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ARE CRYPTOCURRENCIES ALREADY INFLUENCING THE REAL ECONOMY?

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INDEX

ABSTRACT

1. Virtual currency

1.1. Definitions

1.1.1. Origin of the phenomenon ..... pag. 6
1.1.2. Birth of cryptocurrency ..... pag. 9
1.1.3. Double spending pag.10
1.1.4. Trust and privacy .....pag. 14
1.1.5. Definition of cryptocurrency in some legislations ..... pag. 15

1.2. Fiat currency, virtual currency and crypto-assets

1.2.1. Functions ..... pag. 19
1.2.2. Differences..... pag. 21
1.2.3. I.C.O. (Initial Coin Offering) ..... pag. 23
1.2.4. Crypto assets ..... pag. 24
1.2.5. Unit of account, means of payment and deposit of value .....pag. 25

1.3. Features

1.3.1. Legal and virtual currency – comparison ..... pag. 31

1.4. Operative system: blockchain

1.4.1. Protocols ..... pag. 34
1.4.2. Smart Contracts ..... pag. 35

2. Complementary and alternative currencies

2.1. Definitions

2.1.1. Origins ..... pag. 37
2.1.2. Features ..... pag. 39

2.2. Applications

2.2.1. Club del Trueque ..... pag. 41
2.2.2. Time Bank ..... pag. 41
2.2.3. Wir ..... pag. 41
2.2.4. Bestätigte Arbeitswerte ..... pag. 42

2.2.5. Sardex ..... pag. 44

2.3. CBCD (Central bank digital currency)

2.3.1. Features ..... pag. 49

2.3.2. E-Yuan ..... pag. 52

2.3.3. Digital dollar ..... .pag. 55

2.3.4. Digital Euro ..... pag. 56

3 Private entities and cryptocurrencies: applications

3.1 Introduction

3.1.1 Presentation of the sample companies ..... Pag. 60

3.2 E.S.G.

3.2.1 E.S.G. Policies ..... Pag. 62

3.2.2 Studies in the cryptocurrency industry ..... Pag. 65

3.2.3 Analysis of ESG risk ratings of the sample companies ..... Pag. 68

3.3 Performance Analysis

3.3.1 Inverstors perceptions: methodology and calculation..... pag. 72

3.3.2 Inverstors perceptions: analisys..... pag. 76

3.3.3 Opereting performance: methodology and calculation..... pag. 77

3.3.4 Opereting performance: analysis ..... Pag. 82

3.4 Ongoing projects

3.4.1 Facebook: libra association.....pag. 84

3.4.2 Funding members ..... pag. 85

3.4.3 Diem Dollar..... pag. 89

3.4.4 Mastercard ..... pag. 90

3.4.5 Visa ..... pag. 91

3.4.6 I.B.M. ..... pag. 93

CONCLUSIONS ..... pag. 96

Bibliography pag.100

ABSTRACT

This work aims to understand the motivations that lead companies to make increasingly significant investments in the implementation of payment systems based on blockchain technology and cryptocurrencies. To get to the thesis, I considered it necessary to carry out a logical path starting from the definition of cryptocurrencies and a comparison with legal currencies, also in order to highlight their common and distinctive characteristics.

Finding a shared definition is important to understand the features and modes of operation. In fact, any innovation first finds application in the social fabric, influences its economic dynamics, and, subsequently, given the importance it assumes, the legislator finally intervenes to regulate the interpersonal relationships created.

Therefore, in defining the phenomenon, I considered it appropriate to initially evaluate the socio-economic aspects that have been influenced and verify the regulatory positions as constituting a synthesis of the effects that the phenomenon produces in the underlying economic fabric.

Therefore, I highlighted how the various Legislators or Central Authorities have dealt with and qualified cryptocurrencies to arrive at a nomenclature more or less shared internationally.

Even resorting to historical paths was useful to fully understand the evolution of the concepts of trust, transaction, complementary currency and digital currency, concepts necessarily functional and complementary to the study I carried out.

Given these premises, I have structured my work in three chapters and a concluding part:

- In the first, starting from a definition of cryptocurrency, I deepened the problems related to double spending and the concept of the fiduciary third party. Subsequently, I defined and highlighted the functions and differences between legal and virtual currencies and the concept of crypto assets, resulting in comparison. Finally, I dedicated space to the blockchain, the underlying technology of cryptocurrencies.

- In the second chapter, I examined the concept of complementary currency, highlighting some concrete application cases. The phenomenon is currently parallel to that of cryptocurrency without excluding, for the future, convergence with the same, as the high technology that supports cryptocurrency can also fulfil the purposes of social currency. For the sake of completeness, I also focused on the Central Bank Digital Currency, digital currencies whose issuance has been announced by several Central Banks that, using blockchain technology, will flank the current state currencies.

In the third chapter, I deepened the theme of the interaction that exists between private entities and cryptocurrencies. I started by addressing the topic of the sustainability of this technology from an ESG perspective. So, I examined a sample of listed companies operating in the payment services sector, distinguishing those that have implemented the use of cryptocurrencies within their circuits from those that, instead, have excluded them from their services. I compared some performance indicators of these companies to understand whether or not those who use cryptocurrencies can favour exchanges within a platform, linking the result also to productivity. Subsequently, I also referred to ongoing projects aimed at integrating the underlying function and the complementary currency, understood in its broadest sense, namely that of increasing the user base of a "social" network, with blockchain technology, for the implementation of e-commerce (Libra, Amazon)

CHAPTER 1

VIRTUAL CURRENCY

1.1 Definition

In the last decade, the term "*cryptocurrency*" (or virtual currency, or digital currency or cryptoactivity) has been raging in international language regarding a complex financial phenomenon that is rampant at great speed. Defining this term is not easy because there is still no shared scientific definition: the rate of diffusion and proliferation of the blockchain technology and of cryptocurrencies associated with it, often created with diversified purposes, is leading to a continuous evolution that even the interpreter of the phenomenon has difficulty in framing its nature. This nature can be examined from multiple angles ranging from the technical-IT to the economic cut up to the juridical-legal one. The complexity of this theme is also represented by a high degree of technicality and the numerous varieties on the market with different operating characteristics.

For these reasons, we are witnessing more and more a growing debate on the main aspects of cryptocurrency about possible or possible economic and social impacts, up to the evaluation of regulatory issues, currently absent or very incomplete.

The current phenomenon that we are witnessing cannot be overlooked because, in modern monetary economies, banks, other financial institutions, public administrations, businesses, and citizens carry out every day a large number of transactions involving a transfer of funds, that is, a payment by which a debtor extinguishes an obligation to a creditor (for example in Italy Banca d' Italia recorded about 6.500 million transactions using cashless payment services in 2020)[1]. And payment and settlement systems play an essential role in the stability and efficiency of the financial system and the economy as a whole.

1.1.1 Origin of the phenomenon

First of all, it is necessary to frame the historical period in which the birth of the phenomenon in question must be placed and what has favoured the implementation of new facilitated forms of access to financial services.

[1] Banca d'Italia "*Statistics"* 21 May 2021

A first reference is the technological evolution of the first decade of the third millennium that determined the advent of industry 4.0, generating a profound change in the scenarios of the productive mechanisms of the globalized economy by introducing, in the decision-making processes, artificial intelligence and thus determining the beginning of the fourth industrial revolution. The turning point is that artificial intelligence is no longer considered a factor, like the others, of the productive organisation, but the very organisation of the factors of production.

The world of payment services and banking and financial services has also been affected by these crucial changes originating mainly from the continuous development of technological innovation and the digital revolution applied to financial activities (Fintech). The digital revolution we have witnessed in recent years has opened up new development prospects that could radically change the traditional structure of payment services and, more generally, of banking and financial services (think of Pay Pal). The dynamism of the market has also been supported by the massive spread of devices such as smartphones and tablets that have allowed digital access to ever more comprehensive functions[2]. Technological innovation has now given rise to advanced IT platforms capable of allowing the direct meeting between the needs of subjects who have excess liquidity and subject to the search for financing, in such a way as to determine, in the future, potential disintermediation from the related activities of banks and other qualified service providers. These new technological scenarios, on the one hand, favour the entry into the market of new private exchange instruments, which have certain similarities with currency, on the other hand, make possible new ways of circulating securities and providing banking, financial and payment services, which are independent of the intermediation of qualified entities, and even of central banks themselves.

Another reference, contextual to the first, is the global financial crisis of 2008 which led to the tightening of the rules to which banks and other subjects authorised to provide financial services were subjected, undoubtedly contributing to determining the contraction of the profitability margin of the related business activities already strongly weakened with the technological change in progress. In fact, the increase in capital requirements and, more generally, the increasing rigour of the rules governing the exercise of banking, financial and payment activities and the consequent decline in profitability induced by them have risked triggering a centrifugal mechanism, now made possible by the availability of new technologies, which could push part of the banking services, financial and payment to new subjects and new methods of operation less or not at all regulated. From another point of view, it has led to a general distrust in the community of private banking institutions and

[2] M. Carney, The Promise of FinTech – Something New Under the Sun ?, Speech given by Governor of the Bank of England, Chair of the Financial Stability Board, Deutsche Bundesbank G20 conference on "Digitising finance, financial inclusion and financial literacy", Wiesbaden, Germania, 25.1.2017, p. 3: "The emergence of mobile telephony, the ubiquity of the internet, availability of high-speed computing, advances in cryptography, and innovations in machine learning could all combine to enable rapid changes in finance – just as they are in other areas of the economy"

intermediaries in general, as a result of the widespread awareness that they are no longer guaranteed in financial transactions, and in addition, it has also generated an impatience towards the regulation of the economic system and the method of control over it carried out by public authorities.

It was no coincidence that the *white papers*, containing all the technical details of the first crypto-currency that appeared in the financial world, was published in 2008, and Bitcoin (the most well-known and popular digital currency) was released in January 2009 just as a response to the 2008 crisis[3] and, again, not surprisingly, immediately after the bankruptcy of Lehman Brothers, the most important US investment bank: a failure that first shook, and then destabilised, the entire world financial system.

In this scenario, cryptocurrencies find their place because they can also operate outside of government and central bank controls, and the common opinion is that, in the event of new recessions, the public will be able to resort to an alternative free from government supervision and intervention.

