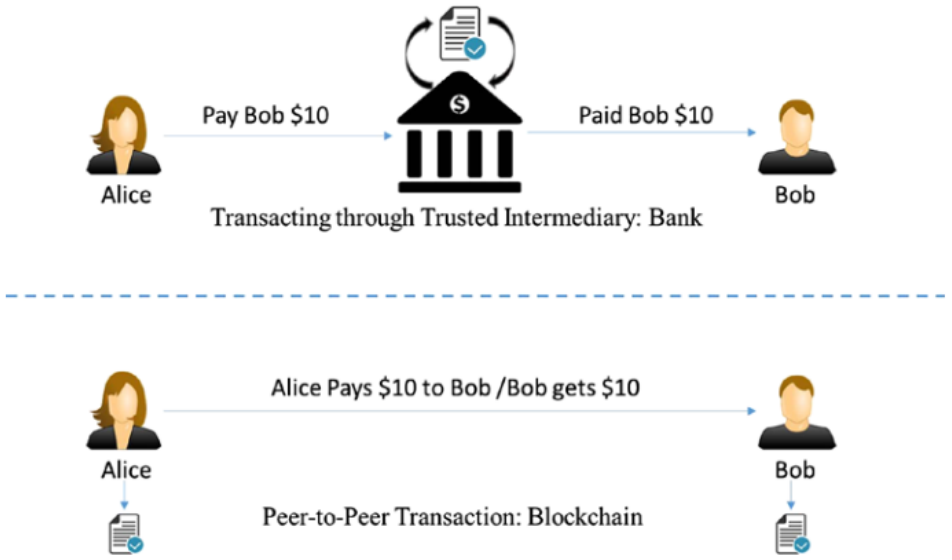

Figure 1. Transaction through an intermediary vs. peer-to-peer transaction (Singhal, Dhameja, & Panda, 2018)

In Figure 2, we can see how a transaction is conducted on the blockchain. Note that a blockchain transaction can involve any type of asset, not just cryptocurrency. The blockchain can store a variety of other data, like legal contracts, state identifications, or a company's product inventory. (Hayes, 2022). However, the way they are conducted on the blockchain is the same. Following the start of the transaction requested by the sender, the transaction data is broadcast to a peer-to-peer (P2P) network of nodes*. The network of nodes then uses a validation algorithm to validate the transaction as well as the status of the user who requested it. The verified transaction is combined with other verified transactions to form a new block of data for the blockchain. There are several transactions in each block. With Proof of Work consensus, the nodes that validate the block are known as "miners," and the miner who validates the new block is rewarded for their work in cryptocurrency. A validated block is added to the chain and linked to the hash of the previous block in a permanent and unalterable way—resulting in the formation of a historical chain of blocks and transactions (see Figure 3). The digital ledger is updated on each of the participating nodes each time a new block or transaction is added to the chain (Ganne, 2018; Puthal, Malik, Mohanty, Kougianos, & Das, 2018).

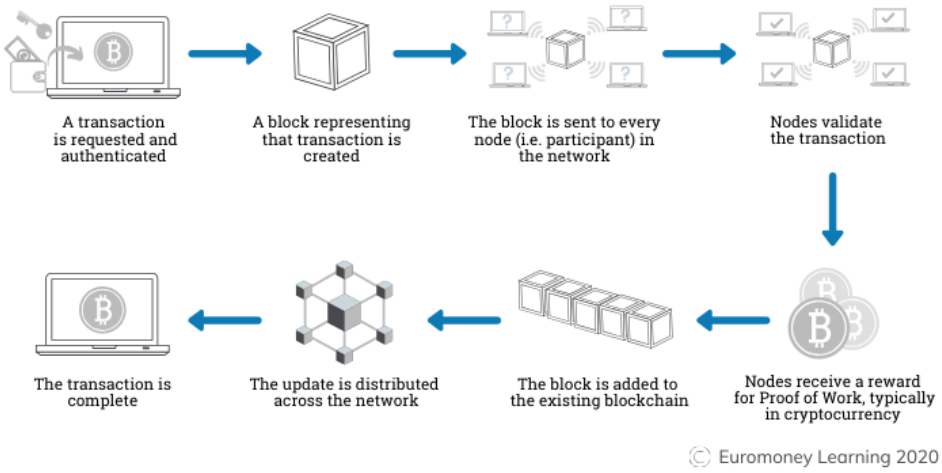

Figure 2. (How does a transaction get into the blockchain?, 2020)

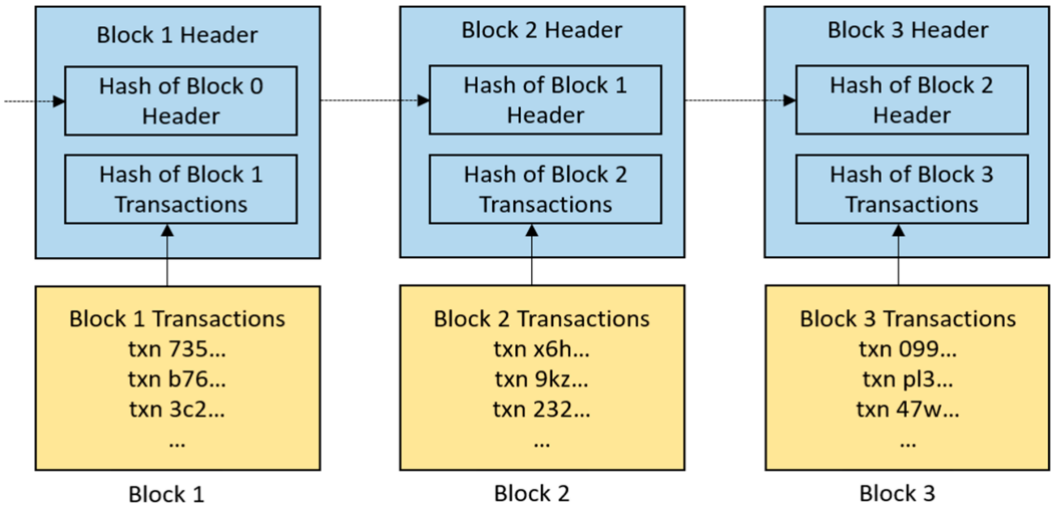

Figure 3. A simplified example of how blocks are chained to form a blockchain (Agbo, Mahmoud, & Eklund, 2019)

A simple way to understand blockchain is to imagine a massive Google spreadsheet that is shared with everyone, and each user has a copy of it stored on their computer. When someone performs a new transaction, the transaction is broadcast to everyone, and their computers download a new version of the spreadsheet (Agashe, Detroja, & Mehta, 2019).

2.2 Differences between public, private, consortium and hybrid blockchains

Behind the simple term of “Blockchain”, there are many different types that vary in terms of the degree of decentralization and other criteria. The four types of blockchains are public, private, consortium and hybrid (see Figure 4) (Wegrzyn & Wang, 2021). Public blockchains are permissionless blockchain that allow anyone to access the platform and validate transactions. A public blockchain is decentralized, there is no central authority that has specific special privileges on any decision (Ganne, 2018). However, public blockchain platforms need to ensure that participants are encouraged to reach consensus. There are a variety of consensus mechanisms, but the two most notable ones are Proof of Work (PoW) and Proof of Stake (PoS) (Puthal, Malik, Mohanty, Kougianos, & Das, 2018). The most common example of public permissionless blockchains is cryptocurrency, specifically Bitcoin. Public blockchains are thought to be very secure and resistant to malicious attacks because of their highly decentralized nature, although they have scaling problems (Ganne, 2018).

