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# **The new distributed ledger technologies in banking transactions and transaction banking platforms**

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## **Abstract**

This dissertation was written as part of the LLM in Transnational and European Commercial Law, Banking Law and Mediation/Arbitration at the International Hellenic University. It is entitled “the new distributed ledger technologies in banking transactions and transaction banking platforms”. This dissertation presents the most significant features of the new distributed ledger technologies and in what manner they differentiate themselves from the nowadays - to a large degree - applicable. The dissertation furthermore examines a number of modern applications of the new distributed ledger technologies and how they can be, or already are, incorporated into the present banking system. These technologies being so modern, since they practically have just a little more than a decade of life, come across several challenges in technical, legal, and regulatory fields. Those challenges are displayed and analyzed in a likewise manner. Special mention is made of the public’s attitude towards the application of the new distributed ledger technologies in banking systems.

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Keywords: DLT, blockchain, cryptocurrencies, Bitcoin, banking platforms

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## Introduction

Throughout the history of mankind and every once in a while, some breakthroughs take place, altering and advancing life, in the social field, the technical field, the economic field etc. In the recent history, the most groundbreaking event was the evolution of the internet, that changed the world as we knew it. Some, claim that after that event, the next equivalent was the invention and introduction of blockchain technology<sup>1</sup>, in short, a decentralized system of data storing, in a manner that the data cannot be controlled or manipulated by a central authority.

Despite the fact that the blockchain technology was first introduced as an idea in the early 1990s<sup>2</sup>, it was only a little more than a decade ago, after the release of a white paper establishing the model for a blockchain by Satoshi Nakamoto<sup>3</sup> that the new technology was introduced to the public. Today, and despite original doubts and disputes, blockchain and related technologies have become more and more vastly used, not just by individuals, but by large corporations, financial institutions and even states and governments.

The technology is already being used in many sectors, whereas various applications will make further use of it in the years to come. The present paper though, focuses on the use of the new technologies in the banking sector.

Regardless of the fact that the decentralized storage of data has become quite common the last few years and many firms and individuals use some types of it, there is still unawareness or confusion among even some of the most common types. On the first chapter therefore, important distinctions of the different types of the said technology will be made, for the reader to identify and differentiate among certain terms, often mistaken for one another.

The most known application of technological decentralization is Bitcoin. On the second chapter Bitcoin and cryptocurrencies are analyzed and they are linked to financial institutions. Many of them appear skeptical and negative towards the possibility of them being incorporated into the financial system, considering them as highly controversial, while others appear willing to follow or even set the trend, and make the most of it. The marvelous traits of cryptocurrencies are highlighted yet their drawbacks which cause the skepticism are presented too.

However celebrated and famous Bitcoin has become, it is certainly not the only or even the most significant application of shared ledger technology in banking. Financial institutions have incorporated the new technologies in various applications, some of which are presented in the last chapter of the present paper. Some of them are already being used and others present an interesting and promising choice for future operations.

In conclusion, an effort is being made to foresee the future of the new technologies in banking, taking into serious consideration, apart from the traits, advantages, and disadvantages of using them, the public's opinion and inclination towards them. Do distributed ledger technologies present a viable and real option or are they just a trend that will be soon surpassed?

The aim of this paper is to present several different applications of distributed ledger technologies in an understandable manner for the reader and focuses on the

feasibility of the technology rather than the technical features. Hopefully, it succeeds in doing so. The study was conducted up to the day that the paper is being delivered, therefore some of the data is very recent, or even remain to be witnessed. The continuous evolution of the system and the fact that the technology has introduced new and modern products and services, leave no room for questioning that there is a challenging path ahead of us, one that nowadays can sometimes dictate the products and services to be introduced, rather than itself adjusting to the needs of customers and the banking system as it used to.

## **1. Identifying the different terms**

### **1.1. Distributed ledger technologies (DLTs)**

Ledgers are an ancient consensus technology of transaction, older than the 15<sup>th</sup> century Venetian Republic, which invented double entry bookkeeping; ledgers are as old as commerce, which is as old as numbers. The ledger is a technology of accounting, of keeping track of (i.e. consensus) about whom (or what) owns what, of who (or what) has agreed to what, of what counts as a what, and to record when anything of value is transacted. Ledgers are instrumental to modern capitalism (Nussbaum 1933, Yamey 1949, Allen 2011). Therefore, a revolution in ledger technology is a deep shift in foundational mechanics of a modern economy<sup>4</sup>.

The DLT is inspired by its paper equivalent. The difference, as deriving from its name, is that the DLT uses a “distributed” ledger, distributed actually standing for “decentralized” or shared ledger. A distributed ledger is in fact a list of shared and synchronized data, geographically spread across multiple sites<sup>5</sup>, a database shared across a network. Unlike a centralized system where there is one central administrator or a single point of control and therefore also a single point of failure, a decentralized system provides data integrity, availability and resiliency, since in case of a failure or a corruption of one of the sites of the system, the rest still hold the data and capacity to maintain the ledger or all transaction details even in the absence of the failed location. Distributed ledgers, or decentralised databases are systems that enable parties who don't fully trust each other to form and maintain consensus about the existence, status and evolution of a set of shared facts<sup>6</sup>. Through this technology, intermediaries (e.g. banks and/or financial institutions) are no longer necessary, since the users are transacting directly, minimizing the cost of transaction on one hand and achieving real-time information and reduced error or fail on the other.

### **1.2. Blockchain**

Most confuse and consider DLT and blockchain to be the same. That is not accurate. A “blockchain” is a particular type of data structure used in some distributed ledgers which stores and transmits data in packages called “blocks” that are connected to each other in a digital “chain”. Blockchains employ cryptographic and algorithmic methods to record and synchronize data across a network in an immutable manner<sup>7</sup>. While blockchain is most used, not all distributed ledgers necessarily employ blockchain technology, and conversely, blockchain technology could be employed in different contexts.

A distributed ledger system can be implemented using a blockchain system<sup>8</sup>. A blockchain is a whole new approach to building and using ledgers, i.e., to producing consensus. Indeed, blockchains are increasingly known as distributed ledger



technology (DLT). The new part is to have figured out a way to use distributed ledgers securely and effectively, and thus to produce consensus without requiring centralized trust, overturning the old technology of ledgers that needed to be centralized to be trusted. A blockchain is a trustless distributed ledger<sup>9</sup>.

The blockchain technology is not very recently addressed to the world. As early as in 2008, a landmark paper written by Satoshi Nakamoto, a person whose identity remains unknown, "Bitcoin: A Peer-to-Peer Electronic Cash System"<sup>3</sup>, proposed a novel approach of transferring "funds" in the form of "Bitcoin" in a peer-to-peer manner. The underlying technology for Bitcoin outlined in Nakamoto's paper was termed Blockchain, which refers to the way of organizing and storing information and transactions stated above<sup>10</sup>.

While Bitcoin was the first real and actual implementation of the blockchain technology and up until the present day, many identify one with the other, the truth is that Bitcoin is empowered by the blockchain technology whereas the blockchain technology can be found in ever-increasing uses and applications.

### **1.3. Bitcoin, digital currencies, and cryptocurrencies:**

As mentioned above, the Bitcoin has been the up until now, most known out of many digital currencies. Bitcoin is a digital currency and a cryptocurrency at the same time. But are all digital currencies also cryptocurrencies?

Digital currency on the one hand is a form of currency that is in digital or electronic form, it is intangible and is used in on-line transactions through the Internet or networks. Digital currencies are used like fiat currencies, for the holder to buy goods or pay for services among other purposes.

Cryptocurrency on the other hand, in its purest form is a peer-to-peer version of electronic cash<sup>11</sup>. Cryptocurrency is just a subset of digital currency. Through a cryptocurrency, one part is able to send a payment to another, without the need for the payment to go through a financial institution. The network time-stamps transactions using cryptographic proof of work (PoW). The proof of work is a process called "mining", a term inspired by the traditional process of gold extraction. A timestamping system allows the Bitcoin or other cryptocurrency proof-of-work system to operate and adjust the difficulty of mining the blocks. The main objective of this timestamping system is to check the integrity of the mined blocks and adjust the difficulty of calculation<sup>12</sup>. The timestamping system will reject the new block beyond a certain margin of error, in case of a dysfunctional or deliberately incorrectly set of a computer clock.

