DEPARTAMENTO DE CIÊNCIAS ECONÓMICAS E EMPRESARIAIS

MESTRADO EM GESTÃO DE EMPRESAS

UNIVERSIDADE AUTÓNOMA DE LISBOA

"LUÍS DE CAMÕES"

CRYPTOCURRENCIES AND TOKENIZATION OF ASSETS: THE MANAGERIAL IMPLICATIONS OF A NEW FINANCIAL REALITY

Dissertação para a obtenção do grau de Mestre em Gestão de Empresas

Autor: Luca Pizzolato

Orientador: Professor Doutor João Adelino Neves Pereira Ribeiro

Número do candidato: 30003950

Setembro 2021

Lisbon

Acknowledgements

I would like to thank my family for their support during these intense years, achieving these results is not an easy task, but without the support of your families it's almost an impossible one.

I express my deep gratitude to my supervisor, Professor João Adelino Ribeiro, for its patient guidance, the valuable and constructive suggestions, and the useful critiques of this work.

My appreciation goes to Sara Veiga for helping me with the translation of certain documents.

Finally, a special thanks to everyone else that contributed to the realization of this project.

"It's not the destination, it's the journey."

Ralph Waldo Emerson

Abstract

Cryptocurrency and tokenization of assets is a phenomenon that is yet to change many sectors in the economy. Already, its impact has had a significant effect on many financial markets. Cryptocurrencies are more than just a means of payment and transactions. The technology behind it, blockchain, has an even greater impact because it can be adopted even beyond the financial sector. The evolution of tokens and their popularity in the financial sector has had both positive and negative implications on the financial markets and companies. This research seeks to show the managerial implications of cryptocurrency and tokenization of assets. The present dissertation aims to address this gap because of the need for regulation of the sector. To understand the managerial implications of cryptocurrency and tokenization of assets, it is essential that we first understand what the two aspects are and how they operate. Later in this document, we shall observe that Bitcoin is currently the most popular cryptocurrency, although various types exist. At its inception in 2008, there were only about 50 coins in circulation, which has since evolved.

Although blockchain technology had long since been invented, it only became popular with Bitcoin. The technology has three versions premised on virtual currency, smart contracts, and other sectors beyond finance and markets. This technology operates through complex algorithms and computers interconnected to minimize the possibility of fraud and hackings. Using companies like PayPal and eBay, valuable assets can be tokenized and traded as well. Blockchain is also popular for its ability to track records. The data is public and easily accessible. However, the privacy and anonymity of persons are also emphasized. Research was carried out using a qualitative method. This was done by reviewing and analyzing past literature on cryptocurrencies and their general impact on the economy. The pros and cons of using cryptocurrency were also examined to form a clear opinion on its economy usage. It was found that cryptocurrency and tokenization of assets guarantee security, are efficient for payment and promote transparency for business. However, it has limitations, such as the increased risk of fraudsters and illegal transactions.

Keywords: blockchain; cryptocurrency; tokenization; finance.

Resumo

A criptomoedas e a tokenização dos bens é um fenómeno que, futuramente, trará alterações a muitos setores da economia. O seu impacto já produziu um efeito significativo em muitos mercados financeiros. As criptomoedas são mais do que um mero meio de pagamento e transações. A tecnologia que as sustentam, ou seja, a "blockchain", tem um impacto ainda maior porque pode ser adotada em vários setores, não apenas o financeiro. A evolução dos "tokens" e a sua popularidade no setor financeiro tem tido implicações positivas e negativas nos mercados financeiros e nas empresas. Este estudo procura demonstrar as repercussões da moeda criptográfica e da tokenização de ativos em termos de gestão. O objetivo da presente dissertação é colmatar esta lacuna em virtude da necessidade de regulamentação do setor. Para compreender as implicações da criptomoeda e da tokenização dos ativos em termos de gestão, é essencial que compreendamos, numa primeira fase, os dois conceitos e a forma como funcionam. Seguidamente, no presente documento, observaremos que a Bitcoin é atualmente a criptomoeda mais procurada, embora existam vários tipos de moedas criptográficas. No seu lançamento, em 2008, existiam apenas cerca de 50 moedas em circulação, número que, desde então, aumentou.

Embora a tecnologia da cadeia de bloqueio (blockchain) tenha sido inventada muito antes, só se tornou conhecida com a moeda Bitcoin. A tecnologia tem três versões que assentam na moeda virtual, em contratos inteligentes, e outros setores para além das áreas financeira e de mercados. Esta tecnologia funciona através de algoritmos complexos e computadores interligados para minimizar a possibilidade de fraude e pirataria informática. Por meio de empresas como a PayPal e a eBay, ativos de valor também podem ser tokenizados e transacionados. A cadeia de bloqueio (blockchain) também é apreciada pela sua capacidade de monitorizar registos. Os dados são públicos e de fácil acesso. No entanto, a privacidade e o anonimato das pessoas são igualmente valorizados. A investigação foi conduzida através de um método qualitativo. Para tal, procedeu-se à revisão e análise da literatura relevante e acessível sobre as criptomoedas e o seu impacto geral na economia. Os prós e contras da utilização da criptomoedas foram também examinados de modo a formar-se uma opinião clara sobre a sua aplicação na economia. Constatou-se que a criptomoeda e a tokenização de ativos oferecem segurança, são eficientes enquanto formas de pagamento e promovem a transparência nos negócios. No entanto também apresentam limitações, tais como o aumento do risco de fraude e de transações ilegais.

Keywords: blockchain; criptomoedas; tokenização de ativos; finanças.

Table of contents

Abstract 3
Resumo 4
Table of contents 5
List of Tables/Figures 7
I. INTRODUCTION 8
I.1 Theme 8
I.2 Background and History of Cryptocurrencies and Tokens 8
I.3 Defining Tokens 10
I.4 Blockchain Technology and Cryptocurrency 11
I.5 How Blockchain Technology Works 17
I.6 Problem Statement 18
I.7 Research Gap 19
I.8 Objective of this work 21
II. LITERATURE REVIEW 22
II.1 Understanding the economics of cryptocurrencies 24
II.2 Advantages of cryptocurrencies and tokenization of assets 26
II.3 Limitations of cryptocurrencies and tokenization of assets 28
II.4 General implications of cryptocurrencies 30
II.5 Legal implications of cryptocurrencies 33
III. METHODOLOGY 36
III.1 Introduction 36
III.2 SLR methodology 36
III.3 Inclusion/Exclusion criteria 36
IV. CONCLUSIONS 38
IV.1 Blockchain and cryptocurrencies 44
IV.2 Blockchain for smart contracts 46
IV.3 General conclusions 48
IV.4 Final considerations 55

V. REFERENCES 56

List of Tables/Figures

Table 1 Research pieces on the managerial implications of tokenization of assets…….....19

Figure 1 The price chart of Bitcoin……...25

Figure 2 Data Bridge market research……..27

I. INTRODUCTION

I.1 Theme

Blockchain is a continuously evolving concept. Its growth has been affected by many countries' negative attitudes towards it, with some people questionably referring to it as a pyramid scheme. Also, the concepts of Bitcoin and blockchain were highly volatile, making them even more unpopular. Besides being a digital currency, this specific technology has been applied in many aspects, such as a health system, market monitoring, and the supply chain (Xu *et al.*, 2019).

I.2 Background and History of Cryptocurrencies and Tokens

The main idea behind blockchain technology can be traced from as far as 1991. The anonymous distributed electronic cash system of "b-money" was published by Wei Dai in 1998. Shortly afterwards, Nick Szabo created "bit gold." Bit gold, just like bitcoin and other currencies that would follow it, was an electronic currency system that mandated users to complete proof of work with solutions being cryptographically compiled and published. Hal Finney, who followed the work of Dai and Szabo, later set up a currency system based on a reusable proof of work. However, it only drew the attention of many in 2009 when it became popular with the invention of Bitcoin.

A pseudonymous developer, Satoshi Nakamoto, created Bitcoin for the first decentralized cryptocurrency in 2009. It used its proof-of-work program SHA-256, a cryptographic hash function. In April 2011, Namecoin was developed as an attempt to establish a decentralized DNS, making it very difficult for internet censorship. Litecoin was released shortly after, in October 2011. It was the first successful cryptocurrency to use script instead of SHA-256 as its hash function. Peercoin another notable block-chain cryptocurrency had also its first, it was the first to use a proof-of-work/proof-of-stake hybrid. IOTA was the first non-blockchain cryptocurrency and uses the tangle instead, which promises high scalability, no fees and near-

instant transfers. Many other currencies were developed, but few have succeeded, and they have done little to prevent technological blockchain from being only a particular form of a database.

However, when talking about blockchain, one can never fail to credit Satoshi Nakamoto for authoring Bitcoin, the first form of cryptocurrency in 2008. The author has since been anonymous, and over the years, many people have claimed to be him, some believes that the name is used to represent a group of people rather than just one person. To implement the first Bitcoin white paper, Nakamoto developed the first blockchain database and was actively involved in its development up to 2010. Bitcoin was the first digital or virtual currency that attracted the world's attention and threatened physical currency. Blockchain technology used in this cryptocurrency has evoked a lot of criticism from governments and the economic sector (Van Erp, 2019).

At its inception, there was only 50 Bitcoins in circulation in the market. Only tech-savvy people showed any interest at this point, and the rest of the world thought it would not last. In 2010, MT. Gox, a Japanese company, initiated a platform where Bitcoin was used as a trading mechanism where each coin was equivalent to 4.951 cents (Fauzi, Paiman, & Othman, 2020). This exchange rate was yet to skyrocket. The value of Bitcoin is premised on the level of scarcity. Transactions to do with Bitcoin are created within a transaction log across a computerized network. This system is highly secure, and there is a minimum risk of fraudsters. The system in which cryptocurrencies operate is rather complex difficult to understand (Fauzi, *et al*., 2020).

Blockchain is different from a traditional database based on the way it stores its data. It stores its data in blocks which are then combined. When new data or, a new block is entered (Conway, 2020). If the block has been filled with the data, it is chained to the previous block, which chronologically chains the data (Conway, 2020). While various information types of data can be saved on a blockchain, the most popular use to date was as a transaction ledger that is used in many blockchain transactions. In the case of Bitcoin, blockchain is decentralized so that no person or party has power — instead, all users maintain control collectively. Decentralized blockchains are permanent, i.e., irreversible knowledge is entered (Conway, 2020). This means that transactions are irreversible and open to everyone who goes on to further apply to Bitcoin (Conway, 2020). Altering and changing data entered is almost impossible. Another important fact to know regarding the blockchain system is that it uses a triple entry accounting feature instead of the double entry used by every finance system that records the debit and credit. In

fact, the transaction is recorded on a repository or database, also referred as public ledger or blockchain. This third entry avoid every possibility of double spending (Harvey, 2016).

The United States takes cognizance of cryptocurrency's future and has been vigorously researching introducing Bitcoin as a payment means since 2019. This was closely followed by the cryptocurrency act of 2020, which officially recognized and legitimized the use of the currency as a form of payment. This changed the financial scene in many aspects, and it appeared that congress was making a step forward from the traditional physical currencies (Mikhaylov, 2020). In December 2017 the first Bitcoin futures contracts were established and made available for trade by the CBOE (Chicago Board Options Exchange).

I.3 Defining Tokens

At the moment, the task of defining such concepts as "token" and "cryptocurrency" for state regulation is exceptionally acute. Various attempts are being made, and the main problem is that they are scattered and not systemic. The situation in which the economic nature of a concept (category) contradicts its legal status indicates a formal institution's presence, the effectiveness of which is not at the forefront. As a result of this approach, artificial, more precisely, unnatural institutions arise. Formalization of existing informal institutions can occur both to limit them and develop them. These are two different approaches to integrating established interactions into the existing framework of formal law. In the first case, the informal institution changes to a form acceptable for formalization. In the second case, the existing formal rules are changed to introduce new institutions.

Thus, from the institutional approach, the tokenization of the economy can be defined as forming an informal institution based on connections and interaction about token circulation. The item is a token: subjects - persons, groups of persons participating in the circulation of tokens. The present study is not aimed at a comprehensive analysis of the concept of "tokenization of the economy" from the perspective of the institutional approach since this may be the goal of a separate study. However, one can be sure that regardless of the approach - institutions as equilibria or institutions as rules (Chod *et al*., 2019), interaction about token circulation is institutional and now, is generally recognized as being informal. Institutional generators, in this case, are the creators of blockchain platforms. Institutional integrators create

various services based on these platforms, and reformers develop and change existing institutions, applying the results of technology introduction.

In linguistics, tokenization is a process of text processing, which consists of dividing it into separately significant units, the so-called “tokens” (Matulionyte, 2019). From a technological point of view, the term "tokenization" is used to describe the process of replacing unprotected elements with specially created protected ones - tokens. The term "tokenization" is also used to highlight the transformation process of representing any accounting information in the form of a digital token. In any case and for any purpose, the term "tokenization" implies the introduction of a "token" into circulation - only the meaning of the concept "token" differs depending on the scope of application (Koutsoupakis, 2020). Thus, the term "tokenization of the economy" in this study is proposed to be used in the context of the process of building economic interactions based on the turnover of independently significant units, *i.e.*, tokens.