On the other hand, private blockchains are permissioned blockchain where anyone who wants to join the network must ask for permission. And it is only partially decentralized as it is controlled by only one entity which is hightly trusted by the other users (The Writing Zone, 2022). A private blockchain allows for higher efficiency and considerably faster processing of transactions than a public blockchain while using much less computing power because the verification of the transactions is carried out by a very restricted number of nodes (Ganne, 2018). Both private and public blockchains have limitations; private blockchains are more vulnerable to outside attacks and have a greater risk of human tampering of data as they are not immutable as public blockchains and can be reversed by permissioned authorities, while public blockchains have a longer validation time for new data than private blockchains. Therefore, consortium and hybrid blockchains were created to overcome these issues (Wegrzyn & Wang, 2021).

The hybrid blockchains and consortium blockchains are similar to each other as they have private and public blockchain features (Parizo, 2021). A consortium

blockchain is a permissioned blockchain and a type of private blockchain, but instead of being controlled by only a single organization, a consortium blockchain is governed by multiple organizations (The Writing Zone, 2022). This type of blockchain enhances cooperation and improves processes among organizations such as banks, businesses, and government organizations (Ganne, 2018). Instead of starting from scratch, consortium blockchain enables new users to join the existing framework and share information. Additionally, it helps firms work collaboratively to solve problems, which saves time and money on development (The Writing Zone, 2022).

A hybrid blockchain is a blockchain that attempts to combine the best features of both public and private blockchain solutions, allowing organizations to set up a private permission-based system alongside a public permissionless system (Parizo, 2021), which enables them to control which data will be made public and who has access to what data stored on the blockchain. In a hybrid blockchain, transactions and data are made private but can still be validated as necessary, such as by enabling access through a smart contract (The Writing Zone, 2022). Compared to a public blockchain network, it has higher scalability and offers fast and affordable transactions (Parizo, 2021). However, because information might be hidden from the user, it is not entirely transparent (GeeksforGeeks, 2022).

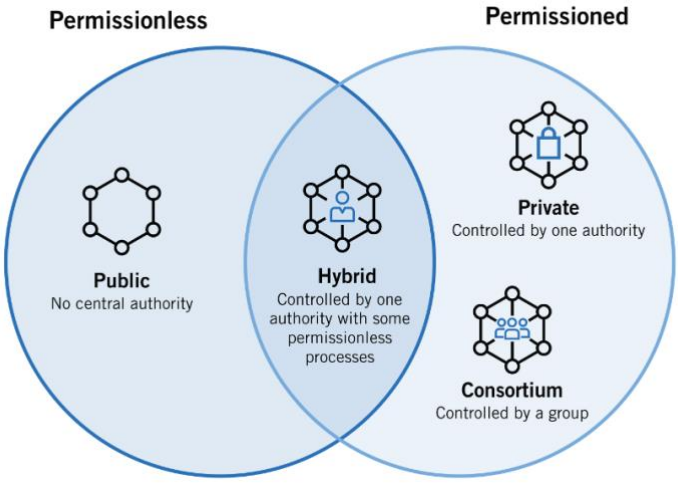

Figure 4. Classification of blockchains (Wegrzyn & Wang, 2021)

2.3 Smart contracts

The second turning point in the development of blockchain technology was Ethereum. A white paper outlining the vision for a blockchain system that could also enable "decentralized applications" was published in 2014 by the 19-year-old programmer, Vitalik Buterin (Buterin, Ethereum: A Next-Generation Smart Contract and Decentralized Application Platform, 2014). Whilst Bitcoin is limited in its function as a peer-to-peer electronic cash system, Ethereum uses smart contracts to enhance the fundamental functioning and usability of Bitcoin (Cryptopedia Staff, 2022). The term "smart contract" is actually a misnomer because it refers to neither contract in the legal sense of the word nor anything that is "smart" in the sense of having a cognitive or artificial intelligence component (Deloitte, 2018b).

Smart contracts are computer programmes that execute a transaction when a precondition occurs (“if the cargo is unloaded at port X, money is transferred”) (Deloitte, 2018b). Smart contracts have three core functions: store rules, verify rules, and self-execute rules. Moreover, it is very secure because it inherits immutable on the blockchain platform (Mack, 2018). Simply compare "smart contracts" with vending machines. When the money is put into the machine and the snack of choice has been chosen, the machine verifies the correct amount, and after verification, the machine gives back the product. Since smart contracts are blockchain applications and executed automatically, there is no need for intermediaries such as brokers, escrow agents, governments, corporations, or even lawyers (Mack, 2018).

3 Research Methodology

3.1 Literature review as a research methodology

Literature review is essential for all research disciplines and all research projects. In order to conduct new research, we need prior and relevant literature to map and assess the research area, motivate the aim of the study, and justify the research question and hypotheses. A literature review might be the best methodological tool to give answers to a variety of research concerns. Reviews can be useful, for instance, when a researcher wants to assess the validity or accuracy of a particular theory or evaluate theories or analyse the theory or evidence in a certain area (Snyder, 2019). This method might be particular, like examining the effect of the relationship between two particular variables, and also studying the collective evidence in a certain research area. Additionally, literature reviews are helpful when trying to give a general overview of a subject or research problem. This kind of literature evaluation is typically done to evaluate how much is known about a certain subject. It can be used, for instance, to develop research agendas, find research gaps, or simply to discuss a certain topic (Snyder, 2019). This thesis aims to examine the relationship between blockchain technology and trade finance processes and discuss the barriers, opportunities, and future of Blockchain Trade Fiance as research questions are conducted. Futhermore, the relationship between blockchain technology and trade finance is a new field of research. Therefore, the literature review methodology is the most suitable approach to conducting this thesis since it allowed the researcher to understand how the complex nature of the trade finance process can transform as a result of blockchain solutions by analyzing many points of view.

3.2 Data collection

Secondary data are a crucial component for researchers, however despite the vast number of such data available on the Internet, educational researchers frequently underutilize them. They have a high potential for producing valuable insights and

research topics. Secondary analysis may be used to test hypotheses, develop new information, support, question, and expand current ideas or discoveries, and so on (Cohen, Manion, & Morrison, 2018). This thesis is using secondary data and qualitative method to summarize previous secondary data. By using secondary data, the scale, scope, and amount of the data are usually much larger and more representative than a single researcher could gather. Data are collected from many sources and may be integrated to provide a strong analysis; they can also be analyzed using alternative methodologies and viewpoints that were not included in the original research.

3.3 Research design

The thesis followed, using four phases, the basic steps and essential decisions involved in doing a literature review.

- **Phase 1**: designing the review

In this phase, we start to answer the question why this review should be conducted. It takes a lot of work to do a literature review, therefore the subject should be interesting to both the author and the reader. Therefore, it is wise to scan the area as a first step to take into account other literature reviews that already exist, to estimate the number of research studies that must be evaluated, and to assist in constructing and precisely defining the purpose, scope, and particular research question the review will address. Following the determination of the research question and the consideration of an overall review approach, a search strategy for discovering relevant literature must be developed. This includes deciding on search terms and databases to use, as well as inclusion and exclusion criteria.

The following keywords have been used separately and in combination when searching for literature in internet search engines such as Google, Google Scholar, Google Books, ResearchGate, IEEE Xplore, DiVA portal (a database for student

theseus and other research publications), and Tritonia Finna portal (library resources of the Tritonia academic library):

- "blockchain"
- "technology"
- "trade"
- "finance"
- "international"
- "Supply chain"
- "future"
- "adoption"
- "Smart contracts"
- "scalability"
- "advantages"
- "barriers"
- "benefits"
- "challenges"

This thesis uses high-quality research papers, books, and articles for the literature review, with most of the materials published between 2018 and 2022. In order to present the themes as objectively and analytically as possible, a number of scientific and credible sources on blockchain were chosen.