Bitcoin deploys the blockchain technology to ascertain its carriers that no corruption in the system will influence their savings and that through this technology, their identity can and will remain unknown. The term "crypto" was added to the term "currency" to highlight that the specific currency is to remain "hidden" and "concealed", since "crypto" comes from the ancient Greek verb «κρύπτω» which stands for that exactly. For that last reason, Bitcoin had for years the negative hue due to it being a mean of transaction among criminals and used in shady transactions, for its holder not to be apparent (e.g. Silk Road, an online market for illegal drugs that used Bitcoins for payments which started in 2011 and was taken down in 2014 by the FBI<sup>13</sup>).

## **2. Financial Institutions and Cryptocurrencies**

Blockchain technology and especially Bitcoin has been for a long time rejected by financial institutions especially due to the negative aura prevailing over its advantages, since at least at the beginning it was mainly used for shady transactions (dark web, transactions among criminals, tax evasion, extortions etc). No financial institution seemed willing to have its name anyhow connected with such a questionable service. Though as time went by, the technology became more widely known and accessible to the public and its traits more and more appealing. Therefore, financial institutions were bound to enter the game, demanding a share of the newly introduced pie.

### **2.1. Public trust in financial institutions after the economic crisis**

What needs to be stated clearly is that Bitcoin and other cryptocurrencies are designed as protocols that transmit economic value across the Internet and not as money. As Satoshi Nakamoto claimed in the inaugural Bitcoin design paper, “What is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party”<sup>14</sup>. The fact though that for financial institutions to be a part of the DLT world, it is first and foremost for them and the public to realize, that in the aforementioned case, the financial institution will not be dealing with money but with something different.

Satoshi Nakamoto launched Bitcoin to the public in year 2009, a year after the world financial crisis and the collapse of a multitude of banks around the world resulting in millions of capitals lost, thousands of jobs lost and millions of people at the verge of economic disaster. The ongoing cover-up for years of the maladies of the banking system and the questionably unavoidable collapse of Lehman Brothers resulting in a domino of financial institutions failing around the world, forcing States to back up the failing banking system using capital coming from public funds among others, had inevitably caused uncertainty and disavowal towards the traditional monetary system. Many depositors seemed, unwilling to place their savings into the hands of a single custodian anymore, and as a result, many capitals were withdrawn from financial institutions<sup>15</sup>. Trust in the banking system, trust in banks and trust in financial institutions such as insurance companies and pension funds, has experienced a decline in many countries<sup>16</sup>.

As stated in the last three five-year period surveys of WVS (World Values Survey) regarding the worldwide confidence in banks, it was and still is relatively low regardless of the measures taken in order to redress the financial system and encourage trust to the banks. To be more specific, for the 2004–2009-year period and according to the above-mentioned survey<sup>17</sup>, when selecting all of the available countries around the world, a total of 69.90% of the respondents claimed that have none at all or not very much confidence in banks. On the following five-year-period (2010-2014), the percentage drops to a total of 42.10%, remaining nonetheless considerably high. On the last available period (2017-2020) in question, the total percentage remains on pretty much the same level reaching a total of 42.90%. The juxtaposition of the results may not itself serve as proof of the previous statement, since the results concern both same and different countries among all, but are assessed in the present paper to feature that action needs to be taken on behalf of

financial institutions in order to invert the current state of mind of the public, especially since, as pointed out in the last of the above mentioned surveys, the least confidence in banks appears among the highly productive age group of 30-49 (50.30%) whereas for the younger (up to 29 years old) and the older (50 and more years old) age groups the percentages reach 46.10% and 41.40%.

## **2.2. Cryptocurrencies gaining market share and financial institutions wanting a piece of the pie**

Blockchain, contrarywise to centralized systems that most financial institutions use, allows for the exchange of data in a way that is both decentralized and secure. Information can be published (in encrypted format, if necessary) and distributed across hundreds of thousands of computers, making it virtually impossible for any single entity to censor<sup>18</sup>. Those exact traits made blockchain and DLT in general, appealing to the public, which for years has been in a disturbing percentage little or not adequately confident regarding the financial and banking system overall.

Despite the mistrust of the public rising, the financial institutions were not eager to examine the possibility of getting involved in cryptocurrencies. No sooner than just ten years ago, few have heard of the term “Bitcoin” and even fewer knew how to use it or have used it. For financial institutions to show an interest, Bitcoin needed to be considered a reliable and accepted form of currency. Ten years later though, more and more businesses and e-commerce websites are doing their business in Bitcoin or accepting Bitcoin as a form of payment.

More precisely, Zogby Analytics was commissioned by HSB (Hartford Steam Boiler) to conduct a survey in October 2019 of 505 small to medium-sized businesses across the United States regarding the matter. Seventy-five percent of the sample had annual revenue under \$5 million and less than 100 employees. The final sample contained 41 percent of the businesses with fewer than 25 employees. Based on a confidence level of 95 percent, the margin for error is plus or minus 4.4 percentage points. That means all other things being equal, the identical survey would have results within the margin of error 95 times out of 100. The outcome of the survey was that at least one-third of U.S. small and medium-sized businesses accept cryptocurrency as payment for goods and services, with newer companies up to twice as likely to trade in digital credits<sup>19</sup>. At the same time a number of large and prestigious companies around the world also accept Bitcoins as a means of payment. Microsoft has temporarily ceased to accept Bitcoin in its online Xbox Store due to the volatility but had been accepting it since 2014 and at present they are accepting it strictly for the Xbox store credits, Wikipedia<sup>20</sup>, Wikileaks<sup>21</sup>, AT&T<sup>22</sup>, Burger King (in Venezuela)<sup>23</sup>, KFC Canada<sup>24</sup>, Amazon through purse.io<sup>25</sup>, ExpressVPN<sup>26</sup> and many others<sup>27</sup>.

Among those firms and enterprises, there are indeed some banks around the world that are already accepting Bitcoins<sup>28</sup>. Probably the most known one is Revolut<sup>29</sup> which runs its business in more than 30 countries around the world, mainly since it promotes and hypes about the possibilities it offers. Revolut is not what one would call a “traditional” bank. In their own words they “are building the world’s first truly global financial superapp”. Modern and innovative appears to be the profile they are serving to the world<sup>30</sup> and pretty much that is the case of every company and entrepreneur willing to explore their possibilities.

On the other hand, many, and highly prestigious financial institutions strict themselves from transacting in cryptocurrencies mainly due to their volatility, making

such transactions a risky business. Many banks view Bitcoin and cryptocurrencies in general as industry disruptors, a potential market anchor, or both. Despite all the stereotypes, the number of banks accepting Bitcoin is slowly increasing. It is hardly a random fact that in May 2018, the World Bank Group published a report called “Cryptocurrencies and Blockchain: Europe and Central Asia Economic Update”<sup>31</sup>. The said report focuses on cryptocurrency and blockchain activities in the region of Europe and Central Asia, attempting to respond to whether the region is prepared for an expected slowdown and how well the economic upswing has been used to adjust to the digital revolution. The press release of 8<sup>th</sup> May 2018 states that “Countries in Europe and Central Asia Can Provide Better Opportunities and Services for Citizens by Leveraging Blockchain Technologies”<sup>32</sup>.

According to the report, central banks seem willing to explore the possibility of issuing digital money for very specific reasons:

- a) The use of traditional cash is steadily declining (Rogoff 2014),
- b) cryptocurrencies have provided a working digital alternative to cash, replicating the original characteristics of cash in digital format,
- c) demand for tokens that are linked to legal tender is increasing.

### **2.3. Covid-19 advances digital transactions**

The aforementioned WBG report was published in May 2018. At the time that the present paper is being written, a pandemic has occurred, and social distancing has been implemented at some point, almost worldwide. As a result, digital transactions have not only increased in number but in many cases have become a sole option for the public. Digital transactions have been increasing in numbers steadily for the last 15 years, experiencing a boost the last five years. Over the said five years, the value of transactions flowing between mobile money platforms and banks has grown fourfold, reaching \$68 billion in 2020, up from just \$15 billion in 2015<sup>33</sup>. Monthly active mobile money accounts topped 300 million in December 2020, increasing from 200 million in September 2018, having tripled in comparison to March 2016<sup>34</sup>. Furthermore, the total annual international remittances via mobile money globally, reached 12,7 billion dollars in 2020, showcasing a growth by 65% in comparison to 2019<sup>35</sup>.

