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Blockchain and EU Trade Finance

Achieving single market harmonisation through payment system improvement

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The goal of the research is to present a detailed, simple and easy to understand explanation of blockchain technology and how it can improve the current situation in the financial industry and trade. Modernising outdated payment systems is a priority in both the banking industry, plagued by bureaucracy and trade finance as it can both aid retention of private and corporate customers and increase transaction efficiency.

Keywords	Blockchain, Payments, Europe

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1 Introduction

Distributed ledger technologies, of which blockchain is the best known, have taken the world by storm in recent years thanks to the surge in popularity of cryptocurrencies such as Bitcoin. Cryptocurrencies and distributed ledger technologies are an entirely new phenomenon and are as of yet not sufficiently explored, but there is high potential for them to be applied to a variety of different areas, including the financial industry.

In the last few years, financial industry giants have extensively researched and experimented with distributed ledgers. Several research consortiums have been created by banks rushing to gain market share by becoming industry innovators, and new payment and trade clearing systems were pioneered. The industry is slowly getting ready for blockchain to replace legacy interbank payment systems, but regulators are lagging behind and some banks remain skeptical, fearing the risks that the new and unexplored technologies may bring.

In the financial industry, payment systems are perhaps the area with the widest reach and largest number of stakeholders. Governments, businesses and individuals all need a fast, secure and reliable method of sending and receiving money. Blockchain technology has the potential to replace outdated payment systems and much has already been done for payment system innovation, most notably with the introduction of Ripple which has gathered support from some of the biggest names in the banking industry. Some of the most outdated payment and assurance protocols are still in use in trade finance. Replacing them with distributed ledger systems could greatly increase trade volume and significantly improve harmonisation of the bureaucracy-laden European market.

The purpose of this research is to summarise the existing data on blockchain technology and the European financial sector, answer the question of whether replacing current payment systems with those based on blockchain technology (or other distributed ledger technologies) could further harmonise European finance and trade and how, as well as explore the potential risks and challenges of blockchain integration into the EU's financial ecosystem.

2 Literature review and research methods

Earlier publications mostly focused on trying to explain blockchain technology as part of the Bitcoin ecosystem, but authors' focus is slowly shifting towards speculation of potential implementations of distributed ledger technologies. The European Union is also recognising the potential benefits of blockchain for citizens, businesses and governments alike. It has launched several blockchain development initiatives, most notably within its Digital Single Market programme. However, much of the available information remains scattered and unclear to laymen and business leaders alike. There are not many sources attempting to explain the European Union's governmental and financial structure and activities, and its compatibility with the complicated structure of distributed ledger technologies. This makes it difficult to analyse the current situation in the European financial sector and get a clear picture of where the financial industry fits inside the structure of the European Union, how technological innovation could change that sector, what impact it would have on the EU's overall structure and how this would affect all industry stakeholders.

Blockchain technology remains in a legal grey area. For many researchers the greatest challenge is finding a suitable way to tackle this topic and break it down into smaller units to be analysed. Blockchain, unrelated to cryptocurrencies, has potentially many applications and encompasses multiple industries, and if implemented could have a variety of different effects on the economy, from the way stock markets operate to modern banking, to rewriting legislation and a change in the role of central banks. In addition, blockchain itself must be thoroughly explained in order for the reader to understand the security and privacy implications of using this technology.

Many governments have online databases of financial legislation and laws concerning international trade and investment available for free. From there, data relevant to the main research questions was collected and examined. Research bibliography ranges from blockchain manuals for both developers and end-users, to news articles about payment systems and trade finance.

Information about the EU's financial structure and governance was sourced from the publications by key European organisations such as the European Central Bank, European Payment Council and European Banking Institute, as well as archives Eur-Lex and Eurostat. Trade finance and payment system statistics and figures used in the text

are based on research by the International Chamber of Commerce, World Economic Forum, the World Trade Organisation as well as recent results by several university researchers. Data relating to blockchain technology was based on literature by various published authors, most notably Daniel Drescher (2017), Manav Gupta (2018) and the Bitcoin whitepaper by Satoshi Nakamoto (2008). All data was collected, sorted by topic and arranged in the order presented below. Sources mentioned in each publication were also examined for accuracy and relevance. Explanations and opinions are the author's own.

The goal of the research is to present a detailed, simple and easy to understand explanation of blockchain technology and how it can improve the current situation in the financial industry, as well as risks distributed ledger technologies carry. The results are meant to educate business owners and individuals about different opportunities in the financial industry in the future and allow them to better adapt to changes in the financial industry.

3 What is blockchain technology?

Blockchain technology was originally devised as the backbone of the digital currency Bitcoin, created by a person or people under the pseudonym Satoshi Nakamoto (Nakamoto 2008). The publication of Bitcoin coincided with a blog post by cryptographer Nick Szabo (2008) describing a similar idea of "bit gold", which prompted some to believe Szabo was in fact Nakamoto (Popper 2015). Szabo denied these claims.

However, although blockchain is often mentioned alongside cryptocurrencies due to their recent popularity, they are separate concepts – Bitcoin is an unregulated digital currency, and it merely uses blockchain technology to verify and secure financial transactions.

The blockchain has many definitions, of which some focus on its implementations whilst others describe its technical properties. Don and Alex Tapscott (2016: 25) define it as a "digital ledger of economic transactions that can be programmed to record virtually everything of value and importance to humankind". In contrast, Drescher (2017: 35) defines it as "a purely distributed peer-to-peer system of ledgers that utilizes a software unit that consist of an algorithm, which negotiates the informational content of ordered and connected blocks of data together with cryptographic and security technologies in order to achieve and maintain its integrity."

The term “blockchain” is commonly used to refer to a single chain containing many transcripts of records, per Tapscott’s’ definition. However, blockchain technology consists of not only one ledger chain but an entire complex system of peer-to-peer protocols, ledgers and cryptographic algorithms designed to preserve the network’s integrity and security, as Drescher’s definition points out.

It has origins in cryptography and data structures, areas of computer science. The first form of blockchain was the hash tree, or Merkle tree, created by Ralph Merkle (1982), which verified packages of data between computer systems in a peer-to-peer network of computers.

In 1991, the first cryptographic “chain of blocks” was designed by Haber and Stornetta (1991: 5). Its purpose was to allow irreversible time-stamping of digital documents in order to protect the creators’ intellectual property rights, a common theme in cryptography as well as a common application of modern-day Blockchain technology. The Merkle tree was implemented into the design in 1992 in order to seal multiple documents into one information set, or “block”.

In 1997, Adam Back (2002) invented Hashcash, a service used to throttle email spam and attacks on a server. Hashcash is one of the most popular examples of a proof-of-work systems, computer protocols wherein a server, which hosts the information a user computer requests access to, sends the user a small task to solve a mathematical “puzzle” in order to access the server. The puzzle must be hard enough to deter malicious attacks but easy enough for the host server to check quickly and easily.

These early cryptographic findings served as the foundation of what is today known as Blockchain, and Hashcash itself was incorporated by Nakamoto in 2009 into the process widely known as Bitcoin mining, explained in chapter 4.

In the meantime, peer-to-peer sharing had drastically grown in popularity – music sharing services like LimeWire and Napster emerged in the late 1990s (Hong 2004: 2), completely changing the music industry by attempting to cut out music producers, industry intermediaries, from the equation. Torrent software became a popular way to share and download files as piracy laws had not yet been enforced to the extent that they are today, which in turn helped normalise peer-to-peer services amongst everyday users.

Likewise, Blockchain allows for information to be equally distributed and verified throughout a network of computers. This information can be of any type – records, contracts or financial data can all be distributed through the blockchain. The network of transactions is completely decentralised, called a “distributed network” – that is, there is no central bank or singular authority controlling the inflow and outflow of information, making the transaction process significantly faster and less costly.

Distributed ledger technologies including blockchain can nevertheless be public (like Bitcoin) or private, and many banks today are experimenting with asset transfers using their own proprietary blockchain networks (Arnold 2017).

4 How does Blockchain Technology work?

In order to examine Blockchain technology in the context of trade finance, and what that means for the EU single market, the mechanics of Blockchain must first be explained.

4.1 Protecting integrity and establishing trust

Software systems of any kind are designed as either centralised, focusing around a central entity which regulates different components or “nodes”, or decentralised/distributed - forming a network of independent nodes which share information between themselves without the need of a central entity to ensure the system’s integrity. Both architectures are shown in Figure 1. Some systems combine features of the two types of software architecture, but always remain either one or the other at their core. For example, if a computer is a part of a seemingly decentralised network of machines but is the only one with the ability to shut it down completely, then that network is inherently centralised.

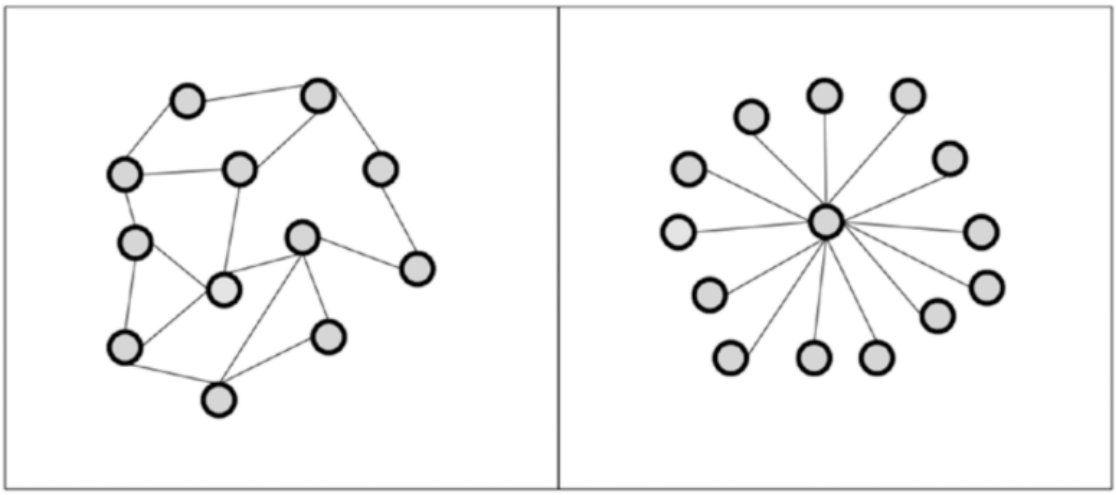

Figure 1. Decentralised (left) and centralised (right) networks (Drescher, 2016)

Distributed software systems require integrity and trust to function as intended: integrity means that every feature functions as intended, all the information is correct and all of the users' sensitive information is private - in other words, the system is safe to access and use. If a decentralised system lacks integrity, it cannot function. Users' trust is given in advance depending on how strongly they believe in the system's integrity and can rise or fall over time. Distributed systems cannot function without users, and if there is no trust in a system - nobody will want to use it.