It should not be forgotten that through the banking system, monetary policies capable of influencing economies are realized, and that through the government control exercised over the banks, it is possible to condition, limit or prohibit not only access to credit but also to the management of one's monetary assets deposited in the banks themselves. Just recall the long lines of users at the ATMs of Greece in the period of the deep economic crisis of 2015 precisely because the local government severely limited the daily withdrawal from its current accounts[4], or the recent entry of the Taliban into the government of Afghanistan that immediately blocked the current accounts by eliminating the possibility of making withdrawals[5]. In addition to these special situations, normally, all the provisions given by the States to stem tax fraud or evasion are widespread (for example, exclude the possibility of making cash payments over a certain amount, thus imposing traceability of the movement of the currency, or determine the amount of the daily withdrawal) provisions which are considered to be major limitations in self-determination. It should also be said that the supervision exercised over payment systems, both wholesale (transactions of high amount including the settlement of transactions on financial instruments) and retail (commercial transactions of individuals or companies), is aimed at the smooth conduct of monetary policy and affects financial stability, as well as the success of transactions and, therefore, to maintain confidence in money and electronic payment instruments alternative to cash. However, the creators of BTC (Bitcoin) precisely questioned

[3]The guiding principles of Bitcoin are accessible online on the site http://bitcoin.org/bitcoin

[4] https://it.m.wikipedia.org , Economic crisis in Greece. In 2015 the ECB stopped accepting Greek government bonds from Greek banks and the immediate consequences, due to a lack of liquidity, were: the closure of branches by banks and contingent withdrawals

[5] https://ansa.it "*Afghanistan long queues in front of Kabul banks"* 31 August 2021 With the arrival of the Taliban in power, international bodies have stopped financial aid to Afghanistan. The guarantees of the Afghan Central Bank have also been frozen, creating liquidity problems.

this banking operating system, which proved fragile and allowed the banks themselves to pursue their own interests at the expense of an increasingly less efficient public function. Despite the considerable state subsidies received, the banks were no longer considered even able to guarantee the regular spread of the monetary policies implemented, thus slowing down the circulation of money[6].

Emblematic was the case that occurred in Europe following the new liquidity introduced into the economic system by the European Central Bank on the occasion of the unconventional measure of quantitative easing put in place precisely to counter the subprime and sovereign debt crisis, as well as the lowering of interest rates up to negative percentages. This manoeuvre should have led to an acceleration of the spread of the currency to reach even small and medium-sized enterprises and ordinary citizens, but which has not fully achieved this purpose due to a banking system capable of countering and often invalidating the expansionary policies implemented by the B.C.E. As a result, the banks have not turned available money into financing the real economy and economic development. And if the banking system is not able to fully transmit monetary policies, in fact making the creation of new money ineffective, then the issuance of money by private individuals supports central bodies in injecting liquidity into the system.

1.1.2 Birth of cryptocurrency

From these premises comes Nakamoto's idea, which is to set the issuance of a currency by anchoring the maximum amount at a fixed amount. This predetermination is essential for achieving purchasing power stability and, therefore, to avoid the devaluation of the currency itself. Thus, the creation of money is left to technology and freed from any human factor.

From what has been said follows the advantage of establishment and use of blockchain technology which, introduced in the finance's field, allows guaranteeing success of transactions without an intermediary to guarantee them[7]. In fact, all the operations carried out through these systems are leading towards the elimination of third parties as intermediaries in transactions between private individuals, creating opportunities in terms of reducing transaction costs, reducing the cost of accessing financing, the possibility of accessing platforms even in the absence of a traditional bank account, as well as the exclusion of any form of control, and therefore of public interference of the money market and in the management of digital payments[8]. In essence, there is the shift of control

[6] https://www.bancaditalia.it
Bank of Italy-Eurosystem *"Surveillance of the markets and the payment system"* Pag. 3 e ss.
[7] European Parliament resolution of May 26 2016, on virtual currencies
[8] In the 90s, the movement of the "Cryptoanarchy", developed first in the United States and then also in Europe, set itself the goal of realizing, through cryptography, disintermediation aimed at creating a process of financial democratization based on the power of the network and characterized by a reduction in transaction costs, the speed of

from the institutions to the people whom themselves become banks, in the traditional sense of the term as guarantors of payments. The private individuals hold the "wallet", and they are responsible for their transactions in the total absence of a centralized body in which to place their trust.

Further, it should also be considered that financial transactions carried out in the banking circuit are long reversible. Just think of those made by credit card where the reversibility varies between three and six months. Even when the transaction may seem instantaneous, it takes two or three days to complete. In fact, It is composed of two temporally distinct elements: **clearing and settlement**, and the settlement system burdens costs, even significant, often also linked to the amount of the sum to transfer.

Of course, in an era in which information travels and transfers instantly at no cost, these processes are inefficient, expensive, and inadequate[9].

This critical issue until the beginning of 2010 did not present particular problems. Virtual and electronic payment systems (think of tokens on video games or credit cards) already existed before the advent of the blockchain. But subsequently, with the growing spread of new information technologies, the development of e-payments was favoured, designed precisely to support e-commerce that in those years raged and electronic transactions increased exponentially with a further acceleration that also occurred following the covid 19 pandemic from 2020 to today[10].

This criticality generates the problem of double spending, defined as spending of the same currency security more than once.

1.1.3 Double Spending

Double spending is a potential flaw in a digital cash scheme in which the same single digital token can be spent more than once. As with counterfeit money, such double-spending leads to inflation by creating a new amount of copied currency that did not previously exist[11]. Prevention of

exchanges and the elimination of government controls. Furthermore, it aimed to destabilize the state monopoly of the economic system. L. D'AGOSTINO, Transactions of issue, exchange and transfer of cryptocurrency: considerations on the profiles of (abusive) exercise of financial activity following the enactment of Legislative Decree 90/2017, in Rivista di Diritto Bancario, 1/2018, p.6.

[9] This is what Prof. Ferdinando Ametrano pronounced in 2015 in an interview collected by Massimo Chiriatti and published in the Sole 24 Ore on November 24, 2015, in https://www.ilsole24ore.com "*Bitcoin is digital gold and can spell the end of cash*".

[10] It is estimated that in 2018 40% of the global population – 2.81 billion people – made at least one online purchase. Data reported on "*The virtuous growth of e-commerce drives every market"* Press release from Wolf Agency.it published on November 20, 2020 on www.ansa.it .

[11] Usman W. Chohan *"The Double Spending Problem and Cryptocurrencies", 2021* on https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3090174

double spending is usually implemented using an online central trusted third party that can verify whether a token has been spent.

In fact, the term transaction traditionally means a one-way transfer of current money between one subject and another carried out by one or more intermediaries (bank or credit institution) by a legal credit-debit relationship. This step consists of two elements: settlement and clearing. As long as transactions took place in cash, these elements participated simultaneously in the transitive process of the currency. Therefore, considering that the passage of the currency was simultaneous with the receipt of the same, the transaction was guaranteed by the two parties participating in the operation. With the advent of coins in electronic format, the two constituent elements of the transaction have undergone a temporal postponement in which the agreement to participate in the transaction is the first act, while the process of verification of the financial coverage, which leads to the concrete transfer of the currency from the debtor to the creditor, takes place later. In this context, the figure of a third party becomes necessary to guarantee not only the financial coverage but that the same is maintained until the conclusion of the verification process. The essential presence of this intermediary generates a transaction cost that we could call "the cost of trust**".**

In this context, the disruptive force of the invention of the blockchain is inserted, changing the financial and monetary world with immediate implications on the individual States' central authorities and both for industry and everyday life.

This new technological paradigm has been generated precisely to support a decentralised validation of all transactions. In fact, it is aimed precisely at overcoming the criticalities mentioned above, with the addition of reducing the costs of the transaction itself. In fact, the temporal deferral between the two phases of the transaction is strongly contracted, the transaction realised is no longer reversible, the system carries out the intermediation.

In the blockchain paradigm, in the case of money transfer, the operation is analysed, verified and approved by networked hardware that, through software, are able to consult the history of all the operations present in an encrypted public archive (blockchain).

Then the creditor's balance is calculated, the feasibility is verified, and the operation is authorised. In the particular "block" created for the transaction, a timestamp is added that uniquely and immutably identifies the operation and specifies the realisation time.

With this system, in considering that settlement and clearing occur in rapid sequence, the hypothesis of double spending cannot be realised. The system follows the model of the circulation of

the payment order in the credit to the order securities: it is the continuous series of turns in a peer to peer or payer to payee model that ensures the elimination of double-payment[12].

Another consequence is the empirical reduction of transaction costs.

This is a substantial difference from an economic point of view, which concerns the principle underlying the remuneration of the transaction.

For credit institutions, the remuneration (subject to economies of scale as there are contracts that provide for reductions in costs based on the monthly or annual number made) consists of a service that they make available to the customer (cash, online platform, money transfer and those related to the exchange rate).

In the bitcoin protocol and Ethereum, on the other hand, there are two "block reward" types: the first consists of new bitcoin awarded to cryptocurrency miners for being the first to solve a complex math problem and creating a new block of verified bitcoin transactions. which is not the responsibility of the interested parties and constitutes the only way to generate bitcoins

According to a self-perpetuating system, the number of cryptocurrencies in circulation grows as the blockchain grows. Block reward that varies based on a pre-established constant rate of reduction.

For example, the Bitcoin algorithm was set by its creator so that the reward decreases steadily as the platform increases to a total zero, which will coincide with the achievement of 21 million Bitcoins[13]. The reduction occurs due to the creation of every 210,000 blocks.

The other incentive, borne by the interested parties, constitutes the commission on the miner's validation activity. For miners, powerful computers that compose and connect to the network, the remuneration is determined by a "transaction fee", which consists of creating the block itself. However, within a block, multiple transactions can be recorded no larger than those of a block (1 MB) added to the blockchain. This reward will be borne by the parties involved in the transactions. Nevertheless, this cost is also inversely proportional to the block's capacity, that is, to the computing power necessary for the execution of the transactions and the size of the data themselves, able to

[12] S. Nakamoto "*Bitcoin: A peer-to-peer electronic cash system*", October 31, 2008, on http://bitcoin.org, "*a purely peer-to-peer version of electronic money, would allow you to directly send online payments from one entity to another without going through a financial institution ..... the main benefits are lost if a trusted third person is still required to prevent double spending. We propose a solution to the problem of double spending through the use of a peer-to-peer network*".

[13] L. Ferraro, *"FINTECH The digitalization of finance between Cryptocurrencies and Blockchain" on* IPE Business School, IPE Working Paper n. 18, December 30, 2019, in https://it.readkong.com. S. Nakamoto, "*Bitcoin: A peer-to-peer electronic cash system*", October 31, 2008, on http://bitcoin.org.

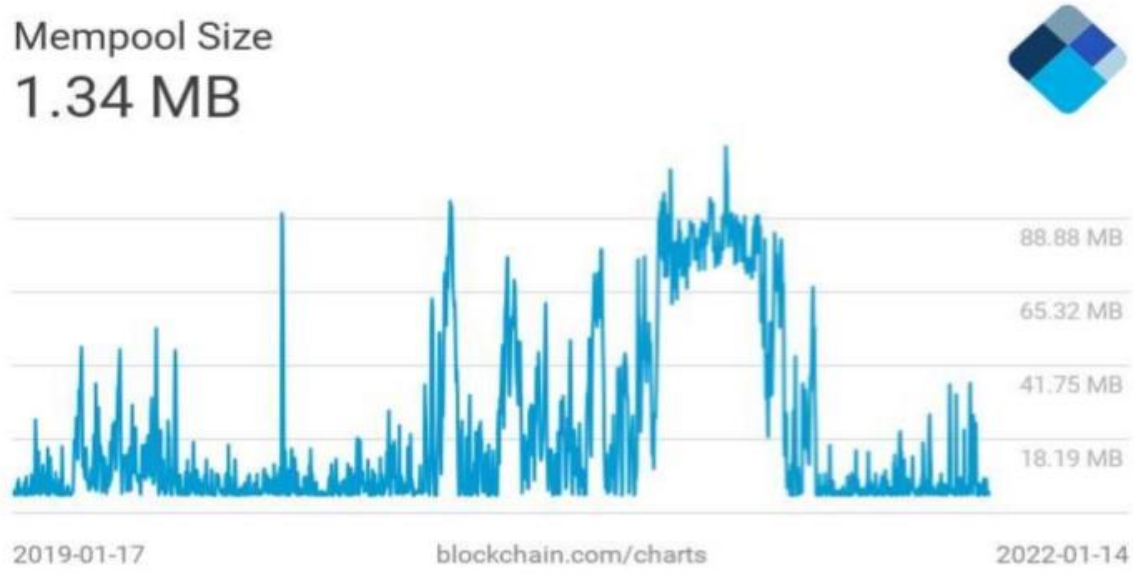
speed up the realization of the same by increasing the scalability of the currency[14]. If a block contains up to 1MB, only a limited number of transactions can be included in it.