Due to the pandemic, governments were forced to implement measures of social distancing, trying at the same time to maintain as much as possible the functionality of their economies. Countries and states around the world realized that adjustments needed to be made to assure the public, companies, and entrepreneurs' potential to continue to participate in the financial life and minimize the effects of that current situation. The impact of Covid-19 was severe on both economies and people's lives. Measures were adopted by governments in order to facilitate the economic life, combat the negative economic consequences and support citizens, including fiscal stimulus packages and support programs for the lower incomes and SMEs. Necessary transactions had to be performed as safely as possible, the monetary system being inevitably in need of the digital world to perform those remotely. The COVID-19 pandemic and the implementation of such measures revealed all weaknesses of low-income people and SMEs around the world. For financial stability to be restored, financial services, such as credit, savings and insurance are of vital importance. As lockdown measures were introduced in many parts of the world, nonessential

businesses were closed, but bank branches and ATMs were deemed essential in most countries. Financial institutions moved on into making decision and implementing measures that in many cases have been pending. Increase of transaction limits, contactless payments, easy opening of accounts were some of those.

In the aftermath of the COVID-19 pandemic, it looks like the boost in digital payments has benefited especially the SMEs who chose to incorporate and encourage modern and innovative technology with their customers<sup>36</sup>. After all, it is not easy to deny the positive effects of remote and contactless transactions in the era of social distancing or total lockdowns, when customers may prefer to make their purchases of products and services using digital means to reduce physical contact, to avoid the possibility of them being affected by the virus.

## **2.4. Digital transactions and privacy protection**

### **2.4.1. Cash transactions and privacy concerns**

Unlike cash that is extensively considered anonymous, digital transactions can easily be recorded and traced back to the person performing them through intermediaries' systems. Banks, as intermediaries, through their centralized mechanisms, process transactions, like credit or debit card activities. Through the centralized mechanism, a transaction is observable to the financial intermediaries and the clearinghouse processing the transaction and it might result in a record of the transaction (i.e., a paper trail), where a clearinghouse debits the paying party's account and credits the receiving party's account whenever a transaction is made<sup>37</sup>. The idea is very well perceived by regulators since it enhances government supervision of monetary policy. That is not the case though for transactors.

Many of transactors would wish their actions and transactions remained anonymous, just like when dealing with fiat money. Cash payments, unlike digital transactions, typically use a decentralized mechanism. No alteration of account balances takes place hence, the said transaction does not need to be observed by anyone else other than the parties performing the transaction themselves. No record of the transaction is kept since the physical currency simply switches hands. It is obvious that in most circumstances, financial privacy may be reserved via the non-account-based mechanism.

It must be said that cash transactions do not guarantee absolute anonymity. Such transactions are just invisible to financial intermediaries since the cash transaction takes place outside their systems and therefore no paper trail is left. Nevertheless, any transaction could be observed after all, if no action to conceal the transaction is taken by the parties, for example through tax auditing and fiscal control. Because such control will most likely happen at a later time, it is considered that cash offers a greater degree of privacy in financial relations than digital transactions.

In like manner, transactions in cryptocurrency, despite usually referred to as anonymous, they are in fact "pseudonymous". The transacting parties interact directly (peer to peer) without any personal information becoming known to one another, since their identities remain encrypted. Nevertheless, the transaction and their data are recorded, and the record remains on the public ledger<sup>38</sup>.

Shady, illicit, immoral, or simply private transactions, tax evasion or just the wish that the government or other parties have no power to monitor their lives are only



a few of the reasons why some people would prefer a means of payment that is more likely to spending cash than digitally transacting. The recent NSA affair increased the concern among internet users that their on-line activity is monitored by governments and corporations. Ever since, privacy protection interest has upsized significantly for Internet users around the world<sup>39</sup>.

On 7 June 2013, The Washington Post and The Guardian jointly published top secret documents leaked by Edward Snowden, a self-identified privacy activist – NSA whistleblower - unknown to the world until then. The papers revealed that the NSA in the United States and the General Communications Headquarters (GCHQ) in the UK could collect data directly from the servers of Microsoft, Yahoo, Google, Facebook, PalTalk, AOL, Skype, YouTube, Apple. The unveiling which was just the first of a series of revelations made by Edward Snowden<sup>40</sup>, triggered a series of events concerning privacy rights, since the public now felt that their privacy could be violated and their actions monitored, not only by financial institutions but from private platforms as well.

In the light of the recent developments, Commissioner Reding declared, in favor of the privacy defendants that “All EU institutions agree that we have to join forces in order to have a strong European data protection law for our continent [. . .] PRISM has been a wake-up call. The data protection reform is Europe’s answer”<sup>41</sup>. More than 90% of Europeans said they want the same data protection rights across the EU and regardless of where their data is processed<sup>42</sup>, which resulted in the General Data Protection Regulation (GDPR - Regulation (EU) 2016/679) to be implemented.

The newly introduced act has been a wakeup call for citizens, companies, and public services, not only within the regions of EE, but throughout the world. Talks about privacy rights of internet users have been made for ages, the GDPR safeguarding those.

Regardless of the steps moving forward on protection of privacy of internet users, truth be told that especially for on-line financial transactions, privacy is a relative term. No transaction where an intermediary is involved could ever guarantee anonymity – according to the present terms – such as the one cash can provide.

#### **2.4.2. Are cryptocurrencies the answer to private transactions?**

When Nakamoto posted the paper with the title “Bitcoin: A Peer-to-Peer Electronic Cash System”, he introduced a “system for electronic transactions without relying on trust” (Nakamoto 2008). The underlying message was the elements of trust, accountability, or oversight, that had characterized commerce and exchange throughout history would be replaced by a system that would simply have *no need* for transacting agents *to know one another*<sup>43</sup>. Same principle applies to all cryptocurrencies using the same technology.

As a result, all parties transacting in Bitcoin or similar cryptocurrencies are assured that both themselves and their actions remain anonymous. Cryptocurrencies enable privacy preservation for their carriers, through anonymous trading systems and applications<sup>44</sup>, new emerging constantly.

Since though the present paper focuses on financial institutions incorporating the technology, it is important to take into consideration that regulators would wish that they could regulate Bitcoin intermediaries. If it comes to Bitcoin intermediaries becoming regulated, anonymity among users will become less guaranteed (Brito and

Castillo, 2013). In such an event, intermediaries will have to collect some data from their users, limiting thereof the privilege of enjoying anonymity in their transactions.

## **2.5. Concerns about cryptocurrencies on behalf of governments and regulators**

### **2.5.1. Criminal activity**

There is a long-standing myth that still holds among regulators, governments, and the public, that anonymity offered to parties transacting in cash, results into crime, and with the diminishment of transactions in fiat money, crime will lessen or even disappear. The truth, nevertheless, is that the great majority of money laundered by criminals is done through banks and it remains hard or even impossible to trace.

As an example, in the recent bust of the fallen Prime Minister of Malaysia, Najib Razak, 28,8 million worth of cash in different currencies was seized after the post-election raid. That amount is not even 5% of the money that authorities are seeking from the corrupt leader. According to the Wall Street Journal<sup>45</sup>, almost 700 million dollars were traced from a controversial government investment fund to the personal bank accounts of Malaysia's prime minister, Najib Razak.

When it comes to criminal activity, the past has shown that lawbreakers adapt to changes quickly and quite effectively in order to continue their activities. Professor Nikos Passas from Northeastern University, School of Criminology and Criminal Justice in Boston, in his presentation entitled "No Cash, Less Crime?" at ESTA's Annual Conference in Budapest in May 2018<sup>46</sup> showcased the matter taking "nearly cashless" Sweden as an example, that is witnessing rising card fraud rates. According to Prof. Passas "In the cashless Sweden experiment, data from the Swedish Ministry of Justice show that less cash means less robberies (cost saving on security) but an increase of money laundering cases and an increasing prevalence of digital frauds and credit card frauds".

The example demonstrates that in the case that people are interested in engaging into illicit activities or purchasing illicit goods and services, even the elimination of the use of cash would not stop them from doing so, instead they would probably switch to substitutes, such as cryptocurrencies<sup>47</sup>. Therefore, instead of governments banning the use of cash and alternative cash-like means of transacting in order to reduce crime and tax evasion, it might be easier or more effective to embrace and incorporate such into their financial systems.