In peer-to-peer networks, however, the number of nodes is unknown, as is each node's trustworthiness. Their number can change over time as users leave and join the network, and there is always a risk of malicious nodes attempting to intercept transactions between nodes and gain access to sensitive information. Napster and LimeWire mentioned in chapter 3, for example, were notoriously rife with computer viruses (Anon 2004). In addition, there could be any number of technical errors that could compromise the users' transactions and security.

In computer science, the problem of network trustworthiness is known as the Byzantine Generals Problem (Lamport, Shostak and Pease 1982) and is the key issue Blockchain technology is meant to solve.

4.2 Proving ownership

As Blockchain technology was developed to be the backbone of Bitcoin, it is only natural that it is based around transactions as its main unit. It is designed to solve the problem of proof of ownership and prevent double spending, a problem unique to the digital economy where the value of an asset is not tied to tangible valuable goods, without the need of a neutral trusted party or “middleman” overseeing a transaction. In order to determine the ownership of an asset, the owner and asset must be identified and a connection between the asset and the owner established.

Proving ownership and verifying information, including identities, in a blockchain is based on the Byzantine Generals Problem. Blockchain technology relies on a distributed network of users in order to function. The users (nodes) in this network act as witnesses for each transaction.

In court, having only one or a few eyewitnesses at the scene of a crime is weaker evidence than an entire crowd viewing an event from different perspectives. One witness can have a biased opinion, and a few can be bribed to lie about what they saw, but an entire crowd of people is a lot more difficult to manipulate and therefore likely to give honest testimonies that resemble one another.

In the blockchain network, all nodes receive the information of the transaction and keep a copy of it for themselves. They act as witnesses of the transaction. As long as there are more honest nodes (the proverbial Byzantine generals) than “traitors” in a network, the ownership transfer will be successfully completed, and all the necessary information verified.

4.3 Preventing double spending

Double spending is an issue unique to digital transactions. Data on computers can be copied infinitely, which is a problem when dealing with digital currencies or other digital products with copyright restrictions. Copying digital assets renders them useless and makes it impossible for any digital economy to function.

Copying data from one user to the entire system takes time, so not all nodes in a distributed network will have the same information at all times. This makes it possible to sell

the same asset twice to separate users. To combat this, blockchain technology uses cryptographic protocols to accurately identify assets and transaction participants, as well as the previously explained Byzantine General principle of honest nodes outnumbering dishonest ones.

Each transaction within a blockchain is encrypted using a hash function, a mathematical function that changes a variable string into a string with a fixed amount of characters and numbers (hash). Any change in the variable string results in a completely different hash. This alone is not enough to make the transactions incorruptible. A hash of a transaction consists of the current transaction data, records of all previous transactions (forming a chain of transactions, as seen in Figure 1), as well as a Nonce – a number chosen so that each hash ends in two zeroes.

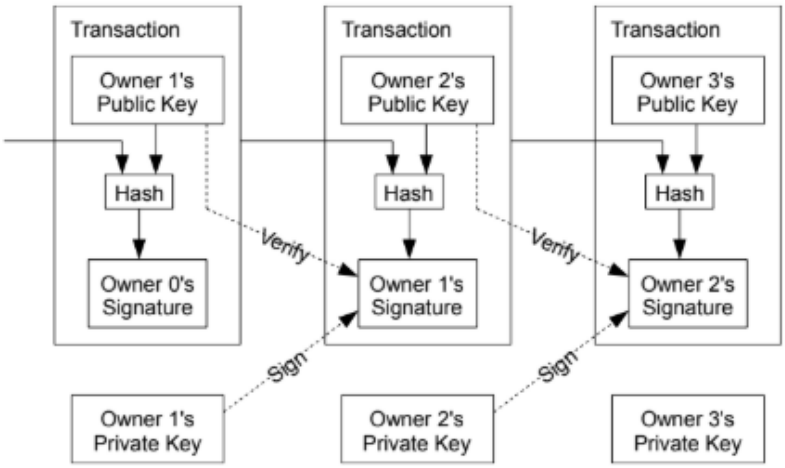

Figure 2. Hash chain (Nakamoto 2008: 2)

The basic unit of the blockchain is a ledger called the block. A ledger consists of a chain of transactions as described above, packaged into a single spreadsheet. This block is then shared across the blockchain system – a distributed peer-to-peer network consisting of many machines all over the world called nodes. Every node in the network keeps a copy of this block, and the information in the chain is refreshed every ten minutes completely automatically on all nodes at the same time. This way, if someone attempts to change the ledger in any way, other nodes will retain the original information. Once a ledger or registry is updated, it can no longer be changed – a user can only add entries into it.

Each transaction is recorded in a ledger one after another. All transactions are encrypted and linked together using cryptography, forming an irreversible chain. Changing or rolling back one transaction would require reversing the entire process and changing all transactions that came before it.

To add additional security to the transactions, the blockchain works on the basis of cryptography, using digital signatures and wallets, which act as two cryptographic keys – encrypting and deciphering hashed transactions. Both digital signatures and wallets are mandatory in order for a transaction to go through and currency to change hands.

Before a transaction is completed, it must first be “signed” using a private key. It is then distributed across the network where individual nodes check the validity of the information in the transaction. If everything is in order, the transaction is logged into a block of transactions and becomes irreversible. In Bitcoin trading, this validity check is known as the “mining” process – individual nodes in the network compete to verify the information and put it in blocks (produce “proof of work”), for which they receive a small amount of coins.

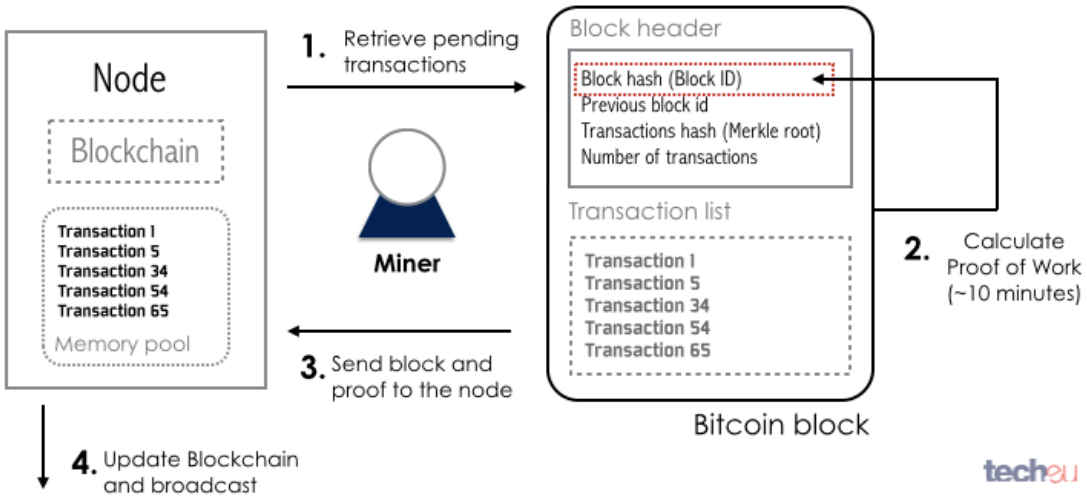

Figure 3. Bitcoin mining (Barrera 2014)

The faster the machines, the more likely they are to succeed, and the more they will be compensated. The probability of success is, however, very low. This led to the increase of Bitcoin miners in mid-to-late 2010s (Xie 2018).

It is important to note that, despite numerous security measures embedded in Blockchain and other distributed ledger technologies (DLTs in further text), these networks are not impermeable, and the information is not incorruptible. In the past, there have been numerous attacks on DLT networks (explained in chapter 5), and several digital coin exchanges were successfully hacked, as the goal of the blockchain security protocols is to discourage abuse rather than completely prevent it.

4.4 Blockchain's relevance and applications

Blockchain technology has soared in popularity in the past few years. This can mostly be explained by the rapid increase in the price of Bitcoin, the most well-known and oldest (Nakamoto 2008) of all digital currencies existing on the market today. Many companies have begun accepting Bitcoin as a form of payment, freelance artists and web developers ask to be tipped in Bitcoin, and risk-loving investors are turning to alternative cryptocurrencies such as Litecoin to make up for missing their chance to invest when Bitcoin's value was negligible. Entrepreneurs and governments also began to realise the potential of blockchain technology and its applications.

Blockchain technology could improve a variety of products and services. Insurance claims, marriage and birth certificates as well as cross-border payments can all be processed faster. The blockchain can be used to manage a ledger of ownership rights and allow for transparent payments of royalties, solving many problems in the photography and music industry. Election polls can also be made more transparent and shipments can be tracked more accurately (Pilkington 2015).

Blockchain technology has many applications and has often been compared with the World Wide Web in terms of innovation. The cryptocurrency bubble, made possible with blockchain technology, is certainly reminiscent of the Dot Com bubble in the late 1990s and early 2000s (McCullough 2018).

5 Controversies

Distributed ledger technologies (DLTs) rely on pseudonimity in order for transactions to be successful and secure. Public as well as private blockchains come with several issues as a result:

5.1 Privacy

Even though information stored in the blockchain is thought to be secure and blockchain technology is associated with data privacy, it is not inaccessible. There have been several cases of privacy breaches since its inception, most notably the hacking of Mt. Gox. Originally started as an exchange platform for cards of a popular card game (Mt. Gox being an acronym of “Magic: the Gathering Online Exchange”), the largest Bitcoin exchange at the time, in 2014, followed by the downfall of DAO (a digital venture capital fund) (Hacker and Thomale 2018: 10) and repeated attacks on Coinbase, another cryptocurrency exchange. In all these cases, the perpetrators were never identified. This brings into question the trade-off between data privacy and security. Blockchain technology is favoured by data privacy advocates who oppose private companies collecting personal information (and in many cases selling it to third parties), but when users’ digital wallets are emptied and personal information is stolen by hackers, there are virtually no ramifications for the perpetrators, as the blockchain is nobody’s property and authorities usually do not pursue them.

5.2 Cost

To run efficiently, blockchains use massive amounts of electricity (Naucler 2019), and any kind of change made on a government level is going to be time-consuming and expensive. Decentralisation, especially decentralisation of administrative systems, is costly. Within DLTs duplication of effort is inevitable, yet many blockchain enthusiasts and evangelists today (Tapscott and Tapscott 2016) are pushing to apply it to everything, arguing that it will cut administrative costs – which is not untrue, but it could be raising others, with the added loss of control.

5.3 Governance

Public distributed peer-to-peer networks are not governed by any single authority. There is no single group or individual responsible for blockchain malfunctions or transaction fraud. As such, they are a regulatory and legal no-man’s land and have been used in the past to fund criminal activities and terrorism (Oftedal 2015: 13) as well as encourage money laundering. Users of DLTs are not always required to provide their full identity in order to receive goods, and company ICOs (Initial Coin Offerings) are not regulated to the same extent as traditional business IPOs (Weinland 2019). They are instead often

regarded as a publicly available, open-source, low-cost and 'trendy' alternative for ambitious finance start-ups instead of a regulatory liability. Even though the situation is slowly improving, and attempts are being made to discourage fraudulent activity, the mechanics of Blockchain technology make it very challenging. Consumer protection laws apply to transactions made through blockchain, but which country's legislation will be applied to a fraudulent transaction depends entirely on the end customer's nationality - and not all have, or will apply (Anwaar 2019), sufficient legislation that can protect them.