- **Phase 2**: conducting the review

It is time to begin conducting the actual review after choosing the purpose, particular research questions, and type of methodology. Before doing the primary review, the procedure can be modified by testing the search keywords and inclusion criteria on a smaller sample. Depending on the type and scope of the particular review, a variety of methods might be used for the actual selection of the sample. At first, around 150 articles are yielded. The researcher could read each piece of literature that appears in the search in full, but it's a time-consuming approach. However, the researcher doesn't have much knowledge of blockchain technology; therefore, some basic literature needs to be read carefully. The rest of the articles focused on the research method or findings; reading the abstracts first and making a selection; and then reading the full articles later. To find more articles that may be possibly relevant, it is also possible to search the references in the chosen articles. The result of the 70 pieces of literature collected includes articles, books, and other topics.

- **Phase 3**: analysis

After the final sample has been chosen, it is crucial to think about how the articles will be utilized to carry out the proper analysis. Numerous analytical techniques are more or less suitable depending on the review and can be utilized. Regardless of the technique of analysis, it's crucial to make sure it can properly address the chosen research question. When the goal of the review is to combine viewpoints to develop new theoretical models rather than to cover every article ever published on the subject, an integrative review technique might be helpful.

- **Phase 4**: writing the review

First, it's important to express the review's purpose and need clearly in writing. All authors are required to conform to acknowledged standards when reporting on the methodology used in the study. The approach used to identify, evaluate, synthesize, and report on the literature must be fully described, as must the review's design and the author's selection process. If done correctly, the reader will have the opportunity to evaluate the accuracy and reliability of the results.

4 Barriers of blockchain technology uses in trade finance

4.1 Technological challenges

Scalability is one of the biggest challenges faced by blockchains due to the predetermined size of blocks and energy consumption issues. Basically, as more nodes and transactions are added to the blockchain, the scalability problem grows (Khan, Jung, & Hashmani, 2021). The limitation applies to public blockchains but not to consortium or private blockchains which is widely used in applications related to international trade (Ganne, 2018). For example, Visa can process 2,000 transactions per second on average, with peaks of 56,000 transactions per second, whereas Bitcoin has a theoretical limit of 4,000 transactions per second but can only handle 7 transactions on average. Ethereum is roughly twice as fast as Bitcoin (Croman, et al., 2016). However, because trade finance transactions are more infrequent and complex than, example, credit card payments, the scalability and speed challenges are less related. Although transaction speed is essential in the financial industry, particularly for capital markets and post-trade settlement, blockchain transaction speeds are still insufficient to meet the sector's demands (Blidholm & Johnson, 2018).

One of the most critical debates is over how much energy blockchain uses. When the world is in the grip of a war, energy is more important than ever. Indeed, the process of verifying blocks for specific blockchains can be computationally and energetically demanding, which directly affects the capacity for scalability of the related blockchain (Ganne, 2018). Cryptocurrency ownership has grown significantly, requiring more mining. As a result, running a blockchain-based system (Bitcoin) requires an unsustainably high level of energy. The annual energy consumption of Bitcoin alone is 204,5 TWh, comparable to Thailand (Bogna, 2022). Beyond Bitcoin, on September 15, 2022, Ethereum made the decision to switch to a Proof-Of-Stake consensus that is more environmentally friendly and requires less energy (Q.ai - Powering a Personal Wealth Movement, 2022). Besides,

permissioned blockchains utilize much less energy-intensive than permissionless blockchains as more energy-efficient algorithms are being developed. And once it is successfully developed, one can envisage its widespread adoption (Ganne, 2018).

Although blockchains are highly resilient compared to traditional security challenges, cyber security is always identified as a potential problem for blockchains in trade finance uses (Blidholm & Johnson, 2018; Ganne, 2018). It is difficult to attack the entire network due to the fact that data can be retrieved much more quickly since it is distributed across participating nodes and there is no single point of failure* (meaning that there is no central entity to compromise) (Singhal, Dhameja, & Panda, 2018). However, there is a possibility in theory for a 51 per cent attack where the majority of nodes are compromised (Ganne, 2018). In August 2018, Vitalik Buterin published a new consensus algorithm that might change the game by requiring an attacker who wants to take control of the network to control 99 percent of the blockchain's nodes rather than just 51 percent (Buterin, A Guide to 99% Fault Tolerant Consensus, 2018). In mid-2016, the most memorable time in the history of blockchain was the attack of the DAO (Decentralized Autonomous Organization) that was built on the Ethereum blockchain. The attack has siphoned off 3.6 million Ether valued around $50M at that time (Price, 2016). It was the code of the contract programmes that the DAO used that caused the issue, not the blockchain technology itself (Ganne, 2018). Even if hackers get access to the network of blockchain, it does not imply that they can read the data information due to data encryption (Piscini, Dalton, & Kehoe, 2017).

4.2 Standardization and interoperability

The interoperability problems that prevent people from taking full advantage of blockchain technology are being addressed. By enabling blockchain interoperability, which makes it simple for blockchain platforms to interact and share information with each other (Geroni, 2021). There are many platforms

being developed that "do not speak to one other". For instance, Microsoft's blockchain solution is based on the Ethereum blockchain, whereas IBM's pilots use Hyperledger Fabric (Ganne, 2018). Due to the fact that the financial ecosystems run on different blockchains, it is impossible for financial businesses and their clients to interact, trade, and communicate with one another in the financial services sector (Cointelegraph). Interoperability concerns are particularly important for international trade since a single consignment of international trade might touch several ledgers, including those for financing, logistics, provenance, and customs (Ganne, 2018).

Beyond the challenge of how we can make blockchains interact with each other, equally important challenges lie in the ability to share information between blockchain networks. Imagine that it would be inconvenient for a person with a Gmail account to not be able to send emails to a person with a Yahoo account (Hickey, 2022). The institutions adopting the blockchain platform and the regulatory authorities managing these institutions will have inefficiencies due to non-standardized information and procedures. Therefore standards encourage interoperability (Blidholm & Johnson, 2018). In order for blockchain technology to be used in trade finance, it is crucial to create standard datasets that include all the data that is required for information exchange for import, export, transit, transportation, and financing. The more parties involved that accept a standard platform, the better (Blidholm & Johnson, 2018). Enabling standardized routes through which various blockchains may easily connect with one another is one of the best solutions to the interoperability challenges. For instance, a protocol that offers the universal language for blockchains (Geroni, 2021). Although it is still mostly theoretical to be able to cross blockchain networks, many projects have made significant advancements in their research to discover a solution to interoperability (Hickey, 2022).

4.3 Cooperation and trust

While blockchain technology itself should make it possible for businesses to collaborate effectively and transparently, this is easier said than done. Since eliminating the need for trust intermediates is one of blockchain's biggest goals, it is ironic to say that blockchain has a trust issue (Davies, 2018). Building a blockchain network requires some level of trust amongst its users. The relationship between importers and exporters is thus made possible through the trust network (Blidholm & Johnson, 2018). Many factors influence trust in blockchain, one of which is the lack of historical proof of existence and ownership. The reliability of data placed onto the ledger cannot be guaranteed by blockchain. It can only assure the integrity of data stored "on-ledger" (Ganne, 2018). Furthermore, the technology is new and difficult to understand. It's intangible and, for the most part, unverified, making it unsuitable for assuring risk-averse board members making adoption choices. Businesses are also hesitant since the regulatory framework surrounding blockchain is uncertain (Davies, 2018). Since the key problem in trade and export finance is how information in registries is stored and transmitted on the blockchain network. Trust concerns in blockchain should thus be carefully analyzed in terms of the situations in which they occur (Blidholm & Johnson, 2018).