### **2.5.2. Terrorism**

Besides cryptocurrencies being used for criminal purposes like money laundering, fraud or extortion, a highly disturbing use of them is for reasons linked to terrorism. Cryptocurrencies provide high levels of anonymity and protection to the transacting parties and the feature is really appealing to terrorist organizations around the world, who seek that. Like any organization, criminal and terrorist organizations need funds to operate. Terrorist organizations are often funded by donations coming from abroad, like IRA that was funded by Irish heritage associations in the U.S. from the early 20th century onwards or ISIS and similar groups that are funded by donations from the Syrian or Iraqi diaspora or from sympathisers in other countries<sup>48</sup>. Donations to terrorist organizations can hardly be underestimated. Prior to the 9/11 attacks, Al-

Qaeda for example was estimated to receive the majority of its annual budget of \$30 million by donations<sup>49</sup>.

Up until now, there has not been enough data on the extent of terrorist organizations being funded through cryptocurrencies, rather than the fact that they are. Evidence implies that their budget depends little on cryptocurrency donations and that is mainly due to the lack of technological equipment, knowledge, and skills as well as the inability to use cryptocurrency to cover everyday expenses. Nevertheless, one cannot neglect the \$2 million in Bitcoin and other types of cryptocurrencies seized on 13<sup>th</sup> August 2020 by the US Justice Department from accounts of three Salafi-Jihadi extremist groups, including al Qaeda and the Islamic State. The funds were gathered to finance those organizations. This has been the largest-ever seizure of cryptocurrency by US intelligence agencies in the context of terrorism<sup>50</sup>. Lots of smaller scale fund raising initiatives have come to be known recently and it is quite certain that a few more exist<sup>51</sup>.

### **2.5.3. Volatility of cryptocurrencies**

Governments remain hesitant to encourage alternative paying methods such as cryptocurrencies for a number of reasons, other than the aforementioned, which are linked to their nature and features as means of payment. Taking Bitcoin as an example, for it to resemble a traditional currency, it needs to become more stable. Bitcoin shows signs of excessive volatility<sup>52</sup> and so do other cryptocurrencies<sup>53</sup>. Bitcoin plunged as much as 30% to about \$30,000 in May 2021, according to Coin Metrics. Ether dropped more than 40% in less than 24 hours, breaking below \$2,000 at one point. Both gained back substantial ground by the end of the day<sup>52</sup>. Taking that into consideration, many might argue that cryptocurrencies resemble more to an investment rather to a currency. But that is not the sole reason.

### **2.5.4. Inflexibility of cryptocurrencies in relation to other means of payment in everyday transactions:**

Although the number of merchants accepting Bitcoin as mean of payment is constantly growing, it is far from being a broad mean of payment. It is far less for not-so-popular cryptocurrencies. Another significant drawback is the small number of transactions being processed in comparison to Visa for example. While VisaNet handles an average of 150 million transactions every day and is capable of handling more than 24 thousand transactions *per second*<sup>64</sup>, Bitcoin transactions *per day* is at a current level of just a little above 250 thousand<sup>55</sup>. This limitation makes it hard for Bitcoin to substitute for large scale digital payment systems. The reason for this is that in order for Bitcoin protocol to prevent malicious participants in the process and retain its trustworthiness, it limits the addition of new blocks to one every 10 minutes and each block to a maximum size of 1 MB<sup>56</sup>. In its current form, the Bitcoin payment network can process just three transactions per second, far less than those processed by a credit card company, as stated before<sup>57</sup>.

As Deloitte Insights puts it, “As a means of processing transactions, blockchain-based systems are comparatively slow. Blockchain’s sluggish transaction speed is a major concern for enterprises that depend on high-performance legacy transaction processing systems.”<sup>58</sup>

### **2.5.5. Cost per transaction:**



As an added shortcoming, Bitcoin's cost per transaction is a significant one since the average is at a current level of \$ 171.06<sup>59</sup>, the cost being linked to the problem of transactions taking a while to be verified<sup>60</sup>. Since blockchain technology requires miners around the world working on confirming the transactions, many of the rest of the transactions will be on hold to be included in the next block. When there's a dramatic spike in transaction activity, the mempool (short for memory pool) can become congested, hence some transactions sit as unconfirmed or pending for a longer period. Blockchain support states that "In most cases, your transactions will eventually confirm. It may just take longer than usual to do so"<sup>60</sup>. What could a Bitcoin user do, to speed up the process? Pay the fee of course, to the miners who will confirm the transaction. Miners will pick the transactions which will pay the most and encompass them in their blocks before others. Transactions that include lower fees are "outbid" on the so called "fee market," and remain in miners' mempools until a new block is found. If the transaction is outbid again, it needs to wait until the next block. Transactions with too low a fee can take hours or even days to confirm, and sometimes never confirm at all<sup>61</sup>. This process causes considerable economic insecurity to users.

Bitcoin has been designed with a hard limit of 21 million Bitcoins, which are expected to be created by 2040<sup>62</sup>. Bitcoins, as briefly mentioned before, are generated through mining process. Miners process transactions and are rewarded with new Bitcoins for contributing their computer power to maintain the network. Through mining new Bitcoins are issued, but also new transactions are added onto the blockchain and are subsequently confirmed. This process is necessary for the said transactions to be verified, considered legitimate and added to the blockchain.

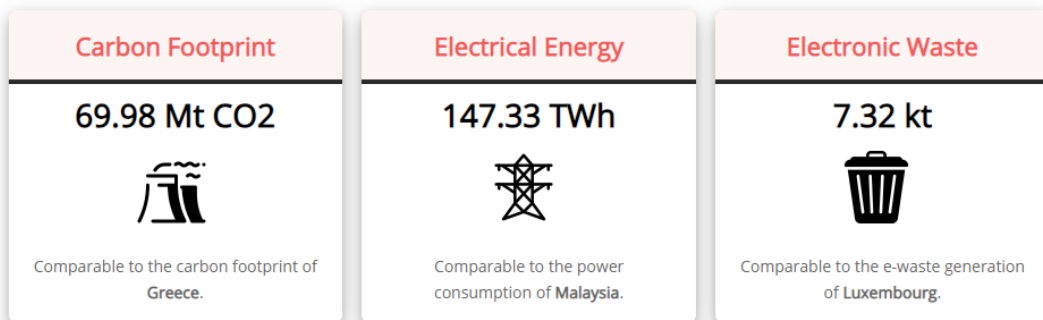
For a new block to be created, miners must find a solution to a predetermined mathematical problem, the mathematical proof of work (PoW). The Bitcoin protocol generates new Bitcoins progressively at a predictable but decreasing rate. To make sure that there is a progressive growth in new Bitcoins, the reward for solving a block is halved automatically every 4 years, and the difficulty of solving increases over time. Sometime in the future, the hard limit of Bitcoins will be reached, therefore the incentive for miners to be rewarded with new Bitcoins will be eliminated. For the system to hold, and the miners to have a motivation to carry on with their work, so as to keep the network up and running, even after the last Bitcoin is mined, rewards will still have to be received, and these will be the transaction fees, possibly elevating those in comparison to today's value.

The profit miners make out of the mining process is considerable, therefore more and more are engaged in that process, both in number and in power. The more power is added to the system, the more difficult the mathematical problem gets and as a result more power is consequently needed. Basic computer power has long not been enough, so the computer power had to become more concentrated. Companies are built for that reason, installing, and using huge range computers in order to achieve the needed results. Miners, not capable to achieve such goals by themselves, had to work together, creating pools. Since the profit of the mining process gets more difficult to acquire regarding the newly issued Bitcoins, those mining pools also rely on the transaction fees, paid by the transactors in order to assure themselves of some steady income. The harder the problem gets to solve and the fewer miners being able to mine new Bitcoins, therefore the fewer miners engaging in the process, could result into fees being the sole profit for a broad number of them. Accordingly, fees could end up rising and users could end up seeing their transactions denied in case they are not willing to pay the applicable fee<sup>63</sup>. The balance of the system appears to be at stake.