I.4 Blockchain Technology and Cryptocurrency

The concept of "blockchain technology" has been disclosed by many authors. Melanie Swan, who is a research associate at the Centre for Blockchain Technologies at University College London, for example, distinguishes blockchain 1.0, blockchain 2.0, and Blockchain 3.0 (Van Erp, 2019). We will consider this classification later, since it is more of an economic division, albeit based on technological differences. Blockchain, as a technology, is primarily a database with many specific properties. In the context of the present work, we see no need to consider all the distinctive features of blockchain technology's construction and operation. Still, it is necessary to pay attention to some of them. Blockchain 1.0 is premised on virtual currency, blockchain 2.0 on technology and its application to contracts, and lastly, 3.0 relate with the extension of the technology beyond finance and markets.

Bitcoin was developed in a way that it needs a blockchain system to operate. However, the inverse is not true. Blockchain does not need Bitcoin, and any asset, whether tangible or intangible, can be traded on a Blockchain network. This negates the need for third parties such as banks and brokers. Using companies like PayPal and eBay, valuable assets can be transferred from one person to another. This technology operates using complex algorithms and

information technology to minimize the possibility of fraud. Stock exchange companies have also adopted this system to facilitate transparent communication (Weldon & Epstein, 2019).

In particular, blockchain technology implies entering information about the movement of a certain unit of account in a distributed register. For example, the Bitcoin network's blockchain stores information about the movement of the unit of account of the same name (Liu & Wang, 2019). Other information is also posted there, for example, the portrait of Nelson Mandela; however, these are more experiments than systematic use of the network because its primary function is to transmit information about the movement of the unit of account of Bitcoin. The Bitcoin blockchain network maintains a database and a registry, i.e., registration and accounting of data on the unit of account.

The term "database" could well be applied to other blockchain networks because they can store information other than information about the movement of the unit of account. Still, here another feature of the blockchain technology is triggered - the chronological data record. All data is recorded in the network sequentially. Changing the past data is impossible without the participation of the majority of network participants, who distribute all the information. Later, blockchain networks appeared which made it possible to write information into the register about the basic unit of account of a given network and the so-called “tokens” - child units of account.

The informal center of information about all traded cryptocurrencies is the coinmarketcap.com website (about 50 million visitors per year), which uses division from a technical point of view: a coin that can work independently; a token is a cryptocurrency dependent on another cryptocurrency. Many projects use their units of account - tokens that use third-party blockchain networks as a platform. The most common "parent" blockchain network is Ethereum, in which "child" tokens are created quite simply. Tokens created on Ethereum exist under so-called “smart contracts”, which, in turn, function within the network.

At the same time, coins can also be released into circulation not through mining but based on alternative consensus. In particular, 100 billion XRP coins (the Ripple project is one of the five largest cryptocurrencies) already exist in the system - they can either be bought or received for real action. Transactions in Ripple are confirmed centrally based on the transaction participants' digital signatures, i.e., the system does not need miners. This is another technological property that distinguishes between tokens and coins - the latter can be mined.

Blockchain 1.0 is currency, and blockchain 2.0 is contracts. There are whole classes of economic, market, and financial applications based on the blockchain work with various types of financial instruments - stocks, bonds, futures, mortgages, legal titles, smart assets, and smart contracts (Zielinski, 2018).

The sequence of development of blockchain technology, presented by Schmidt, and Wagner (2019), very well reflects the essence of the changes taking place: version 1.0 is just a currency; version 2.0 is already a collection of various tools. Ethereum is exactly blockchain 2.0, and not only has this network chosen the expansion of the list of tools as its development path. However, the networks related to version 1.0, in theory, could also go along the path of using functional add-ons. Still, in fact, at the moment, they continue to remain in a state of simplified functionality.

The last technological aspect, in turn, is that up to this point, we have studied exclusively cryptographic units of account. However, there are also digital, electronic, and virtual. Many authors confuse these concepts to a greater extent based on their economic essence.

From a technological point of view, we have digital data, such as a network unit of account, which can be encrypted (cryptographic data). Cryptographic units of a network can be basic - independent coins and tokens (child units of account). Tokens are not mined, and coins can be released into circulation differently, including through mining. The token is easier to put into circulation. It practically does not require the costs of maintaining the network; on the other hand, the token is always dependent on the underlying coin, which cannot be said in the opposite direction.

When establishing the legal status of a cryptocurrency within the framework of state regulation, four main approaches should be distinguished: cryptocurrency as a currency [virtual (digital) currency, money, an analogue of fiat currency], acting as a means of payment; cryptocurrency as a universal financial instrument; cryptocurrency as a commodity (property, asset); cryptocurrency as a monetary surrogate (Subramanian, 2017). These approaches do not fully repel the economic essence but rather try to interpret this phenomenon within existing legal structures. The positions "cryptocurrency - currency" and "cryptocurrency - monetary surrogate" obviously have the same monetary nature, but different legal statuses are legal/illegal.

Morphological limitations lie in the fact that this concept implies exclusively encrypted information (i.e., the use of cryptographic algorithms), and some functions of money must

appear in this information. The economic nature of cryptocurrencies requires addressing the problems of defining the essence of money and currency (the terms "cryptocurrency" or "digital currency" actually derived from them). The authors have not challenged the monetary essence of cryptocurrency for a long time nor the fact that cryptocurrency is one of the types of digital currency/money (Onik *et al*., 2018).

As noted earlier, cryptocurrency is just one of the states where a unit of account can be applied. This is one of the main arguments of this work. Moreover, the definition of the concept "unit of account" has not yet been disclosed and substantiated. This is because the "unit of account" does not have its essence: it is only a unit of measurement of the resource, which its creators provide. At the same time, it is necessary to pay attention to the unit of account's mandatory signs: it is standardized and unchanged. The attribute "unchanged" means that the characteristics established about the unit of account cannot be changed after its creation. Thus, the distributed ledger can record the movement of any resource that can be expressed in a unit of account, taking into consideration its mandatory features.

As we mentioned earlier, for the purposes of the present work we designate the entity embedded in the unit of account, as "resource". In this context, a resource is some opportunity, but not rights, from a legal perspective. The possession of a unit of account gives various possibilities, which are not always legal. Opportunities are provided either by legal protection or by algorithms—for example, the “key”. Moreover, the opportunity to get into the apartment is provided by the algorithm for matching the key to a specific lock. That is, in fact, for many centuries, we have had a construction when a certain object algorithmically provides us with an opportunity, which has not been confirmed in any way from a legal point of view. And this is far from being the only example.

The presented design can be described as schematically (Onik *et al*., 2018):

- There is a resource.
- The resource is expressed in units of account.
- Calculated resource unit means the amount of resource proportional to its nominal value.
- A certain amount of a resource provides certain opportunities.
- Provision of opportunity is provided either by legal protection or algorithmically.

From an institutional point of view, the existence of several options for providing opportunities either through legal protection or algorithmically reveals a very interesting phenomenon that requires additional research.

If the guarantor is professional and continually implements this function - the institution is formal; if the function is implemented irregularly - the institution is informal. Then a paradox arises, which we will conventionally call the "paradox of the algorithmic guarantor": any informal institution operating on an algorithmic basis (*i.e.*, when the interaction is based on an algorithm, for example, a smart contract) is informal only in terms of interaction that is not reflected in the algorithm. The need for its formalization in the norms of law is limited only by relations that are not included in the algorithm. This paradox is probably the key to studying “tokenomics” from an institutional point of view.

From the point of view of the economic essence, the primary role is played by the concept of "resource", which we use in this work through the definition of "opportunity". Variants of "opportunities" / "resources" depend only on the creators' imagination but still subject to classification. And here, we must not forget that by a resource, we mean not a physical object but a digital reflection of the possibilities of using this object.

Even before the advent of Ethereum, many blockchain enthusiasts thought about the limited content of the Bitcoin network. Transactions in the Bitcoin network have no other meaning except for the transfer of some "value". For this reason, quite a lot of research and development has arisen about the so-called “Colored Coins”. And it was then that the first classifications of the possible use of coins/tokens began to appear. In particular, M. Rosenfeld, Chairman at Israeli Bitcoin Association, back in 2012, suggested as a possible application (Ertemel, 2018):

• smart property (ownership of physical assets such as cars or mobile phones can be verified in the form of a token, and the device will only be responsible for the owner of the token);

• shares of the company (the company could issue tokens equivalent to its shares, and it would be easy to distribute dividends to shareholders and vote by shareholders on the platform);

• Deterministic contracts (a person or company can enter into contracts specifying specific future payment, such as a production bond or a commodity option);

• bonds (a special case of deterministic contracts, bonds can be issued with a certain par value and a maturity schedule, denominated in bitcoins or some other currency or commodity);

• Deposits on deposits (like bonds, except that the issuer guarantees at any time to redeem the token at its face value. This can be used as a tool with interest rates or as a way to work more efficiently with physical assets);

• New currencies (the community may want to use a local currency, which is technically similar to Bitcoin. They can issue tokens for this purpose and distribute them among themselves, receiving economic benefits from their use);

• Decentralized digital representation of physical assets (This is a hypothetical use case that seems to not be viable but eagerly awaited by some groups. Over time, there may be a consensus that a token is commensurate in value for some traditional currency or commodity without a specific assistant except for the boot-up period, which will keep the digital value tied to physical assets).

As we said, the term "cryptocurrency" is a derivative of the concepts of money and currency. There are many similarities between money, currency and what we call cryptocurrency today. Simultaneously, cryptocurrencies are fundamentally different from electronic money, which is only a mechanism for transferring fiduciary money in digital format. Digital currency can be defined as an alternative form of currency circulated, stored and created online but does not have a physical form. Most authors distinguish between fiduciary/electronic money and crypto / digital currencies while endowing the latter with money functions. Some authors additionally share electronic money between themselves, functioning within the banking system and outside it, thus revealing an independent set of electronic money as a form of non-cash payments, which exists in parallel with the banking payment system.

There is one more point that should be attributed to the technological part. All blockchain networks are subdivided into public and private. This division, of course, occurs technologically: either the characteristic property "stored in a distributed manner" is provided by an unlimited number of agents - public, or their number is limited - closed. Corporations and states will use "closed" technology to solve the overwhelming majority of problems, so the property of distribution will be somewhat limited. As we mentioned earlier, technological sets have objective characteristics and have clear boundaries. The characteristic that is applied to some extent in this study refers to economic sets. For this reason, we carry out the division of blockchain networks into public and closed ones in the section of economic essence.

I.5 How Blockchain Technology Works

Cryptocurrencies are digital assets, and some scholars argue that it is not a currency because it is not visible (Bashir, 2017). Transactions are recorded on ledgers using distributed ledger technology. Whereas new transactions can be added to these ledgers as often as new blocks are created, old transactions cannot be manipulated or changed. Thus, accidental transactions cannot be reversed like other online transactions as Visa and Mastercard. New blocks are added using a computerized network without the need for a central management system.

In each transaction, the previous owner gets to sign using a secret key that corresponds with his/her address and a record of how the user received the Bitcoins in the first place and the address of the next owner (Bashir, 2017). Transactions can have more than one input or output address. The signature of the current transaction is then added to a set of transactions that will constitute a Bitcoin. The current owner must specify where the coins came from. A user must check the Bitcoin's validity before purchasing by ensuring that the signatures are valid. This prevents double spending comparable to an owner of Bitcoin attempting to transact over the same Bitcoin or value of it more than once. Blocks thus act as timestamps and determine which transactions happened at what time, which solves the problem in case there is a possibility of double spending (Weldon & Epstein, 2019)

Cryptocurrency is public except with a few exceptions. Users of cryptocurrency only need to download the software, and they can begin transacting. Owners of cryptocurrency have an encrypted key used to access the network, which enables them to transfer assets. After a transaction is completed, it is added to a block and then incorporated into the network. Bitcoin is the most popular of all the currencies, but as already mentioned, there are many more cryptocurrencies. Cryptocurrencies have no precise value attached to them at any particular time. They are highly volatile, which can be disadvantageous, as we will discuss later on. The currency can be used for the exchange of goods and services by users who deem it as a considerate payment (Crosby *et al*., 2016).

Bitcoin ensures all transactions are transparent while at the same time maintaining the anonymity of the users. They do this by giving every user a private key rather than using personal bio data information. Transactions are added to blocks using a process called “mining”. Mining consists of computers competing to solve crypto-related math problems. After the problem has been solved, the block is added to the ledger using distributed ledger

technology. A new block is created every 10 minutes. Only a maximum of 21 million coins is allowed to be on the market at a single time (Babich, & Hilary, 2018).

A new development on the market is the concept of initial coin offerings (Babich, & Hilary, 2018). Through this new concept, companies can raise funds from their investors by buying cryptocurrency and exchange it for Bitcoin. The value of these tokens usually represents the value of the company and leads to speculation of its promising value. This is a good form of financing for companies that want to raise funds rapidly. However, it constitutes a risky move for investors because its nature is raising funds and this should be a process regulated by the SEC (security and exchange commission), which for the time being did not approve such form of financing. In short, it is a chance and more of a blind investment.

I.6 Problem Statement

As already stated, blockchain technology is more than just Bitcoin. Today, assets can be equated to tokens. This involves the creation of digital tokens that represent real assets. The assets that can be tokenized are unlimited, and any asset, whether tangible or intangible, can be put on the blockchain. For example, a pilot study was made that tracked a 28-ton shipment of oranges on the IBM blockchain platform. The most important document, the bill of lading, was recorded on the blockchain. Tokenization of assets is more than just simply tracking data. The evolution of assets' tokenization has both positive and negative implications for companies' financial markets and managers.