During a period of high traffic on the network, when a large number of users send funds, there may be multiple transactions waiting for confirmation of when there is no space in a block. Therefore, when a user decides to send funds and the transaction is transmitted, it initially goes into a mempool (short for memory pool) before being included in a block.

From this mempool, miners choose which transactions to include, prioritizing those with higher fees. If the mempool is full, the commission market could become a competition: users compete to bring their transactions into the next block, including higher fees.

Eventually, the market will reach a maximum balance fee that users are willing to pay, and miners will work through the entire mempool in order. At this point, once the traffic has decreased, the equilibrium tariff will return to fall[15]. This was particularly evident in the case of bitcoin. During April 2021, when there was high traffic on the network, the mempool became saturated, and transaction fees rose significantly (figure 1 and 2).

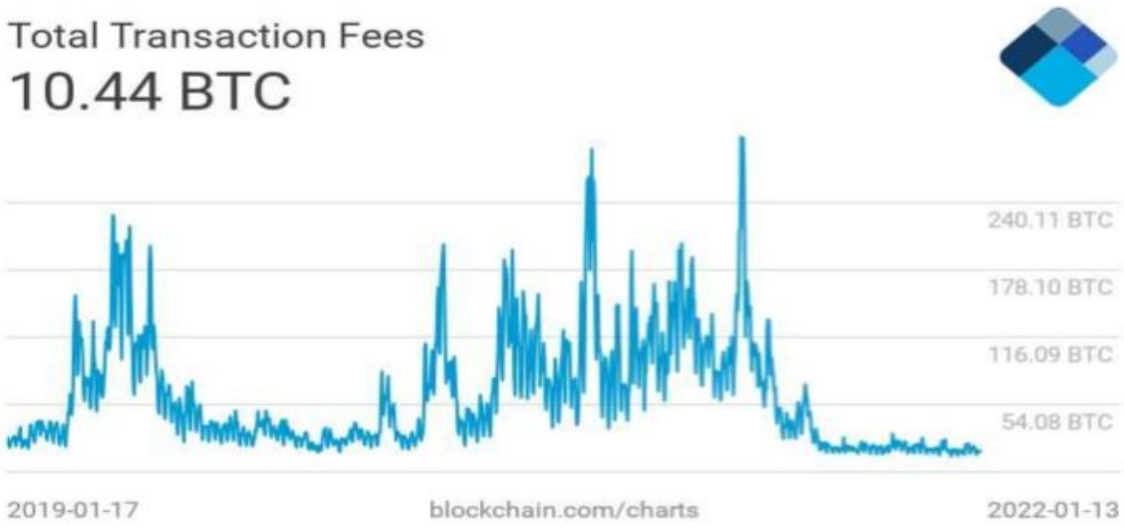
FIGURE 1



[14] P.Vigna, "Crypto and Its many fees: What to Know About the Hidden Costs of Digital Currencies" on The Wall Street Journal, December 18 2021.

[15] www.supportblockchain.com "*Explaining Bitcoin Transaction Fees" December 12, 2021*

FIGURE 2



Therefore, considering that part of the transaction cost is connected to the capacity of the network, bitcoin cash (bch) was born in the year 2017. It is a platform derived from Bitcoin capable of making transactions with greater speed that determines the lowering of costs.

1.1.4 Trust and privacy

From what has been said, it is clear that the **concept of "trust",** or rather, the element "trust", takes on another guise. It is the same Bitcoin protocol that defines the trust-less system: "What is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party". While the traditional system cannot do without the trust that every citizen places in institutions, banks, intermediaries and monetary authorities in general, in the perspective of the promoters of Bitcoin, instead, the trust, on the part of users, is moved by man to the laws of mathematics, computer science, cryptography and all the algorithms that form the backbone of the system, controlled no longer by a small number of people, but by participants in the entire network.

The concept of **privacy** is also different between the two systems: in the traditional banking model, the guarantor and the parties involved have access to the sensitive information underlying each transaction. Through the blockchain, on the other hand, all participants in the network see that

someone is sending a certain amount of virtual currency to someone else without, however, having access to information related to the transaction and the subjects involved[16].

Moreover, it is also highlighted that the systems in use can generate "virtual coins". The issue, therefore, takes place by private individuals on the basis of acceptance of rules hinged in an algorithm and not by public authorities to which the law delegates this task by recognizing the right to issue money.

The possession and custody of the same are possible through digital keys, based on cryptography, through which the ownership of the same and the value they represent is reconstructed. The transfer takes place electronically also through fractionations of the original value.

Currently, cryptocurrencies can be understood as a means to buy goods and services and convert traditional currencies, so-called FIAT money[17], as well as real assets to invest in through trading on online platforms called Brokers. However, this new scenario gives a glimpse of a rapid evolution process of the cryptocurrency's concept and nature and the currency in general.

Regardless of public evaluation or perception, it is interesting to understand how the legislation of some States or judicial and economic authorities that have taken an interest in the sector has defined the concept of cryptocurrency.

1.1.5 Definition of cryptocurrency in some legislations

At the European level in Directive no. 843/2018 of the **European Parliament** and of the Council of May 30 2018, on the occasion of the enactment of rules for the prevention of the use of the financial system for money laundering or terrorist financing, amending the previous Anti-Money Laundering Directive no. IV of 2015, the European Legislator, for the first time, defined virtual currencies (Article 1, point d)) to be distinguished from electronic money (Article 1, point c)) indicating them as "representation of ***a digital value*** that is not *issued or guaranteed by a Central Bank and a public body, is not necessarily linked to a legally established currency, it does not possess the legal status of currency or money, but is accepted by natural and legal persons as a medium of exchange and can be transferred, stored and exchanged electronically".*[18] Understanding virtual currencies as "value" means recognizing them as an intrinsic value over time even if they do not have

[16] . Nakamoto "*Bitcoin: A peer-to-peer electronic cash system*", October 31, 2008, on http://bitcoin.org.
[17] For *FIAT*, money is a national currency not pegged to the price of a commodity – gold or silver – but linked to trust in the authority that issues it, usually a state or a central bank. It differs from the commodity currency, whose value derives from the material with which it is created.
[18] https://eur-lex.europa.eu, Official Journal of the European Union.

the legal status of a "currency" or a "currency" in the sense of economic doctrine[19]. Therefore, understood as a "valuable" good and not a "consumer" good.

Turning to the **Italian Legislator,** the same introduced the definition of virtual currency when transposing Directive no. 849 of the European Parliament and of the Council of 20 May 2015 always on the subject of prevention of the use of the financial system for money laundering or terrorist financing[20], transposition occurred through the enactment of Legislative Decree no. 231/2017 (so-called anti-money laundering regulations), anticipating in part what was then established in the European directive of 2018.

In fact, in art. 1, c.2, letter q), virtual currency is defined as "***a digital representation of a value,*** *not issued by a central bank or a public authority, not necessarily linked to a currency having legal tender, used as a medium of exchange for the purchase of goods and services and transferred, stored and traded electronically*". However, a difference emerges from comparing the aforementioned definitions: the Italian legislator, departing from the European one, does not expressly exclude the equivalence between legal currency and virtual currency.

In the same period, the **Bank of Italy**[21], following an opinion expressed in July 2014 by the EBA (European Banking Authority) to promote a process of regulatory convergence at the European level on virtual currencies (VV), defined virtual currencies as[22] ***"digital representations of value*** *not issued by a central bank or public authority. They are not necessarily linked to a legal tender currency but are used as a medium of exchange or held for investment purposes. [...] Virtual currencies are not fiat money* and should not be confused with electronic *money."* Subsequently[23], in relation to the virtual currencies present then in the market, it indicated that the same "are created *by a private issuer or, widely, by users who use highly sophisticated software: they are not physically held by the user, but are moved through a personalized account known as "electronic wallet (wallet)); they are traded in special platforms, which offer the service of converting virtual currencies into fiat currency; they can be purchased with traditional currency on such platforms or received online directly from someone who owns them, and then is held on an electronic wallet [...] In addition, wallet holders and those involved in transactions remain anonymous[...]* ".

Even the current **President of the ECB**, commenting on the growing popularity of Bitcoin and Ethereum, said that *"cryptocurrencies* ***are not currencies,*** full stop*"*. In all respects, they are financial assets, too speculative to be equated with the means of exchange. A separate discussion

[19] "Money, as money and not as a commodity, is wanted not for its intrinsic value, but for the things it allows to buy", Samuelson, Economia, Zanichelli, 1983, p. 255.
[20] https://eur-lex.europa.eu, Official Journal of the European Union.
[21] https://www.bancaditalia.it Communication 30 January 2015 – Virtual currencies.
[22] https://www.bancaditalia.it Communication 30 January 2025 – Virtual currencies.
[23] https://www.bancaditalia.it Warning on the use of so-called virtual currencies 30 January 2015

must be made for stablecoins whose value is pegged to currencies or commodities such as the US dollar or gold.

Even if the digital euro becomes a reality, it would be a very different tool from virtual currencies[24].

Remaining in Europe, it might be interesting also to consider a judgment of the **European Court of Justice,** No.C-264/14 of the Fifth Section, which ruled that Bitcoin, although not a tangible asset, constitutes "a means *of payment used in a manner corresponding to legal means of payment"* and adds that this "means of payment is *directed to all those operators who accept it*"[25].

If we cross national borders, we find different realities. The legal systems of **Japan and the United States of America,** for example, have been able to carry out organic regulatory interventions on crypto-currencies by identifying the different components of the phenomenon considering them as digital **resources** without dwelling on the question of whether or not they are instruments that do not have settlement power by *law* [26]. In particular, in the United States, as early as 2014, with notice 2014-21, cryptocurrencies were considered commodities and subject to declaration and taxation if they generate capital gains. And Japan already in April 2017 recognized cryptocurrencies as means of payment[27].

On the other hand, **China and Russia** have declared illegal all transactions made with cryptocurrencies and activities related to virtual currencies. In China, the decision was taken by the People's Bank of China on September 24, which, in a statement, qualified transactions and exchanges with virtual currencies as "**illegal financial activities**" as "they do not have the same legal status as legal tender and cannot be distributed on the market as money". The reason for this decision is to be found in the desire to hold the monopoly on the digital currency given the launch of the digital Yuan Coin 2021 that the Chinese government is implementing with pilot projects in order to innovate monetary policy radically[28] [29].