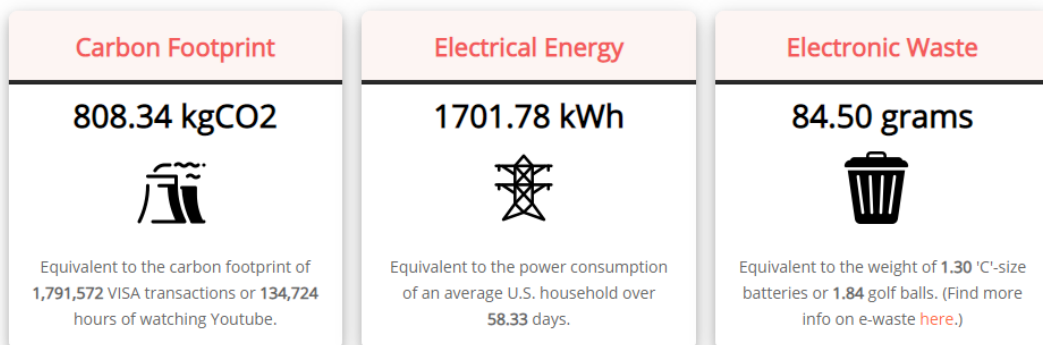
### 2.5.6. The energy problem:

The concept of proof-of-work (PoW) and the reward of newly issued Bitcoins for miners has proved to be quite costly and wasteful. Miners, in order to be able to solve the mathematical problem which will allow them to add a new block to the chain, have used enormous computer power and consumed massive energy (electricity). As more computer power was added to the network, the puzzle automatically became more difficult, as already mentioned. As a result, more and more electricity is needed to solve the puzzle. The system currently consumes an estimated 53 TWh of electricity a year—almost as much as the entire country of Bangladesh consumes (Digiconomist n.d.)<sup>64</sup> 31. No wonder why there is a lot of concern about Bitcoin’s environmental impact<sup>65</sup>. According to Bitcoin Energy Consumption Index published by Digiconomist<sup>66</sup> Bitcoin’s energy consumption on a per-transaction basis is shocking. These electricity costs are likely to rise.

#### Annualized Total Bitcoin Footprints



#### Single Bitcoin Transaction Footprints



To minimize the environmental effect of the mining process, proof of work (a.k.a. mining) could be replaced by proof-of-stake (PoS), where instead of mining, the validation is assigned to a specific node. The selected node would most probably be the one that would hold the largest number of crypto-assets in the network. PoS greatly reduces the effects of the computing power needed to achieve consensus since only a few computers are working and verifying the transactions for each block. PoS, though has not been able to show that it can defend itself against malicious attacks and bad actors. Nevertheless, it is the most popular consensus algorithm after PoW and Ethereum is strongly considering it<sup>67</sup>.

### **2.5.7. Consumer protection:**

Another important factor to be considered is the issue of consumer protection when it comes to Bitcoin or other cryptocurrencies users. Laws may apply for transactions in cryptocurrencies but since it is hard for a government to foreclose and take possession of Bitcoins, consumer protection becomes an unsecured check. The requirement for cryptocurrency holders of having advanced knowledge of computing makes it even harder to ensure consumer protection. Fraud<sup>68</sup>, hacking<sup>69</sup>, gambling addiction<sup>70</sup> or even accidental loss<sup>71</sup> are all part of the game.

#### **2.5.7.1. Who holds the most? The example of a country-owner.**

It is interesting to mention at this point that following the person who created Bitcoin, hiding behind the name Satoshi Nakamoto, who is the one holding the largest number of Bitcoins in the world, there is a country. The Bulgarian government owns at least 213,000 Bitcoins, an amount big enough to cover a large amount of the country's GDP. Bulgarian law enforcement authorities seized the said Bitcoins during an operation related to identifying cyber-crimes committed by an international group of hackers<sup>72</sup>. The SELC offered that the "offenders choose the Bitcoin way of investing/saving the money, because it is rather difficult to be tracked and followed"<sup>73</sup>. Since the number of Bitcoins seized rise to a value of \$3 billion USD, it is quite safe to predict a regulatory framework at least in that country in the near future. Similarly, the US Federal Bureau of Investigation (FBI) allegedly holds 144,000 Bitcoins as a result of a crackdown on the Silk Road, the anonymous drug-selling site which was taken offline by the U.S. Department of Justice in 2013<sup>74</sup>.

### **2.5.8. The problem of regulating the use of cryptocurrencies:**

It seems that both the two above holders of the enormous numbers of Bitcoins are having trouble figuring out what to do with them, after years of having them in their possession. Given the fact that one of them is an actual country, the problem appears prickly. Regulating cryptocurrency is hard because the existing regulatory framework was not designed for it<sup>75</sup>. Not only that, but new technologies and innovations are hard to follow while existing rules were formed for means of transaction that have been pretty much the same for ages. The uncertainty of what a cryptocurrency in fact is, can be witnessed since different Authorities consider it as something different. While Chief Judge Beryl A. Howell wrote for the U.S. District Court for the District of Columbia that Bitcoin is a form of money, the U.S. Internal Revenue Service (IRS) considers cryptocurrency as capital asset for taxation purposes<sup>76</sup> for example.

The problematic nature of cryptocurrencies results into different attitude towards them by different countries around the world. Cryptocurrencies are legal in some countries but remain illegal in many others (China, Russia, Vietnam, Bolivia, Columbia, and Ecuador<sup>77</sup>). Even if not explicitly declared illegal, they are not considered legal thereby<sup>78</sup>. El Salvador is the first country in the world to acknowledge Bitcoin as legal tender as of June 2021. The country's Congress approved a proposal by President Nayib Bukele to formally adopt Bitcoin as a form of payment. As stated by Bukele "If you go to a McDonald's or whatever, they cannot say we're not going to take your Bitcoin, they have to take it by law because it's a legal tender"<sup>79</sup>. The bold move will surely clear the way for future developments, even though it is still seen in caution. El Salvador's Finance Minister Alejandro Zelaya reported that the country had asked the World Bank for technical assistance with the implementation of the cryptocurrency as an official method of payment. The World Bank though rejected the request due to

concerns over transparency and the environmental impact of Bitcoin mining. Financial regulators and policymakers warn Bitcoin facilitates money laundering and other illicit uses. According to Bukele though “the problem is not the dollar, it is the criminals,”, since criminals already use U.S. dollars and other assets to launder money<sup>80</sup>. Despite the rejection, the discussion on the adoption of cryptocurrencies as legal tender has opened up globally. After 7<sup>th</sup> September 2021 El Salvador will welcome the use of cryptocurrencies in its economic life, 90 days after the lawmakers of the country voted in its favor.

The fact remains though that apart from the recent development in El Salvador, the rest of the world does not yet adopt cryptocurrencies as legal tender. So, the question is, are transactions carried by currency that is not legal tender valid and legal? Cryptocurrency advocates could claim that in the absence of any express provision that declares such transaction as illegal, it may not be considered as illegal. Nevertheless, the transaction cannot be characterized as legal, also because of the lack of express provision. The absence of uniform law regulating cross-border transactions makes the use of cryptocurrencies that much more troublesome, especially nowadays that because of the internet, such transactions are performed in large scales.

Since cryptocurrencies are not backed by any centralized regulator, transactors may come across legal issues while using or owning such if complications arise. The most common is the jurisdictional issue. In the case of a cryptocurrency transaction, the ledger’s location is unknown. Additionally, different, and perhaps conflicting jurisdictions may apply on the different nodes of a transaction since they are located in different places in the world. Therefore, on a cross-border transaction it is extremely difficult to determine the applicable legal framework. In a traditional transaction, if complications occur, for example if a party experiences fraud or misconduct, the financial institution that keeps the account could step in and resolve the matter. The transactor could even file a claim against the institution in case of proven negligence or fault. However, if a like situation occurs regarding a transaction in cryptocurrency, there is no intermediary to solve the dispute or compensate the person who suffered the loss. Accordingly, it is extremely difficult for transactors to be compensated through a legal path.

#### **2.5.9. Alternatives to cryptocurrencies introduced by central banks.**

Although cryptocurrencies are yet to acquire a definite and unified definition, and despite in some cases not even considered a legal and valid mean of transaction, tax laws apply, since even illegal income attracts tax<sup>81</sup>. It has already been mentioned that the U.S. Internal Revenue Service (IRS) considers cryptocurrency as capital asset for taxation purposes. In the European Union cryptocurrency taxation varies among member states, but applies in each one of them, since cryptocurrencies are considered legal across the European Union. Furthermore, the European Union is actively exploring ways to regulate the use of cryptocurrencies within its territory and in fact, apart from inserting new legislation the European Central Bank has even expressed an interest in issuing its own public digital currency<sup>82</sup>, expressing concerns about cryptocurrencies that are deemed too high-risk. Digital currencies - also known as stablecoins - usually backed by traditional money and other securities, are considered of lower risk, while crypto coins like Bitcoin are not<sup>83</sup>. An electronic platform which would implement DLT on which central banks might launch a digital currency is an issue of much interest and attention among central bankers<sup>84</sup>. For instance, in April of this year, the U.K. Treasury and Bank of England said they would evaluate the potential launch of a digital version of the British pound, dubbed “Bitcoin” by the U.K.

press. According to Jose Fernandez da Ponte, PayPal's general manager for blockchain, crypto and digital currencies, central bank digital currencies, or CBDCs, were a "fantastic prospect" but it would take policymakers some time to iron out the key issues involved<sup>85</sup>. Apart from the European Central Bank and the Bank of England, numerous other Central Banks have initiated proceedings, are researching, or have even launched their central bank digital currencies projects<sup>86</sup>.