5.4 Regulation

The lack of financial regulation remains the greatest challenge facing blockchain technology to date. An unregulated market is an untrustworthy one, which brings into question the feasibility of a service that aims to be the transfer of trust in a trustless world, by way of increasing privacy and transparency and lowering barriers to entry. This issue is closely related to blockchain's problems with governance and security (mentioned in chapter 4.3) and its reputation as the financial Wild West. The financial industry of every economy relies on few central figures to regulate the market, both domestically and globally, and is based on practices which predate the Industrial era and are modified on a regular basis to fix existing issues in the economy, often creating new ones. It is important to remember that, even though it is difficult to imagine life without them, all economic practices and norms known to date are man-made and therefore inherently imperfect. Instead of replacing old economic standards with new ones (which would inevitably result in chaos), new legislation and technologies are usually adapted to older principles, some of which date as far back as ancient Mesopotamia, resulting in the creation of countless legal and logical inconsistencies.

Blockchain technology was originally designed to be the basis on which digital currency Bitcoin works and is, as such, intrinsically connected to the financial industry. From chapters 3 and 4, which explain how the blockchain works and why many consider it to be revolutionary, it is clear that the new distributed technologies are the antithesis of the current global economic model - a series of interconnected economic constellations each regulated by a central entity. Old regulations must be adapted to include blockchain, which will inevitably change the way the economy works. Changing these regulations and the inclusion of blockchain-based trading platforms and services will introduce new opportunities, as well as new threats on every level of the financial supply chain.

6 EU regulation and financial supervision

Trade finance refers to the financial processes and products used in international trade and commerce in order to ensure a secure and efficient exchange between a buyer and seller. Banks and financial institutions act as intermediaries in order to reduce various risks associated with international and domestic trade, as well as offer additional financing services and make payments more flexible. Financial intermediaries in international trade also help with issues of currency exchange rates and can consolidate conflicting trade legislation, acting as the grease in the wheels of international trade and creating a safe environment where cross-border commerce can thrive. According to the World Trade Organisation (2019), “some 80 to 90 percent of world trade relies on trade finance”.

In order for international trade to prosper, all parties must maintain a certain degree of trust in the system. This is currently accomplished by relying on intermediaries to facilitate trade and heavy regulation of trade finance institutions. This reliance means that, although easier than two unknown parties exchanging goods over the border amongst themselves, each transaction involves a considerable amount of documentation and bureaucratic procedures in order to maintain trade integrity. This is also the case within the European Union where, in addition to laws and regulations made at the European level, participants in cross-border trade must also comply with local restrictions.

The European Union is an economic and monetary union forming a single economic market, allowing goods and capital to be moved freely between all of its member states. The official currency of the EU is the Euro. Countries that have adopted the Euro comprise the “Eurozone”, and are considered a priority in the EU’s financial decision-making). Both the EU and its member states are members of the World Trade Organisation.

The European Central Bank maintains price stability and is in charge of the Eurozone monetary policy. The ECB has the sole authority to authorise issuing euro banknotes (European Central Bank 2019a). The ECB, along with the national central banks (NCBs) of all Eurozone member states, forms the Eurosystem. The Eurosystem is in charge of foreign reserves and foreign exchange operations for all member states. The ECB forms the European System of Central Banks (ESCB) together with all EU member states’ national banks, which is in charge of price harmonisation between the Eurozone and non-euro member states.

Much of the EU's existing activities involving financial supervision and regulation were introduced as a response to the global financial crisis in 2008. Due to fears that some Eurozone member states could default on their debt, the European Financial Stability Facility (EFSF) was created in June 2010 as a temporary solution to address the sovereign debt crisis and provide emergency funding for the affected member states using the EU budget as collateral. Alongside EFSF, the European Systemic Risk Board (ESRB) was created to supervise the entire European financial system (see Figure 4).

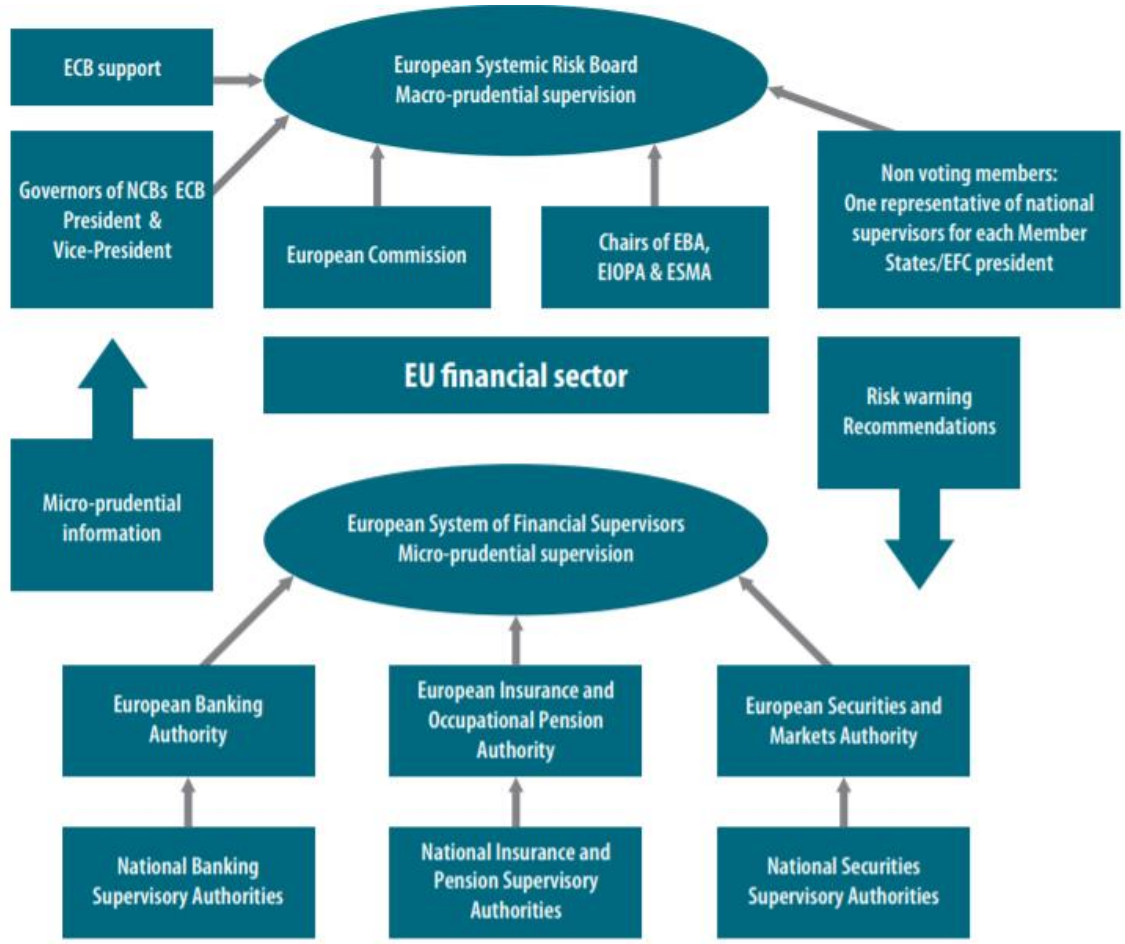

Figure 4. European supervisory architecture, circa 2011 (European Court of Auditors 2014: 14)

Three new supervisory authorities (ESAs) were introduced in 2011 with a mission to harmonise financial supervision in the EU. The European Banking Authority (EBA), European Insurance and Occupational Pensions Authority (EIOPA) and European Securities and Markets Authority (ESMA) are in charge of developing the Single Rulebook, a set of standards for all financial institutions operating in the EU. The Rulebook ensures that all financial institutions in the EU behave fairly and offer better services to consumers and is the foundation of the European banking union. The three authorities also monitor

the financial sector for any existing risks and vulnerabilities, and report directly to the European System of Financial Supervisors (ESFS). The ESAs are concerned with matters on the national level, whereas the ESRB deals with financial supervision on the EU level.

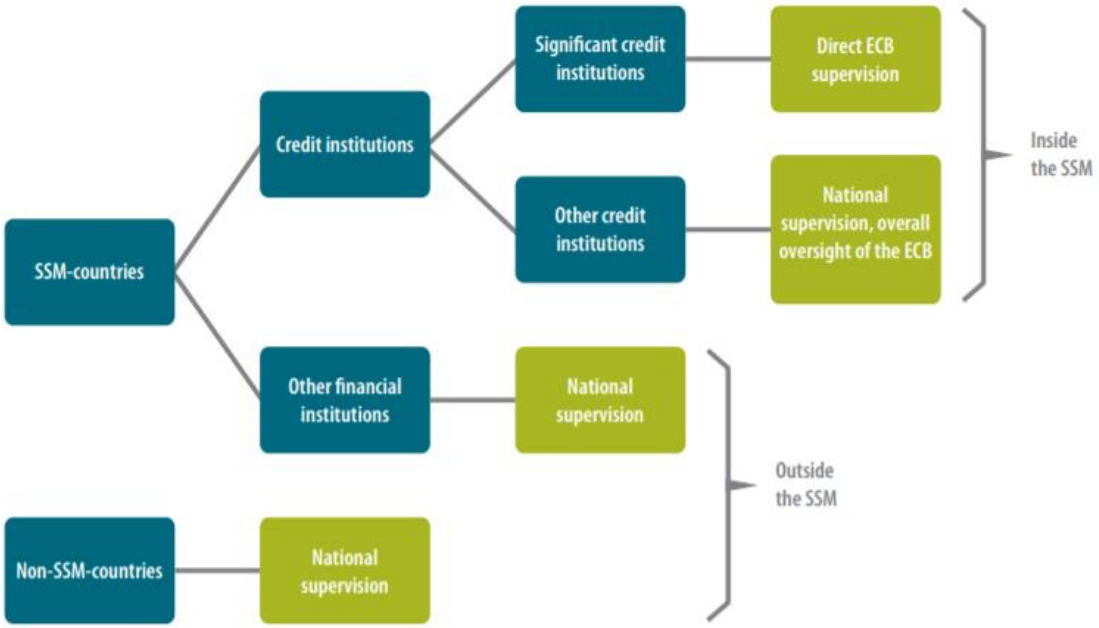

Figure 5. European financial supervision post-SSM (European Court of Auditors 2014: 18)

In 2012, the European Stability Mechanism (ESM) was established as a permanent rescue framework and successor of EFSF. In late 2013, the EU introduced the Single Supervisory Mechanism (SSM) as well as the Single Resolution Mechanism (SRM), its sister programme. The two mechanisms are based on rules that apply on all banks in the EU introduced in the aftermath of the global financial crisis. The SSM and SRM are the two pillars of the European Banking Union and give the European Central Bank authority over banks in all participating member states, as shown in Figure 5. Participation is mandatory for all Eurozone countries and voluntary for non-Eurozone member states, as the crisis gave proof that Eurozone countries were proven to be more economically interdependent and thus required to be supervised and treated as a single entity. In the case of a bank failing, a Single Resolution Fund (SRF) will be established over the period of eight years and the bailout happen on a European level, rather than the cost being borne by taxpayers as was the case in the past.