On the other hand, Russia is one of the countries in Europe with the highest rate of adoption of cryptocurrencies and with the largest number of mining farms. Institutions have always shown themselves in favour of the use of cryptocurrencies, the financial authorities manifest the desire to limit their circulation and therefore their use. Recently the President of the Russian Central Bank stated that "These *cryptocurrencies are anonymous, no one is responsible for them and, in our*

[24] Speech reported by G. Talone in "*Lagarde, cryptocurrencies are not real coins"* of 16 September 2021 on www. Milano Finanza. it.
[25] The judgment in question is published on the website curia.europa.eu.
[26] G. Rinaldi, *Regulatory Approaches and Legal Qualification of Cryptocurrencies* Pag. 271 ss.
[27] F. Pascucci, "*The legal nature of Bitcoin*" on Magazine Court of Auditors n.5-6 of 2018 p. 362.
[28] *China has banned cryptocurrency transactions* in www.agi.it of September 24, 2021.
[29] C. Palleschi, "*China declares cryptocurrencies illegal: the digitization of the economy?"*, September 30, 2021, on www.cesi-italia.org.

opinion, a responsible state should not stimulate their spread"; they are "private *currencies pretending to be* money"[30]. It should be noted that in the intentions of the Russian Central Bank there is the imminent issuance of the digital ruble that will have the status of legal tender and that will replace all cryptocurrencies in circulation.

In other parts of the world, however, some states have officially legalized the use of Bitcoin to carry out exchanges and transactions: **Ukraine,** in Europe, and **El Salvador** in South America. For example, in the Ukrainian law of legalization of Bitcoins, it is stated that cryptocurrency is defined as an intangible[31] asset expressed in the form of electronic data. So, while in El Salvador, citizens will be able to make exchanges or transactions with Bitcoin, Ukraine, on the other hand, will be able to use it as an investment tool. Only in the first case is it to be considered a real currency.

Cuba too, with Resolution No. 215 of 2021 issued by the Banco Central de Cuba (BCC) issued on September 15, 2021, cryptocurrencies have been recognized as legal means of payment for reasons of "socioeconomic interest", thus following in the wake of El Salvador[32].

Suppose we exclude the experience of the only two countries that have recognized the legal tenderness of cryptocurrencies; what unites all the definitions given to them is the absence of equivalence between virtual currency and legal currency due to the lack of prerequisites from a functional point of view. If the virtual currency is used as payment, like a fiat currency, the payment does not have a liberating effect *erga omnes* since the acceptance as a means of payment is left to the will of the other party[33]. Another difference is the fluctuation of quotations that compromises the typical value function of fiat currencies.

Because of the absence of specific legal qualifications of the currencies in question and the hybrid nature of the same, the doctrine has difficulties in qualifying them unequivocally, mainly considering the different functions and structures they may have. Moreover, there are no prevalent ones able to characterize all those in use among all the possible ones. The doctrine, however, has tried

[30] www.punto-informatico.it Or. Lasperini "*Cryptocurrencies: Russia has decided to ban them completely"* November 24, 2021

[31] Since June 7, 2021, bitcoin has been legal tender alongside the national currency, the dollar, in the state of El Salvador, the first country in the world. Subsequently, the Parliament of Ukraine also legalized Bitcoin and defined rules for the use of cryptocurrencies.

[32] G. Talone, "*Ukraine legalizes bitcoin and protects crypto-investors from fraud."*, 9 September 2021 on www.milanofinanza.it .

[33] In the Italian legal system, art. 1278 c.c. in the event of a debt of the sum of coins not having legal tender, the debtor's right to pay in a legal tender is recognized. At the time of the formulation of this rule, there were still no and certainly not yet provided for the possibility of having virtual coins on the market, and therefore, the Legislator, speaking of "non-legal tender coins", could not think of cryptocurrencies. To date, however, considering that in the regulatory text, there is no explicit exclusion of virtual currencies, for non-legal tender coins, it is necessary to include not only the legal currencies of other countries but also all the virtual ones in circulation.

to classify them by addressing, mainly, the issue of whether or not crypto-currencies are included in the category of financial instruments or products or consider them intangible movable assets[34] [35].

Therefore, a comparison of legal currencies with virtual ones is necessary to deepen and identify any convergences and divergences.

1.2 Fiat Money, Virtual Currency and Crypto-Assets

Money, according to doctrine, is understood as a "good" intended for circulation, a definition that is based on the *"functional approach"*[36]. This is the result of the functions recognised to the currency constituting characterisations of the same. Money has four important and direct functions: Medium of exchange, Measure of value, Standard of deferred payment, Store of value. In recent economics, the functions of measurement and standard are often combined into the "unit of account" or numeraire[37]**.**

1.2.1 Functions

Unit of account means quantifying credits and payables and facilitating the exchange of goods and services, making them commensurable and comparable. Medium of exchange, on the other hand, means the ability to perform an intermediary function in exchanges and to fulfil a debt. Finally, the store of value consists of the ability to maintain purchasing power over time and the inflation rate that reflects the trend of prices on the market. The latter function puts money in competition with financial assets (stocks and bonds) and real assets (works of art, gold, real estate). Compared to these activities, however, the currency is to be recognised with the greatest degree of liquidity, that is, the ability to transform into purchasing power quickly. When all three of the above functions do not occur, we speak of partial currency. For example, when the euro was introduced in Europe, from 1999 to 2002, it only served as a unit of account as it could only be used for accounting purposes as scriptural money. Cash in circulation only entered in 2002.

It is started from the commodity currency to guarantee these functions as a payment instrument represented by a good with its intrinsic value. It is also a consumer good and not intended

[34] www.dirittobancario.it, n. 2, 2019 P. Career, *The "cryptocurrencies" in the light of our legal categories of "financial instruments", "transferable securities" and "financial products" between tradition and innovation.*
[35] A. Magliocco, *Bitcoin and taxation*, in *Financial instruments and taxation*, n. 22, 2016 p.27 ss.
[36] C. Proctor, *Mann on the Legal Aspect of Money*, Oxford, 2012, VII ed., p. 12.
[37] Gautam Vora, Cryptocurrencies: Are Disruptive Financial Innovations Here? 2015 on Modern Economy, 2015, 6, 816-832

for specific use as a payment instrument. It could be any object (but also animal) representing a means of exchange or payment taken in exchange not to be consumed but to be exchanged later for something else of equal value[38]. Subsequently, it is moved on to manufactured objects of a material that had a market value, for example, gold coins. In later times, representative money was introduced, consisting of banknotes that could be exchanged for a certain amount of gold or silver, through which what circulated was the information contained in them. Subsequently, it has been adopted the metal coin[39], followed by the standardisation of monetary pieces of the same type. In this last case to the traditional functions of the currency mentioned above was added the **fungibility** of each monetary piece compared to the others of the same type and, therefore, the standardisation of the information represented and conveyed[40]. In later times, the representative currency consisted of banknotes that could be exchanged for a certain amount of gold or silver.

In addition, it should also be noted that a currency understood in this way, in order to be considered legal, must be issued by a sovereign State or be legal tender within the territory of a sovereign State[41]. Therefore, on the one hand, it is linked to state power, on the other by mandatory acceptance in the territory of a given State. It is not possible to think of a currency without thinking about the relationship that binds it both to a specific community (which is required to use it) and to specific territoriality (territorial scope of state power).

On the other hand, modern economies are based on **fiduciary money**, declared legal tender and issued by a central bank, unlike representative money, not convertible into a fixed amount of commodity (gold, for example). Fiduciary money has no intrinsic value and "*is an object that is intrinsically useless (never wanted for its own sake) and inconvertible (the issuer does not promise to convert the money into anything else)"* [42]. Useless since never be used as a consumer good, inconvertible refers to the fact that it is not backed by intrinsic worth. Therefore, by definition, fiat money is only a medium of exchange and never a consumer good[43].

The paper used for banknotes or the metal for coins are generally worthless, so acceptance in trade does not depend on an intrinsic characteristic. Still, both are accepted in exchange for goods and services because users trust that the issuing central bank will keep the value of the currency stable

[38] Kiyotaki-Wright "*Acceptability, means of payment, and media of exchange*", 1992 quoting the theory of K. Wicksell *"Om penningar och kredit"*, 1906

[39] Already used in Greek *Poleis,* especially Athens

[40] F. Capriglione, vocals *Coin*, in *Enc. Dir., Update,* III Milano, 1999, p. 761 e ss.

[41] Some states have experimented, under their control, the use of virtual currency in their own countries: Uruguay with the e-peso, Venezuela with the Petro. However, initiatives about it are not yet implemented and are also recorded in Estonia and Sweden). While El Salvador is the first country in the world that has recognised bitcoin as legal tender on a par with the national currency.

[42] Wallace "*Fiat money is an object that is intrinsically useless ("never wanted for its own sake") and inconvertible ("the issuer does not promise to convert the money into anything else")*, 1980.

[43] Kiyotaki-Wright "*Acceptability, means of payment, and media of exchange*", 1992.

over time. If the central bank does not deliver on this commitment, fiat money will lose general acceptance as a medium of exchange and consequently all interest as a store of value[44].

The first examples of trust attributed to a fiat currency were made within places of worship where priests were responsible for standardizing the value of what was commonly exchanged (stones, salt, jade) and became the guarantors of the first forms of money.

They constituted the third fiduciary party in the exchanges. They attached a value to every commodity that passed through the temple and certified it. In this way, those who intervened in the deal were not required to verify the certified goods as they accepted the evaluation carried out by the priests. It was the pre-currency age[45].

1.2.2 Differences

To legal currency, virtual currency is opposed. The term **virtual** indicates that it does not exist physically and is issued and exchanged exclusively through telematic means. Its introduction into the economic and financial world has led to questions about its traceability to the concept of money as well as about the main problems that concern not only the use as a means of execution of bonds but mainly the control of its circulation and the activities of those who place it in the market. In this regard, reference can be made to the European Directive 2018/843 of May 30, 2018[46], whose declared objective "is to cover all possible uses of virtual *currencies*", where it states, meanwhile, that "Virtual currencies should not be confused with electronic money. [...] Although virtual currencies can often be used as a means *of payment, they could also be used for other purposes and have wider uses, for example, as a medium of exchange or investment, as products of value, or it can be used in online casinos. "*. Therefore, virtual money is a very different thing and cannot be equated with electronic or scriptural money: the latter do not represent new goods distinct from legal money but constitute legal tender like banknotes or checks (they are the different forms that can take the availability of money that is legal tender and all express an institutionally recognised economic purchasing power able to determine the extinguishment of a pecuniary debt by attributing them to the debtor's assets[47]); moreover, the link between traditional and electronic money lies in the fact that central banks control both and that the unit of account expressed by one is identical to that expressed

[44] *"What is money?"* in https://www.ecb.europa.eu/ecb/educational/explainers/tell-me-more/html/what_is_money.it.html 24 November 2015 (updated on 20 June 2017).
[45] D. Graeber, "Debt", Il Saggiatore,2012; G. Comandini, "*Blockchain works because humans don't work."* intervention on TEDx Talks, November 5, 2019; G. Svevo "*But before in the portfolio we had sheep and oxen"*, in cronologia.it.
[46] https://eur-lex.europa.eu, Official Journal of the European Union.
[47] What makes the difference is precisely the imputation criterion: possession of banknotes, writing into the current account or recording bytes on the magnetic card.

by the other. It cannot assert itself for virtual currencies because their use does not involve a transfer of fiat money but only a transfer of value that can be spent within a small community. Moreover, according to the doctrine[48], the intermediation of the State is the characterising element of the monetary phenomenon, absent in cryptocurrencies whose issuance is left to private individuals. This intermediation explains the function, recognised to the legal currency, of a payment instrument that cannot be refused, regardless of the intrinsic value of the currency itself[49]. Finally, virtual currencies are linked to real money through an exchange rate, and therefore, they are exposed to fluctuations of the same amplified by the fact that the money supply is carried out by non-financial institutions and often decentralised.