Blockchain has the potential to make international trade smarter, but smart trade need smart standards, which can only occur via cooperation (Ganne, 2018). However, businesses have historically been more habituated to competition than cooperation (Blidholm & Johnson, 2018). In order to integrate blockchain technology into international trade processes effectively, cooperation between the public and private sectors is vital (McDaniel & Norberg, 2019). One of the important things we need to consider is how to build an ecosystem that includes regulators, clients, and banks rather than simply the internal operations of the bank. Banks' services are built on trust, which is a major factor in why they invest in it. Although investing in a private, internal blockchain may serve a purpose but

there are no trust issues internally, the reward would be trivial (Blidholm & Johnson, 2018). With 45% concerned about user trust, 44% concerned about the ability to bring a network together, and 41% wondering if different blockchains would be able to function together, blockchain has a lot of challenges before it can be effectively adopted (Davies, 2018).

5 Multifaceted opportunities of Blockchain Trade Finance

5.1 Build trust and enhance the transparency

These are alarming figures, especially given that the banks were involved in at least 36% of the rejected trade financing transactions. The usual reasons for rejection were insufficient paperwork and transparency (Hellwig & Huchzermeier, 2019). The trade finance process might be carried out using a blockchain in a transparent, reliable manner that reduces the danger of fraud. Additionally, it would also eliminate the amount of paperwork and the time-consuming manual processes that slow down transactions. A trade finance application using smart contracts to automatically execute payment is shown in Figure 5. In step 1, when a buyer agrees to purchase goods from a seller, a purchase agreement is created and shared using a smart contract. The smart contract conditions include all the terms of the purchase, and the involved parties will verify them through the smart contract. After deciding on the parties involved and the terms of purchase, both the financier and the seller evaluate the agreed agreement and digitally sign the contract. In step 3, the seller starts shipping the goods and updates the shipment condition to the smart contract. In reply, the shipper acknowledges receipt and updates the contract by issuing a bill of lading. The seller invoices the buyer for the goods shipped, the goods are traced during transit using data inputs from IoT devices. Lastly, the buyer will digitally acknowledge receipt of goods and initiate payment upon delivery (Deloitte, 2018b).

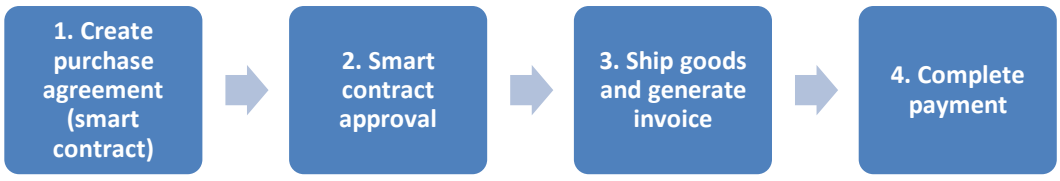

Figure 5. Smart contract application in trade finance (Deloitte, 2018b)

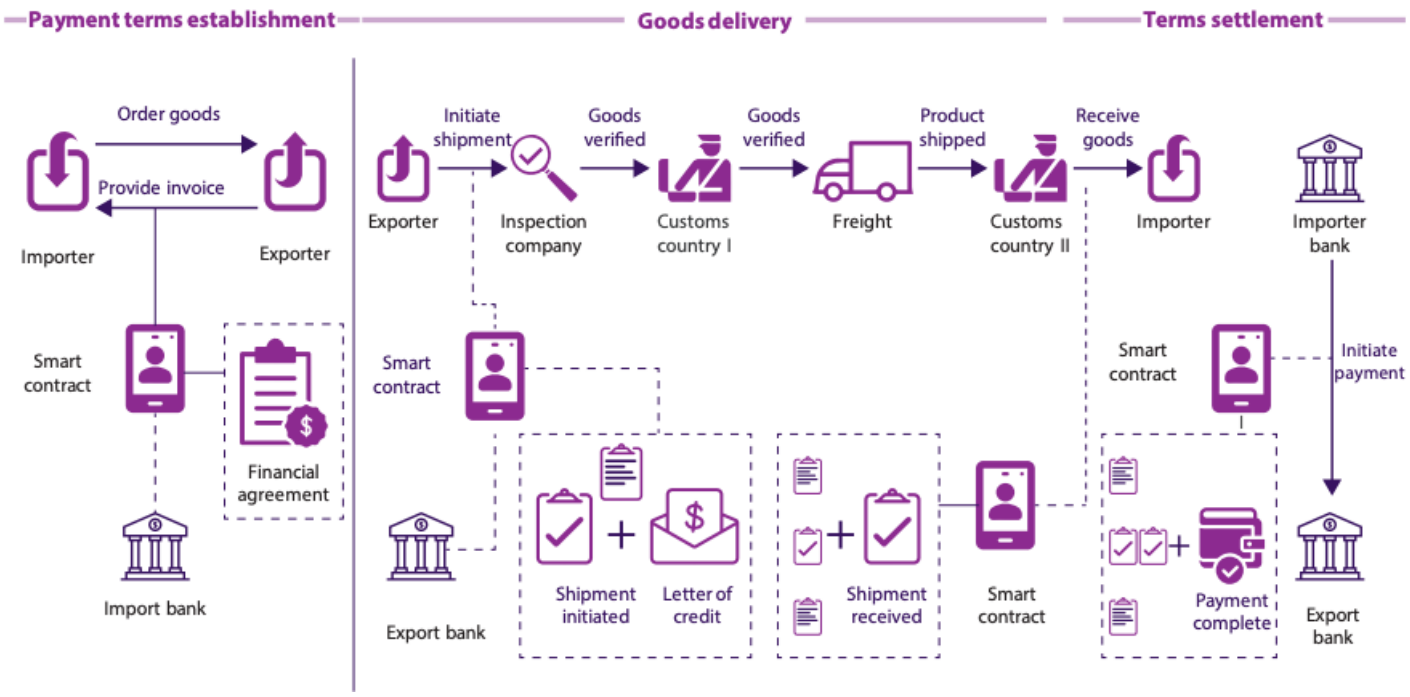

Figure 6. Illustrative trade finance process flow under blockchain setup (Vysya & Kumar, 2019)

The more detailed trade finance process with the use of smart contracts in figure 6 has illustrative the benefits of blockchain, which is real-time examination of approval of financial documents and reduced shipment initiation time. Moreover, invoices accessed on a blockchain platform can enable transparent and real-time views that can track the location of goods, provide ownership proof, and assist in anti-money laundering (AML) (Vysya & Kumar, 2019). Blockchain may be a potent instrument to encourage transparency and traceability of supply chains, assist in the battle against counterfeits, and increase customer trust since it offers new ways to track the journey of goods. However, although using blockchain can improve transparency and assist with product tracing along the supply chain, it can only provide a guarantee that data on the blockchain has not been altered (Ganne, 2018).

5.2 Reduce trade costs

In a survey conducted by the Asian Development Bank (ADB), more than half of the surveyed banks (59%) highlighted the high transaction costs as a significant obstacle to expanding trade finance operations (Asian Development Bank, 2021). Catalini & Gans (2019) studied the economic impact of blockchain and identified two key costs affected by the technology: verification costs and networking costs. The cost of verification refers to the ability to cheaply verify status, which includes information about past transactions and their attributes. Instead, the cost of networking is related to the ability to bootstrap and manage a marketplace without relying on a centralized intermediary. The previous chapter's examples confirm the potentially large influence that Blockchain can have on verification costs, as the technology's transparency and immutability, paired with the ability to automate operations using smart contracts*, might cut verification costs to nearly nothing. Furthermore, by facilitating the establishment of peer-to-peer marketplaces and eliminating traditional intermediaries, blockchain technology has the potential to reduce networking costs (Ganne, 2018).