7 Regulatory challenges

There are still hurdles that the ECB must tackle in order to harmonise the EU single market.

Some member states still resist the Banking Union for fear of being forced to bailout foreign banks (Jackson 2018a: 2). National tax systems still vary from one member state to another, the disparity between national E-commerce laws and standards within the EU market hinders European trade, and financial services, energy and transport remain largely confined to individual national markets, unable to compete with institutions across the border. Fewer competitors means fewer choices on the consumer end, as well as insufficient competition between financial service providers, which affects the quality of consumer services and increases the risk of financial institutions becoming “too big to fail” on a national level (Jackson 2018b: 2), indirectly affecting other member states.

The current frameworks, originally set in place to prevent economic disasters, are largely inflexible and cumbersome: many small and medium enterprises in the EU (SMEs) have limited access to finance and short-term insurance services provided by export credit agencies:

> Member states may deem it unfair that they are hamstrung by EU state-aid rules which do not apply elsewhere in the world. The export credit agencies of Japan, Korea, China, US, Canada and Brazil are far more actively involved with their own export markets and able to adapt to the needs and wants of their exporters. (...) This leaves [Export Credit Agencies] seeking short-term dispensation beholden to a system which is at best time-intensive and laborious, but ultimately inflexible and inherently flawed. (Trade Finance London 2011: 3)

The current complicated ecosystem of frameworks, regulations and directives also affects the cost of banking services across the continent from the point of view of both consumers and businesses by increasing the number of steps and amount of time required for goods and capital to be able to move from one member state to another. Introducing red tape to cross border movement of capital isolates member states from one another, discourages economic prosperity (see Figure 6) and prevents the European Union from functioning as a single market.

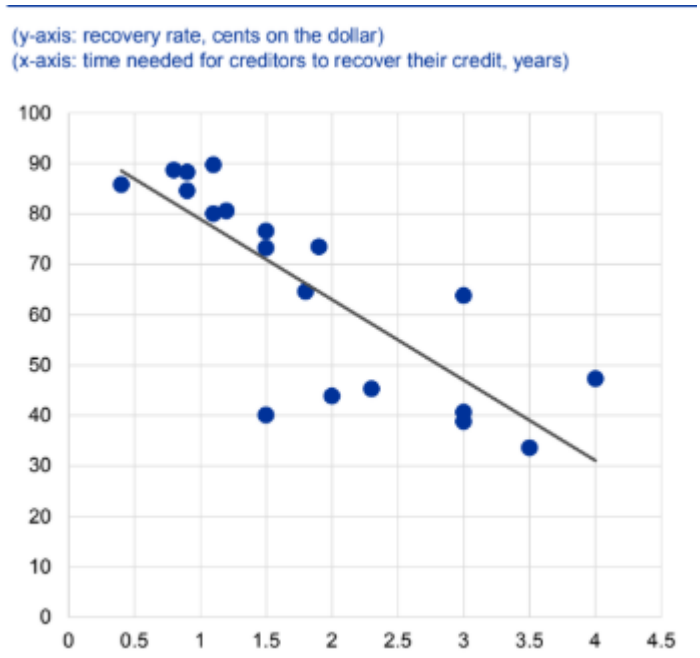

Figure 6. Judicial system efficiency is linked to recovery rate in the Eurozone (European Central Bank 2018: 17)

On top of a complicated system of financial governance and regulation by the European Central Bank, regulatory red tape in the European banking system and disparate legislation between member states, businesses in the EU must also deal with the steep fees and procedures imposed by financial intermediaries. For the European single market to function as intended - allowing for a competitive market and free movement of goods and services across the continent without giving an unfair advantage to well-established multinational companies, these barriers must be reduced.

Trade finance is an important but largely inefficient part of European and global commerce. The role of financial intermediaries in trade finance is to reduce counterparty risk for both the importer (for example, if they do not receive their goods or if the goods are not as described) and exporter of goods (if their products are damaged or lost in transit or in case the buyer does not pay). Global trade relies heavily on intermediaries for even the smallest of transactions, yet an overwhelming majority of financial companies providing trade finance services employ antiquated protocols that can date as far back as 16th century Venice (Arnold 2017).

Most of the processes are still paper-based (see Figure 7) and can take weeks until a transaction of goods is complete and both sides compensated.

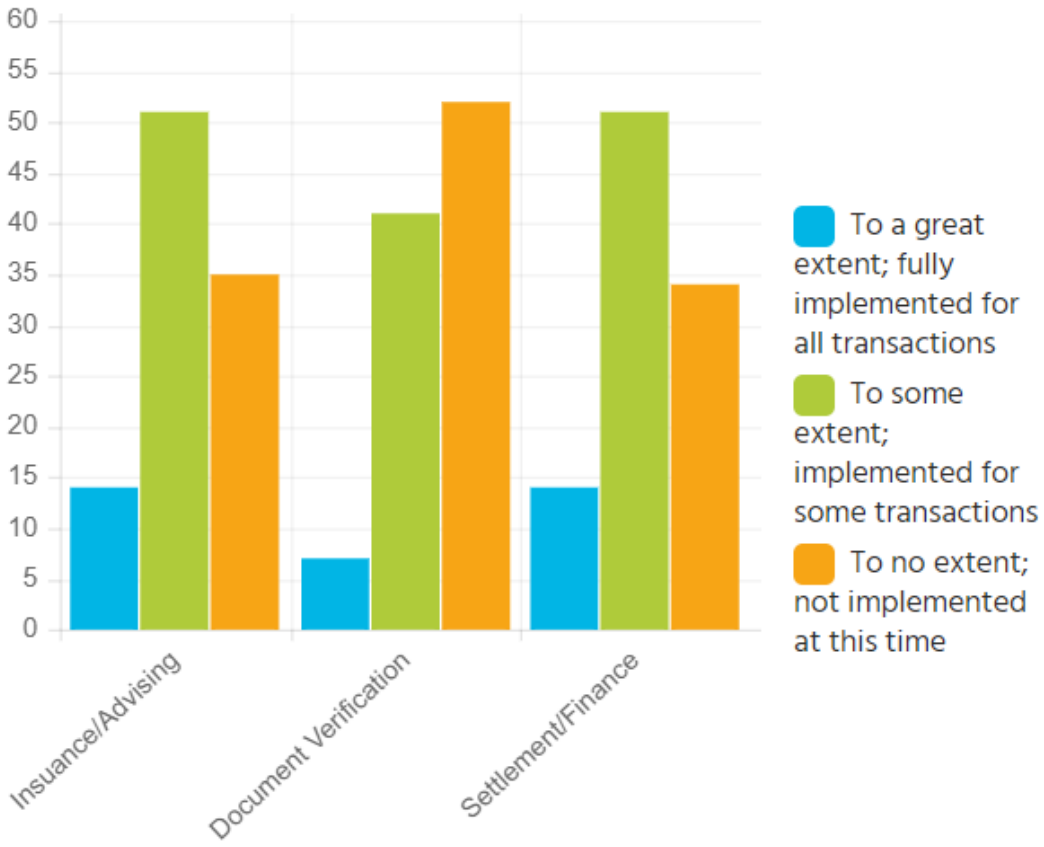

Figure 7. ICC 2018 Global Survey: ”To what extent has your bank removed the use of physical paper for documentary transactions”, results (International Chamber of Commerce 2018)

This excessive bureaucracy also means that the services offered by intermediaries are pricey, and costs only increase when cross-border trade is involved due to the disparity in trade regulations. Transaction costs reduce the threat of competition for large multinationals who can afford them, but also create a market gap and restrict market access for SMEs who often find themselves priced out of foreign markets and forced to only sell domestically. The European economy, where SMEs make up over 60% of employment according to Macknight (2018: 2), suffers as a result.

The barriers of entry for SMEs from poorer member states can be even greater as they are often not seen as creditworthy, shown in Figure 8. This means that trade insurance premiums can often be greater for companies based in Central Europe and the Balkans, where the average income and firm net worth is paradoxically lower than the rest of the continent (Eurostat 2017). According to the World Trade Organisation (2016: 27), “lack of access to trade finance is a key obstacle to low-income countries participating in global

value chains". This allows Western European companies to dominate the market, further deepening the illusion that the quality of products and services coming from this side of the continent is superior to that of their counterparts in the East. As a result, SMEs from lower income member states often find themselves unable to compete on a European level. At the moment, 70% of SMEs trade only within national borders (Macknight 2018: 2).

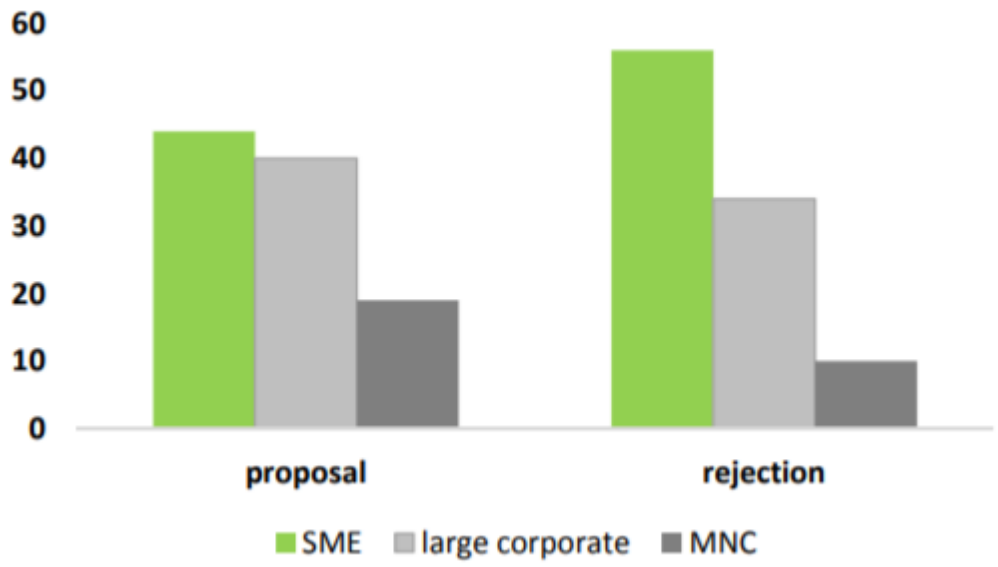

Figure 8. Trade finance ratio of proposals to rejections by firm size (World Trade Organisation 2017: 11)

In the European Union, these issues are amplified by its elaborate administrative and financial ecosystem and create enormous market gaps and inequalities that hinder the EU's economic growth.