Tokenization is a process similar to assets backed securitization. The token is not durable and is consumable on the financial market. Tokens can be viewed as both financial and monetary assets. Many other unregulated cryptocurrencies have arisen since Bitcoin. These include Dogecoin, Peercoin's, and Litecoin's, among others. These cryptocurrencies use similar technology but different algorithms.

Assets' tokenization's evolution has both positive and negative implications for financial markets and companies that this dissertation aims to address.

I.7 Research Gap

As the concept of cryptocurrency and blockchain grows, so does the literature about it. Research has been carried out to show the advantages and disadvantages of the currency and how it operates (Weldon et al., 2017) and (Weldon & Epstein, 2019). Research has also been done to show the relevance of tokenization of assets (Voshmgir, 2019) and (Ammous, 2018). However, limited research has been made to show the impact of the managerial implications of cryptocurrency and tokenization of assets. This area is essential because of the many cryptocurrencies that sprout now and then, and the unavoidable necessity for their regulation.

Table 1 Research pieces on the managerial implications of tokenization of assets

Author	Topic	Conclusions
(Voshmgir, 2019)	Collective fractional ownership	Taxi drivers may lack the money to invest in their own car, so they work for cab companies that provide the infrastructure. Fractional ownership tokens would allow several taxi drivers to collectively purchase a car, instead of renting it, and split the shifts of the day. Car maintenance fees could be managed by a smart contract that collects a portion of everyone's revenues, which then will be allocated for car insurance, repair and maintenance costs.
(Ammous, 2018)	International and online settlements	The vast majority of international payments are denominated in US dollars, Euro or Gold, to send a few thousand dollars' worth of other minor, exotic currencies internationally, there are usually very high fees and is subject to through examination by financial institutions. Bitcoin as global unit of account could address this problem as the gold did during the Gold standard era without the issue of being physical and therefore centralized.

(Casey & Vigna, 2018)	Tracking the products. The supply chain.	Barcodes and RFID chips have improved traceability of goods across the world, but the real problems lie behind the doors of every supplier. End-producers and consumers can't see if the suppliers are fulfilling compliance requirements. Blockchain technology, with its ability to get groups of mistrusting people to gather and coordinate around a common interest, offers a possible solution to the problem. Companies that wouldn't otherwise share information can now use a cryptographic hash of information to verify that key procedures have taken place without sharing vital and secret information.

I.8 Objective of this work

We have tried to find what are the different perspectives from the previous literature on the subject of the managerial implications of cryptocurrency and tokenization of assets, We then focused on the various benefits that may derive from the implementation of cryptocurrency and tokenization of assets in a managerial context. Finally, we tried to understand what obstacles is facing cryptocurrency and tokenization of assets that hamper its adoption.

II. LITERATURE REVIEW

Blockchain is a compilation of different technological platforms that has been a work in progress for a long time, even without necessarily giving a name to it. Because it is still work in progress, there is plenty of literature about it. Initially, the technology was limited to mostly cryptocurrency. Nevertheless, it has since been widely adopted in other transactions outside the financial sector, such as the health and education sector.

Cryptocurrency has salient features that differentiate it from traditional currencies. These features are its prioritization of transparency, security, and privacy. If these features are applied without fraud, the digital currency can guarantee an effective system for making transactions and payments (Chang *et al*., 2018).

The currency appears to be the financial sector's future and has been accepted as a means of payment by large companies such as Tesla, Subway, and Microsoft. These companies are trendsetters that show the possibility of usage as a payment mechanism in more sectors of the economy (Vandamme, 2019). Banks such as Bank of America have also started using the technology as an exchange value for small assets. Companies have also started to view cryptocurrencies as future investment opportunities and have ventured into tokenization instead of going public and thus using the tokens as a form of financing.

In addition to companies viewing blockchain technology as an investment strategy, some countries have adopted the technology in some of their key systems. In Chile, for example, the use of Ethereum was introduced in the energy industry to control financial systems. Similarly, the United Kingdom has used blockchain technology to distribute students' loans and take care of their welfare payments. The UK also created a blockchain service known as " Baas" to give retirement benefits to the elderly (Vandamme, 2019). These examples clearly demonstrate the applicability of the technology to many aspects of the economy.

The development of technology is inevitable, and blockchain technology and its fast growth have brought about economic changes for both individuals and organizations. The technology that operates cryptocurrency is not without risks, but the positive outcomes outweigh the potential risks. In a paper to expose some of the intersections of cryptocurrency with cybercrime, Șcheau *et al*. (2020) observed that there is a need for a balance between the two aspects and modifying laws and regulations to accommodate the flexible nature of cryptocurrency.

In a study by Chu *et al*. (2019), two popular currencies, Bitcoin and Ethereum, were compared with two physical currencies: The Euro and the US Dollar. It was demonstrated that cryptocurrency coincides with changes in the efficiency of markets. Sentiments and events were found not to be significant in the effectiveness of cryptocurrency markets.

Blockchain technology offers decentralized consensus, and the contracting space is theoretically expanded using smart contracts. In the meantime, it requires sharing information that inevitably impacts the information environment to create decentralized consensus. Smart contracting can minimize information asymmetries and boost welfare and consumers' surplus by improving entry and competitiveness, but it can foster further collusion by sharing information during consensus-building. Blockchains typically promote the balance of the economy with a broader range of economic performance.

Also, it should be noted that while blockchain and its decentralized ledger have a broad range of meanings, descriptions, and implementations, the technology and its various versions share a key functionality in the "decentralized consensus." A decentralized consensus is a concept that is widely agreed and enforced by all agents in the system — *e.g*., if the goods were shipped or the payments made. Economists have long understood that consensus allows individuals with diverging points of view and incentives to trade and confront without intermediaries, this provides significant effects on society's functioning, including ethics, contracting, and compliance.

Public blockchains and several blockchains approved collaborate with disaggregated recordkeepers to reach decentralized consensus via the new technologies. Of course, two economic strengths come into being. If reached, programmable decentralized consensus promotes the contracting of contingencies due to their tamper resistance and automated existence. Attaining such a consensus, however, requires adequate distribution of verification information. Blockchain applications, therefore, usually have a fundamental tension between decentralized consensus and the sharing of knowledge. The former increases contractibility and improves health, while the latter can damage society.

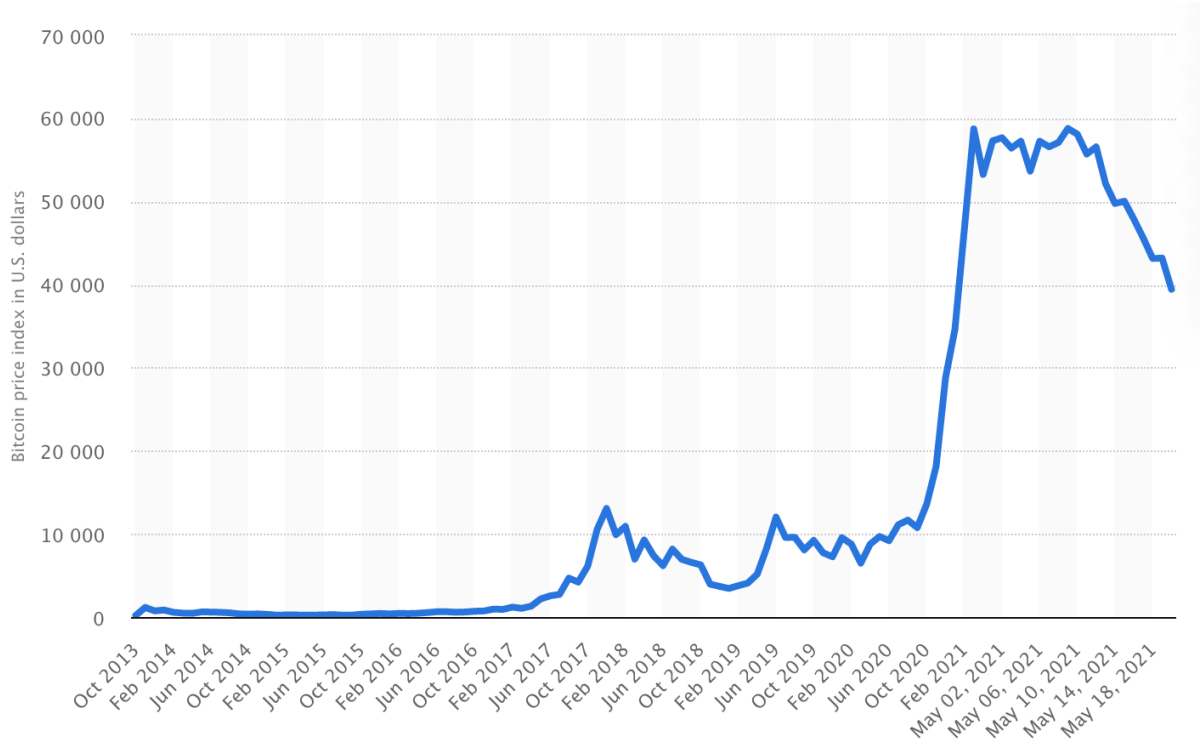
To understand cryptocurrency and which values it stands for; we shall review some of the key principles associated with cryptocurrency and tokenization of assets in this work.

II.1 Understanding the economics of cryptocurrencies

The ownership of cryptocurrencies are recorded in a decentralized ledger. Information is public and maintained by a network of computer nodes. Because it is public, anybody can access the network. Owners of cryptocurrencies can then store the currency using a software termed as "wallet". For users to send currencies from one person to another, their payments are finalized only when they are removed from the mempool, (a mechanism for storing unconfirmed transactions) and added to the blockchain. New blocks are created randomly with limited space. A bitcoin has only 1 megabyte worth of space which can only have not more than 4000 transactions. Blocks are limited for security purposes to ensure that all blocks are verified before added onto the blockchain (Hinzen *et al.*, 2019).

The value of Bitcoin started to skyrocket in 2017. It increased from USD 1000 to USD 20,000 (Zimmerman, 2020). This surge inspired an increase in cryptocurrency trading which caused an overhaul in the system. The system suffered major drawbacks. For example, it was not working well as a payment system for tickets. The Bitcoin blockchain technology has limited capacity and can thus be easily overhauled by congestion. It only allows 7 transactions to take place per second which, when compared with other means of payment like Visa and Mastercard, is really low. The congestion of transactions on the Bitcoin blockchain affects the level of speculation and monetary usage of cryptocurrency (Zimmerman, 2020).

Figure 1 - The price chart of Bitcoin



Source: www.statista.com

The limited trading space on blockchain creates competition among the traders. This is because it increases speculation, which eventually reduces the currency's money value and eventually its price. Thus, there is an uncontested relationship between speculation and usage of cryptocurrency. Unlike the standard economic theory, the price curve can mean to fluctuate. This is because of the limited space on blockchain. If it is crowded, speculation increases which eventually reflects reduced value for the currency and makes it ineffective for making various payments. In terms of assets, the prices attached to them are highly volatile. The pricing of these assets is highly dependent on the news and speculation (Zimmerman, 2020).

Cryptocurrency also operates so that the popularity or willingness to use the currency does not directly lead to an increment in its price value. Instead, its price is determined by the current blockchain capacity and how often it is used as a means of payment. Also, the two determinants do not occur concurrently for a particular asset (Zimmerman, 2020).

Miners regularly create new blocks by increasing their computer power which, in turn, is increased by solving crypto problems. As the rate of new blocks increases, the price volatility

also tends to rise. The reduced competition enables the value of cryptocurrency to rise. If perhaps there is a specified and concise number of speculators that also send household signals, these households could trade at low costs and encourage more trading. The price of cryptocurrency could thus depend on household decisions and welfare and thus solve the problem of low-value Bitcoin caused by speculation and congestion (Fauzi *et al*., 2020).

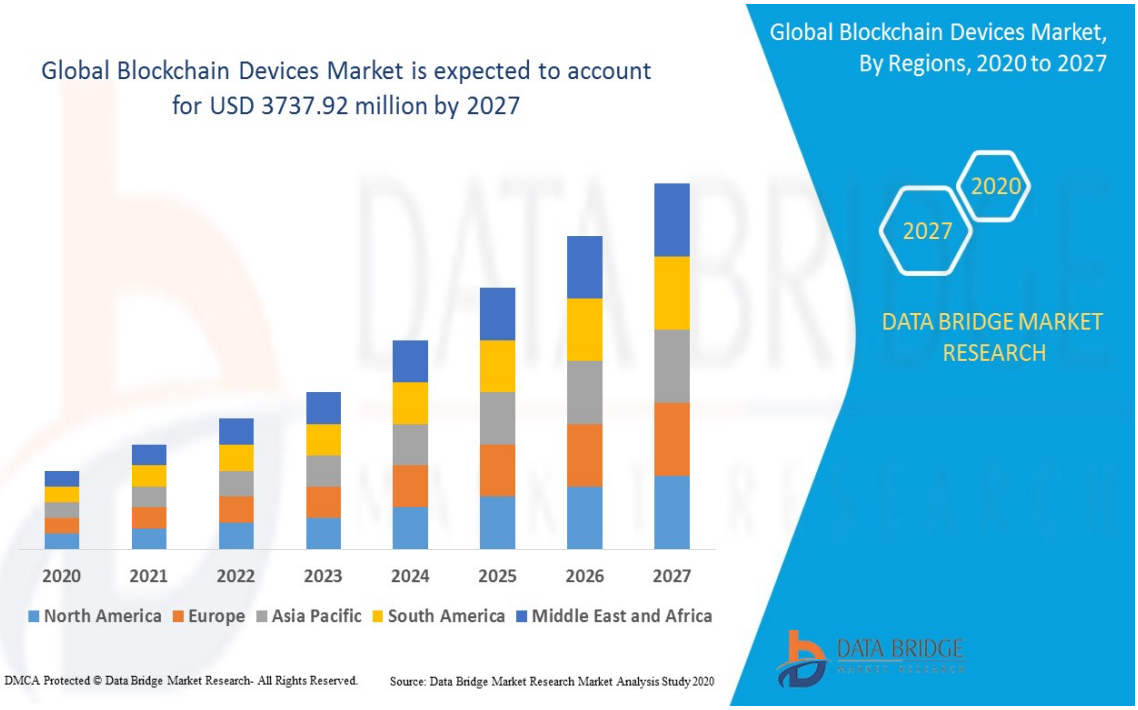
II.2 Advantages of cryptocurrencies and tokenization of assets

The economy can significantly benefit from the rise in digital assets. However, existing business models, more often than not, feel threatened by these digital assets because they could turn them irrelevant. Digital assets redefine economic systems, especially the actors that generate value.