Blockchain has the ability to drastically lower trade costs, including verification, networking, coordination, transportation processing, and logistics as well as financial intermediation and exchange rate costs, by enhancing transparency and enabling the automation of procedures and payments through smart contracts. Although it can be challenging to estimate, the adoption of blockchain technology may have a significant impact on trade costs (Ganne, 2018). According to Bain & Company, if all parties in the trade ecosystem adopt blockchain correctly, it has the potential to lower trade finance operating costs by 50-70%, depending on the trade finance product (World Economic Forum, 2018). In addition, a Santander FinTech study found that blockchain technology has the potential to reduce infrastructure costs for financial services by $15 billion to $20 billion US annually by 2022 (Gregorio, 2017). Significant cost savings might be expected in the shipping sector, which transports around 90% of all goods sold globally. According

to IBM, shipping a container of avocados from Mombasa to Rotterdam costs about $2,000, of which $300 is spent on paperwork. Additionally, the cost of international maritime transportation might be reduced by up to 15% with digitalization, and shipping companies could save around US$38 billion annually by being completely digital (Allison, 2017). However, the expenses of transitioning to and sustaining a blockchain-based system must be carefully considered. Creating a blockchain platform is a difficult task that requires complex integration techniques. In fact, a major portion of the cost savings received from blockchain technology may not be related to the technology itself, but rather to the integration and streamlining effort required to transition to a blockchain system (Ganne, 2018).

Micro, small, and medium-sized enterprises (MSMEs), which have proportionately higher fixed costs than larger companies, are especially well-positioned to benefit from the potential reductions in trade costs that the use of blockchain technology may enable. This is especially true when these MSMEs are small producers from developing nations (Ganne, 2018).

5.3 Opportunities for MSMEs

Around 90% of all businesses and 50% of employment globally are held by micro, small, and medium-sized enterprises (MSMEs). They are crucial to the regular delivery of products and services across the world. However, many MSMEs have difficulties in trading and growing. One of the major challenges for MSMEs in the informal economy, according to the World Bank's Enterprise Survey, is a lack of access to financing (Bizama, 2022). The rejection rate for MSME trade finance proposals is 45 percent (Figure 7). According to the Asian Development Bank (ADB) “among MSMEs initially rejected that sought alternative financing, 47 per cent were unable to find anything appropriate”; this excludes companies that never request for finance in the first place (Kim et al., 2019). MSMEs, especially those in developing nations, often find it difficult to secure funding for a number of reasons, including a higher risk profile and a lack of additional collateral (Patel &

Ganne, 2012). According to anecdotal data, banks are hesitant to invest money and time in performing KYC, especially for new clients who are unlikely to be profitable. Banks are reluctant to provide credit guarantees to MSMEs due to the frequently poor profitability of their transactions and the absence of detailed financial and other records, which makes it difficult to assess their creditworthiness using standard methods (Ganne, 2018).

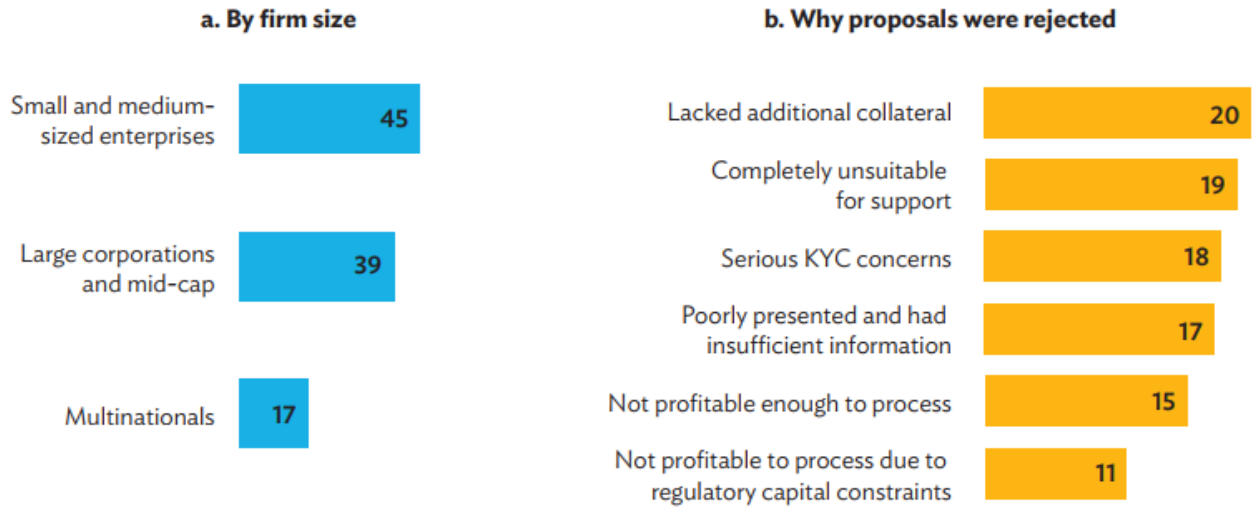

Figure 7. Trade finance rejection (% of applications, average across bank respondents) (Asian Development Bank, 2019)

At three levels, blockchain could assist small businesses and producers in gaining access to finance.

First, a significant barrier for MSMEs and small producers is the ability to trace transactions and evaluate the creditworthiness of businesses and individuals. The immutable nature of Blockchain may make these tasks easier. To take it a step further, in December 2017, six international businesses, banks, and fintech startups introduced a project that would employ technology to collect data on the cost, sustainability, and quality of 10,000 Malawian rice farmers' production processes in order to help them access financing on preferential terms based on the information supported by the blockchain (Hutton, 2017).

Secondly, MSMEs lack the abilities and resources necessary to handle complicated procedures. There are several platforms that are using blockchain that can make it easier to track shipments and payments and approve orders. The We.trade is a platform for MSME buyers and sellers that is supported by twelve European banks. The platform makes sure that all participants follow KYC requirements by developing a standardized registration process for MSMEs that subscribe to the platform. It enables MSMEs to identify counterparts for open account* trade transactions, whilst the blockchain system enables all participants to have real-time access to the same documentation (OECD, 2021).

Thrid, Blockchain-based solutions enable SMEs to participate in international trade by eliminating the need for potential intermediaries to connect buyers and sellers. The FastTrackTrade platform is one example of a platform that uses technology to create a digital trade network of MSMEs to facilitate business transactions between buyers and sellers and give participating companies direct access to the trade finance services of various fintech* companies, thereby avoiding banks (OECD, 2021).

By lowering transaction costs, blockchain may not only make it simpler for MSMEs to communicate with customs officials but also with customers and companies along the supply chain, allowing MSMEs to increase their exports. MSMEs might benefit the most from blockchain, as indicated in a European Parliament report (European Parliament, 2018). Like every innovation, the technology carries with it the potential to disrupt specific industries and worker segments, even while it can make it easier for MSMEs and small producers to participate in global trade. Opportunities and advantages may not be distributed fairly (Ganne, 2018).