It is the introduction of an institutional convention that changes the essential characteristics of the currency by introducing legal tender, but this should not exclude the possibility that in addition to the legally recognised currency, conventional currencies derive their function as an exchange from non-institutional conventions may also circulate. The contractual freedom, in fact, can identify a certain good, without use-value, as an instrument for the exchange of goods and services. Private individuals can also accept non-legal currencies as a means of payment, as they can also agree on a discipline of their debit-credit relationship along the lines of that dictated by the Legislators for pecuniary obligations. All this is part of the freedom of negotiation. However, all of it does not entail the automatic extension of all the rules provided for by law for obligations relating to legal tender. If we return to examine Article 1277 of the Italian Civil Code.c., which as already highlighted there is no doubt about the non-applicability to cryptocurrency debts, the rule identifies in the sum for its nominal value the object of the service; at the same time, it imposes on the creditor the obligation to accept the currency having legal tender with a solvency function. The same provision excludes the possibility of referring it to any other debt of money. The same can be extended to other fields. For example, the accrual of interest moratoriums or legal. If there are no express agreements to that effect, the rules governing pecuniary obligations with all the case consequences do not apply.

Therefore, the use of cryptocurrencies as a means of payment is part of the dynamics of an exchange relationship, with the difference that the instrument used is not legal tender. This makes it possible to affirm that in the case of the use of fiat currency, the rules that draw their source in

[48] B. Inzitari, *The coin* in *Tratt. dand. comm*., Galgano, VI, Padova, 1986, p. 40 et seq.

[49] www.milanofinanza.it The current President of the B.C.E., Christine Lagarde, at the Conference The state of the Union of the European Institute of Florence, in Lagarde, yet another stockpile to cryptocurrencies. But bitcoin is not affected by M. Vigliali May 7 2021 on Milano Finanza, said: "They are a category that has nothing to do with the possible digital euro or the digital currencies of other central banks, they are cryptoassets on which people are free to invest taking all the risks". Andrew Bailey, Governor of the Bank of England, also said at the same conference: "They have no intrinsic value... it's the people who value it."

institutional conventions operate; in the other case, however, the rules related to the characteristics of the circulation of a good should prevail[50].

1.2.3 I.C.O. (Initial Coin Offering)

But the most significant problems posed by the spread of cryptocurrencies concern, more than the protection of a hypothetical pecuniary debtor, mainly the possible protection of savings[51]: reference is made to the case in which cryptocurrencies are used as an investment, or rather, cryptocurrency is part of a broader economic investment operation. Through the **ICO,** Initial Coin Offering, it is possible to collect, through the Bitcoin Blockchain and especially Ethereum Blockchain, the public savings in the form of virtual currencies for the financing of start-ups. The investor who agrees to believe in the project pays with cash (USD, EUR) or already existing cryptocurrencies (Ether, Bitcoin...); follows the issuance of tokens, securities that legitimise the exercise of a right, which may consist in the use of goods or services that will be launched into the market, excluding a purpose of a monetary nature. In this case, we speak of a utility token that differs from the securities because it refers to a broader classification of tradable assets. Utility token represents a real financial instrument, such as traditional bonds or shares, and it consists of voting rights and cash flows rights of the issuing company determined in virtual currency[52]. There are also payment tokens, which match as a means of payment to purchase goods and services[53].

Subsequently, the investor can convert the tokens into traditional currency on any exchange platform or private transactions. If the project fails, investors will have a worthless digital currency in their portfolio. The White Paper contains the description of the project, business plan, rules relating to the tokens offered for sale, and information concerning the start-up team and founders; if the minimum limit of the required funds is not reached, the funds will be returned. ICOs are an intermediate mechanism three a crowdfunding platform and the stock exchange market.

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[50] www.ilsole24ore.com, in *Draghi studies the blockchain and says about bitcoin: it is not the ECB that has to write the rules* February 13, 2018, reports what was declared in February 2018 by M. Draghi, then President of B.C.E., on the occasion of the exchange with Debating Europe, answering a question asked by an Italian student "*Bitcoin or something like that are not really currencies, they are assets. A euro is a euro: today, tomorrow, in a month's time, it is always a euro".*

[51] . Semeraro, *Fiat currency, virtual currency and border relevance* in *Journal of Banking Law*, April/June 2019, p. 252 et seq.

[52] L. Ferraro, "*FINTECH The digitalisation of finance between Cryptocurrencies and Blockchain*" in IPE Working Paper n. 18 30/12/2019 p. 26; https://www.consob.it/web/investor-education/criptovalute.

[53] This category is very similar to bitcoin even if it does not use its own proprietary blockchain but relies on an existing one.

The system is similar to IPOs, Initial Public Offerings and equity crowdfunding. In this case, instead of the issuance of digital tokens, traditional financial instruments are issued, for example, shares[54].

In this regard, CONSOB has already intervened by qualifying ICOs as "offers of financial products" and, under the provisions of the TUF (Consolidated Financial Act), in Article 94[55], suspensions have already occurred for the failure to submit the required prospectuses.

1.2.4 Crypto assets

Still, different problems arise if virtual currencies are sold to the public through digital platforms or the meeting between supply and demand (the **so-called crypto-assets) is facilitated[56].** As we have already pointed out, many problems are linked to the high volatility rate in the markets relating to virtual currencies. It results from sudden fluctuations in value, often due to external factors. Sometimes, these are legislative interventions by the Sovereign States that profoundly affect demand and, therefore, their value. For example, in the first days of September 2021, when the news spread that El Salvador had adopted bitcoin as a legal tender currency, there was immediately an increase in the value of the aforementioned cryptocurrency, a value that soon after the announcement of the People's Bank of China to declare all transactions in cryptocurrencies illegal recorded a significant decrease[57]. In this scenario, speculative operations proliferate.

Preliminarily, we should qualify the activity of "offering" virtual currency carried out by the platforms. It is necessary to distinguish the case in which it is received legal tender in exchange for the virtual one and qualify it as "trading on own account"; from the case in which the platforms put third parties in contact for foreign exchange operations and speak of "execution of commissions"[58].

However, it should be noted that in the TUF, cryptocurrencies and crypto-assets are currently not among the typical sized financial instruments. Therefore, they can only be framed and placed under "financial products" category. Thus understood, the aforementioned activities carried out by digital platforms can be qualified as "offers to the public of financial products".

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[54] An IPO represents the operation by which a closed or semi-closed company becomes part of the stock markets by listing on the stock exchange for the first time.

[55] The rule provides that, before launching an offer to the public of financial products, it is necessary for the issuer to communicate to Consob the prospectus for its publication. The prospectus shall contain all the information necessary for investors to "*reach a well-founded judgment*" of the financial situation of the issuer, the products offered and the related rights.

[56] These activities also include those of platforms for trading tokens issued by those who promote ICOs.

[57] www.ilsole24ore.com *Bitcoin, what's behind China's latest ban on crypto* by V. Loprs, September 25, 2021.

[58] M. Semeraro, *Fiat currency, virtual currency and border relevance* in *Journal of Banking Law*, April/June 2019, p. 255

1.2.5 Unit of account, means of payment and store of value

Returning to the functions performed by fiat currencies, we must clarify what is meant by "**unit of account**", "**medium of exchange**", and "Store **of value**".

The answer is not simple and, concerning virtual currencies, must be anchored to a factor that we could call intrinsic or genetic, meaning that they can be issued up to a certain maximum limit of units because, not being linked to a real or financial economy of the issuing country, the issue without limits would determine inflationary mechanisms nullifying their value.

Because of the high volatility and the related fluctuation of value over time, a virtual currency should certainly not perform the function of "**unit of account**" or "numerary" because it fails to express a clear value over time, since it does not allow a potential buyer to perceive the value of a good or service to be purchased, comparing it with a similar good or service, especially at different times. Moreover, fluctuations in values are often very large, even within the same days. So, it is highly inefficient, not to say impossible, to price goods and services in units of cryptocurrencies.

Also, as a **"medium of exchange"** and "store of **value"** is the European Union itself, in the fifth anti-money laundering directive of 2018/843 / EU, also transposed by our legal system, which does not recognise the same such functions. It affirms and recognises that "virtual currencies *can often be used as a means of payment"* and "*as products of store of value",* functions that traditionally belong to the fiat currencies, indeed is their distinctive and characterising features[59].

These functions do not constitute characteristics of cryptocurrencies, as it is the interested parties who attribute them to them through manifestations of will. As already mentioned above, cryptocurrencies do not have a liberating effect *erga omnes* since the Legislator subordinates acceptance as a means of payment to the will of the counterparty[60] (a certain exclusion concerns countries that today recognise cryptocurrencies as legal or equivalent to legal tender, namely El Salvadore, Ukraine and Cuba).

Thus, it is precisely this circumstance that allows virtual currencies to perform the function of a means of payment, a function that they would not otherwise have. The difference with a fiat currency lies in the fact that the function of means of payment is recognised by law, while for virtual ones, the interested parties' agreement is required. Even the European Court of Justice[61], about Bitcoin, has stated that the same is "a contractual means of payment used in a manner corresponding to legal means of payment", assimilating the latter to the legal ones.

[59] G. De Nova, *The contractual type*, Padova, Cedam, 1974, p. 60 et seq.
[60] For Italian law, see Art. 1277 and 1278 c.c.
[61] Court of Justice of the European Union, Sec. V, judgment C-264/2014, 22/10/2015.

The definition that we could call "statist"[62] (money is only that which emanates from a State and which is, therefore, legal tender) opposes the "economic" one, where money must be defined essentially in a functional key and therefore must perform the three main functions (medium of exchange, store of value and unit of account), features not all present in virtual currencies. These two theories are flanked by the "social" one[63]. Money is a social phenomenon directly attributable to the parties' will, free to establish how to regulate their transactions. According to this theory, the virtual currency can also be qualified as money, even if it is not legal tender.