Unlike the traditional monetary system where the currency is centralized around banks, cryptocurrencies are decentralized, and there is no central authority that controls its operations. This is achieved through the use of a ledger where transactions are recorded electronically. The ledger is publicly available and cannot be tampered with unless the ledger is updated. Since the information is mostly public and stored electronically, these are measures to minimize the risks of fraud while maintaining data protection (AbouJaoude & Saade, 2019).

Its decentralized nature allows transactions to be made anonymously without the prying eyes of banks. Although wanting anonymity in business transactions is often associated with fraudulent transactions such as money laundering, some people prefer to transact anonymously for their security (Pagnotta, 2018). Privacy is important to protect users from fraud and spam, which is the trending advertising mechanism. In the chart below the market forecast for the devices related to blockchain as blockchain smartphones, crypto hardware wallets, crypto ATM machines and POS devices is presented.

Figure 2 – Data Bridge market research



Source: Data Bridge

In addition to that, the blockchain system is highly secure. It provides an alternative way of transacting that is free from counterfeit products and fraudulent dealings. Different brands can trade there without worrying about other non-standardized products (Crosby *et al*., 2016).

Tokenization of assets gives liberty to both societies and businesses to define what is valuable and to which degree it can be valuable. This shifts the economic paradigm away from the few elite and redistributes it among many users. For instance, individuals can add economic value to their passive work by getting rewarded for the value they bring into the marketplace. This passive work can take on many shapes, including sharing personal information, doing research in exchange for a token (Boucher, 2017). Since the assets that can be monetized are unlimited, digital assets can unlock previously dormant markets. Everyone has access to financial services with digital currencies, hence creating many investment sources that geography would have otherwise limited.

Blockchain technology operates through streamlined IT systems. There is thus no requirement for third parties which are a necessity in ordinary business transactions. The third parties are

usually insurance brokers, lawyers, banks and other entities. This greatly reduces transaction costs. Also, the streamlined system means that some of the work that was once manual is automated. Simple transactions as send or receive and clearance are automated and completed in seconds, which speeds up the process. The time taken to complete the transaction is short and cheaper than the traditional mode of doing business. Tokenization of assets promoted shared ownership of assets, where more than one person can own one asset and profit from it jointly. They can easily use it equally without the continuous haggles of ownership versus usage haggles (AbouJaoude, & Saade, 2019).

One of the key pillars of blockchain technology is transparency. All transactions are open and visible to all participants. However, there is an option for private blockchain for users who may have sensitive information and assets, such as the government and banks. Transparency creates a sense of accountability because it allows the tokens to be traceable. It allows any user to trace the entire history of an asset that they want to purchase. For instance, in the supply chain, they could help the users determine the assets' authenticity. This could solve many more problems, such as the issues of copyright in music and books. Thus, the ownership chain can be identified, which reduces the possibility of fraudulent transactions (Boucher, 2017). The system thus promotes a balance between maintain transparency and keeping the use of information private.

II.3 Limitations of cryptocurrencies and tokenization of assets

As much as there are optimists that see cryptocurrencies like Bitcoin and the blockchain technology as the future of our economy, some scholars are not enthusiastic about the concept, and rightly so, since their main argument is the high volatility rate of the currency, a feature that can promote its usage for money laundering and illicit activities. The volatility of the currency is premised on government announcements, news as well as speculation. The fact that the prices are always fluctuating creates a big investment risk and could result in heavy losses (Bunjaku *et al.,* 2017)

Prices of cryptocurrency tend to drop dramatically in scenarios where there are speculations of scam or possibility of hacking. A popular example is a scenario in June 2019 where the Bitcoin price dropped by 10 % in a couple of minutes because of crashes in the Coinbase digital exchange market.

A more recent example of the volatility of cryptocurrency was in February 2021 where the Bitcoin value rose by 60% in one month. According to the data website, Coinmarketcap.com, the value of all the Bitcoin in circulation amounted to $1 trillion which exceeded the $50,000 mark for the first time in one day. The reason for this was the fact that Elon Musk, the billionaire that owns Tesla (a car-making company) made high a profile purchase of many Bitcoins. It was estimated that the billionaire had bought about $1.5 Billion worth of Bitcoin. This influenced both small and big investors to make investments (Partridge, 2021).

In their study, Fantazzini and Zimin (2019) have proposed various ways to make a risk analysis for cryptocurrencies. This research was conducted based on 42 digital coins. With that, they can differentiate between the two similar aspects of credit and market risk. Credit risk is associated with the failure of the other party to pay while market risk is also the market risk of cryptocurrencies, which is largely driven by Bitcoin coated with the change in prices of different assets. In assessing risk, it was resolved that market risk is usually driven by Bitcoin which suggests the homogenous nature of the blockchain. In regard to credit risk, it was suggested that indeed, there is a similarity between the credit risk in traditional asset classes and the risk in cryptocurrencies. Also, the currency lacks a central management system that promotes fraud and is decentralized. This poses security rights and promotes the rise of illicit and terrorist activities because there is no central system that tracks transactions. An example is the 50 million dollars that were stolen in the Decentralized Autonomous Organization during an attack in 2016 (Șcheau *et al.,* 2020).

As earlier stated, cryptocurrencies are advantageous because they do not restrict the assets that can be traded thereon. However, this is not always an advantage because some of these purchases can be illegal, such as drugs and harmful substances. A study was conducted by Foley *et.al.* (2019) which showed that in the early days of Bitcoin as a cryptocurrency most transactions made were related to drugs and illegal substances. As of 2019 when the research was conducted, 46% of all Bitcoin transactions were for illegal activities (Foley *et al.,* 2019).

Many investors have lost enormous amounts of money because of the flexibility of cryptocurrency and the rate at which fraudulent transactions are deemed acceptable. However, not many people are aware of the possibility of fraud when using cryptocurrencies. A survey conducted by Bitcoin.com News in 2018 discovered that investors of cryptocurrencies lose $9.1 million daily due to cryptocurrency *fraud*. This shows that the possibility of fraud is not just a myth but a real problem.

Anonymity can be advantageous for users but also has certain drawbacks. It alleviates the possibility of criminal transactions. Users of cryptocurrency can only be identified using a public key. Their identities thus remain unknown, and users are supposed to overlook the usual fiduciary relationship that more often exists in economic transactions. The lack of identification poses a threat to investigations into illicit activities like money laundering and tax evasion. Tracking financial crimes becomes more difficult and users can create more than one wallet and can have different keys. They can thus duplicate their personalities. Fraudsters are essentially given a platform to operate without fear of repercussion (Chu *et al.,* 2019).

Another disadvantage is the lack of scalability of the Bitcoin payment system. The proof-of-work principle prevents the blockchain from being overwhelmed by malicious participants, assuring its veracity. But adding new blocks is limited to one every 10 minutes, and each block is limited to a maximum size of 1 MB. The average number of transactions included in such a block is 2000, a value considered to be low (Bashir, 2017).

Understanding how blockchain and cryptocurrency operate is complex and difficult for individuals that are not tech-savvy. Such fact limits the use of the technology and puts holes in the assumption that blockchain technology is the future of payments and many transactions. It also limits its usability and makes it unpopular, and many prospective users and investors do not get an opportunity to benefit from it because they simply do not understand how it works (Bashir, 2017).

II.4 General implications of cryptocurrencies

Cryptocurrency and blockchain pose a challenge to policy makers. For transfers with cryptocurrencies or smart contracts, there is no regulatory structure. Transfers take place outside of regulatory schemes to prevent money laundering and intelligent contracts are not subject to consumer protection law or financial supervision.

Cryptocurrencies are recognized not as payment systems but are considered commodities, albeit tax codes do not fully cover the new markets. To integrate these emerging practices in direct and indirect tax schemes, tax laws must be modified. The topic of promoting or banning these new practices is another ambiguity for policymakers. One wonders whether it is because of beneficial externalities and first movement gains that they should be encouraged or whether they are meant to be limited (Cryptocurrencies and Blockchain World Bank, 2018).

The wasteful use of electricity in mining is an unwanted side effect of cryptocurrencies. When mining firms pay a cheaper price of electricity than the marginal consumption costs for more power, governments should consider raising prices or at least estimating the implied subsidy. The sudden rise in demand for energy could provide the potential to establish an intra-daily price fluctuation electricity market to match real costs. Uncertainties regarding potential demands for energy for bitcoin mining require a representation of governments' contingent obligations where public-private alliances construct additional power plants (Cryptocurrencies and Blockchain World Bank, 2018).

Blockchain technology allows for the use of distributed ledger technology (DLT) which, in turn, allows users to record and regularly update records without having a centralized system. The effect of DLTs on financial post-trade institutions is based on at least three aspects, i.e., the level of the post-trade value chain, the kind of governance they are exposed to, and how they are able and authorized to introduce developments. Since validating the current contract and no reversal of the respective change to the distributed ledger, the transaction is resolved in the ledger. However, the implications are not obvious. This is an aspect that we would like to stress.

Only one or a small number of securities-value layers were offered by many developers when DLT's began to be widely talked about. The situation has changed now and an increasing number of DLT solutions are being developed whose functionalities cover various layers of the value chain of the securities transactions, as well as the supply of their products to financial institutions (Mills *et al.,* 2017).

DLTs will have an impact on the need for third parties in negotiations and transactions. However, this does not necessarily mean that they will be eliminated. Transactions need to be validated, and thus settled. By many markets a decentralized system raises issues relating to confidentiality at least in the light of current DLT technology and transactions, such as current financial market infrastructure, and may therefore need to be validated by third party institutions because the efficient validation of transactions within a DLT currently requires validators to have access to detailed information.

Blockchain technology could minimize the risks associated with banks and similar institutions because it is not governed by the trust intermediaries normally used for transactions to be completed. All transactions are tracked in ledgers and constantly updated so there is limited risk of human error and failure of the system or risk of losing crucial data.

For the financial sector, the fact that the currency is not regulated has already sparked negative comments from many financial intermediaries and yet for the currency to become widely accepted and used. Financial institutions would have the most success if they decided to launch cryptocurrencies because they have earned the trust of people over time. A central bank has the ability to bring together different markets in the economy and even create one means of payment. A centric cryptocurrency stem will be a force of change in the financial sector of any economy. This will create a balance between the need for flexibility and transparency of the currency while at the same time putting in place mechanisms to prevent fraudulent transactions (Tasco *et al.,* 2018)

Blockchain has a real impact on stock markets. Throughout history, the stock market has stood the test of time and can be largely unstable. Cryptocurrency can change the entire stock market using the proof of work concept, verifying a transaction could take a matter of seconds thus reducing the money laundering that is carried out through the stock market.

Blockchain technology could have positive implications for the health sector. A report from Deloitte showed that about 35% of the surveyed health care organizations were looking at adopting blockchain technology in their operation (Pilkington, 2017). Blockchain technology could be relevant for health care management for both the health care providers and protecting patient data. Hospitals and physician practices are prone to cyber-attacks and using blockchain technology could be effective to modify the current electronic health records system.

Using the current electronic health records system as it is now, patient data and information is fragmented around a central management system that is more accessible to only the health care provider but not to the patient - unless it's on-demand. According to the U.S Department of health and human services, not all health records should be readily available to patients. Blockchain introduces a new aspect called “MedRec” that gives patients access to medical information across many sites. The solution thus bridges the gap between customers and healthcare providers and makes them more involved. MedRec enables quick access to medical history and improves the efficacy of healthcare providers (Pilkington, 2017).

Supply chain management could benefit a great deal from blockchain technology. Supply chain management has features that are similar to that of Bitcoin - for example, they both emphasize transparency and traceability. Blockchain technology would shorten procurement processes since it enables smart contracts to be made automatically after the transactions. It also reduces

the need for intermediaries such as brokers and hence businesses can trade openly (Babich, & Hilary, 2018).

Blockchain technology could be applied to ease processes in the human resource management sector as well. Being based on a ledger system, it can ease the process of putting into effect certain specifications. A research was conducted to show the extent to which IT systems have been applied in the human resource processes. It was shown that technology, and, in this case, blockchain technology can help to establish error-free and effective systems that are cost-effective in comparison to the traditional system (Onik *et al.,* 2018).