The majority of financial intermediaries' activity in international trade finance involves ensuring that all parties fulfill their part of the contract as agreed. Trust has always been a major concern in commerce due to counterparty risk, and many of the current back-stops and safeguards against financial loss date back to ancient times. The first iterations of letters of credit, documents of key importance in international trade, were found as early as 1867 (Mead 1922: 303). The earliest documents resembling what is now known as the bill of lading date back to 15 AD (Du Toit 2005: 13).

Key documents in trade finance include the invoice (a document listing the agreed list of purchased products and their price, quantity and delivery costs), policy of insurance

(agreement on compensation to the seller if the cargo is damaged or lost), bill of lading (issued by a carrier to confirm receipt of cargo) and letter of credit (payment mechanism and guarantee from a bank that a buyer will pay for the goods delivered), the latter being the focus of this paper.

8 Payments

Letters of credit (LC) or letters of undertaking are used extensively in international trade as a method of trade risk reduction due to differences in legislation between two parties' specific countries, distance as well as trust. The exporter's bank acts as an underwriter as a form of guarantee that the seller will receive a payment from the buyer under specific conditions (see Figure 9). Exporters will usually not ship goods without being provided with a letter of credit.

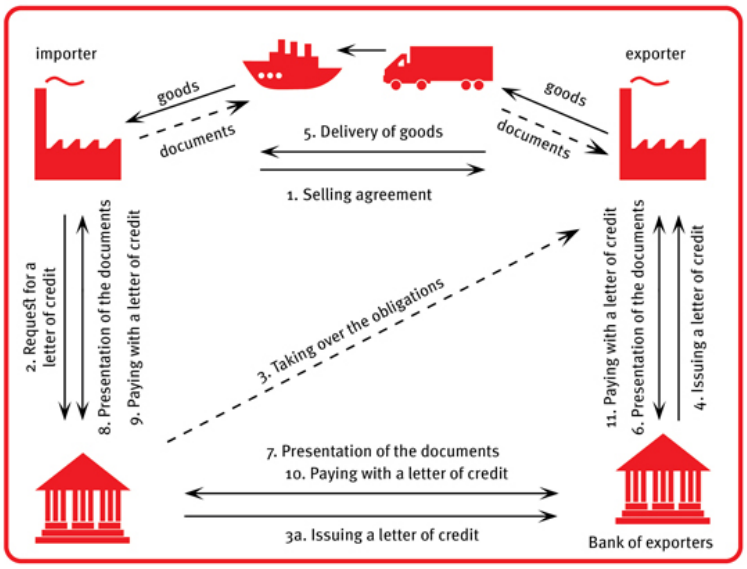

Figure 9. How letters of credit work (ProCredit Bank 2019)

Letters of credit are negotiable and can exist in several forms, with or without additional clauses that dictate how and when the payments can be withdrawn. Commercial LCs stipulate that a bank will directly pay the recipient, whereas with standby LCs the bank only pays the seller when the buyer is unable to. They can be requested by either the importer or the exporter (named import and export letters of credit, respectively), be revocable or irrevocable (modifiable or nonmodifiable), or allow the beneficiary to withdraw

funds at specific banks abroad (traveller's letters of credit). Back-to-back LCs are used when there is an intermediary between two parties (such as a distributor) and consists of two LCs, one issued from the buyer to the intermediary's bank, and the other by the intermediary to the seller. LCs can also be turned into banker's acceptances, financial commodities that function much like post-dated checks and can be sold at a discount on a secondary market.

Banks charge fees for issuing letters of credit in the form of a percentage of the credit amount, usually 2-3% per year. Issuing an LC can take several business days, but the entire trade process can take weeks before exporters are paid in full (Arnold 2017). "40% of LCs have a tenor of between 31 and 60 days, followed by 33% being between 61 and 90 days", according to the International Chamber of Commerce (2017: 96).

Payments and money transfer are a concern not only in trade finance but retail banking as well. Regardless of whether the client is a business or a private individual, all transfers of funds must be completed as quickly as possible without errors or delays. A payment system must keep its integrity and reliability in order to maintain trust and function as seamlessly as possible.

Technological innovation and standardisation have greatly reduced the amount of time needed for both domestic and international money transfers and made many payment options available worldwide. Whereas the option for physical money transfers exists via courier services, almost all interbank transfers are nowadays done electronically at a fraction of the time and cost.

However, e-commerce, globalisation, labour outsourcing and greater cross-border mobility of individuals are driving the market to expand and setting a high standard for the payment services currently offered by banks. Businesses and individuals alike now make more frequent cross-border transactions and in greater amounts than ever before. Foreign investment has become increasingly popular, and individuals are no longer restricted to buying goods from domestic brick-and-mortar retailers. Standardised payment systems offered by traditional financial intermediaries are prone to error, expensive and complicated, often involving clumsily backported, outdated methods that struggle to support the modern user's needs and strain under the volume of today's trade (see Figure 10). Modern companies' supply chains are frequently automated but not supported by legacy payment systems still used by most banks.

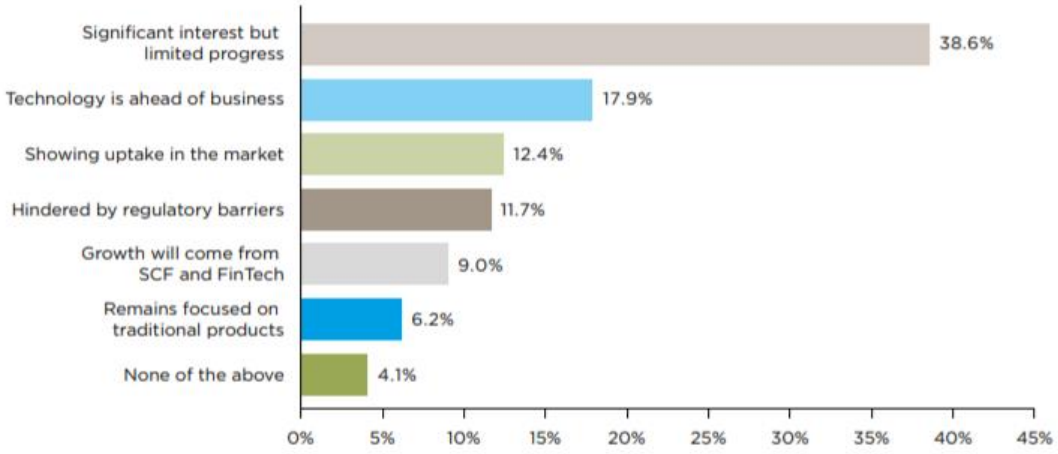

Figure 10. ICC 2017 Global Survey: views on trade finance digitisation (International Chamber of Commerce 2017: 77)

Financial institutions and globally established financial services providers such as Western Union are now not the only providers of money transfer and payment services. More competitors are entering the market than ever, and many customers prefer using alternative methods offered by startups (Holvi, Venmo), telecommunications companies (Telenor Bank, Orange Money), E-commerce platforms (Amazon, Alipay) as well as tech industry giants like Apple and Google (Apple Pay and Google Pay Send, respectively). Many of these services boast more innovative and convenient payment methods, almost instantaneous transfers, lower waiting times, no complicated bureaucratic procedures and considerably lower fees than most financial industry heavyweights. They continue to win over not only private customers but also businesses, especially SMEs who cannot afford most trade finance services offered by banks or to export their products Europe-wide due to excessive red tape.

These new entrants are rapidly shaping the future of the European banking sector. The European Commission's new and updated Payment Services Directive 2 (European Commission 2018) aims to improve pan-European competition in the payment services industry by giving more freedom to non-bank payment providers and harmonise the obligations of these providers with EU consumer protection and rights. Digital companies and financial technology (FinTech) startups are smaller, more agile and not as encumbered by regulation. This makes them excellent innovators in the payment services industry and early adopters of innovative technologies like blockchain and cryptocurrencies, posing a challenge to banking giants in the European market.

As a response to competitive pressure, banks are investing in these companies in order to regain control of the flow of investments, but nevertheless struggling to grow due to the pressures of EU regulatory bodies imposed on them in the aftermath of the financial crisis. Regulations such as Basel III (BIS 2019) limit their growth options and incentivise mergers, yet both regulators and banks remain reluctant to allow this, since mergers could create more global systematically important banks (G-Sibs) that can become an economic liability - in other words, “too big to fail”. Still, the number of banks operating in the EU has been on a steady decline since 2008 (Jackson 2018b: 1), with many choosing to consolidate to benefit from economies of scale and risk diversification.

Applying Porter’s Five Forces analysis (Table 1) to the EU financial sector, it is evident that the industry threat of new entrants is at its historical highest, as barriers are lowered thanks to technological advancements and support from European lawmakers (European Commission 2016).

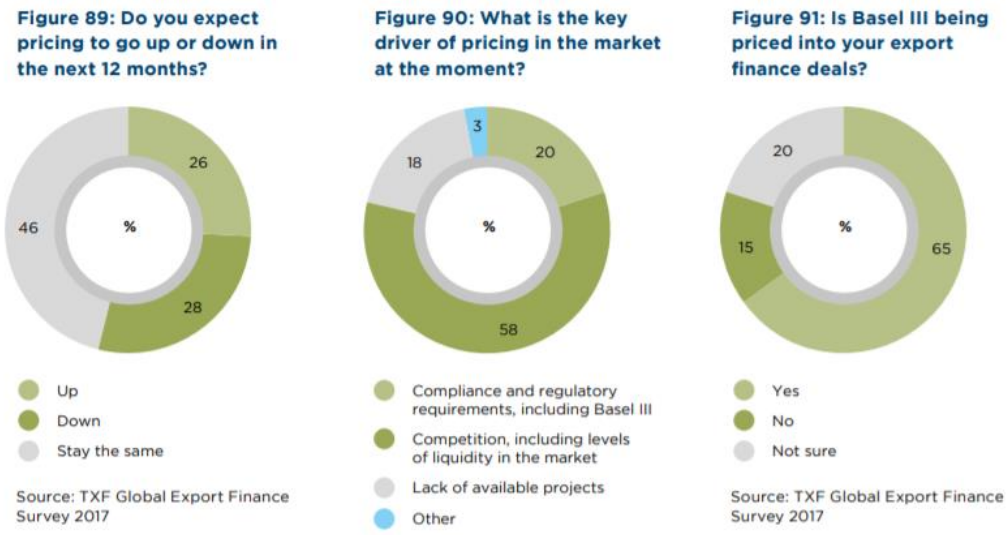

Figure 11. Opinions on pricing in trade finance, according to a survey by TXF (cited by International Chamber of Commerce 2017: 139)

The number of agile, innovative competitors in the payment services industry is steadily increasing and, despite banks having considerable power in the industry, the power also comes with many regulatory restrictions, which drive the price upwards (see Figure 11). More customers are favouring payment services offered by startups due to a lack of accessibility to conventional trade finance, cost of services and long processing times (Wragg 2019).