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### **3. DLT in banking**

#### **3.1. Financial institutions may not be willing to accept cryptocurrencies, but they seem willing to accept the technology behind them**

The rising popularity of Bitcoins and cryptocurrencies in general leave no room for questioning their presence both in the present and in the future financial life. At the time the present paper is being written, Bitcoin prices exceeded \$44,000, and the total market capitalization reached almost \$842 billion<sup>87</sup>. At present time, compared to the largest fiat currencies in the world, Bitcoin is 14<sup>th</sup> in line regarding market cap, while Ethereum, the second most popular of cryptocurrencies, appears in the 29<sup>th</sup> place<sup>88</sup>. Recently, on July 24, 2020, a U.S. Federal Court has declared that Bitcoin is a form of "money" under the Washington, D.C. Money Transmitters Act. "Money "commonly means a medium of exchange, method of payment, or store of value," Chief Judge Beryl A. Howell wrote for the U.S. District Court for the District of Columbia. "Bitcoin is these things"<sup>89</sup>. While the ruling may have a small effect on how the market treats Bitcoin, could be an antecedent to lead to a legal evolution regarding cryptocurrencies.

On a random on-line search "how to buy cryptocurrency" it appears that more than enough well-respected sites such as Investopedia, Forbes advisor, the Telegraph, CNBC etc. are willing to provide the interested party with information on that. The Apple store and Google Play store provide applications to users for buying and selling cryptocurrency. The technology is in the hands of anyone that is willing to use it and skepticism based on former reservations appears somewhat obsolete.

The popularity of cryptocurrencies on one hand and the concerns of using them as fiat currency on the other have been an issue of long discussion and research on the part of financial institutions and regulators. In the recent times of high demand of fast and reliable banking and financial services, ones that do not follow up with the developments can easily be left behind. It is undeniable that blockchain technology incorporated in Bitcoin (and others) has been revolutionary and the public has welcome it since its traits are noteworthy. On the other hand, financial institutions and regulators cannot overlook its disadvantages.

Bitcoin, which is the most known of the cryptocurrencies at present time, has not yet managed to establish itself as an alternative to central bank fiat currency, due to its aforementioned weaknesses. Thus, the attention of central banks has turned to DLT in alternative applications and services which could safeguard fast, secure, and private transactions for customers and consumers. The interest of central banks in DTL derives from their role in defining and implementing monetary policy, promoting financial stability, supervising financial institutions, issuing physical currency, overseeing payment systems, and operating financial market infrastructures for the settlement of payments and securities<sup>90</sup>.



### 3.2. The advantages of DLT in banking platforms:

DLT are attached to electronic platforms. Electronic platforms are self-regulated communities managed by a platform operator. Platforms are mostly centralized structures, yet in certain cases, some functions can be designed and implemented to operate on a decentralized basis<sup>91</sup>. The present paper focuses mainly on decentralized structures.

The minimizing of costs can dramatically change global banking and the future of financing while DLT and Blockchain more precisely, is characterized by Openness, Independence, Speed, Robustness, Global Nature and Effectiveness among other benefits<sup>92</sup>. And that is, according to Vincenzo Morabito, author of “Business Innovation Through Blockchain - The B<sup>3</sup> Perspective”<sup>93</sup> because:

Blockchain technology is a data store that is characterized by the following:

- It subsists within a decentralized peer-to-peer network
- Specific users can write it
- It employs the use of digital signatures and communication security(cryptography) to authenticate, verify user identity and implement access rights in a read or write format
- Its scheme brings about a huge difficulty in altering historical records
- Its scheme brings about a great level of ease in the awareness of users in cases of any attempt to alter historical records
- Financial transactions are typically a part of the constituent of Blockchain technology
- Specific users as well as an extensive audience can read it
- In virtually real-time, it is reproduced throughout a couple of systems on the network.

Haruhiko Kuroda, governor of the Bank of Japan, as early as 2016, has stated that “Given that the development of financial services has been supported by ledgers as the basic infrastructure for information, the dramatic changes in how ledgers are kept may have the potential of significantly changing the structure of financial services”<sup>94</sup>.

Kuroda’s example is certainly not the single one. In fact, numerous bankers advertise their strategies in incorporating Blockchain technology to upgrade their services and many of them have already done it. The interest of banks and financial institutions in general has been attracted mainly because the technology has the potential to speed up, simplify and minimize expenses and hazards. Taking intermediaries off the table could result in saving billions of dollars in costs for institutions, since the internal costs of operations and information technology systems on one hand and the fees paid to external providers of services on the other, will no longer be necessary<sup>95</sup>. Avoiding the paperwork, lessening the time needed for a contract to be signed and a deal to close, even the absence of staff to handle each case, are factors that are surely worth considering.

Most of the financial institutions still use centralized ledger systems to record their transactions. In such a system, all transactions are controlled by a single entity i.e., it has a single point of control. In the case of a bank, if that system shuts down, because of a technical problem or a malicious attack, all transactions will be terminated which could cause miss-representation of transactions in the bank statement and/or all

clients could be affected. In the event of bank forgery, in a centralized system due to the single point of control, there could be an impact on all the clientele of the bank. In centralized ledger system a user can modify a transaction and back date it, since that system knows no restrictions on the operations performed in the ledger. Therefore, for a bank to assure the integrity of transactions both internal and external reconciliation of data is required.

In case a financial institution should adopt a system of distributed ledger, permanent data structures are replicated across numerous computers and synchronized across all locations of the system. If a location fails or stops functioning the rest of the system's locations maintain the data and save the integrity of the transactions in question, both in quality and in real time. Such a system has the capacity to significantly reduce errors, delays of hazards and is considered totally transparent. Even complete strangers who have no reason to trust each other can interact in a fully transparent way, without needing an intermediary such as a bank to control the transaction<sup>96</sup>.

### **3.3. Examples of applying DLT in banking:**

#### **3.3.1. Cross-border Payments and Remittances:**

One of the most important applications of DLT is on cross-border transactions and remittances. Unlike in developed countries where such transactions are carried out in most cases in due time and with limited expenses since many of the financial institutions have branches or subsidiaries in many of the other countries, in developing economies parties face uncertainty, high costs, and long delays in making inter-bank, cross-border payments. The reason is that such transactions are currently typically conducted across a network of correspondent banks or money transfer providers, without a central clearing system. The parties are restricted in making payments by the banks' business hours and are obliged to pay the fees that the banks charge, multiple at times, according to the number of intermediaries involved in the process<sup>97</sup>. Fees for such payments are still significantly high even if a party chooses to make the payment through Money Transfer Operators like Western Union and others<sup>98</sup>. A distributed network to replace the current banking network using DLT, could provide the necessary solutions to the current shortcomings resulting in more immediate payments and less costly cross border payments and remittances.

#### **3.3.2. Syndicated loans:**

A syndicated loan is a loan offered to the borrower by several lenders who provide the loan in parts, each undertaking the part that it offers, and they all share the risk of lending. One of the lenders that will be the arranging bank, is given the authority by the borrower to organize the funding based on the mutually agreed terms. The arranging bank acquires the rest of the institutions willing to participate in the syndicate and administers the loan on their behalf. A syndicated loan is issued in the case of a single borrower asking for a large loan, that the bank that the borrower applies to, is unable or unwilling to provide for risk assessment reasons. The syndicate allows them to share the risk and exposure and reap the rewards. The liability of each lender is limited to their share of the total loan. The loan agreement is one. Apart from the arranging bank, there is the agent that has administrative duty among the borrower and the lenders and the trustee, that is responsible for holding the security of the assets of the borrower on behalf of the lenders<sup>99</sup>.