II.5 Legal implications of cryptocurrencies

From a legal perspective, the rise of cryptocurrency comes with many implications. Blockchain technology is capable of being applied to many sectors of the economy and is not dependent on Bitcoin or other cryptocurrencies. It is not logically possible to explore all the different sectors in blockchain technology that could be applied. However, some of the most common applications are in financial markets, taxes, and insurance contracts. Of late, many businesses are trying to incorporate this technology in their activities (Smith, 2019). A popular example is Tesla by Elon Musk. Because of this surge, there is an automatic surge of corporate responsibility and possible legal associated challenges. Regardless of how blockchain is used, its systems present many legal challenges. Tokenization of assets is a new reality and some important issues, like how they can be classified, have not yet been widely addressed.

Given its ability to disrupt traditional finance systems that already have stipulated laws and regulations, governments want to regulate cryptocurrencies as well. However, most of the time, the regulations overlap, and innovators have to bear the high costs of licensing. Large scale firms are thus able to bear this cost while individual users cannot (Giudici *et al.,* 2019). It is difficult to regulate currency that on the face of it, has no value. The US. Security Exchange Commission (SEC), while prosecuting a Bitcoin Ponzi related scheme, encountered an argument on whether cryptocurrencies should be considered a form of security and thus subject to the jurisdiction of the SEC (Minor, 2020). It was the court's opinion that since Bitcoin is used as an exchange for goods and services and can thus act as legal tender, and the investments meet the terms of contract, then the SEC had jurisdiction over cryptocurrency matters.

However, the court decided that they would consider each case subjectively on a case-by-case basis. The lack of regulation for cryptocurrencies was the main motivator behind this decision and presents many challenges to the legal fraternity whose clients have tax disputes or own digital assets.

The Unites States' Internal Revenue Service (IRS), which is the body responsible for collecting taxes, has classified cryptocurrencies as virtual currency. They are not regulated by the tax regulations of fiat currencies and such opinion have been facing a lot of criticism. The IRS defines cryptocurrencies as a digital representative value that can function as a means of exchange. However, it is also described as a convertible virtual currency, meaning it can also be exchanged for real currency. This leads to the dilemma of whether a virtual currency can be exchanged for money and whether, in those terms, should be considered currency (Minor, 2020).

The reason why it has proven difficult to tax cryptocurrency transactions is because of the versatility of these transactions. The liberal nature of cryptocurrency means that there is no limitation to the things that can be monetized; for example, if someone earned Bitcoin from mining at home, it would be taxed as self-employment income. However, if someone purchased or transacted for a real estate asset using cryptocurrencies, they could sell it and make either a profit or a loss. As far as the IRS is concerned, any transactions of coins and tokens incurs a taxable event (Smith, 2019).

Transactions that are completed over the blockchain have to follow the rules of traditional contracts of offer, acceptance, consideration, consent between the parties, and creation of obligations between the two contracting parties. However, they also provide for smart contracts, which execute automatically upon completion of the transaction (Weldon & Epstein, 2019). They are made possible by software programs that execute the agreements immediately as the obligation accrues. The contracts are however not legally enforceable because they are virtual. A party to the contract will not be liable for voluntarily breaching the contract because litigation is not a mechanism for enforcing the contracts. Also, some rules under ordinary contracts do not apply to transactions on the blockchain. For example, the rules on contracts that are against public policy would not stand because of the anonymous nature of transactions.

Smart contracts could change century-old contracts in many ways. Traditional principles of contract would have to be modified to accommodate digital currency transactions, otherwise users of these transactions would have no remedy if their rights become violated. This is

because traditional laws of contract apply more to the enforcement of contracts while smart contracts are premised on the assumption that there is no possibility of breach and that all outcomes of the contracts can be predicted. However, in reality, this is not always the case, and the intent of the users could be misunderstood. This could cause many modifications to traditional contract principles.

The decentralized nature of cryptocurrencies creates uncertainty over the traditional contracts and which laws should be used. Transactions are virtual and, in most cases, cross-continental which leads to issues of jurisdiction and the question of whether the contracts were concluded to determine the laws to apply since the law is not static and is affected by different cultures. Also, issues to do with mistakes, duress, and misrepresentation are left unattended. The jurisprudence on cryptocurrency and tokens is quite limited but it is bound to increase as the transactions become more complex and sophisticated. Due to the privacy enjoyed by blockchain technology, if a party to a contract is disgruntled, they may not know who to sue or who to hold liable unless the malfunction is traceable to an operator of the system (Weldon & Epstein, 2019).

III. METHODOLOGY

III.1 Introduction

This research aims at determining the managerial implications of cryptocurrency and tokenization of assets in the economy. For this work, we used the qualitative research strategy. This method is concerned with the subjective review and assessments of opinions or literature. This research also aims to interpret past research and meanings that are socially constructed. This was coupled with an inductive approach to add to the already existing literature.

III.2 SLR methodology

Systematic Literature Review (SLR) was used to collect data selectively and restrictively based on the years the material was published. We conducted the research work in order to obtain information and understand the relationship between cryptocurrency, tokenization of assets, blockchain, and the how these elements turned into a new financial reality. This further enabled us to answer the research questions that were posed. With this kind of method, we scrutinized the literature by further emphasizing following the set standard process while making comments and placing suggestions. We did select papers ranging from 2016-2020, given that the concept of blockchain technology is new and hasn't been a decade since its invention.

To do the research and explore all the available online studies related to cryptocurrency and tokenization of assets and subject them to intensive analysis, we used Google scholar and major online libraries of the major academic publishers, such as SSRN.

III.3 Inclusion/Exclusion criteria

We used the criteria for article selection to do away with those that do not fall under the desired qualification, including those that gave ambiguous information. We focused on using keywords like blockchain, cryptocurrency, tokens, tokenization of assets, smart contracts, etc. Terms like DLT and ‘‘decentralized ledger system’’ (DLS) were also used. To ensure quality and also ensure that the chosen articles comply with the set standards, the articles were subject to intense

scrutinization. First, the abstract was read and the title to pick out the keywords, and lastly, the chosen articles were read for deeper analysis. The selected papers were further classified based on the research questions and methods.

IV. CONCLUSIONS

This section concentrates on the conclusion of our analysis and research. Various observations and key findings were made from reviewing the various previous literature. Our main questions were: "what are the different perspectives from the previous literature on the various features of cryptocurrency and tokenization of assets? What benefits arise from the various features of cryptocurrency and tokenization of assets? What hurdles come from the tokenization of assets and the use of cryptocurrency?". This involved analyzing the past literature and discourse to assess the advantages and disadvantages of cryptocurrency and tokenization of assets. Finding results to these research questions further enables us to find a solution to the gap that this dissertation is trying to humbly bridge.

During our qualitative research, we considered various types of articles from different sources for our analysis. Our articles were ranging from a period of 1-6 years. Our research shows that words like blockchain had started being written about by 2013 but data sources illuminate blockchain as of 2015. Since then, the concept of blockchain and digital currency had not been well received or adopted. Our selected articles showed consistency in the major keywords used and theses. Most of our articles had words like blockchain, cryptocurrency, smart contracts, distributed ledger system, digital identity, automation, and finally decentralization. These words are the center of our topic and dissertation. The most prevalent keywords were tokenization, blockchain, and Bitcoin.
We further classified the previous research based on the kind of research it cantered about; whether it was a cry for improvement in a particular sector that suggested recommendations to solve pitfalls and gaps in the new financial technology, or whether it was a report that provided detailed reviews and discussions, especially on previously suggested recommendations; or, finally, an article on the applicability of blockchains to the financial sector.

One of the key findings involves the management of digital identity, which is converting from a purpose drive necessity to a self-standing activity that develops to a resource for many digital applications. New technologies as the blockchain may transform digital identity management into a basic infrastructural service, sometimes even a commodity or a tokenized asset (Zwitter *et al.,* 2020). Identity control is not done by the government and this serve and promotes the concept of 'self-sovereign individuals' since people are given a chance to manage their identity (Zwitter *et al.,* 2020). Many people currently use blockchain to safely keep their personal

documents like professional credentials, certificates, driver's licenses, personal identifications online and this has further helped to curb identity theft and fraud (PricewaterhouseCoopers, 2020).

This digital system works in a manner that goods are reduced to tokens that are sold online on specific platforms and as such, a sale can be easily accessed by anyone in any part of the world. Furthermore, the myth that this digital technology only works with money transfers is disapproved with this new technological advancement and innovation. According to Bhandarkar *et al.,* (2019), the peer-to-peer system that is used for money transfers when it comes to cryptocurrencies and tokenization can also be used and adapted to other transfers which also involve the transfer of real assets or shares of companies. The buy and sell of these assets can easily be made with this blockchain technology by tokenizing them and digitally transferring them to another person (Bhandarkar *et al.,* 2019). When the real stocks are turned into digital stocks through tokenization, these digital stocks act as digital stocks. This form of digitalization that allows real stocks to trade online has helped to solve so many issues that face the current stock market including short sales and high frequency trading (Bhandarkar *et al.,* 2019). This further helps to protect the transfer of physical goods from apparent and actual damage, for example, art pieces are protected from damages that usually happens during sell since the sale was made physically and never digitalized. Now, the pieces are left in their mint conditions with no damage as sales and bids are made online.

Additionally, cryptocurrency and tokenization promote efficiency. The decentralized nature removes third parties and bureaucracy. Taking a quote from Lo and Medda (2020), "The public blockchains on which the sampled tokens operate, are systems where no higher authority is necessary to create trust between distrusting agents. This decentralization equates to no single point of control, and a reduction in establishment costs. Without system critical gatekeepers, such as governments or banks, blockchain is dramatically reducing the barriers to creating provably scarce tradeable tokens." Pg. 10. The need for an intermediary is done away with when it comes to dealing with crypto-technology or blockchain. Further, Tapscott and Tapscott (2016) also agree that the absence of a middleman helps the easy transmission of digital monetary value and, also, is cheaper since no one requires one to pay straight into the bank. Similarly, Bikalova (2017) states that payments, the security of financial operations, and transfers are efficiently made using cryptocurrencies. The blockchain allows parties to transfer funds directly to one another with no hindrance or middleman using its peer-to-peer system.

Bhandarkar *et al.,* (2019) equate this to an email like system when he says, "This disruptive technology has done for money transfers what email did for sending mail — by removing the need for a trusted third party just as email removed the need for using the post office to send mail." Pg. 44.

In this conventional world, vendors cannot give rates following the success of the distribution of the goods because of contractual incompleteness. This prevents entry from the issue of "lemons". Two incumbents, on the other hand, might be involved in balance collusion. However, as incumbent salesmen cannot distinguish between a buyer's failure to steal his market share and a second seller's failure to make it possible to retain an agreement amongst incumbent sellers, violent price wars are too often occurring. In comparison, blockchains allow agents to contract distribution results and automate contingent transfers through a decentralized consensus. Hence, the genuine entrant can now completely demonstrate its authenticity. This removes data asymmetry as an obstacle to access and increased competition and further increases welfare and consumer surplus in this "blockchain environment." We also demonstrate, apart from authenticity and distribution, that blockchain consensus can also reduce asymmetry in terms of knowledge on utilities, thereby enhancing customer surpluses and welfare, through the extension of private salesman characteristics.

Harvey (2016) is one among the many studies on the application and economic impact of the technology, an early survey of mechanics and applications of crypto finance. Yermack (2017) assesses the future corporate governance effect of the technology. Besides, Bartoletti and Pompianu (2017) empirically explain how intelligent contracts are perceived and programmed on different blockchain platforms in addition to our discussion of intelligent contracts. We add by considering, arguably, the most distinguishing characteristics of the blockchain, and how they deal with the asymmetry of knowledge and influence market competition. Studies of Bitcoin mining games are linked to our evaluations of the process underlying decentralization. Kroll *et al.* (2013) noted the "longest chain rule" miners' balance should be Nash equilibrium. Biais *et al.* (2018) officialise and addresses several balances in the mining game.

The idea that the distributed ledger in tokenization and cryptocurrency is governed by automation and disintermediation especially by smart contracts and the on-chain settlement via security tokens which further enhances and promotes efficiency in the transfer of assets with transactions occurring rapidly as seen in the system designs of the reviewed articles' system designs (Babich, & Hilary, 2020). Bikalova (2017) analyzes the merits of cryptocurrencies and

their effects on the monetary system. He is of the view that tokenization of assets through blockchain uses state-of-the-art cryptography that enables all the documents and works to be properly organized and this further enables the work and all transactions made to be easily tracked. Such fact increased the promotion of transparency with the management of all the financial assets in this new financial era. Additionally, the cryptocurrency and tokenization system use a distributed ledger that improves the recording and information sharing which creates immutability that strengthens the data integrity and improves the safety of securities (Babich & Hilary, 2018). The decentralized system of the blockchain technology like cryptocurrency protects the information and the database from being hacked and exploited since it gives no central point of control and access and each transaction is recorded once and makes it hard for data to be altered (Weldon & Epstein, 2019).

Blockchains are widely known to have various functionalities, such as storing distributed data, providing anonymity status, fudging, shared ledgers, etc. Since solutions to these problems are well known outside the blockchain, the effect of blockchain is somewhat incidental to these dimensions. Nevertheless, we concentrate on its main functionality of offering a decentralized consensus. Therefore, our model does not apply to an authentically centralized subset of acceptable blockchains or private blockchains that generate consensus. This work, in other words, emphasizes the economic consequences of blockchain technology like cryptocurrencies and the tokenization of assets as being a new financial reality.