Table 1. Five Forces Analysis of the EU banking sector

Power of suppliers	Low	Banks are industry decision-makers, but this is not guaranteed to last
Power of buyers	Medium	Customers are increasingly opting for cheaper, more convenient alternatives offered by innovative startups and tech conglomerates who are starting to apply for banking licences
Threat of substitutes	Low	Market is heavily standardised and regulated, relying entirely on trade finance services for international commerce
New entrants	High	Technological innovation drives industry competition and levels the playing field between big and small service providers, lowering barriers of entry
Industry competitors	Medium	The financial industry has thus far been a largely symbiotic environment due to stiff market regulations and conventions, but new alternatives are emerging, and the number of competitors is increasing, with heavyweights from other industries as the biggest threat

The data mentioned in this chapter points to the fact that modernising outdated payment systems is a priority in trade finance as it can both aid retention of private and corporate customers and increase transaction efficiency.

8.1 Current EU payment systems

Real-time gross settlement (RTGS) systems transfer funds in real-time, meaning without any waiting periods. When a transfer is processed, it can no longer be cancelled. Once the funds are transferred to the recipient, the process is complete.

RTGS systems are operated by a country's central bank and are usually used for high-value transactions that must be cleared immediately in order to eliminate credit risk. For this reason, transaction fees for RTGS system transfers are very costly, so the service is rarely used for everyday transfers, with rare exceptions in cases of emergency or absence of other same-day transfer systems.

TARGET2 (Trans-European Automated Real-time Gross Settlement Express Transfer System) is an RTGS transfer system used in the Eurozone by both central and commercial banks and is also available to countries outside of the Eurozone (European Central Bank 2019b). More than 55000 banks worldwide can be reached via the TARGET2 system. For settlement of securities in Europe, EU banks use TARGET2's sister platform, T2S (European Central Bank 2019c).

The Single Euro Payments Area (SEPA) was created for the purposes of retail and non-retail payment integration in the European Union. Prior to adopting the euro, each EU member state had its own cashless payment methods. Paying by credit or debit card abroad was a challenge as not all cards issued in another member state were accepted, and transactions as well as ATM withdrawals involved processing fees for foreign residents (European Central Bank 2014: 18). Contactless and online payments were not supported.

SEPA was introduced in an attempt to harmonise the EU financial market under a single payment standard. Its goal is to erase the differences between domestic and cross-border payments.

The SEPA system was first outlined in the Lisbon Agenda in March 2000. Today, SEPA covers all EU member states together with Switzerland, Norway, Iceland, Liechtenstein, Monaco, Andorra, San Marino and Vatican City. As of 2014, 99.9% of direct debit, 79.2% of card payments and 99.4% of credit transfers have moved to SEPA in the euro area (European Central Bank 2019d).

In 2009, the EPC, representing payment service providers, created the SEPA Card Standardisation Volume (European Payments Council 2019a) together with the Card Stakeholders Group, representing vendors, retailers and processors. By introducing the Volume, the two organisations reached an important milestone in single market harmonisation. The Volume introduced a number of requirements for face-to-face (card-present) and remote (card-not-present) transactions that made card standardisation simpler. Card standardisation improved investment planning, security, and transparency of payment services and the card industry. It increased the number of payment options and growth opportunities for European businesses. By cutting down on unnecessary bureaucracy, the new system lowered transaction costs for card payments and withdrawal. Consumers can now use their credit and debit cards anywhere in Europe without worrying about hidden fees, excessive bureaucracy, currency restrictions or payment rejections, whilst businesses are able to serve more customers, pay lower fees on card transactions and choose which card schemes and providers suit them best.

SEPA currently offers several payment schemes for its members (Credit Transfer, Instant Credit Transfer and Direct Debit), with plans to also expand its services to mobile platforms outlined in the EPC's white paper on mobile payments (European Payments

Council 2017: 28). SEPA Credit Transfers (SCTs) and Direct Debits (SDDs) rely on STEP2, a pan-European automated clearing house for settling mass credits and direct debits within the SEPA system. STEP2 serves nearly all European banks that offer SCT and SDD services. The infrastructure for STEP2 is provided by EBA Clearing, a cooperative organisation owned by 49 largest European banks (EBA Clearing 2019).

As part of the EU's harmonisation process, the EPC aims to create a Single Euro Cash Area (SECA) (European Payments Council 2019b) for increasing market consolidation and cost efficiency of cash payments, which it considers one of the most expensive forms of payment.

SEPA is governed by EU Regulation No 260/2012 (2012), which introduced several new standards and technical requirements for EU banks. All banks now have Business Identifier Codes (BICs) and all accounts their own International Bank Account Numbers (IBANs). This regulation also lists all necessary data requirements for bank transfers within the SEPA scheme.

The SEPA system pioneered ISO 20022 (SWIFT 2019), both a set of standards and a directive for creating further sets of standards for the entire financial industry, so that all European financial service providers "speak the same language". ISO 20022 is one of several SWIFT standards.

SWIFT (Society for Worldwide Interbank Financial Telecommunication) is a Brussels-based cooperative owned by more than 11000 banking and securities organisation. SWIFT is the leading worldwide network that provides financial institutions with secure messaging services. It was founded in 1973 and went live in 1977, connecting 518 institutions from 22 countries. The company also sells software and offers other services to banks, and is the registration authority for several industry standards, one of which the European Central Bank's SEPA is based on.

SWIFT does not facilitate clearing or settlement, nor does it hold accounts. Instead, it is used as a method of communication between financial institutions. Money transfer is requested via the SWIFT network using payment orders, and the money is manually transferred using nostro ("our" money, held in an account in another bank), and vostro ("your" money, another bank's funds held in our bank) accounts created bilaterally between two banks in the process outlined in Figure 12. Financial institutions must either

affiliate themselves with one or several banks or be banks themselves in order to perform transactions.

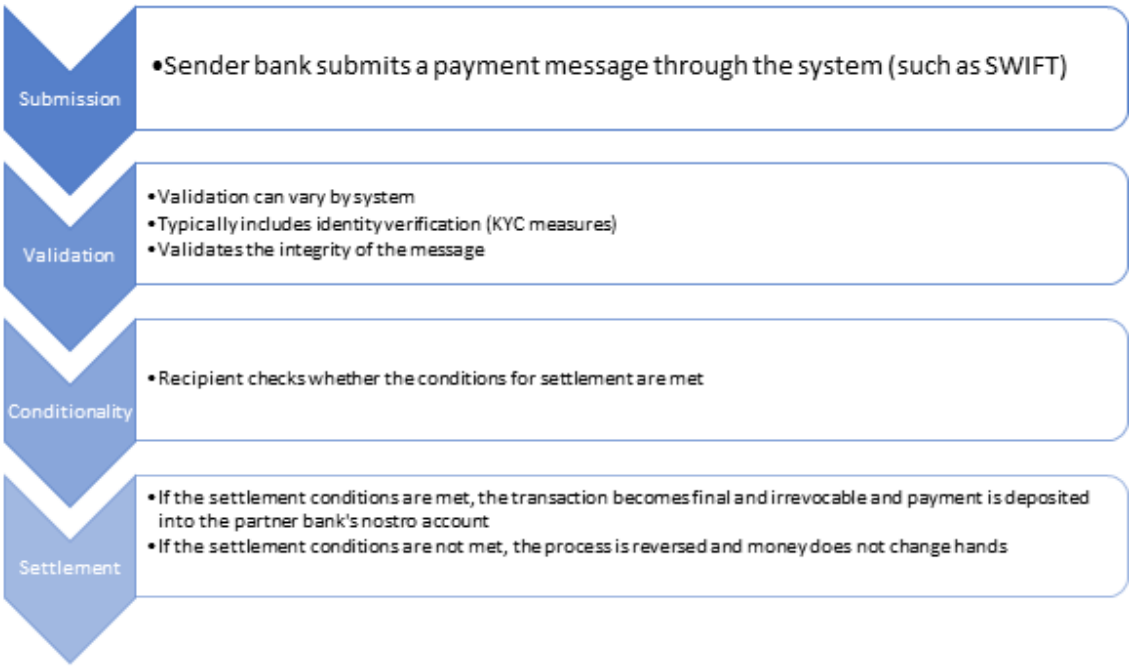

Figure 12. SWIFT transfer process

SWIFT and SEPA are not mutually exclusive. Rather, the SEPA scheme relies on the SWIFT financial messaging system to transfer information between banks across the EU. The SEPA-mandated IBANs, in the SWIFT network, are considered no different than any other account numbers outside of the EU. Bank Identifier Codes of European banks are also interchangeable with SWIFT codes.

The main distinction between the two schemes is that SEPA concerns transfers made in euro alone, whereas SWIFT transfers encompass several different currencies. SWIFT also enables transfers globally whereas SEPA only concerns the European Union and several other nations comprising the European Economic Area.

9 Drawbacks of legacy payment systems

SEPA transactions officially take from 1 to 2 banking days (OP 2019) whilst, according to SWIFT's own research (SWIFT 2018: 16), 95% of SWIFT transfers take place within one day.

However, for most clients this is not an accurate assessment. Transfers made to banks outside of the EU's SEPA system can take weeks. Within the European Economic Area, transaction processing times (and fees) vary from bank to bank and often take several days as payments made after the bank's processing cutoff time are transferred the next day. Domestic and international interbank payments are, despite the EPC's claims, not treated equally. Non-euro SEPA transfers take 3 days for the Bank of Ireland to process compared to same-day payments domestically (Bank of Ireland 2019).

> Because of the charges levied by each bank along the way, combined fees of over £50 can be charged for a single payment. Poor exchange rates and fluctuating currencies can shave off an extra chunk.
>
> According to the Financial Conduct Authority, which regulates UK banks, an online payment should reach its destination by the end of the next working day. Bank websites tend to leave it open-ended, however. Nationwide's guidelines advise that while payments within the European Economic Area should take one working day, those sent to the rest of the world "may take longer". Santander reckons a payment will "usually" take up to four working days, TSB up to 12 working days and Lloyds and its brands state it "should" take no more than 14. None specify the total cost (Tims 2018).

Alternative money transfer services such as Western Union and Tieto boast being able to complete transfers within minutes (Western Union 2019) and affordable real-time payments (Tieto 2019). TransferWise, an Estonia-based service, transfers money between multiple company bank accounts around the world, boasting lower fees and more favourable currency exchange rates than regular bank transfers despite relying on the SWIFT system itself, which can be very costly.

Outdated, centralised legacy systems are frequently outpaced by technological innovations in the banking industry and can hinder even the fastest innovative payment schemes that rely on clients' bank accounts to deposit or withdraw money. Individuals and businesses find themselves stuck between the instantaneous digital transfers that could be and the harsh reality of poor interbank communication. Demand is growing for better payment solutions but banks are slow to follow, burdened by regulations, standards and an inherent fear of risk.