6 Can Blockchain transform the future of trade finance?

6.1 A game-changing in Letter of Credit and towards paperless trade?

For trading activity, trade finance availability is essential. Since most purchasers prefer to make payments after receiving their purchases in a timely manner, only a small portion of international commerce transactions are made in cash up front. Approximately 80% of trade is funded by some banking services, including traditional procedures like letters of credit (WTO, 2016a). However, this financial service has always been critical in funding international trade operations to supply any country with essential goods. Despite all of this, there are still many problems with this payment method because it relies on a slow, outdated paper-based system that requires communication and cross-verification of official papers between all parties (Amaren, Ismail, & Nor, 2020).

The Boston Consulting Group discovers that throughout the process, more than 20 participants are typically involved in a single trade financing transaction. There can be about 5,000 data field interactions in a single transaction, according to a review of the end-to-end trade finance process. Only 1% of these interactions add value, while 85% to 90% of transactions are just "ignore/transmit to the next party" actions. The numerous parties and documentation necessary to facilitate and manage one transaction account for a major portion of the complexity in trade finance (Figures 8 and 9) (Botton Consulting Group, 2017). In a typical transaction, multiple copies are sent back and forth between the parties via various telecommunications methods, such as postal mail, faxes, or scans. This traditional model has a significant impact on the letter of credit and lengthens the process between the applicant and the issuing bank, particularly when the transaction involves shipping at tight schedule. The time and money required to process these documents frequently have negative impacts on the transportation businesses and slow down the transaction (Amaren, Ismail, & Nor, 2020).

A growing number of institutions are now looking into how Blockchain could assist automate the procedure, increase transaction efficiency, and improve security due to its transparent and secure nature (Ganne, 2018). In the past few years, numerous proofs of concepts have been created to simplify and automate letters of credit procedures, and blockchain technologies in this area are currently heading toward commercial use. In China, the first cross-border Letter of Credit blockchain transaction was successfully performed in 2020 by HSBC banks, a step that brings the commercial reality of China's trade's digitalisation one step closer. The live transaction featured Fox & Lillie, an Australian exporter of wool and a customer of HSBC Australia, selling a bulk cargo of wool to China SDIC International Trade Nanjing Company Limited ("SDIC Trade Nanjing"), the owner of the largest B2B wool trading market in China. On behalf of SDIC Trade Nanjing, HSBC China issued a digitized Letter of Credit (LC) through Voltron, a blockchain-based documentary trade finance network. To finalize the trade, Fox & Lillie then examined, and uploaded their own trade documentation to the platform (HSBC, 2020).

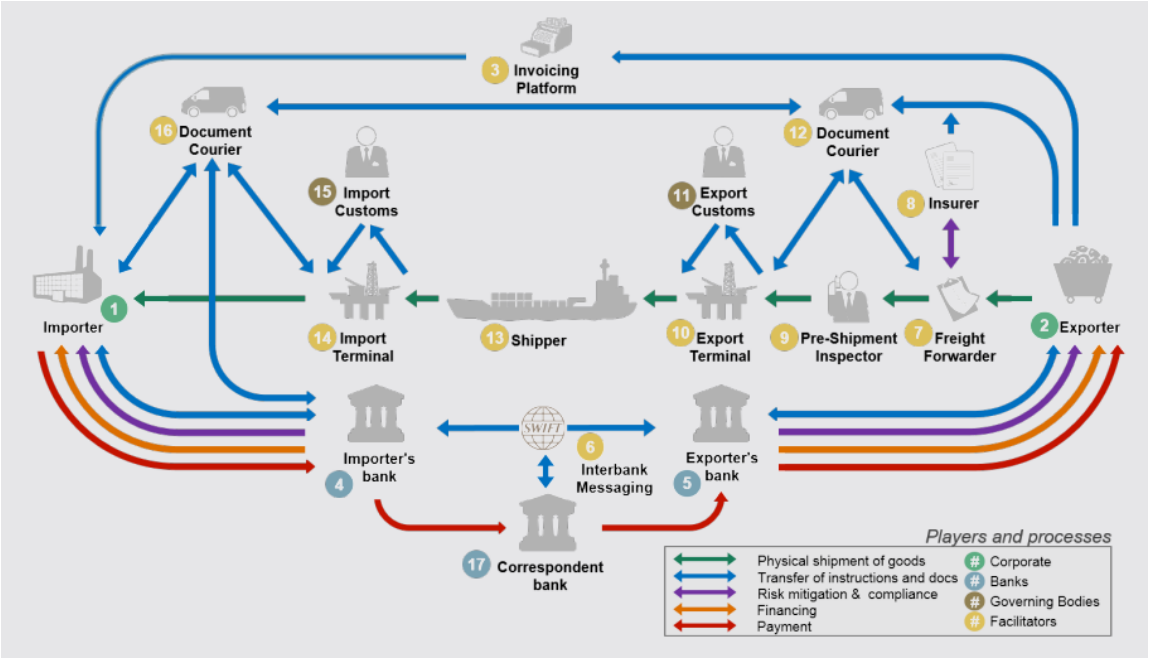

Figure 8. Traditional Trade Finance ecosystem highly fragmented across multiple different entities and processes (Botton Consulting Group, 2017)