As we have seen, the United States, already in 2014, in the 2014-21 Notice, consider cryptocurrencies commodities**.**

These functions, however, must always be considered on the basis of the fluctuation in the value over time of the virtual digital currency. Therefore, those who intend to preserve savings will opt for a currency that, on the one hand, is not subject to devaluation or poor liquidity and, on the other hand, is guaranteed by the trust granted to a government authority or a central bank. Otherwise, we enter the field of speculation.

Precisely regarding the "volatility", the continuous fluctuation of the prices of cryptocurrencies, the so-called "stablecoins", a particular category designed to stabilise their value, have been introduced into the virtual currency market. They can be linked to fiat money by some reserves, such as Tether, which is pegged to the dollar. In this hypothesis, we speak of **stablecoin collateralised by fiat currency**. If they are linked to other cryptocurrencies or to a wallet formed by several cryptocurrencies, we speak of **stablecoins collateralised by cryptocurrency**. On the other hand, if they are anchored to raw material, such as Petro[64], which can be oil or gold, we speak of **stablecoins collateralised by commodity.**

In addition, there is also the category of **non-collateralised stablecoins,** whose purpose is always to guarantee stability in the value by acting on the protocols **(stabilisation by protocols)** or applications (**stabilisation by application**s).

The investigation carried out leads to the possibility of considering cryptocurrencies as coins, even if virtual that can be alongside the legal ones, even if with their own characteristics.

Therefore, even if physically stored in a paper wallet or a hardware wallet, virtual currencies can be considered an object of possession, like fiat currency, if they are software or present online with password access. The choice of money that can be used both for exchanges and as a means of

[62] R. Bocchini, *The development of virtual currency: first attempts to frame and discipline economic and legal perspectives,* in *Say. Information and informatics*, 2017 p. 27.
[63] M. Lewis e P. Milzen, *Monetary economics*, 2000, Oxford, Oxford University Press.
[64] It is a stablecoin issued by the Venezuelan government in 2018 that uses oil as collateral.

payment is left to individuals who, in compliance with self-determination, can voluntarily choose to use currencies with legal tender or currencies from private individuals.

Virtual currency, therefore, can be identified as an intangible object of exchange that takes place on a blockchain platform. Therefore, it is an exchange convention on a par with a currency in a real market.

This statement goes towards realising financial inclusion, a theme that is also favoured by global policies. On the subject of financial inclusion, the World Bank itself has published a report that examines the factors that influence it in the context of payment systems and services, suggesting measures aimed at promoting it[65]. Even the recent acknowledgement of some virtual currencies, already in circulation in the market, as legal tender, shows that virtual currency should be evaluated as a currency even if issued by a private individual and not by a central bank. It could mean that we are moving towards a new reality that global monetary policies cannot ignore.

1.3 Features

The main characteristics of cryptocurrencies, or rather the characteristics common to almost all cryptocurrencies, are:

- **the issuance by a private individual** (centralized currencies), **or by users** (widespread currency) who use highly sophisticated software, based on spontaneous adherence to established rules enclosed in an algorithm;
- the possession and custody of the same is based on **cryptography,** meaning ", digital keys" through which it is possible to reconstruct the ownership and the value represented, but which are able to guarantee a high level of anonymity in the exchanges that take place between users;
- it does not exist in **physical form,** but is generated and exchanged exclusively electronically through a personalized account (wallet); they can only be stored in wallets installed on PCs, tablets or smartphones, or on online wallets managed by those who offer this service;
- the monetary **system** used is **decentralized.** It does not operate within a banking system, and there are no Central Banks that issue the currencies and control their flows. There is also no control by central authorities of a public or private nature, and to date, they are also released and, therefore, not related to forms of state or government controls;
- since no intermediary is involved, transaction costs are also **much lower.** The cost of transactions made with virtual currencies constitutes the miners' compensation exclusively. It is the

[65] Bank of Italy, "*Payment instruments*" your www.bancaditalia.it .

technological infrastructure that, compared to an international payment system, is a lean, direct, efficient and economical tool;

- **speed of transactions**: the process of closing them usually takes about ten minutes for decentralized currencies, and for those with a centralized scheme, it can even be instantaneous and is not susceptible to variations due to the geographical distance between the interested parties[66]. Indeed, Transfers made with traditional currencies are often very slow and expensive;
- When a transaction is made and inserted into the blockchain, the same cannot be modified even by the sender; therefore, it is **irreversible;**
- To carry out transactions, it is not necessary to communicate the personal identity and, if precise measures are adopted, the system can guarantee a **pseudo-anonymity.** They take place between public addresses from which it is not easy to trace the identity of the natural or legal person carrying out the transaction;
- Another feature is **transparency:** anyone is able to follow the process of transactions. All payments, even if encrypted, are tracked on the blockchain.

Therefore, transactions guarantee comprehensive security, speed, efficiency, and transparency as unique and sophisticated networks guarantee availability seven days a week and 24 hours a day.

Virtual currencies, moreover, can also be exchanged through special platforms, which offer the conversion service of virtual currencies into fiat currency and can also be purchased with traditional currency, always through the platforms mentioned above, or received online directly by those who hold them by moving from one wallet to another[67].

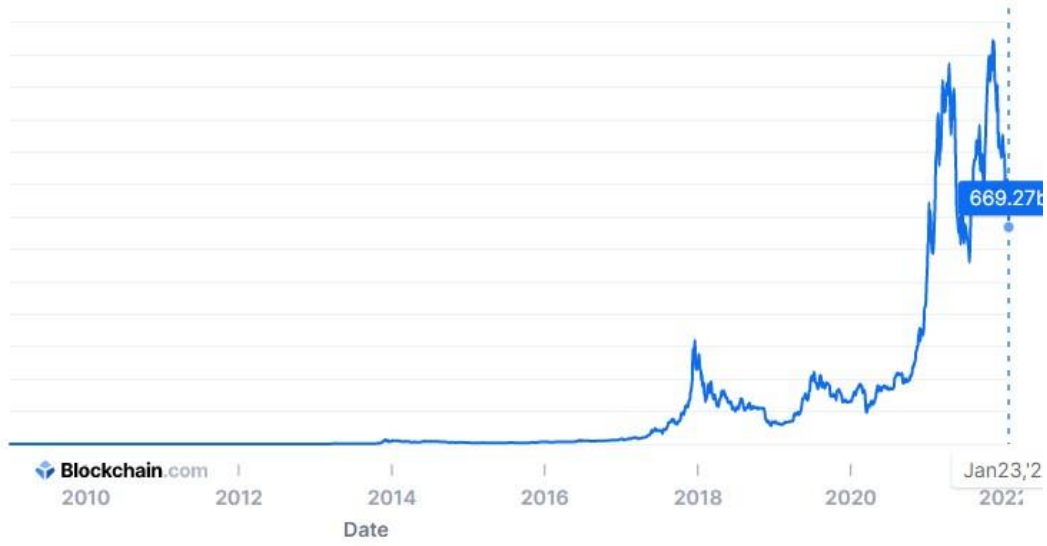
The preparation of digital tools through trading platforms allows customers to receive a free service without physical intermediaries. The service thus rendered tends to debase the intermediarys' figure, who, by now, remains a figure completely in the shadows.

The ease of finding the technological infrastructure needed to use cryptocurrencies and the widespread internet make these coins accessible to a worldwide audience. It allows transactions to be carried out even between subjects belonging to different States without the exchange risk of fiat currencies. They are above national borders and, not being linked to certain territorialities, they are partially protected from local political instability, catastrophic environmental events, armed conflicts that often generate effects on the value of local currencies[68].

[66] M. Mancini, "*Virtual currencies and Bitcoin" Legal analysis of the economy,* Il Mulino, 2015, pp. 117-138.
[67] This is how the Bank of Italy expressed itself in the *Warning on the use of so-called virtual currencies*, Rome 30 January 2015 in https://www.bancaditalia.it
[68] M. Mancini, "*Virtual currencies and Bitcoin" Legal analysis of the economy,* Il Mulino, 2015, pp. 110.

Currently, more than 2,000 digital currencies are in circulation with a total capitalization of about 670 billion dollars with different functions and purposes that create difficulties even in cataloguing them[69].

Figure 3



However, it is necessary to compare the two currencies examined and verify whether or not the virtual ones perform the functions of the legal ones.

1.3.1 Legal and virtual currency – comparison

First of all, it should be specified that virtual currencies should not be confused with traditional electronic payment instruments. Starting from the definition given by the European Community to electronic money in the Directive of 2009/110 / EC, art. 2, point 2, i.e. "*electronically stored monetary value*", which is a claim against the issuer, it is understood how electronic money represents a monetary value as it documents a claim of the holder of the same against the issuer; therefore the amount of the credit is to be considered equal to the "nominal value" of the currency received. "*At the request of the holder of electronic money*", continues the EC Directive in art. 11, issuers are required to repay "at any time and their nominal value, *the monetary value*". With this

[69] https://www.blockchain.com/charts/market-cap updated at 26-01-2022.

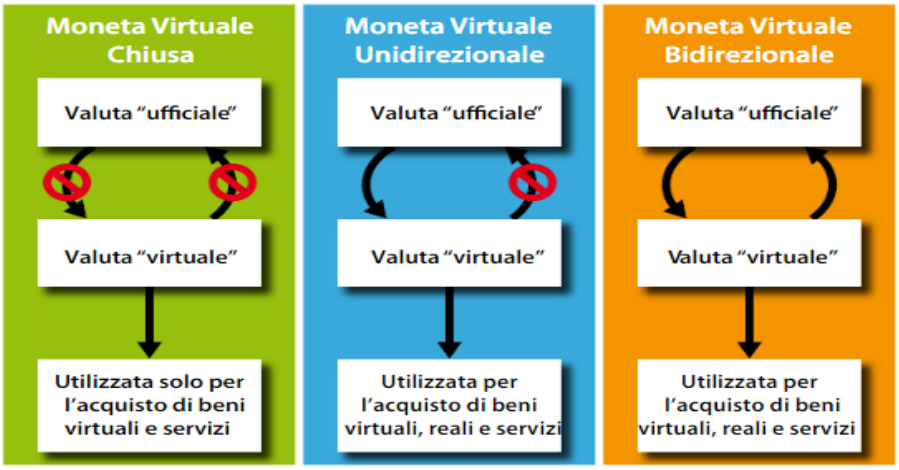
statement, it is possible to recognize a real claim towards the holder of electronic money and, towards the issuer, a pecuniary obligation for an amount equivalent to the value indicated in the currency received.

In virtual currencies, the logical-legal model represented does not find application as the possession does not grant the right to pay its equivalent in fiat currency: the value of cryptocurrencies is given by the market of the same because, generally, they are not linked to a legal currency. An exception could be the Tether currency, whose value, as the creators have always assured, corresponds to one dollar (that is, a currency with legal tender) for each Tether created. It would seem, therefore, that that virtual currency and those similar to it would have a value comparable or similar to the electronic ones[70]. Nevertheless, even in this case, it is essentially impossible to identify a debtor issuing the cryptocurrency as there is no central authority responsible for monitoring them, as for fiat currencies.

Virtual currencies can be classified into three systems[71]: closed virtual currency, unidirectional and bidirectional. In the first case, there is no link between the virtual currency and the real economy (e.g., online gaming currencies, where currencies have a value only within the game and the virtual community of reference); in the second, virtual currency can be purchased using legally recognized currencies at the exchange rate.