The structure of the SWIFT network makes it possible for some governments to tamper with intergovernmental transfers, seize funds and impose sanctions by manipulating the SWIFT network to their benefit. SWIFT describes itself as a "neutral global community" (SWIFT 2019) yet complies with political decisions that impede global trade and the EU's economic growth.

SWIFT is based in Brussels and is under European jurisdiction. However, in 2006, the Washington Post discovered that US authorities were granted access to the SWIFT transaction database (Brand 2006) under the guise of counter-terrorism investigations in a secret transfer deal with the US Treasury, breaking EU privacy laws and bringing the network under fire for giving away personal data to foreign authorities.

In 2012, the US seized 137,000 Danish kroner from Torben Nødskouv, who had made an entirely legal purchase of Cuban cigars from a German importer that he intended to resell through his business (CPHPost 2012). The payment was automatically routed through the US, whose authorities froze the transaction, claiming that the transfer violated America's trade embargo with Cuba. Four years earlier, another Danish citizen lost $205 after attempting to buy dresses from Pakistan.

In 2013, Der Spiegel reported that the US National Security Agency (NSA) had been monitoring SWIFT and credit card transactions, revealed by former NSA contractor Edward Snowden (Spiegel 2013; Baldwin 2017).

From 2012 to 2015, at the urging of US President Barack Obama, Iran was excluded from the network (Torchia et al. 2016) in light of the US and EU sanctions against the country and later reconnected.

Yet in other cases, SWIFT refused to comply to requests for sanctioning. Despite the UK's urging of the European Union to block Russian services from using the network in 2014 (Hutton 2014), SWIFT issued a statement in which it refused to impose any restrictions. That same year, multiple pro-Palestinian organisations called for SWIFT to disconnect Israeli banks from the system (Ravid 2014) but were rejected.

> This does not imply that global banking is a US fiefdom that Mr. Trump can control without incurring significant costs. Imposing his will on Swift will increase the chances that alternative communication systems will gather support around the world. Such a shift might extend to other parts of the dollar-based global payments system. US rivals China and Russia are open in their desire to see this system fracture. The US, by bulldozing its allies, will have weakened a key element in its own strategic arsenal (Financial Times 2018).

This double standard is a troubling indicator of who really holds sway over the SWIFT system and means that EU member states who refuse to comply with US demands or whose economy depends on trade with a country under economic sanctions can also find themselves excommunicated from the SWIFT network or forced into submission. It

creates a precedent for SWIFT to be used as a mechanism of power to manage different sectors of the economy.

For this reason, banks in some countries are moving away from the SWIFT system in favour of rival networks, creating further obstacles to trade and payment system harmonisation. Banco de México has created SPEI (EBANX 2019), an interbank payment network that allows for almost instantaneous transfers and payments. China and Russia have joined CIPS (China International Payments System) to improve transactions between the two countries and reduce dependence on SWIFT for important interbank transfers (Ngetich 2019).

10 Blockchain technology as a solution for payments and trade finance

The most obvious flaw of current legacy systems are the centralised networks they are based on. By gaining access to a few key areas in the network, the privacy of stakeholders around the world can be compromised due to the clustered structure of intermediary networks, where one central node holds access to multiple other nodes lower in ranking that otherwise do not communicate with anyone else in the network (explained in chapter 9), and the very need for intermediaries for establishing trust which ultimately leads to trade and network bottlenecking.

Blockchain is a concept that has recently received a lot of attention in the finance industry, particularly when discussing FinTech services and companies. Its most praised features are innovative data storage and information transfer thanks to the distributed ledger technology it is based on. With many important players in global trade and banking conductive extensive research and stress tests to find new solutions for the ails of antiquated payment and trade processing systems, it has the potential to transform the payment services industry and trade risk assurance. The growth of e-commerce, as well as trade and payment process simplification by third-party companies are forcing banks to catch up, and exporters are demanding digital solutions to bureaucracy-laden LCs.

Table 2 Comparison of traditional banking businesses, Internet finance businesses, and blockchain + banking businesses

	Traditional banking businesses	Internet finance businesses (FinTech 1.0)	Blockchain + banks (FinTech 2.0)
Customer experience	Uniform scenarios	Rich scenarios	Rich scenarios
	Homogenous service	Personalized service	Personalized service
	Poor customer experience	Good customer experience	Good customer experience
Efficiency	Many intermediate links	Many intermediate links	Point-to-point transmission, disintermediation
	Complex clearing process	Complex clearing process	Distributed ledger, transaction = clearing
	Low efficiency	Low efficiency	High efficiency
Cost	Large amount of manual inspection	Small amount of manual inspection	Completely automated
	Many intermediate links	Many intermediate links	Disintermediation
	High costs	High costs	Low costs
Safety	Centralized data storage Can be tampered	Centralized data storage Can be tampered	Distributed data storage Cannot be tampered
	Easy to leak users' personal information	Easy to leak users' personal information	Use of asymmetric encryption, Users' personal information is more secure
	Poor safety	Poor safety	Good safety

Figure 13. Advantages of blockchain systems over traditional banking (Guo and Liang 2016: 6)

DLTs provide the financial industry with an opportunity to solve existing issues with payments, clearing and settlement and may inadvertently change the existing structure of the market. However, this change can evolve in different ways depending on how banks adopt new technologies and address problems in the current systems.

In a distributed network, regardless of whether it is public (open) or private (closed), nodes can be differentiated by the roles they are permitted to assume and actions they can perform (see Figure 14). DLTs where all members can play any role are permissionless, and those that restrict certain roles to certain members are permissioned. For example, some can be allowed to view the ledgers whilst others can also edit them, not unlike an online group homework assignment. The financial industry mainly favours permissioned DLTs (Collomb 2016: 110) due to the transfer of sensitive information, whereas cryptocurrency networks are usually permissionless. Ownership information can also be easily stored in the blockchain and distributed across the network, as explained in the third chapter. Even if all participants can read and edit information stored in the blockchain, some data can still be encrypted so that only select persons can decrypt it using a private key (Mills et al. 2016: 12).

Table 3 Categories of blockchains

	Public blockchains	Consortium blockchains	Private blockchains
Degree of centralization	Decentralized	Multi-centralized	Decentralized
Participants	Anyone can freely participate and leave	Specific group of people who agree to enter an alliance	Central controller decides members that can participate
Credit mechanism	Proof of work	Collective endorsement	Self-endorsement
Bookkeeper	All participants	Participants decide in negotiation	Self-determined
Incentive mechanism	Needed	Optional	Not needed
Prominent advantage	Self-established credit	Efficiency and cost optimization	Transparency and traceability
Typical application scenario	Bitcoin	Clearing	Audits
Load capacity	3–20 times/second	1000–10000 times/second	-

Figure 14. Difference between private, consortium and public blockchains (Guo and Liang 2016: 9)

Smart contracts are algorithms that perform a certain set of transactional events automatically based on terms that all participating parties previously agreed on. These contracts can be executed automatically based on information received in the blockchain or outside of it (Mills et al. 2016: 14). This enables many transactions where bureaucratic procedures are done manually to be automated, saving time and making previously pricey transfers more cost effective (see Figure 15).

This could help with payment process simplification, improve processing speed, increase transaction transparency, improve network resiliency by switching to distributed data management and reduce operational and financial risks. Since any information can be stored in the blockchain, there is a wide range of applications for blockchain technology in the financial industry.

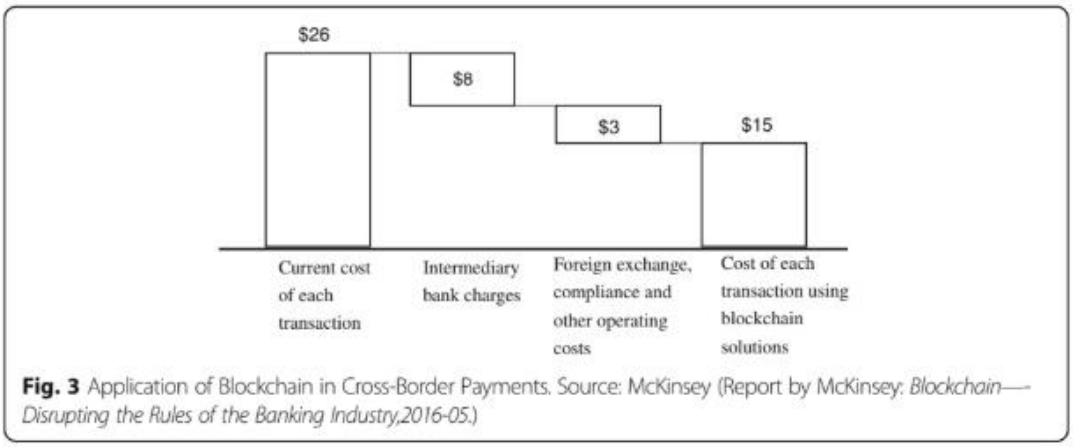

Fig. 3 Application of Blockchain in Cross-Border Payments. Source: McKinsey (Report by McKinsey: *Blockchain—Disrupting the Rules of the Banking Industry,2016-05.*)

Figure 15. Effect of DLT system applications on transaction price (McKinsey, cited by Guo and Liang 2016: 7)

Although SWIFT messages are received almost instantaneously, they are often not acted on immediately. Costs are generally paid for by the customer and deducted from the amount of funds transferred, and transactions cannot be tracked, leaving clients in the dark about where their money is. Smaller banks may need to rely on partnerships with larger financial institutions for making cross-border SWIFT transfers, which only increases transaction fees for the end user, bringing it out of reach for low-income households and many SMEs. Introduction of DLT based payment systems could boost financial inclusion the payment services industry.

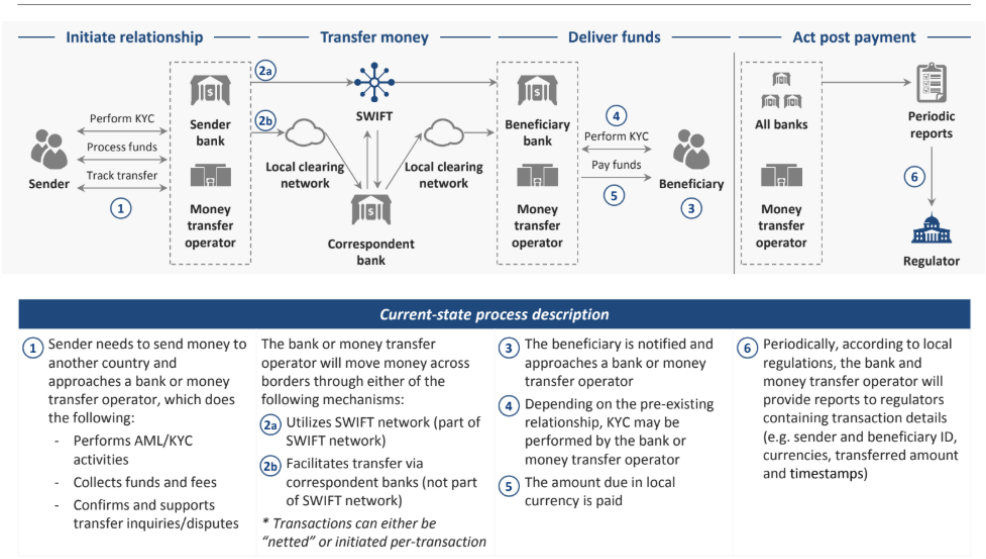

Figure 16. Current process for letters of credit (World Economic Forum 2016: 77)

Blockchain's global reach and ability to share data across great distances and time zones could also reduce the amount of necessary intermediation in trade and payment services (see Figure 16 and Figure 17). Regional and smaller banks could directly access the network, resulting in more transparent transfer procedures. Ripple's recently developed Interledger Protocol (Thomas and Schwartz 2016) allows information to be transferred between different ledgers can further improve the structure of global financial networks and allow financial service providers to better communicate with one another.