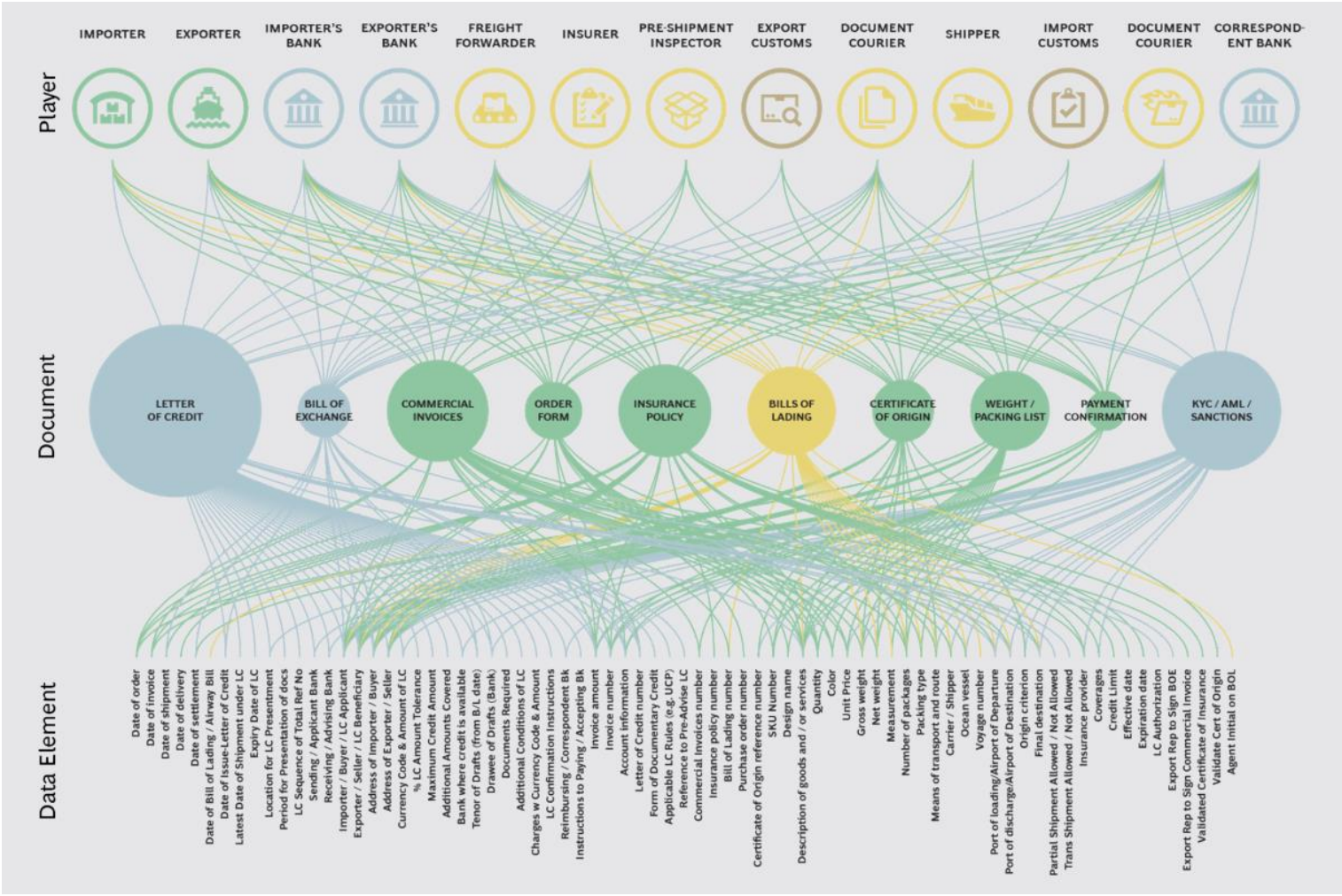

Figure 9. Numerous players, documents and data elements are involved in a trade finance transaction (Botton Consulting Group, 2017)

According to the bank, the exchange of the electronic documents took place in under 24 hours as opposed to the standard 5 to 10 days for exchanging traditional paperwork (HSBC, 2020).

Paper-based letters of credit take longer to process since they require "physical documentation exchanges," transfer bills of lading, and separate interactions between several parties. Blockchain can change this by allowing for the electronic transfer of bills of lading and other required documents, connecting all parties in a single, private network, allowing for immediate updates, and getting rid of the lengthy lead time for back-and-forth communication among the various parties in L/C transactions (Figure 10). This reduces the time of credit transactions (Amaren, Ismail, & Nor, 2020).

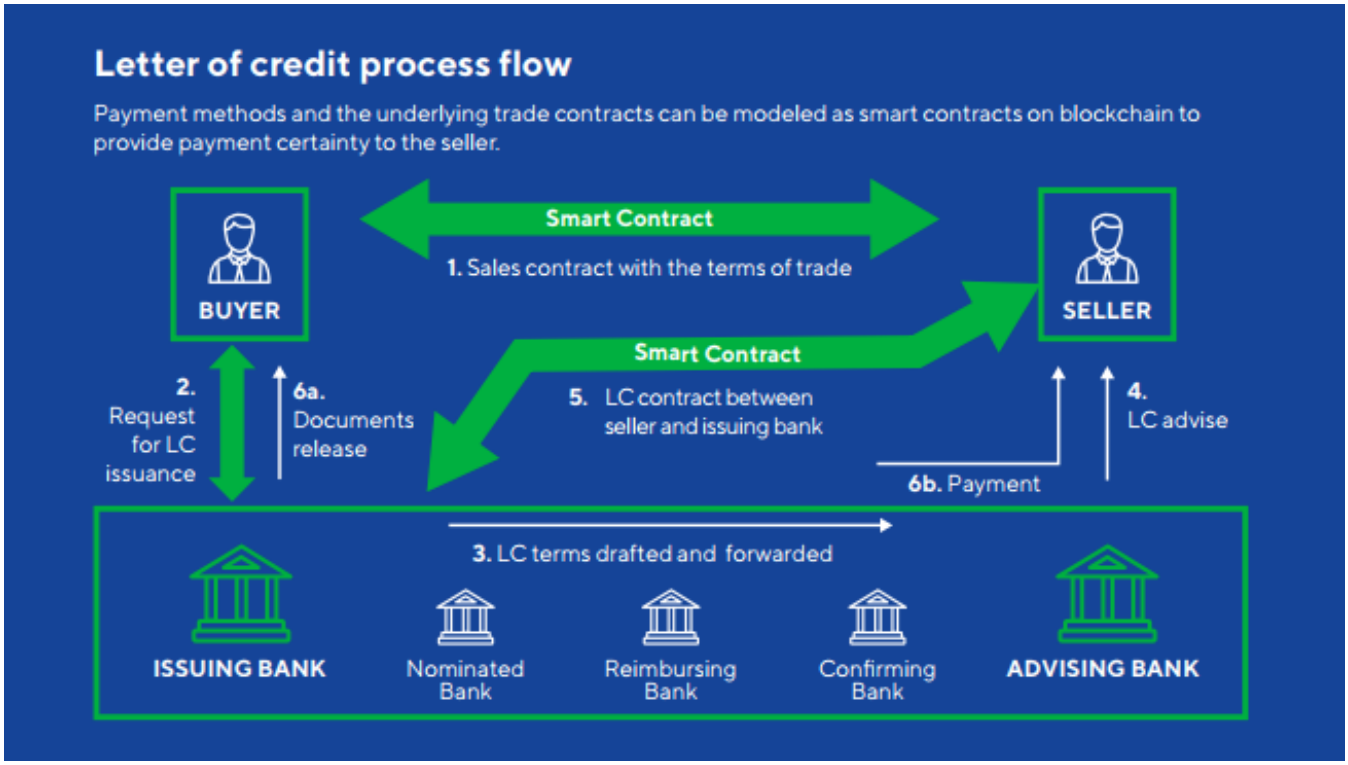

Figure 10. Example of letter of credit process (Cognizant, 2017)

6.2 Cross-border payments

Cross-border payments, which make up around 40% of worldwide payment transactional revenues, are one area where blockchain technology might have a big influence (McKinsey & Company, 2016). With the rise of new players that offer customers and businesses alternative, improved value offerings to process cross-border payments through the internet or via mobile phones, cross-border payment processes have already evolved significantly over the last several decades. Nowadays, many people use e-payment alternatives like PayPal, Amazon Payments, Alipay and Revolut. Due to low levels of banking penetration in developing nations, particularly in Africa, mobile service providers have created mobile banking products as an alternative to and addition to traditional banking. Mobile banking, or using a mobile phone to transmit and receive payments and carry out other banking operations, has grown tremendously in recent years and is beginning to take on a global scope (WTO, 2016b).

Cross-border payments are frequently routed through a number of counterparties as banks continue to utilise a complicated infrastructure. When banks in different countries do not have a relationship with each other, a correspondent bank must be used when making cross-border payments (Figure 11). The payer's bank frequently uses the SWIFT network to look for a correspondent bank that has a relationship with the payee's bank because many banks globally do not have a link with one another. The payer’s bank sends the money to the correspondent, and it will pass on the right amount to the destination account after deducting a fee. In addition to the transfer charge and exchange rate markup you've probably already paid upfront, costs between 25 and 75 USD are typical. While most cross-border payments can be completed in one to two days in theory, it usually takes three to four working days to complete. This method can be secure and dependable, but it's often costly and time-consuming at the same time (Rozsa, 2022).