In the syndicated loan, each participant maintains its own set of records. Although all lenders are paid under the same terms of agreement, each party is keeping its own book of records, keeping them in a central database, with the shortfalls and risks already mentioned previously. If the lenders would decide to keep their records in a distributed database, each lender is still contributing data to the database but this way everyone has the exact same copy of the database stored in its computer and all nodes which are linked to each other assure the database is always synchronized across the network. Any alternation made in one node will be reflected in all others, safeguarding the transparency of the system<sup>100</sup>.

Distributed ledger technology provides participants with a high level of trust since any modification in data in the distributed ledger will be discovered by all participants in real time. Furthermore, it minimizes the risk of “double spending”, “a potential flaw in a cryptocurrency or other digital cash scheme whereby the same single digital token can be spent more than once, and this is possible because a digital token consists of a digital file that can be duplicated or falsified”<sup>101</sup>. DLT provides with a double spending preventing transaction verification solution, since for a fraudulent agent to cancel a payment he would have to outpace all of the network’s honest agents, which requires controlling a majority of network’s computational power<sup>102</sup>. Though not impossible to happen, in the case of a syndicated loan where the number of participants is specific, such an event can be considered unlikely.

### **3.3.3. Smart Contracts:**

Self-executing and enforcing digital contracts (smart contracts) are programs executed automatically by the DL network, drawn on the underlying distributed ledger. Using a distributed database, like the blockchain, parties can confirm that an event or condition has in fact occurred without the need for a third party<sup>103</sup>. The transactions performed and recorded on the distributed ledger will trigger the smart contract and the actions taken will in consequence also be recorded on the distributed ledger. Through a smart contract, interaction can automatically be verified between the parties of the contract<sup>104</sup>. This way, parties can enter into an agreement without having to express themselves in legal terms and provisions and without the need to technically enter into the agreement (e.g. paperwork, signatures)<sup>105</sup>.

Although smart contracts, at least for the time being, are limited to the ability of the data to describe these interactions<sup>106</sup>, one cannot overlook the advantages of a smart contract for the transacting parties, since they can provide them with a fast and secure way to interact.

### **3.3.4. Banking platforms with shared data:**

While the best and most known example of an implementation of DLT in transactions is Bitcoin, the blockchain introducing the new framework for digitally organized financial services, the new technology has been deployed by financial institutions in general. As a matter of fact, most financial institutions around the world, regardless of their mentality towards cryptocurrencies, appear more than willing to investigate and apply the revolutionary technology (DLT) and adopt the profile of innovative and open to new trends in banking and financing institution. By pairing traditional banking API’s (Application Programming Interface) with Blockchain technology, banks can create new digital ecosystems, adjust operating models and connect with customers in whole new ways. Layering DLT on top of the existing banking systems, a strong, flexible, new digital platform is created, the banks offering



their customers a whole new experience of next generation Digital Banking<sup>107</sup>. In the new platform, a customer has access to products and services from various departments and partners onto a single integrated platform. Using such a platform, the customer is not limited any more to products and services offered or presented by the financial institution but has full information and choice among not only everything the provider offers but if the case applies to everything various providers are willing to offer. Therefore, the customer can benefit both in time and quality of service, not having to physically connect to the provider or providers.

On the 3<sup>rd</sup> October 2017, European Commission officials carried out unannounced inspections in a few Member States concerning online access to bank account information by competing service providers, in order to identify whether the companies involved and/or the associations representing them may have engaged in anti-competitive practices in breach of EU antitrust rules that prohibit cartels and restrictive business practices and/or abuse of dominant market positions. On 6<sup>th</sup> October 2017, the Commission confirmed the inspections. Such practices were aimed at excluding non-bank owned providers of financial services by preventing them from gaining access to bank customers' account data, despite the fact that the respective customers have given their consent to such access<sup>108</sup>.

The financial information and advice provided to customers by their banks are often biased because that particular bank will provide the information and advice orientated towards that said bank. The fact that customers are often unaccustomed with financial information only worsens the case<sup>109</sup>. A banking platform with shared data can offer various price comparisons and money management strategies after accessing customer account data. In such a way, customers are able to choose the product most appropriate and in their best interest, in their own time and space.

### **3.3.5. P2P funding:**

Peer to peer (P2P) funding or crowdfunding has been considered by many a threat to banking. Crowdfunding refers to “the web-based applications that allow for the sending or pulling of funds from various persons for a specific purpose”<sup>110</sup>. A part of crowdfunding is crowdlending. Through an online platform, borrowers are matched with lenders who do not offer the entire amount of the loan required, but a small part of it, creating among other lenders a “crowd of lenders”<sup>111</sup>. Crowdlending resembles a lot to syndicated loans, that have been previously analyzed.

The market for P2P lending has shown a significant growth in the last years, considering that it will reach \$897 billion by the year 2026<sup>111</sup>. P2P lending applies mostly to individuals and SMEs. In many cases such are unable to achieve a loan from a traditional funding institution like a bank, due to lack of coverage, risk evaluation on their part or credit limitations. In the case of crowdlending though, potential lenders, sharing the risk of exposure, can provide the requested funding to the individual or SME in question. Another important factor why a borrower might end up in P2P lending is that his banking system profile is not a desirable one. This could happen if for example the potential borrower has no credit history or has a bad one. The crowdlending platform to evaluate the borrower's application though is not necessarily taking into consideration those factors. This means that an undesirable candidate for a loan at a bank could get funded through P2P lending. This choice threatens retail banks who are losing potential customers.

### **3.3.6. Non-performing loans (NPL):**

One of the largest problems in the banking system of the western world following the Financial Crisis of 2007-2008, is the total gross volume of non-performing bank loans. The banks under the European Central Bank supervision had non-performing loans worth over €550 billion on their books in mid-2020, which represented nearly 3% of their total loan amount. Even if the amount of NPLs has decreased after 2016, the recent Covid-19 pandemic is likely to cause another increase, them reaching levels as high as €1.4 trillion by the end of 2022<sup>112</sup>. Banks tend to dispose NPLs, once stocks reach a critical mass. Once they decide to get rid of those, they sell them to investors usually for a fraction of the initial value.

When banks offer NPLs for sale, potential investors come across a significant drawback. They cannot be sure that the credit quality of the assets is as good as the banks portray it to be. Information asymmetries in the NPL market cause distress between the potential investors and the offering parties, since it is hard to reach an agreement between the prices that investors are prepared to pay and the prices that banks are prepared to sell the NPLs for<sup>113</sup>. To overcome the burden, transaction platforms for NPLs appear to be a solution.

The European Central Bank published the Financial Stability Review in November 2017, where the idea was presented, while the Council of Europe included the idea in the 2017 Action Plan to tackle non-performing loans in Europe<sup>114</sup>. Next year, the European Commission presented a staff working document in Brussels on 28<sup>th</sup> November 2018 entitled “European Platforms for Non-Performing Loans” where a European platform for NPLs is described as “an electronic marketplace and a data warehouse where banks and investors could trade individual NPLs and NPL portfolios”<sup>115</sup>. On 15<sup>th</sup> January 2019 in Brussels, a roundtable of industry experts was arranged by the Directorate General for Financial stability, financial services and capital markets union in order to advance the setup of NPL platforms in EC<sup>116</sup>. Recently, on 16<sup>th</sup> November 2020, in an effort to minimize the effects of the Covid-19 pandemic in the area of NPLs, the European Commission has presented a strategy to prevent a future build-up across the European Union<sup>117</sup> which included the idea of creating a central NPL data hub at EU level to facilitate such cases. Even if, the idea remains in theory yet, the European Community’s orientation towards a digitalized process of managing NPLs is evident.

### **3.3.7. Know Your Customer (KYC):**

In the case of financial institutions, it is of vital importance that they know who their customer is, that is to make sure that their customers are indeed who they claim to be and be able to verify that. The process of verifying the identity of their customers is critical to help prevent money laundering, terrorism financing, and other illicit activities. Financial institutions are obliged by regulators to implement procedures to identify and prevent such activities, but those procedures fall within the own’s institution’s anti-money laundering (AML) policy. KYC procedures can be expensive, time-consuming, and demanding for companies to implement and maintain.