The virtual currency obtained can be used for purchases of goods or services if it is accepted as a form of payment. In the bidirectional system, on the other hand, the virtual currency can be exchanged for fiat or fiat currency and vice versa and can be used to buy goods and services (Bitcoin belongs to this category).

FIGURE 4



Fonte: http://www.telecomitalia.com/tit/it/notiziariotecnico/2014-01/capitolo-06.html

[70] M. Longo, *Bitfinex, scandal on the Bitcoin exchange*, in *The Sun-24 hours*, 30 April 2019, p. 12.
[71] "*Virtual Currency Models*" ECB Report of 12 October 2012 in www.ecb.europa.eu

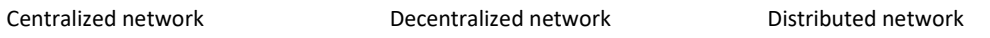
1.4 Operative system: blockchain

About the digital revolution, the investigation should switch to what has been one of the most innovative and disruptive elements in the world of information technology, namely the blockchain. Together with computer platforms and algorithms, it constitutes the triad from which the different experiences called virtual currencies, peer to peer payment transactions depart, collection operations (crowdfunding)and use (peer to peer lending). The technological innovation that underlies the cryptocurrency system is the blockchain, which is also used today in different contexts. The real revolution of the cryptocurrency phenomenon is precisely the conception of this system.

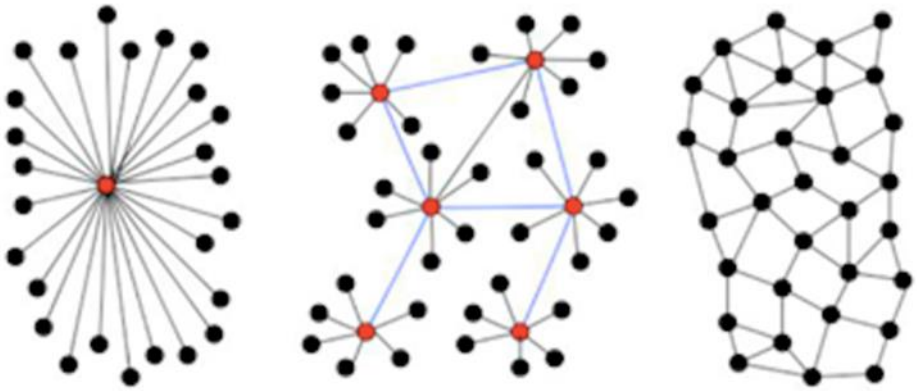
The technology known as the blockchain was first revealed by Satoshi Nakamoto in his paper "Bitcoin: A Peer-to-Peer Electronic Cash System, which laid out the mathematical foundation for the bitcoin cryptocurrency. Blockchain technology is not only at the foundation of all crytocurrencies, but it has found wide application in the more traditional financial industry. It also opened the door to new applications such as smart contracts[72]. For example Ethereum, conceived in 2014 by the young Russian Vitalik Buterin, expanded the idea of Bitcoin by creating a system on which it is possible to generate such kind of contract, i.e., digital contracts or smart contracts. An idea then improved by **NEO (the Chinese counterpart)**, which, starting from June 2017, provides that the system will also run on the most popular ordinary operating systems[73].

While there is still no globally shared definition of blockchain, the one typically used outlines it as a distributed database that is shared among the nodes of a computer network. This kind of distributed database differs from the centralized one because in the last one only a central authority can validate transaction. Moreover, it differs from a decentralized database because the authentication of the transaction is carried out by different autonomous subsidiaries. In a distributed database each participant contributes to the creation of the network and to the validation of the transaction without any authority.

Figure 5



[72] M. Di Pierro, "What is blockchain?" ,2017 https://ieeexplore.ieee.org/abstract/document/8024092
[73] S. Seth *"Why NEO Can Do What No Other Cryptocurrency Can Do" https://www.investopedia.com*



As a database, a blockchain stores information electronically in digital format[74] and records transactions, property rights, and asset informations. Theoretically, blockchain technology does not identify with cryptocurrencies, as it could also exist outside of them. It should be emphasized that virtual currency is the vehicle, blockchain is its circulation system. It plays the role that a credit institution usually plays; it verifies that online business transactions are regular, and that the beneficiary of payments receive the money, just as senders do not spend money that they do not own. As Nakamoto explained[75], the system works through the network created by the computers of all connected users. These are open-source software that allows the aforementioned to exchange digital coins by recording all transactions and making them public. The database structures its data into chunks (blocks) that are strung together. This data structure inherently makes an irreversible time line of data when implemented in a decentralized nature. When a block is filled, it is set in stone and becomes a part of this time line. Each block in the chain is given an exact time stamp when it is added to the chain. It is practically a distributed **ledger,** a public register, verifiable and available simultaneously on several computers, in which are stored, in addition to transactions, the codes that identify the wallets of the interested parties, the amount of money exchanged and the moment in which this exchange takes place.

The participants who contribute to validating the transactions are the **miners**, and their work is remunerated through the issuance of new currency and a commission fee. Miners discover new coins by solving exceedingly complex mathematical problems and contribute to the strength of the system by verifying all transactions. Both actions, discovery and verification, constitute mining. Based on decentralized nodes of hardware processing power, individual users ("miners") deploy their computer hardware to mine cryptocurrencies, thus increasing the processing power of the network as

[74] A. Hayes "*What Is a Blockchain?",* 2022 *https://www.investopedia.com*

[75] It is the one who is attributed the paternity of Bitcoin. It is a pseudonym of a still unknown entity that, in October 2008, introduced an electronic payment system based on a network of users, allowing negotiation between two users without the intermediation of any authority. The currency used was called "Bitcoin".

a whole[76]. Every successful operation is registered and timestamped in these blocks to avoid double transactions, a system or protocol known as proof-of-work. Suffice to say that not unlike finding a nugget of gold or a rough diamond in nature, the proof-of-work system takes place once a value is found or a puzzle is solved.6 In addition to the infrastructure of blocks, the basic component of this digital labor is the hash. Hash could be compared to gravel in mining operations—a concentrate of stones that need to be excavated to produce the desired mineral. Though made of data, rather than an aggregate of minerals, hash is a composite sequence of bits. To follow the analogy, hashing is similar to sifting through gravel— the labor of artisanal miners—or grinding diamond-rich ore—as done much more effectively in industrial mines[77]. The information collected in blocks grafted in chronological order, thus forms a chain that can extend to infinity. Miners compete with each other, and the quickest to undermine the block receives a reward by generating new cryptocurrency that did not exist before: this is the "crypto-alternative" to the system by which banks borrow liquidity from central banks. Since there is no single point of failure, given precisely by the decentralization, the system is hard to attack by malicious people. In addition, it is structured to avoid double-spending. This phenomenon could occur in the hypothesis in which a user makes several purchases at the same time using the same currency. The blockchain, in fact, does not allow to make two or more transactions with the same cryptocurrency because it cannot belong to the same block. Therefore, a transaction that belongs to one block after another cannot conflict with a later transaction. The network can recognize the first chain that it identifies as valid and excludes, rejecting them, the subsequent ones.

Users of cryptocurrencies usually are equipped with **two cryptographic keys: a public one, and a private key.** The public key allows to code the information to send while the private one can decode that information[78]. Each blockchain make cryptographic keys work in different ways. For example Ripple users are equipped with a pair of signing/verification keys to securely send transactions, Bitcoin system uses public key security in which bitcoins are linked to public keys through unspent transaction outputs (UTXOs). The UTXO model requires that each transaction input has a referral to the output of a previous transaction and the concept of user balance is a derived construct created by the cumulative amount of unspent bitcoins associated with the corresponding public key of the user. Finally, concerning the Ethereum, the externally owned account (EOA) defines the basic form of account, which is controlled by a private key and akin to the abstract concept of Bitcoin accounts. EOAs have no code and are directly controlled by real human beings; therefore, the

[76] F. Calvão *"Crypto-miners: Digital labor and the power of blockchain technology",* 2019 on https://anthrosource.onlinelibrary.wiley.com/

[77] F. Calvão *"Crypto-miners: Digital labor and the power of blockchain technology",* 2019 on https://anthrosource.onlinelibrary.wiley.com/

[78] J. De Santis *"La finanza decentralizzata – Blockchain & cryptocurrencies"* 2018

simple ownership of the private key associated with an EOA gives the ability to send ether (Ethereum's intrinsic currency) and messages from it[79].

1.4.1 Protocols

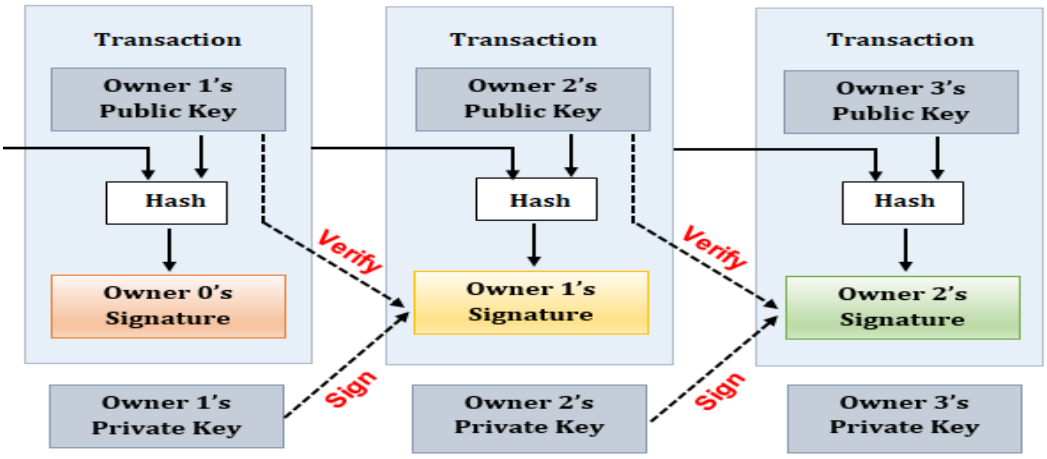
Ultimately some words should be spent about the authentication protocols as proof-of-work and proof-of-stak.e Authentication **protocols** allow each user to prove the ownership of a certain amount of cryptocurrency and, therefore, the ability to spend or transfer it. Authentication within encrypted networks is a problem that involves multiple servers working together. For example, when a server needs to validate a transaction, it needs certain information.