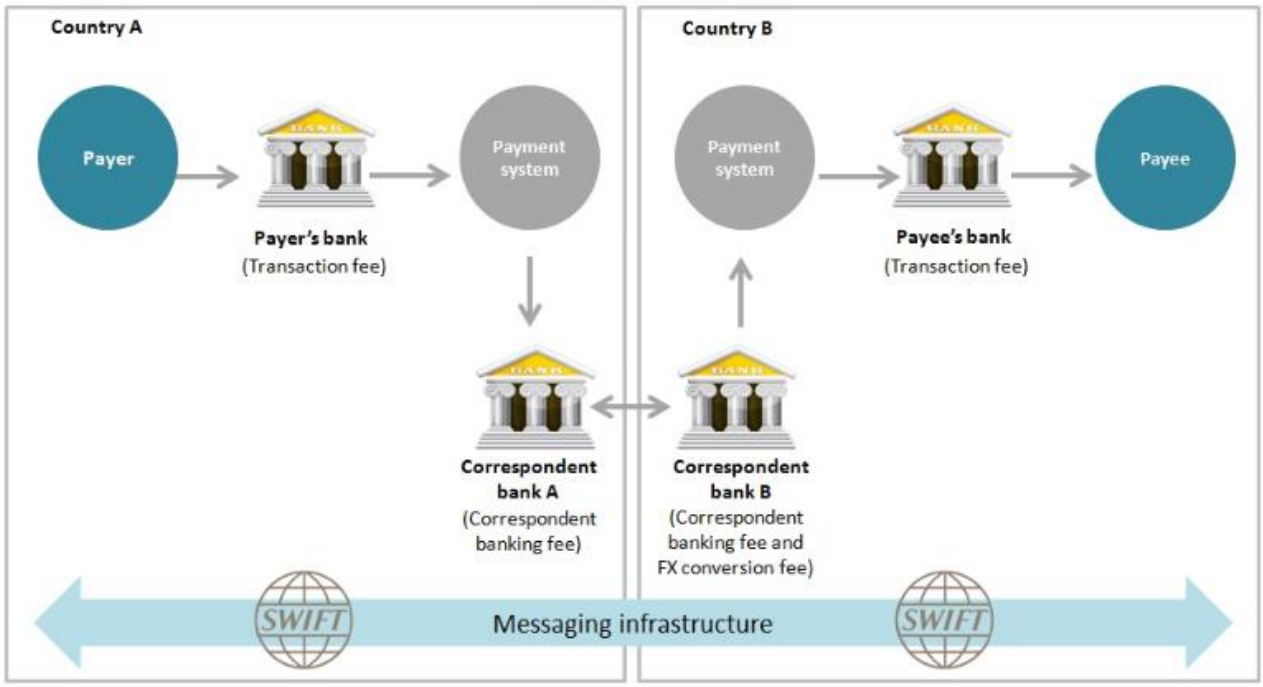

Figure 11. The Correspondent Banking Model (Barry & Zaccardi, 2015)

Due of the current system's limited efficiency, businesses like Ripple have been working to provide alternatives using the Blockchain technology. Ripple is a service that enables real-time worldwide payments without locking up capital in destination markets by removing pre-funding requirements and introducing variable payment terms to help unlock trapped capital. The primary goal of Ripple is to provide solutions for this combination of digital assets with the current fiat economy. By enabling transaction settlement in 3 to 5 seconds, Ripple gives banks and other financial organizations a way to enhance their systems (Villafuerte, 2022). More than 100 banks and financial organizations have given Ripple licenses, and the company's goal is to make cross-border payments a truly global activity (Ganne, 2018).

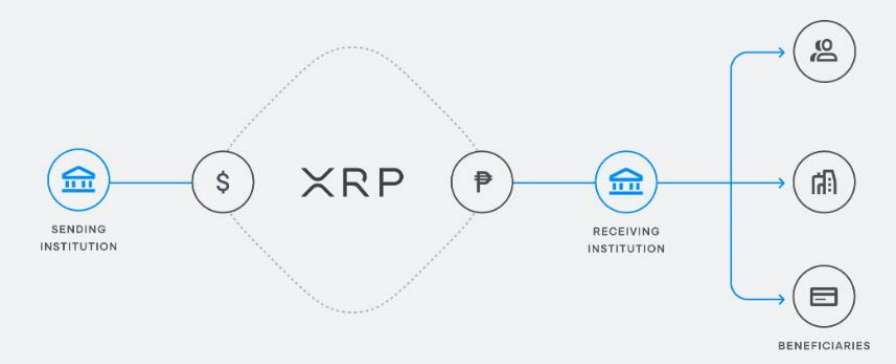

Figure 12. How Ripple's cross-border payments solution works (Ripple, 2022)

In October 2022, Visa has submitted multiple cryptocurrency-related trademark applications. With an emphasis on Latin America, Asia, and Europe, payment giant Visa has partnered with the worldwide exchange FTX to offer debit cards in 40 countries (Dovbnya, 2022) . The change would allow FTX users to pay for goods and services with "zero-fee" debit cards. Furthermore, according to the firm website, card ownership is free, thus spending cryptocurrency may become a lot easier (Hall, 2022). Moreover, crypto exchange Blockchain.com has teamed with Visa to launch a crypto card, initially available only to US residents, that allows users to purchase with their crypto or cash balance wherever Visa debit cards are accepted. Mastercard, the main opponent of Visa, joined together with BitOasis, the top cryptocurrency platform in the Middle East and North Africa (MENA) to introduce a number of crypto card programs aimed at promoting the adoption of digital assets in the region on October 25 (Huigsloot, 2022).

With its promise of improved efficiency, faster settlements at lower costs, decreased risk of fraud, auditable traceability, Blockchain is considered as a "must have" technology by many financial institutions. Will blockchain be the future of cross-border payments? Only time will tell. The technology is still growing, and its full potential is being explored. Furthermore, numerous significant operations have tried the system and are actively establishing themselves in the blockchain world. Current technical challenges and a lack of interoperability of platforms remain a challenge. As a result, adoption is likely to be moderate (Ganne, 2018).

7 Conclusions

Technological developments have shaped the world as we see it. Blockchain – a distributed ledger technology – has attracted a lot of attention for its ability to transform the world, particularly the trade finance system.

Several challenges must be resolved before the technology can be widely used. The technology is not new, but it is still in its testing phase and has not yet gained widespread use. Additionally, changing current systems can be quite costly and time-consuming. It is important to thoroughly consider the trade-offs. More importantly, challenges including technical, interoperability need to be addressed before it can be adopted worldwide. In particular, blockchain solutions need to consider developing the ability to communicate and exchange data with each other in order to remove the standardization barrier.

Despite the shortcomings of blockchain, the technology has brought a lot of opportunities for trade and financing. Blockchain provides appealing promises because it eliminates the need for a single reliable third party and enables secure, transparent, and immutable sharing of digital documents and information. The use of smart contracts that provide a real-time view that can improve transparency and assist with AML. It could have a significant impact on trade operations, which depend heavily on paper. By streamlining and digitalizing processes, it can remove the border between countries and help payments move more easily. It might eliminate fraud, improve value chain traceability, trust, and provide new business opportunities for MSMEs.

The industry is being shaking up by blockchain, which is forcing reputable financial institutions to change. Blockchain might end up being the infrastructure for financial services in the future if the recently developed applications are successful and interoperability problems are solved, allowing for the connection of various payment platforms. Blockchain has the potential to transform global trade finance, but smart trade needs smart standardization, and smart standardization can only be achieved through collaboration. International trade, including trade

financing, will transform tremendously in 10 years if we are successful in building an ecosystem that supports the further development of Blockchain.

7.1 Suggestions for future research

Basically, this thesis does not deeply discuss the four blockchain types and how they can be used. It would be interesting to do research on which blockchain type should be used and for which parties.

Like many other innovations, blockchain has the ability to disrupt some sectors and categories of workers. For example, the bank So the question is, would blockchain completely remove the bank and how can the bank adjust to the changes by adopting blockchain?

Supply chain companies might start using cryptocurrency to trade and settle cross-border payments. So, how can firms manage the changes that cryptocurrency makes to their cash flow as the price of cryptocurrency is not quite stable.

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