For financial institutions to abide with the KYC process, they need to collect documents from the customers, process and hold them, and give others to the potential or existing customers. Those documents are related to the identity of the customers for purposes of checking out alleged illicit activity. The financial institutions also apply risk management protocols before accepting with new customers, transaction monitoring and some specific customer policies for banks<sup>118</sup>. On top of that, the financial institutions need to comply with data and privacy protection regulations, e.g., GDPR in

the European Union law. In the event of an institution failing to comply, it risks large fines imposed by the relevant Authorities. In 2020 alone, global institutions were fined \$10,4 billion related to anti-money laundering (AML), KYC and data privacy issues<sup>119</sup>. To avoid such an event, the financial institutions take the compliance quite seriously and this results into significant bureaucracy, time spent on the processes, lots of working hours wasted and expenses regarding collecting, storing, and protecting the data in question. On the other hand, a customer needs to go through such a procedure each time he or she intends to work with a new financial institution.

Using DLT, this verification process needs to happen only once. The verified information will be stored on a blockchain, created, and accessed by a group of financial institutions. By granting permission to overview the verified information along with the documents, the new financial institution will gain access to the above. In such a manner, the verification procedure for each institution can take place in a segment of the initial time necessary and at a much lower cost, since the cost of the KYC compliance process could be shared among the parties participating in the group.

KYC through DLT is still far from being the norm. But appears promising enough for various initiatives on states' part to commence<sup>120</sup>. On July 2020 Dubai's Department of Economic Development (Dubai Economy) and local bank Emirates NBD announced that the UAE Know Your Customer (KYC) platform was live<sup>121</sup>. A year later, HSBC has signed on as the fourth founding member bank of the blockchain-based KYC data sharing coalition<sup>122</sup>. In Italy, 100 bank members from the Italian Banking Association joined the Spunta initiative<sup>123</sup>, while the rest of European banks are carefully examining the project. Australia<sup>124</sup>, Spain<sup>125</sup>, Sri Lanka<sup>126</sup> are three more countries that have announced working towards applying DLT in KYC processes.

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## 4. Conclusions

### 4.1. A new era in banking:

It is evident, that the banking sector is experiencing in the last years a period of dramatic change. Standard services offered to financial institutions' customers for decades in pretty much the same manner have already become obsolete and some are bound to cease to exist. Most, if not all financial institutions, had to enter the digital era by creating digital platforms for their customers to manage their accounts and financial products and other related services. The evolution was deemed necessary due to rising interest of customers to have access to their accounts and manage them themselves, without needing the bank's employee to service them. It has become clear in the last decade that no financial institution could survive and stand in the years to come without incorporating features and services related to digitalization. The pandemic, as mentioned already, has pushed such initiatives a lot forward.

A new trend in banking is digital-only-banks. Digital-only-banks or mobile banks are not traditional banks offering digital services but are banks that function exclusively in the digital world. Such banks offer some significant advantages to those who wish to explore them, such as availability whatever time the customer chooses, paperless transactions, borderless banking, and usually lower fees. Even without a physical environment, such institutions are banks in every sense, performing all transactions like any traditional bank.

The introduction of such entities in the banking world should come as no surprise, considering the circumstances and events that took place especially in the last decade and moreover the public's drive towards institutions that differentiate from those of the problematic past. Taking into consideration the latest trends in banking though, one cannot help but wonder, if banking nowadays takes as much as a network and apps to perform, is the world far before digital giants, engaging in different fields until now, choose to focus their energy and know-how on the banking sector?

#### **4.2. The example of Paypal:**

The release of the 1994 EU Report by the Working Group on EU Payment Systems which was made to the council of the European Monetary Institute, took place after many small venture capital firms appeared targeting the development of e-money systems (DigiCash etc.). After the release, three firms, PayPal, Liberty Reserve and E-gold made their first appearance. Both Liberty Reserve and E-gold were forced to shut down for reasons related to criminal activity and money laundering. PayPal on the other hand was careful enough to negotiate and not "disturb" the monetary system, by doing business in a way that was considered acceptable by central banks and regulators<sup>127</sup>.

Paypal, which is today the largest world supplier of electronic payment services, began its business by linking its payment platform to E-bay's electronic purchase platform. Paypal, at present, has evolved its business to offering services linked to its customers' bank or credit card accounts (also linked to bank accounts), and in fact has a bank charter<sup>128</sup>. It appears that modern money services businesses (MSBs) like Paypal are likely to ratchet up their works to take on more deposits as their market share grows. As their activities expand in various sectors and digital transactions become more and more common, Paypal and like businesses will more frequently retain their customers' credits, the latter not needing to "cash" out their balances<sup>129</sup>.

Paypal and like businesses (e.g. Amazon Payments, Google Wallet) are chosen by their customers for various reasons, some of which are guaranteed fraud protection and personal data protection, the availability of services in many countries, payments in various currencies including cryptocurrencies (PayPal just recently let its British customers buy, hold and sell digital currencies, a crypto service first launched in the U.S. in October 2020 which is similar to one from U.K. fintech firm Revolut<sup>85</sup>), integration with shopping carts in most e-shops around the world, customized features and user-friendly experience<sup>130</sup>. Such reasons make Paypal and like providers very appealing especially among the younger ages. As a matter of fact, a multi-year survey by Scratch (an in-house unit of Viacom), revealed that among persons born from 1981 to 1994 in U.S., a percentage as high as 73% would prefer financial services provided to them by Google, Amazon, and PayPal than by traditional banks. On top of that, the same group characterized their visit to a traditional bank "more painful than a visit to a dentist" at a rate that reached 71%<sup>131</sup>. More than half (53%) of the persons in question said that nothing sets their personal bank apart from its competitors, one in three said that they would consider switching to a new bank within the next 90 days while 33% believed that they didn't need a bank at all. Additionally, the four largest banks in the U.S. were ranked among the 10 least-loved brands in the survey<sup>132</sup>. This must have been a real kick on the face for the traditional financial institutions.

Thiel, a founder of PayPal, has stated that PayPal is not a bank because it does not engage in fractional-reserve banking. Rather, PayPal's funds that have not been disbursed are kept in commercial interest-bearing checking accounts<sup>133</sup>. The PayPal

Buyer Protection Policy gives the consumer the right to file complaint if he or she did not receive the item that he or she ordered, or it shows up significantly different from its description and Paypal will (subject to terms and limitations) reimburse him or her for the full purchase price plus any original shipping costs<sup>134</sup>. Apart from that benefit which comes in handy in purchase cases, Paypal is mostly known for safeguarding its customers' privacy and data. According to Paypal's FAQ when a customer sends a payment using PayPal, the recipient won't receive sensitive financial information like the payer's credit card or bank account number. This feature significantly limits the hazard in dealing with online transactions for customers and making Paypal appear even more appealing<sup>135</sup>.

Since Paypal is not subject to banking regulations, a customer faces the danger that Paypal for example, could freeze his or her account and therefore the money at will. Certain high rates, limitations on the number of transactions per day and amount per transaction, and security holes<sup>130</sup> are some disadvantages to be considered by a customer, yet they do not seem enough to discourage its customers.

#### **4.3. Incorporation of DLT by financial institutions seems to be for their benefit.**

In the recent paper, an effort has been made to present the traits of DLT in its different forms and how each can be incorporated into the banking system. DLT is surely not a panacea for the banking sector, considering its many shortcomings at certain aspects which have been presented in the dissertation. Nonetheless, for the time being, DLTs seem that they are here to stay. Despite the fact that their challenges trouble regulators, authorities, governments and financial institutions, individuals and firms seem to embrace the new technology and encourage the developments in the financial world. Those that are not eager to come aboard are bound to be left behind, and that is evident for someone studying and evaluating the clues available.

The vast number of individuals still remain unfamiliar with either the terms "distributed ledger technologies" or "blockchain" or their application in banking platforms or even platforms in general, but that will not necessarily be the case in the years to come. As time goes by, more and more people become accustomed to them and in the near future it is highly likely that they will be a big part of our lives. Globalization, the need to do business fast and securely, the protection of privacy that gained the importance it deserves the last few years, the on-going pandemic or perhaps a new similar global challenge, among other factors will most probably force the competent authorities and regulators to deal with the problems arising from the fact that there are important gaps in regulating their use.

Finally, the financial institutions themselves will have to examine more closely, and surely more effectively the chances and opportunities rising before them, otherwise they face the danger of someone other than them catching up and taking over. After all, in the public's mentality, as demonstrated by the various surveys mentioned above, banking services are inevitable, while banks themselves are not.

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