According to Casey and Vigna (2018), blockchain is historically known for its ability to record transactions made across many participants. People can access the same information and data across the globe at any given time. Bitcoin was invented in 2008 and released in 2009 by Satoshi Nakamoto and it was invented at the time trust in the financial system was being questioned by people. Bitcoin was soon embraced by people due to the decentralized feature that made it free open-source software without the need of third parties. The driving force to its invention was to actually eliminate the need to trust banks or other third parties. Koutsoupakis (2020) and Yu *et al.* (2018) further agreed that the decentralized future of cryptocurrency and tokenization helps to keep its monopoly free. They are controlled by the developers that created them and also by the people with the tokens/coins. This, according to Weldon and Epstein (2019) protects the system from the hands of the government or any other organization that has the potential to determine its flow and this further keeps it stable and secure. This decentralization is accessed by anyone through factual ownership, and this further makes it accessible by anyone especially small investors in any part of the world. Similarly, the inventor of smart contracts, Nick Szabo,

as stated in Weldon and Epstein (2019) was also driven by the need to remove third parties and most especially government interference. He explained in further detail that "[i]insecurity drives up costs and gets you stuck inside national silos. [The] biggest reason traditional finance is stuck inside national silos: it depends on governments for its security." Pg.845

On analyzing the previous literature and research papers using keywords like cryptocurrency and tokenization, we noted that cryptocurrency and tokenization of assets remove all the boundaries as to who is to invest that many other traditional investment systems implement (Weldon & Epstein, 2019). This has further created a broad market exposure for the cryptocurrencies and tokenization of assets to investors that many investment opportunities do not have (Weldon & Epstein, 2019). Cryptocurrency and tokenization remove all the boundaries as to who is to invest - a feature that many other traditional investment systems implement. This feature implies that investment is made easy especially for small investors and SME's who are enabled to easily access finances anywhere (Weldon & Epstein, 2019).

Much as traditional money has become more stable (Weldon & Epstein, 2019), cryptocurrencies and tokens have a high value and significance in the current new financial reality and currently are at the top of the daily transactions in the world since the world has now gone digital. According to Bikalova (2017), the values of cryptocurrency have moderately increased in the past years due to its increase in digital demand over the years which further drove its value up and this has seen a daily increase in the transactions globally**.** In 2017, the initial coin offerings (ICO) which are the tokens of blockchain, sold up-to $5.3 billion (Adhami *et al.,* 2018). Bitcoin is the leading digital token and is the leading medium of exchange for a plethora of imitators and extensions (Lo & Medda, 2020).

We organized the selected papers according to terms and themes related to cryptocurrency, blockchain, and tokenization to identify and pick out the research foci to analyze the benefits, features, and challenges forced by the cryptocurrency system and tokenization of assets, and to determine its managerial implications of a new financial reality. It is worth noting that according to the previous research, cryptocurrency and tokenization have a high potential of facing many monetary stability risks such as structural deflation and failure to respond to the growing money demand due to its lack of many crucial features that they are expected to have (Haksar *et al.,* 2016) as compared to the traditional system of money where the supply and demand relationship is regulated by the government.

Bikalova (2017) used an example of Bitcoin to demonstrate how the value for cryptocurrency and tokens keeps increasing and fluctuating and emphasized the need to come up with possible

systems to cater and regulate such changes and fluctuations because they have a big potential of causing massive financial disruption. Bikalova (2017) stressed that the high price fluctuation rate and average quarter price of a bitcoin in both US dollars and Russian rubles. This author illustrated such fact by using a graph showing the moderate increase of its value in 2016 and associated this increase in value with the increase in the digital currency demand.

The music industry is facing many pitfalls, and this can be attributed to the centralization of music. With the tokenization of musicians, the control of the music industry and its regulations becomes decentralized, and this helps to further reduce the costs of music that are incurred with the creating and its distribution. Musicians get the ability to directly connect with fans instead of having record labels as middlemen hence reducing conflicts and fraud in the music business. These middlemen usually extract outrageous fees from musicians – a harmful fact for the artist's career and personal growth. The record labels dilute the power and autonomy of the musicians.

According to industry experts Lennon and Tomlin (2019), there is a need for blockchain technology if there is to be a new industrial revolution that involves the use of cyber-physical systems. This era will see work done in a new and different light. There will be real-time connections of physical and digital systems alongside new technologies. This will increase the flexibility and speed at which work is being done especially in industries where goods are being produced including the factories, the agricultural sectors, among others (Lennon & Tomlin, 2019).

The relationship between international commerce and domestic commerce is strained for many reasons which include inefficiency in transfers. With the introduction of blockchain technologies, international trade and domestic trade will be simplified. These barriers and hindrances further come from the lack of transparency that is depicted from the cross-border transactions coupled with lack of trust. This has made these international and cross-border transactions riskier. Removing these barriers can lower the threshold for firms to access new markets and participate in global supply chains. Improvements in trade finance are especially important for small and medium-sized enterprises (SMEs), which may have difficulty accessing credit, and for firms in countries with less developed financial markets (Nassr *et al.,* 2016)

Cryptocurrencies further create a high possibility and potential for tax evasion due to lack of government control and regulations (Bikalova, 2017) since, unlike traditional money, it is decentralized and controlled by cryptographic protocols (Van Erp, 2017). Governance problems complicate the blockchain and security token system. These systems need effective

governance and regulatory standards since fractal ownership is an exciting feature that is new and needs to be regulated. For instance, when it comes to real estate or any property, companies may fail to renovate their high-value properties or incentivize them if the transfer of property is through fractal ownership and there is no one to regulate and inspect them. When it comes to smart contracts, their legal status remains undefined which makes their enforceability hard to implement. Most jurisdictions do not even consider them as being legal and this seems to be the major issue behind the adoption of the concept of crypto assets and tokenization of assets (OECD Blockchain Policy Series, 2020). This has led to the massive outbreak of financial conflicts and issues in the financial market. The code of such intelligent contracts must be audited with extra support from market players who wish to validate the basis on which such smart contracts are administered (OECD Blockchain Policy Series, 2020).

Tokenisation of assets influences liquidity but also trade, asset pricing, securities clearance, settlement, and even transmission of monetary policy. In considering the possible disturbances in securities markets arising from such a phenomenon, the two following mechanisms must be distinguished: i) tokenization of securities which still exist off-the-chain, for example, securities exchanged off-chain and tokenized and distributed on-chain by certain or all of them; and (ii) issuance in the tokenized form of securities directly in-chain and native to the blockchain; that is, without issuing "group" securities.

We noticed that each paper we categorized referred to more than one topic to better respond to the scope of the selected papers. Their topics were mainly concerned with the impact of blockchain and tokenization on a specific sector. But from those papers, we recognized that there is much more to the digital world than what just meets the eye. We noticed that as much as many benefits accrue from the use of tokens and cryptocurrency, so many challenges and failures come with it. The blockchain regulatory system is very complex. There is a need to have a new system built with the purpose of making sure that the blockchain and security token market are compliant with the existing regulatory systems and framework.

IV.1 Blockchain and cryptocurrencies

To understand cryptocurrency and its impact on the financial system, one has to first understand the meaning of blockchain. Blockchain is also called Distributed Ledger Technology (DLT). It is one where information is stored with enough security while also using cryptocurrency.

Applications in cryptocurrency are the most common and historically the first. The data to be stored is organized into blocks, which are linked together. This data can be very diverse: transactions of cryptocurrencies such as Bitcoin, the encoding of images for possible intellectual property claims, contracts between parties. A block can't be changed after it's been stored in a blockchain (this is called the 'principle of immutability'). A blockchain is a database, but the key breakthrough is that the storage mechanism is completely decentralized: the database is replicated without interference from any trusted third party on the nodes of a web of (eventually) unreliable computers.

The size of this computer network will vary, up to tens of thousands of times. Clearly, the difficulty in developing such technology was to design stable consensus protocols, both computers can agree on the information stored in the blockchain thanks to the blockchain's protocols. Many consensus mechanisms are still being studied (Seang and Torre, 2018), but only the Proof of Work (PoW) process has also been rigorously studied. Since 2009, this mechanism has been the cornerstone of the Bitcoin network, and according to Antonopoulos, (2017), it operates as follows: Any network nodes, known as miners, receive data from all other nodes involved in storing transfers in the blockchain. The information gathered by the miners is then verified by the miners. In the case of Bitcoin, miners can verify that payment is real, meaning that the debtor has sufficient funds to settle his debt. Then, to be the first to include the details he/she verified into a block, miners enter a competition that include this block further into the blockchain.

The winner is compensated with a crypto-currency bounty. A competitive cryptographic undertaking means solving a complicated cryptographic problem, in which miners have no other solution than randomly drawing certain numbers to find one of them satisfying a certain condition. This computational task requires energy, hence the name Proof of Work, to run computers. Despite enormous investments in specialized computer equipment, the system was designed to take roughly 10 minutes for miners of the Bitcoin network to meet the requisite requirements. The miner validating the next block to be included in the blockchain is indeed drawn almost randomly in this process (although a higher computational power will of course increase the probability to be the winner).

Once substantiated, only after a certain number of blocks have been subsequently added can this block be deemed definitive (immutable). Blockchain work goes way back from the 1990s, but it was not until 2008 that Satoshi Nakamoto made popular blockchains through the Bitcoin

cryptocurrency (Nakamoto, 2008). Its simplest type involves a distributed database that autonomously holds a continuously increasing list of records of public transactions in "block" units, shielded from tampering and revision.

IV.2 Blockchain for smart contracts

In the context of the present work, it is important to understand the potential implications of storing contracts between parties in blockchains, especially contracts between franchisees and franchisors. Smart contracts are considered such contracts. They also have the functionality to be able to unlock automatically, in addition to the fact that these contracts are held on a blockchain (Antonopoulos and Wood, 2018). Let us have an example of a carriage deal between an airline and a customer. The transportation arrangement is held on a blockchain in the form of an executable code after a fare is bought. The carriage deal specifies both parties' rights and liabilities. Many of these laws are encoded under the form "If ... then... otherwise" as executable computer programs, that is to say, a certain action may be caused, and if not, there is another action if a certain condition is fulfilled. For example, let’s assume that the passenger's flight is substantially late, with a partial or complete refund to the passenger under one of the provisions of the deal. We realize that, because of the difficulty of this request, most travellers do not demand this refund. In the case of an intelligent contract, compensation can be made immediately, however, provided a third-party skilled in this is aware of the aircraft delay (such a third party is called an oracle).

In the event of a transport deal, this digital success will definitely change the contractual link. Ethereum is probably the most frequent forum for intelligent contracts. Ethereum is a public, smart contract-supportive blockchain that can write customizable contracts through powerful programming languages. Many cryptocurrency-associated blockchains, where the blockchain is first built to store transactions for that currency, often include the smart-contract storage functionality in general, rather than always transactions. This would be the case for Bitcoin's blockchain, but the related programming language is not sufficiently efficient to encrypt random, complicated contracts. Indeed, Ethereum has been developed to bypass this restriction. Contract concepts are first formulated in the vocabulary of programming between at least two parties. This code is then converted into a blockchain. When any condition encoded in the

intelligent contract is satisfied, it immediately executes it. Smart companies will communicate with each other, while on the blockchain, via the exchange of transactions.

The interest of the blockchain storage is its immutable property: while in the blockchain, a group cannot avoid its own implementation; nor can it modify its material. It is also important to remember that such a blockchain is typically connected to its own right cryptocurrency. Ether is the one connected to Ethereum. Although they can still be used as payment instruments and open to speculation, these currencies are specifically intended to work for the entire system. Ether is utilized for the payment of electricity, which calculates and accounts for the expense of the performance of the programmed contract version. The success premium is charged (in Ether) by the entrepreneurs in advance, which supports those nets, also known as miners in the case of Bitcoin. A miner will be compensated after he has successfully validated the material to be used in a new block and some payments from the execution of the intelligent contracts. Any programmed smart contract process consumes a certain amount of gas that is predefined. Finally, if vendors pay enough for petrol, the deal is fully applied (possibly remaining gas being refunded to contractors). Failure to do so would terminate all activities carried out and no part of the deal would be met.

It is important to remember that information from outside the blockchain might be needed to carry out an intelligent contract. If a pause is found, this detail shall be delivered to the intelligent contract in the case of the carriage contract. This service, which supplies data to intelligent contracts, is known as oracles. An oracle is stored as an ordinary intelligent contract in the blockchain and can communicate with any other intelligent contract. A third party is clearly an oracle and as such needs to be trustworthy. Mechanisms for maintaining trust between parties were established back then. Any businesses sell oracle services now (Oraclize, Reality Keys from Social Minds...). This is an essential feature: automated systems, like IoT (Internet of Things) devices, can provide information: cameras, RFID readers, sensors in general.

IV.3 General conclusions

With blockchain, companies can now easily hire people and cut off time that is usually taken with traditional methods to verify people's credentials. With information being stored online, universities and other awarding bodies are now creating degree and qualification certificates that are easily shared by graduates with prospective employers at the touch of a button and this saves time and money. It also further improves efficiencies which can be a deterrent to fraud (PricewaterhouseCoopers, 2020). Tokenization of assets allows businesses especially those dealing with the supply chain to trace the origin of their goods or do follow-ups (Kottler, 2018). It helps to prove the provenance of various goods and commodities ranging from raw materials to diamonds and, as goods change hands, the records of the transactions are taken note of and safely stored (Chang *et al.,* 2018). This trust that blockchain technology offers has on occasion helped to ease the transfer of goods and running businesses like the supply chain management sector (PricewaterhouseCoopers, 2020). Blockchain and smart contracts track all steps that products pass through starting from production in the supply chain sector and each step is further recorded, this enhances the supply chain financing, insurance, and risk (Potts & Rennie, 2018), and helps to reduce fraud and theft.