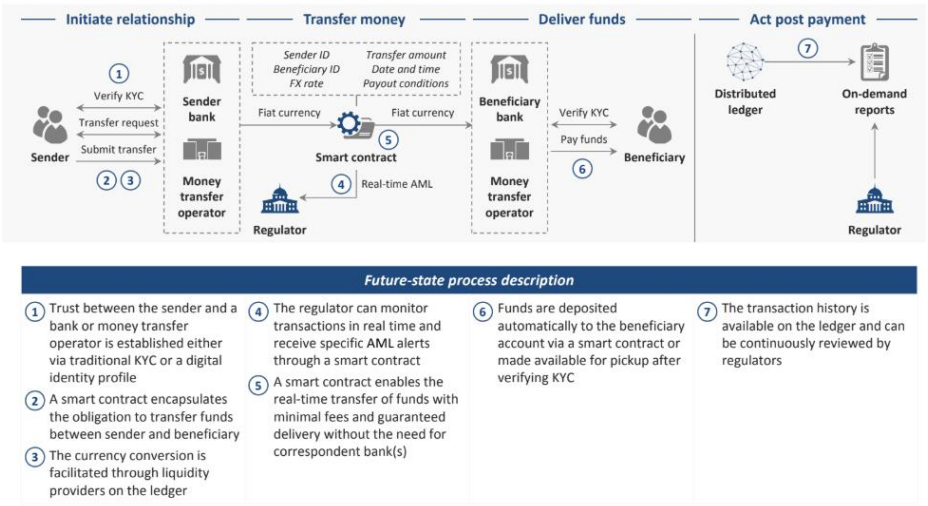

Figure 17. Future process for letters of credit (World Economic Forum 2016: 79

11 Recent developments

Industry giants and governmental agencies are recognising the potential impact of DLTs on the financial industry and investing in blockchain R&D. In 2017, the European Union set up a "Blockchain Observatory and Forum", an expertise hub on blockchain and DLTs in order to determine threats and opportunities, legal and regulatory challenges as well as scalability issues. (European Commission 2017) One of EU's new strategies is the Digital Single Market proposed in 2016, creating new initiatives to improve e-commerce, privacy, copyright and digital services. The two initiatives combined could help EU officials introduce blockchain into all aspects of Union governance and improve harmonisation of the financial industry with the EU's legal and regulatory bodies.

In trade finance, major industry stakeholders are also paying attention to blockchain. Banks, corporates and third parties have formed several trade finance networks focusing on the blockchain with Voltron (some of its participants are banking heavyweights like

BNP Paribas, HSBC and Standard Chartered), Marco Polo (Commerzbank, OP, SMBC) and We.Trade (Nordea, Deutsche Bank, Société Générale) being the largest (Blockdata 2019). We.Trade (2019) is unique in that it directly targets the problem of trade finance availability for SMEs.

Seven biggest banks in Europe (Arnold 2017) have commissioned IBM to build a cross-border trade finance platform for SMEs using blockchain technology. HSBC Holdings, a British multinational financial services company, has been running pilot tests and experimenting with various blockchain proofs of concept (PoCs) for years, and has recently performed what they claim to be the industry's first LC between China and Australia for a shipment of wool. However, it was actually a similar transaction in 2016 orchestrated by Barclays and Wave, an Israeli startup, that carried the torch. It guaranteed nearly $100000 of cheese and butter exports from Ornua (Taylor 2017), an Irish dairy producer, to the Seychelles Trading Company. The process that normally takes 10 days was said to have been completed in less than 4 hours.

As SWIFT is becoming noticeably outdated, banks are investing in DLTs and FinTech startups working with blockchain technology to find a suitable replacement for cumbersome legacy systems. Ripple (2019a) is a RTGS system that started as a currency generator in 2004, became a consensus-valued cryptocurrency in 2011 and grew to become the second largest cryptocurrency in 2012. German bank Fidor adopted the Ripple protocol for international payments, with several other banks following suit, soon recognising it as a legitimate payment system. The Ripple currency was designed to allow for fast and cheap money transfers at little cost for the end user.

Ripple is built using an open source (non-proprietary) protocol and supports several tokens such as commodities, fiat (government-backed) currencies, cryptocurrencies as well as frequent flyer miles or other units of value. The Ripple network is managed by a network of independent servers that can belong to anyone and uses its own XRP tokens for transfers. However, actually owning XRP to use the Ripple system is not required. Like in other DLTs, all Ripple transactions are final and irreversible and, like SEPA, Ripple offers different systems for payment processing (xCurrent), liquidity sourcing (xRapid) and sending money (xVia). RippleNet, the network of banks using Ripple as a payment option, could become a more efficient alternative to SWIFT.

At the Payments Panorama conference in Calgary, Canada, ReiseBank and ATB Financial used Ripple to exchange 1000 Canadian dollars to euro (Ripple 2019b). The exchange was processed in mere seconds, considerably shorter than the 2-6 days it would normally take. Santander, a Spanish bank, is the first in Europe to use Ripple for cross-border payments.

Ripple is not the only DLT-powered platform in the financial industry. R3 (2019), a company specialising in DL technology, leads a consortium that has over 300 partner firms from multiple industries and has launched its Corda platform in January 2019. Corda is specifically designed to handle complex financial transactions and can restrict access to transaction data. R3 was also the first pilot platform aimed at LCs, using a working system called CryptoBLK.

12 Challenges and opportunities

There are several issues making the introduction of DLTs in trade finance and payment processing difficult.

The first is the problem of old versus new. It may be tempting to attempt to completely replace old protocols and risk reduction systems with new, blockchain-based ones. Blockchain's versatility has spurred enthusiasts to attempt to apply it to anything and everything, and its popularity spike thanks to the rise in value of native cryptocurrency Bitcoin brings with it blockchain evangelists, looking to turn a profit by selling promising, praise-laden literature. The claims these blockchain gurus make are rarely unfounded and are often backed by significant research, but there must be a degree of skepticism when considering blockchain applications, as the research backing it is currently only theoretical, and directly implementing it poses many risks and uncertainties for the financial industry and entire global economy - which is exactly what current systems and regulation are designed to prevent. Furthermore, it is evident that the global financial industry will introduce more than one DLT system in the future, and many innovations are yet to come. In order to respond well to both current and future changes, blockchain solutions should be designed to be interoperable - able to effectively communicate and work with a variety of other systems, old and new.

It is certain that governments will have to cooperate more closely than ever in order to prevent fraud, terrorism and crime financing. Terrorist organisations are already receiving donations in the form of cryptocurrency (Oftedal 2015: 13), and as DLTs become more commonplace this is likely to increase. Blockchains themselves are not impermeable, and there is always the question of information asymmetry - a dysfunctional or rigged algorithm is not visible to laymen and not all information about a blockchain network is available, usually for security reasons. Developers could create backdoors to systems they themselves created in order to benefit financially, and widely-used DLT system network could be breached in order to gain personal and payment information of clients. In 2018, Ripple entered into a legal battle (Alexandre 2019) with a number of investors in XRP tokens (that the Ripple payment system uses for payments). The company was accused of controlling the price of tokens and treating them as their stocks. However, no action against the company was taken and the court process is still ongoing.

Another issue is regulation and governance. Blockchain networks operate globally, and two nodes could be separated by oceans or be located a street away from one another without it making a significant difference. This brings into question how different countries' laws will apply to a single blockchain network, which laws to apply, and whether certain governments will be able to exercise political power over foreign businesses, governments and individuals using the blockchain network, as described in chapter 9.

The financial services industry must be heavily regulated in order to preserve the integrity of the global economy. With DLT platforms, this becomes a challenge. DLTs favour decentralisation, but regulation is not effective in decentralised systems. The only way to regulate a fully automated DLT payment system is to control what goes in and what goes out, which is exactly why banks are pioneering permissioned and highly selective DLT payment systems that are still on a small enough scale to have access to them regulated in full. Even if regulators were to form rules and standards about blockchain technology, many would currently struggle to understand it, which could have unexpected consequences for clients as well as the economy. However, any innovation carries with it a significant amount of risk, and blockchain technology must be regulated in order to be implemented into the EU and global financial infrastructure properly.

Distributed ledger technologies could create opportunities for new financial products, cut transaction costs and reduce the need for intermediaries in trade finance with the introduction of smart contracts. However, smart contracts are difficult to introduce without any legal and regulatory basis as is the case now.

Some stakeholders warn that in order for DLTs to successfully increase transparency, this cannot only be done partially and must include transparent systems throughout the supply chain.

13 Conclusion and recommendations

New technologies should be backwards-compatible and adaptable to other systems, but current systems are not all compatible with DLTs. Researching, developing and introducing new DLT systems into the financial ecosystem is costly, and not all financial industry stakeholders will be interested in accepting new technologies. More time must be taken to allow industry experts to better examine and understand all features and properties of blockchain and other distributed ledger technologies. Instead of focusing too much on the new, DLT systems must be designed with the current legal, regulatory and financial infrastructure in mind to allow for a seamless transition to distributed ledger payment system. As large blockchain networks are hard to moderate and could pose a security risk to users, care should be taken to make sure that proper safety mechanisms are included and that they work properly before they are used.

The EU Commission should focus not only on regulating blockchain systems, but also making sure that current regulations remain valid after said systems are introduced. Currently there is not enough information on how these systems will affect market regulation, and most research that exists is theoretical. New payment systems are used in a controlled environment, which can yield in results drastically different than when they are implemented in the real economy. Regulation is still a major issue for EU authorities so it should be a focus in future research of the EU Digital Single Market scheme. Blockchain technology could be a great improvement over the current payment systems and trade risk reduction procedures, but how it is handled and implemented will be the deciding factor of how EU finance and trade will look in the future. For the time being, there needs to be more real market experimentation and research that includes all industry stakeholders. All stakeholders in the financial industry must be included in the design process and accounted for.

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