Blockchain technology has a big impact on healthcare, education, public administration, and many other sectors. All these sectors rely on the efficiency in terms of personal credentials/identity that the blockchain technology offers to dispense off with their activities/work. According to PwC economists, it is believed that these sectors are likely to greatly benefit - a $574bn by the year 2030 is projected and all that through utilizing blockchain technology (PricewaterhouseCoopers, 2020). The blockchain technology that allows the tokenization of assets takes customer service to a whole new level. Businesses are now able to interact and engage with their customers online and do transactions and sales online. This will largely benefit the communications media, the business services, retailers, wholesalers, manufacturers, construction services, among others (Blemus, & Guegan, 2019).

The developers of this blockchain technology have sold to us a vision and the opportunity to ease transfers, especially through smart contracts. In this new financial reality, businesses and corporations now transfer literally everything through blockchain technology starting from cars,

houses, travel insurance, corporate bond transfers, and can lease properties like cars online (Weldon and Epstein, 2019). In a survey performed by Weldon *et al.* (2017) 82% of retailers surveyed on the benefits of blockchains believed blockchain technology to be a perfect way to reduce costs and increase efficiency. Furthermore, blockchain technology is further employed by public and private actors that use blockchain today to track food, address land grabs, protect refugee identity rights, combat bribery and corruption, eliminate voter fraud, and facilitate financial transactions for those without access to banks (Weldon and Epstein, 2019).

The healthcare system benefits from blockchain technology in a manner that if patient records are now easily accessible online other than having them scattered everywhere among different and various service providers. Furthermore, research trials and the results can be easily accessible online which further reduces data breaches. The patient data in clinical trials and health records is further managed by the blockchain technology and also helps to reduce and minimize insurance fraud (Pilkington, 2017), and a journal on the utilization of blockchain especially in the medical field has been established to that effect (Li *et al.,* 2018).

When talking about cryptocurrency and the tokenization of assets, one cannot miss noting how much impact this innovation has had on the finance industry because of all the benefits and features of blockchain that are highly needed in the finance sector, including its suitability, reliability, transparency, among other functions and benefits (Yu *et al.,* 2018). Financial institutions such as banks have further adopted blockchain technology because it will gain them a financial advantage in making financial solutions and providing them to the financial era. Global banking is currently a $134T industry, blockchain technology, and DLT could disintermediate key services that banks provide, including payments, clearance and settlement systems, fundraising, securities, loans and credits and trade finance. According to Huberman *et al.* (2021) the 2018 total revenue of the payment industry was $1.9T, with the recipients of this revenues, namely the payment-processing firms, enjoying the network effects and economies of scale resulting in limited competition and barriers to enter. The Bitcoin Payment System (BPS) is a platform that provides a decentralized alternative to the status quo, because it is actually a payment system that is not controlled by any agency, in fact governed by a computer protocol and which obtains the required infrastructure from anonymous independent and profit-maximizing parties called miners (Huberman *et al.,* 2021).

The blockchain distributed ledger technology (DLT) is said to facilitate the global finance development as it transforms the payment systems of many organizations and companies, the clearing and settlement processes with the means with which funds are being transferred, securities, goods, and commodities are being done and settled (Babich, & Hilary, 2020). This

has created a groundbreaking means of managing and handling finances. This further helps in reducing bureaucracy which is usually encountered in the traditional means of settlement, clearing, and payments (PCS) and also further helps to reduce and solve financial and operational deficiencies that are involved in the storing, transfer of many digital assets in this new financial reality. It further promises and fosters safety and security in the PCS activities and payment systems (Babich, & Hilary, 2020).

Increasing retail investors' involvement in previously restricted asset classes does not imply completely unrestricted participation of retail investors in high-risk products (Lennon & Tomlin, 2019). Participation restrictions and reasonable criteria to protect their interest which applies, for example through the US Accreditation of Investors or through applying adequacy standards under Regulation D. Tokenized assets comply with the relevant (pre-existing) regulatory framework would make such protections possible. For issuers and investors in tokenized markets, clarification about the applicable regulatory framework is of primary importance (Lennon & Tomlin, 2019).

A possible proliferation of tokenization of such securities could increase access to finance for SMEs, not only in markets previously restricted to large or institutional investors but also by enabling any form of the investor, including retail ones, to indirectly or directly fund small and medium-sized enterprises projects. Private funding from capital owners to small businesses may help to make the allocation of capital more effective and more inclusive, not just for investment, but also for seekers of capital that cannot otherwise access the capital markets.

Financing for small-scale SMEs and the real economy will theoretically be beneficial not only by investing directly and by holding previously inaccessible or unlicensed assets of a part of the investor base. By allotting equity to historically liquid asset groups (e.g., private equity and venture capital) implicitly encouraging certain capital flows from institutional investors to SMEs and Start-Up companies and allowing a global pool of capital to fund their needs, investors can diversify their risk further.

The current blockchain experiments can create and form artist-centric business models which avoids the middleman and agency businesses that traditionally help musicians and upcoming artists create a connection with fans (Potts & Rennie, 2018). This enables the artists to set their terms for their market and also helps to activate and support new based economics through the automation of the value components, licensing, and intellectual property management. It further helps to provide artists with platforms to produce their music (Potts & Rennie, 2018).

Cryptocurrencies and tokenization of assets have greatly helped in the running of human resources and their management (Chakraborty *et al.,* 2017). Human resource management is a very important aspect of every business. It helps to maintain the organizations or the business' efficiency levels and oversees the well-being of the clients and the personnel. The introduction of blockchain into human resource management has several ways to impact it. Human resource usually has a centralized aspect in it. It relies on information from centralized servers (Chakraborty *et al.,* 2017). With blockchain, the centralized aspect is decentralized. The human resource department can get hold of easily of the employee CVS that are uploaded onto blockchain servers and any update to the CVS will be reflected on blockchain technologies, hence enabling future employees to have easy access to references and verified resumés. Smart contracts ease the roles of the human resource as the terms and condition, including payments is reflected and this saves the human resource the hustle of drafting another. Using cryptocurrencies, payments to workers are also made efficiently without the need for middlemen interference (Chakraborty *et al.,* 2017). Blockchain technology is still a new concept and still in its development stage and has trouble and issues with limited data processing capacity, information confidentiality, and regulatory difficulties but, in the short run, it will be used by the public as a platform for firms to voluntarily disclose information (Yu *et al.,* 2018).

Financial institutions check various data points concerning any future corporate and individual customer to comply with 'unique' responsibilities and 'beneficial ownership' criteria. The banks and other conventional service providers are now searching for 'KYC' (Know Your Customer) offices to reduce the huge duplication inherent in the current KYC cheques, with DLT being potentially the cross-institutional proof-source. These institutions create models by which account holders can export the institution's once-in-a-lifetime attestations to other entities requiring ID proof, thereby providing a more seamless digital service access mode. A group of banks in Singapore joined forces to create a blockchain system along with the Singapore Media Development Authority Info COMM (Casey *et al.,* 2019).

Listed businesses partly eliminate information asymmetry by delivering routinely audited financial statements to external information consumers. However, the presence of agency concerns weakens the active role of financial accounting and independent auditing in addressing the asymmetry of data (Healy and Palepu, 2001). As a decentralized DLT, the blockchain technology has clear, encrypted, permanent, immutable features, and it has the capacity for

strengthening confidence among market participants (Narayanan *et al.,* 2016); Antonopoulos, (2017). Yermack (2017) addresses the possible consequences of mixing corporate governance and blockchain technology.

Blockchain technology is being used in financial accounting because of its limited data processing capacities, the confidentiality of the information, and regulatory issues. Blockchain can serve as a forum for companies to voluntarily communicate short-term financial and non-financial information. This is high-quality signaling which helps companies to solve the problem of trust with external users of knowledge. In the long term, blockchain technologies and smart contracts can be used to minimize disclosure and earnings errors and improve the reliability, timeliness, and comparability of accounting information efficiently, thus reducing the asymmetry of information.

One must understand that the process of property transferring if one is to understand how a blockchain land registry system can be capable of changing property. If a buyer wants to purchase a property today, the buyer must locate and secure the title, and the legally enforced owner must sign it (Van Erp, 2017). On the surface, it seems straightforward, but the “devil is in the specifics”. For a substantial number of residential mortgage holders, the land ownership papers have tampered with insufficient documentation, forged signatures, and flaws in foreclosure and mortgage documents.
As a result, the property is no more "good title" attached and cannot be legitimately vented and in many cases does not fix the prospective buyer's problems (Van Erp, 2017). According to (Van Erp, 2017), blockchains in the land registry aim to address these 'eminent problems and offer solutions in the conventional registry: corruption and systematic property theft in foreign markets, cross-border hurdles, sluggish processes of registration or ownership, and unregistered capital of developing countries.'». 200 pg.

These new technologies have the ability to influence trust, intermediation, accountability, responsibility, and transparency notions that are very key and crucial to corporate governance. Costs for making information available to minority stakeholders are reduced by the distributed ledger system and also promote transparency. Furthermore, this technology can redefine corporate governance by modifying risk management, compensation governance, accountability to shareholders, and redefine the current shift between stakeholders and shareholders (Fenwick & Vermeulen, 2019). When goods are reduced into tokens that are sold online, the physical transaction of those goods does not happen, and they are protected from

getting broken during physical transfers. This implies that the transfer and exchange of goods, services, and assets has been simplified which has further encouraged a transformational change in the global economy.

Future economic development relies on the exchange of global data. The EU GDPR (European Union General Data Protection Regulation) was enacted on 25 May 2018 and EU regulations on data protection will be standardized in wording. In terms of access by EU residents, GDPR protects extraterritorially any entity which can join the EU market (Sater, 2017). Although a clear and organized interpretation of the GDPR offers the necessary guarantees to organizations, tougher requirements and higher penalties demand that organizations reconsider their protocols for the enforcement of their international data protection systems (Sater, 2017). Problems associated with trust failures are the engine behind this comprehensive system of regulation, but new technologies such as blockchain will help to mitigate these privacy concerns (Sater, 2017). This includes, among other things, decentralization, authentication, confidentiality, transparency, and management of access control. Blockchain applications may use rules to allow a safe exchange of information by treating data fluids as transactions (Sater, 2017).

Recognized cryptocurrency price volatility will distract practitioners from potential innovations in the blockchain space that could produce audits and others (Smith, 2018). The possible consequences for accountants and lawyers can be important, as more applications and innovations are built on existing blockchain programming (Smith, 2018). The importance of being able to confirm and report on this information, particularly as various blockchain tools and platforms become more robust and encouraging to business and transactional use, is moving closer to the mainstream (Smith, 2018).

Blockchain, as a shared distributed ledger promotes transparency which helps to reduce and mitigate potential trust issues and helps to prevent conflicts in businesses and companies, and further helps to regulate the human- and paper-based administration**.** Blockchain's digital ledger enables participants to have and enjoy unlimited access to information transmission among various sectors which further helps in the reduction of the time and costs that come with searching for related information. Smart contracts can improve the interactions among businesses and help various corporations in the facilitation of payments and the management and transfer of their assets and, also, further help in the development of supply chains using the concept of principal and agent relationship. The assorted blockchain platform creates a

collaborative ground that helps in the execution which further helps to mitigate information issues. It has further been noted that the distributed ledger of the blockchain leads to unemployment due to its ability of automatic auditing which can lead to many auditors, registrars, and transfer agents getting out of a job since they can easily be replaced by the distributed ledger. The broad market exposure of cryptocurrency and tokenization of assets globally creates new investment opportunities to even retail traders and small business owners through factual ownership, especially in the real estate sector.

IV.4 Final considerations

One must recognize and acknowledge that the invention of cryptocurrency and the phenomena of tokenization of assets introduced into the world and forming the new financial assets has exceeded the expectations of many namely the technologists and financial professionals. The adoption of cryptocurrencies especially Bitcoin and the idea of the tokenization of assets has a wide range of managerial implications that range from reduced cost when it comes to the transfer of assets due to the decentralized nature of the cryptocurrencies and tokens. Safety and security are guaranteed, efficiency in payments and transfers, transparency in business entities and corporations. It is also worth noting that the introduction of these two phenomena has negative implications as noted above. Economic stabilization can't be guaranteed as the two have no essential features to control the inflation and deflation of money value caused by the supply and demand relationship.

This dissertation aimed at being a humble contribution towards illuminating the gaps that have been left unanswered in this new financial reality. There is a need to address these gaps to prepare for any financial disruptions. There is also the need for the establishment of new systems to cater for the regulations and control of this new reality because nevertheless, tokenization of assets is an exciting feature in the development of blockchain and the financial sector (Ammous, 2018). Finally, there is also the need for a developed and improved scalability to facilitate the transition from the traditional financial system to the digital system of blockchains.

V. REFERENCES

- Aboujaoude, J., & Saade, G. R. (2019). Blockchain applications - Usage in different domains. IEEE Access, 7, 45360-45381. https://doi.org/10.1109/access.2019.2902501
- Adhami, S., Giudici, G., & Martinazzi, S. (2018). Why do businesses go crypto? An empirical analysis of initial coin offerings. *Journal of Economics and Business,* 100, 64-75. https://doi.org/10.1016/j.jeconbus.2018.04.001
- Ammous, S. (2018). The Bitcoin Standard: The Decentralized Alternative to Central Banking*, John Wiley and Sons, Inc. Hoboken, New Jersey*.
- Antonopoulos, A. M., (2017). Mastering Bitcoin: Programming the open blockchain. *O'Reilly Media Sebastopol, USA*
- Antonopoulos, A. M., & Wood, G. (2018). Mastering Ethereum: Building smart contracts and Dapps. *O'Reilly Media, USA*
- Babich, V., & Hilary, G. (2018). Blockchain and other distributed ledger technologies in operation. *SSRN Electronic Journal, DOI: http://dx.doi.org/10.2139/ssrn.3232977*
- Babich, V., & Hilary, G. (2020). OM forum-Distributed ledgers and operations. What operations management researcher should know about blockchain technology. Manufacturing & Service operation management, 22(2), 223-240. https://doi.org/10.1287/msom.2018.0752
- Bartoletti, M., & Pompianu, L. (2017). Na empirical analysis of smart contracts: Platforms, applications and design patterns. https://arxiv.org/pdf/1703.06322.pdf
- Bashir, I. (2017). Mastering blockchain - Master the theoretical and technical foundations of blockchain technology and explore future of blockchain technology. *Packt Publishing Limited, Birmingham UK*
- Bhandarkar, V.V., Bhandarkar, A.A., & Shiva, A. (2019). Digital stocks using blockchain technology - the possible future of stocks? *International Journal of Management, VOL 10*(3) pp. 44-49. https://doi.org/10.34218/ijm.10.3.2019/005
- Biais, B., Bisiere, C., Bouvard, M., & Casamatta, C. (2018). The blockchain folk theorem. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3108601

- Bikalova, N.A. (2017). The phenomena of cryptocurrency and its implication on the monetary system. *"Science and Education: New Time", (3)*.
- Blemus, S., & Guegan, D. (2019). Initial crypto-asset offerings (ICOs), tokenization and corporate governance. *SSRN Electronic Journal,* https://doi.org/10.2139/ssrn.3350771
- Boucher, P., Nascimento, S., & Kritikos, M., (2017). How blockchain technology could change our lives: In-depth analysis. *European Parliamentary Research Survey PEE 581.948*
- Bunjaku, F., Trajkovska, G.O., & Kacarski, M.E. (2017). Cryptocurrencies-Advantages and Disadvantages. *Journal of Economics Vol.2 (1)*
- Casey, M., Crane, J., Gensler, G., Narula, N., & Johnson, S. (2018). The impact of blockchain technology on finance: A catalyst for Change. *Geneva reports on the world economy 21 International center for Monetary and Banking Studies.*
- Casey, M.J., & Vigna, P. (2018). The truth machine: The blockchain and the future of everything. *HarperCollinsPublishers, London UK*
- Chakraborty, S., Dutta, K., & Berndt, D. (2017). Blockchain based resource management system. *SSRN Electronic Journal* https://doi.org/10.2139/ssrn.3104351
- Chang, J., Katehakis, M.N., Melamed, B., & Shi, J. (2018). Blockchain design for supply chain. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.3295440
- Chod, J., Trichakis, N., & Yang, S.A. (2019). Platform tokenization: Financing, governance and moral hazard. *SSRN Electronic Journal*, https://doi.org/10.2139/ssrn.3459794
- Chu, J., Zhang, Y., & Chan, S. (2019). The adaptive market hypothesis in the high frequency cryptocurrency market. *International Review of Financial Analysis, 64,* 221-331. https://doi.org/10.1016/j.irfa.2019.05.008
- Conway, L. (2020). Blockchain explained. https://www.investopedia.com/terms/b/blockchain.asp
- Crosby, M., Nacchiappan, N.A., Pattanayak, P.P., Verma, S.V., & Kalyanaraman, V. (2016). Blockchain technology: Beyond Bitcoin. *Applied Innovation Review, 2, June.*

- Ertemel, A.V. (2018). Implication of blockchain technology on marketing. *Journal of International Trade, Logistic and Law, 4*(2), 35-44.
- Europe and Central Asia economic update, Office of the Chief Economist (2018). Cryptocurrency and blockchain. *World Bank Group*. http://www.24activ.com/tickets/scp/public_attachment.php?id=6fe7a
- Fantazzini, D., & Zimin, S.. (2019). A multivariate approach for the simultaneous modelling of market risk and credit risk for cryptocurrencies. *Journal of Industrial and Business Economics, 47*(1), 19-69. https://doi.org/10.1007/s40812-019-00136-8
- Fauzi, M.A., Paiman, N., & Othman, Z. (2020). Bitcoin and cryptocurrency: Challenges, opportunities and future works. *The Journal of Asian Finance, Economics and Business*, *7*(8), 695-704. https://doi.org/10.13106/jafeb.2020.vol7.no8.695
- Fenwick, M., & Vermeulen, E.P. (2019). The end of the corporation. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3472601
- Foley, S., Karlsen, J., & Putnins, T. (2019). Sex, drugs and Bitcoin: How much illegal activity is financed through cryptocurrencies? *Review of Financial Studies*, Vol 32, (5), pp. 1798-1853.
- Giudici, G., Milne, A., & Vinogradov, D. (2019). Cryptocurrencies: Market analysis and perspectives. *Journal of Industrial and Business Economics, 47*(1), 1-18. https://doi.org/10.1007/s40812-019-00138-6
- Haksar, et al. (2016). Virtual currencies and beyond: Initial consideerations. IMF *Staff Discussion Notes, 16*(3). https://doi.org/10.5089/9781498363273.006
- Harvey, C.R. (2016). Cryptofinance. *SSRN Electronic Journal*. http://dx.doi.org/10.2139/ssrn.2438299
- Healy, P.M., & Palepu, K.G. (2001). Information asymmetry, corporate disclosure and the capital markets: A review of the empirical disclosure literature. *Journal of Accounting and Economics, 31*(1-3), 405-440.
- Hinzen, F.J., Irresberger, F., John, K., & Saleh, F. (2019). The public blockchain ecosystem: An empirical analysis. *SSRN electronic Journal.* https://doi.org/10.2139/ssrn.3478264

- Hubermann, G., Leshno, J.D., & Moallemi, C.C. (2017). Monopoly without a monopolist: An economic analysis of the Bitcoin payment system. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3025604
- Kottler, F. (2018). Potential and barriers to the implementation of blockchain technology in supply chain management. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3231695
- Koutsoupakis, D. (2020). Tokenization of unearned revenue under the quantity rule. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3683047
- Kroll, J.A., Davey, I.C., & Felten, E.W. (2013). The economics of Bitcoin mining, or Bitcoin in the presence of adversaries. *The twelfth workshop on the economics of information security*. https://asset-pdf.scinapse.io/prod/2188530018/2188530018.pdf
- Lennon, O.T., & Tomlin, B. (2019). Industry 4.0: Opportunities and challenges for operations management. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3365733
- Li, P., Nelson, S.D., Malin, B.A., & Chen, Y. (2018). DMMS: A decentralized blockchain ledger for the management of medication histories. *Blockchain in Healthcare Today, 2, 1*. https://doi.org/10.30953/bhty.v2.38
- Liu, C., & Wang, H. (2019). Crypto tokens and token offerings: An introduction. *Cryptofinance and Mechanisms of Exchange, 125-144. Contribution to Management sciance. Springer*
- Lo, Y., & Medda, F. (2019). Assets on the blockchain: An empirical study of Tokenomics . *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3309686
- Matulionyte, R. (2019). Can Copyright be Tokenized? *SSRN Electronic Journal*. https://dx.doi.org/10.2139/ssrn.3475214
- Mikhaylov, A. (2020). Cryptocurrency market analysis from the open innovation perspective. *Journal of Open Innovation: Technology, Market and Complexity, 6*(4), 197. https://doi.org/10.3390/joitmc6040197

- Mills, D., Wang, K., Malone, B., Ravi, A., Marquardt, J. *et al. (*2017). Distributed ledger technology in payments, clearing and settlements. *Journal of Financial Market Infrastructures, 6*(2/3), 207-249. https://doi.org/10.21314/jfmi.2018.095
- Minor, A. (2020). Cryptocurrency regulations wanted: Iterative, flexible and pro-competitive preferred. *Boston College Law Review vol. 61 (3)*
- Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. Available at https://bitcoin.org/bitcoin.pdf
- Narayanan, A.J., Bonneau, E., Felten, A., Miller, S & Goldfeder. (2016). Bitcoin and cryptocurrency technologies. *Princeton University Press. Princeton, New Jersey.*
- Nassr, K.I., & Wehinger, G. (2016). Opportunities and limitations of public equity markets for SMEs. *OECD Journal: Financial Market Trends, 2015*(1), 49-84. https://doi.org/10.1787/fmt-2015-5jrs051fvnjk
- OECD Blockchain Policy Series. (2020). The tokenization of assets and potential implications for financial markets. *The Secretary General of the OECD*.
- Onik, M., Miraz, M., & Chul-Soo Kim. (2018). A recruitment and human resource management technique using blockchain technology for industry 4.0. *Smart cities symposium 2018*. https://doi.org/10.1049/cp.2018.1371
- Pagnotta, E. (2018). Bitcoin as decentralized money: Prices, mining reward and network security. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.3264448
- Partridge, J. (2021). Bitcoin's market value exceeds $1tn after price soars. *Available at* https://www.theguardian.com/technology/2021/feb/19/bitcoins-market-value-exceeds-1tn-after-price-soars-to-above-54000#:
- Pilkington, M. (2017). Can blockchain improve healthcare management? Consumer medical electronics and the IoMT. *SSRN Electronic Journal.* https://doi.org/1011+.2139/ssrn.3025393
- Potts, J., & Rennie, E. (2018). Web3 and the creative industries: How blockchain is reshaping business models. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.3270663

- PricewaterhouseCoopers. (2020). Time for trust: The trillion dollar reasons to rethink blockchain. *Available at* http://www.24activ.com/tickets/scp/public_attachment.php?id=6fe5b
- Sater, S. (2017). Blockchain and the European Union's General Data Protection Regulation: A chance to harmonize international data flows. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.3080987
- Scheau, M.C., Craciunescu, S.L., Brici, I., & Achim, M.V. (2020). A cryptocurrency spectrum short analysis. *Journal of Risk and Financial Management, 13*(8), https://doi.org/10.3390/jrfm13080184
- Schmidt, C.G., & Wagner, S.M. (2019). Blockchain and supply chain relations: A transaction cost theory perspective. *Journal of Purchasing and Supply Management, 25*(4), 100552.
- Seang, S., & Torre, D. (2018). Proof of Work and Proof of Stake consensus protocols: A blockchain application for local complementary currencies. *Available at* https://gdrescpo-aix.sciencesconf.org/195470/document.
- Smith, S.S. (2019). Blockchain, Tokenization, and implications for finanacial services practitioners. *International Journal of Accounting and Financial Reporting, 9*(1), 1. https://doi.org/10.5296/ijafr.v9i1.14164
- Subramanian, H. (2017). Decentralized blockchain-based electronic marketplaces. *Communications of the ACM, 61*(1), 78-84.
- Tasco, P., Aste, T., Pelizzon, L., & Perony, N. (2018). Banking beyond banks and money: A guide to banking services in the Twenty-First Century. *Springer International Publishing, Switzerland.*
- Tapscott, D., & Tapscott, A. (2016). Blockchain revolution: How the technology behind Bitcoin is changing money, business, and the world. *Penguin Books Ltd, London, UK*
- Van Erp, S. (2017). Land registration systems: Public, private, or privately public? *European Property Law Journal, 6*(1), 1-3. https://doi.org/10.1515/eplj-2017-0001
- Vandamme, E. (2019). The future of Blockchain Technology. *Available at SSRN:* https://ssrn.com/abstract=3463178

- Voshmgir, S. (2019). Token Economy: How Blockchain and Smart Contracts Revolutionize the Economy. *BlockchainHub Berlin. available at:* https://blockchainhub.net
- Weldon N.M., & Epstein, R. (2019). Beyond Bitcoin: Leveraging blockchain to benefit business and society. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.3443675
- Weldon, R., Herridge, M., & Cohen, J. (2019). Retail: Opening the doors to Blockchain. *Cognizant Reports 4. available at:* https://www.cognizant.com
- Xu, M., Chen, X., & Kou, G. (2019). A systematic review of blockchain. *Financial Innovation, 5*(1). https://doi.org/10.1186/s40854-019-0147-z
- Yermack, D. (2017). Corporate governance and blockchains. *Review of Finance,* vol.21 (1) pp.7-31. https://doi.org/10.1093/rof/rfw074
- Yu, T., Lin, Z., & Tang, Q. (2018). Blockchain: Introduction and application in financial accounting. *SSRN Electronic Journal.* https://doi.org/10.2139/ssrn.3258504
- Zielinski, D. (2017). Is HR Ready for Blockchain. *HRMagazine, 63*(2), 62-63.
- Zimmermann, P. (2020). Blockchain structure and cryptocurrency prices. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3538334
- Zwitter, A.J., Gstrein, O.J., & Yap, E. (2020). Digital identity and the blockchain: Universal identity management and the concept of the "self-sovereign" individual. *Frontiers in Blockchain, 3*. https://doi.org/10.3389/fbloc.2020.00026