In the absence of these, the transaction will not be accepted. The authentication, therefore, involves multiple servers that must agree on specific values. Once an agreement on a value is reached, it is immovable, definitive. The most famous authentication protocol is **proof-of-work, first** used within the Bitcoin network. In such a system, miners compete, and the fastest to mine the block receives a reward and gets new cryptocurrency. The blocks are difficult to create and require multiple attempts to be completed. To mine Bitcoin, therefore, a huge computing power, is needed such that very often miners join in mining pools. The largest in the world are AntPool, BTCC Pool and F2 Pool: these three together represent 62% of the computing power of the entire Bitcoin network. This verification protocol is very secure and was introduced with a narrow network of nodes in mind; on the other hand, it was impossible to predict that cryptocurrencies would come out of the system they were born, namely that of SilkRoad or deep web in general. As the number of people involved increases, however, this system shows obvious scalability problems due to the environmental and social impact that mining requires. Different protocols are used in mining cryptocurrencies such as Ethereum: ***proof-of-stake.*** *This protocol* works using much less energy than the previous algorithm and has different characteristics. In this model, the higher the holding of cryptocurrency, the greater the chances of being "chosen" for the creation of the block**.** In practice, the nodes that create the most transactions in terms of volume qualify are chosen to undermine the block in which those transactions are involved. The proof-of-stake blocks are not mined but *issued.* This makes them much easier to fix. The resources required for mining are much lower than proof-of-work. For example, for Ethereum **mining**, it will be enough to own a computer with at least 8 Gb of RAM that is easily found on the market for figures around 500 euros. For Bitcoin mining, on the other hand, some hold server farms full of graphics cards that cost hundreds of thousands of euros. There are no rewards for creating

[79] L. Mauri, S. Cimato and E. Damiani *"A Comparative Analysis of Current Cryptocurrencies",* 2018 https://pdfs.semanticscholar.org/

blocks within systems that use this protocol. The incentive for miners is represented by the **transaction fees** paid by users, which are assigned to those to whom the solution of the block itself is delegated. The main advantages relate to lower energy consumption and a greater number of blocks created. In contrast, the proof-of-stake protocol is more complex and less robust than proof-of-work and needs corrections to avoid network centralization[80]. The following scheme represents an in easy intuitive way to understand how blockchain works. (Figure 6)

Figure 6



1.4.2 Smart Contracts

Another possible use of the blockchain is the smart contract, which transposes a contract into computer code. It is based on scripts (characters) that read the agreed clauses.

Among the European countries, Italy first defined smart contract in paragraph 2 of Article 8-ter of Legislative Decree no. 135/2018, converted by Law no. 12/2019: *"Smart-contract"* is defined *as* a program to process that operates *on technologies based on distributed registers and whose execution automatically binds two or more parties on the basis of effects predefined by the same. Smart contracts meet the requirement of the written form after computer identification of the interested parties..."*.

With the contract registration on a digital ledger, the same becomes unchangeable and, through encryption and digital signature, the origin and destination of the message object of the smart contract are guaranteed.

[80] F. Calvão *"Crypto-miners: Digital labor and the power of blockchain technology"*, 2019 on https://anthrosource.onlinelibrary.wiley.com/

A particular type of smart contract is the one that is being developed by the payments giant Visa that aims to create a universal hub that allows you to make **transfers of value even on different blockchains,** thus allowing to make payments and transfers of digital assets between different protocols and wallets, whether they are cryptocurrencies, stablecoins or CBDC (Central Bank Digital Currency)[81]. Furthermore, in the official announcement made in September 2021, there is talk of "Universal **Payment Channel"**, which is a system of interoperability between blockchains that the company has been working on since 2018, intending to develop a framework that works independently of the mechanisms of the underlying blockchains.

[81] https://usa.visa.com, 29/09/2021

CHAPTER 2

COMPLEMENTARY AND ALTERNATIVE CURRENCIES

2.1 Definitions

2.1.1 Origins

In the context of virtual currencies or currencies, **complementary currencies** should also be examined. It is an important tool of the collaborative and solidarity economy, which aims to put the economy back at the service of people by increasing their participation in an economic model based on trust and community. They are instruments through which it is possible to exchange goods and services alongside the legal currency (to which they are complementary). They are different monetary systems not intended to compete but to coexist with fiat currency, as they aim for different purposes based on socio-economic relationships[82]. Through the coexistence of different types of money in the same territory, they realize "non-monetary" exchanges or "economies without money"[83] that do not represent an alternative economy but constitute complementary circuits to traditional monetary systems within the market economy. Usually, complementary currencies are not legal tender and are accepted on a voluntary basis: this helps to identify the community that uses them, enhancing the role of the individual in the community itself and placing it in the foreground to what is the object of commodification[84]. It is the term **"solidarity"** that characterizes complementary currencies, and that determines a close connection between *"money, land and labour"*[85]. This currency generates real wealth in the local economy, combining unmet needs and unused resources. It benefits local residents without determining, indeed preventing, the relocation of the production or supply of raw materials. This contributes strongly to achieving and supporting local economic development and social solidarity. At the same time, they represent in depressed economic areas a complementary source of purchasing power intended mostly for those without it.

[82] J. Blanc *"The Currencies Parallel. Unit and diversity of the fact monetary"*, 2000, L'Harmattan, Paris.
[83] M. Pittau "*Economies without money. Non-monetary exchange systems in the market economy"* EMI Bologna, 2003, p. 6.
[84] B. Lietaer "*The future of money"*, Century London 2001.
[85] http://www.complementarycurrency.org/materials.php M. Amato and L. Fantacci *"Introduction to complementary currencies: history and institutions"*, 2005; M. Amato and L. Fantacci "*Complementary coins for DES. Districts of solidarity economy in Lombardy"*, 2007, p.8.

In this way, economic demand is expressed within localities, thus creating local productive activities and employment[86]. The fundamental role is to link unmet needs (social, commercial, ecological, cultural, educational) to resources that would otherwise remain unproductive and able to satisfy a demand that remains uncovered.

A complementary currency system is designed to flow within a geographically circumscribed trading community in consideration of the historical identity and the economic and social characteristics of the community itself. It is accepted and used within a group on a social basis' relationship to facilitate and promote the exchange of goods, the movement of goods and services. They promote long-term planning, stimulating circuit participants to invest in related productive activities, rather than in the accumulation of money, and encourage trades and cooperation within their network through the circulation of the exchange good (the complementary currency) that has, usually, an ethical and ideal value.

It should be noted that the circulation of complementary currencies can create the possibility of contrasting a "conventional" economy with a "complementary" one able to build a new model of economic and social organization capable of strengthening a solidarity economy and, therefore, also to transform the model of capitalist accumulation[87].

Monetary innovation at the local level in particular highlights the emergence of both instrumental and expressive networks which, are one of the main phenomena in the dynamics of technological innovation at the local level[88].

These systems were born for several reasons: in addition to realizing a form of solidarity and cooperation, they tend to revive the real, local economy through "unconventional" ways.

The phenomenon does not belong exclusively to post-modernity but has very ancient roots[89]. In ancient Greece, there were silver coins of small value (local issuance) and silver coins of greater value (currency outside the *poleis*). The first was meant for domestic trade, the second for foreign trade[90]. In republican Rome circulated both the *denarius* and the *axis*[91]. In the modern era, complementary currencies were born simultaneously in the USA and Germany as a response to the devastating crisis of 1929. While in the past local currencies were created and used to protect the

[86] J. Blanc *"The Currencies Parallel. Unit and diversity of the fact monetary"*, 2000, L'Harmattan, Paris.
[87] http://money.socioeco.org/ H. Primavera and F. Wautiez "*Social money as a stimulus to the new economic model. Notebook of proposals for the XXI century,* 2001, p. 3.
[88] F. Ramella (Italy), "*Social networks and economic performance in ITC enterprises. State and market"*, 2005.
[89] L. Palermo *"Economic development and pre-industrial societies. Cycles, structures and conjunctures in Europe from the Middle Ages to the early modern age"* 1997, Viella, Rome.
[90] M. Bustreo and A. Zatti, *"Money and psyche. Psychosocial values and meanings in exchange relationships"*, 2007, Franco Angeli, Milan.
[91] http://www.toshare.it F. Bernabei, *"Alternative currencies: counterfeiters or visionaries?",* 2011, p. 481.

internal economy from external factors (wars, economic depressions, inflation), today the purposes can also be different[92].

2.1.2 Features

Complementary coins can also be:

- ***Fiat currencies****: they are* issued by an organ without cover. The credit is granted without collateral entering the circuit: the fiduciary credit does not correspond to a debt[93].
- ***Backed currencies***: hedged (commercial currencies).
- ***Mutual credit currencies****:* created as an active mail of a current account of a subject. It borns when the trade starts and consists of the contextual transcription of the amount on credit for the seller and debit for the buyer[94].

Another distinction may concern the function of **the unit of account or the measurement of value**. The exchange rate can be:

- **Fixed to an official currency:** it is often adopted to trade goods (1 American Ithaca Hours corresponds to 10 dollars, 1 Italian Sardex corresponds to 1 euro).
- **Fixed to a unit of time**: usually, it is adopted to trade services (generally the hour of work, as for the American Time Dollars).
- **A ratio between physical entities** (pounds, grams, kilos): for example, one Japanese WAT corresponds to 1 kWh of electricity from renewable sources, 1 Yen in Osaka corresponds to 1 gram of charcoal).

Moreover, in order to identify a network of trades that emerge in the convergences between capitalist markets and pressing problems in order to create alternative solutions, the following elements should be found[95]:

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[92] M. Pittau "*Economies without money. Non-monetary exchange systems in the market economy"* EMI Bologna, 2003; M. Meggiolaro, *"Values. Dossier complementary currencies",*2006.

[93] This is the case of the Ithaca Hours conceived in the rural community of Ithaca (NY), http://www.complementarycurrency.org/materials.php M. Amato and L. Fantacci "*Complementary coins for DES. Districts of solidarity economy in Lombardy"*, 2007.

[94] This is the case of the LETS widespread in England, of the SEL in France, of the Fueai Kippu Japanese http://www.complementarycurrency.org/materials.php M. Amato and L. Fantacci "*Complementary coins for DES. Districts of solidarity economy in Lombardy"*, 2007.

[95] http://www.socpol.unimi.it V. Zelizer, *Circuits in Economic Life,* 2005, University of Milan, p.5.

- defined boundaries that divide the members of the network from the non-members;
- control over trade from the inside out and vice versa;
- accounting systems for assessing economic activities;
- connections between participants;
- possibility to transfer goods or services through personal interconnections

Therefore, they are born in delimited contexts and between subjects linked by social connections[96].

Characteristics of social currencies, therefore, and the differences with fiat money, are:

- **course on a voluntary basis**
- presence of incentives to circulation (**cost for those who hold the currency for too long, or expiration date – expedients aimed at avoiding the stagnation of the economy**)
- distinctly local profile (the wealth produced remains in the social context)

Particular complementary currencies are also **commercial (business to consumer)** currencies, for example, the miles earned by air travellers (frequent flyer miles), the points of supermarkets or gas stations, meal vouchers or points collected with telephone top-ups. Through these complementary currencies, it is possible to pay for goods or services without using current money, and their purpose consists in retaining the customer. They can be considered complementary currencies but not social currencies[97].

The *so-called barter trading* or *corporate barter is a* system spreading worldwide consisting of the exchange of goods in a business to business commerce. Its peculiarity is that those firms that adhere to the network buy goods or services by assuming debt that they subsequently compensate with the sale of their goods and services.

Another example of complementary currency is represented by the "pay-pal" payment system initially used for online purchases or auctions, mainly on the e-Bay (Consumer to consumer) site. The service offered consisted of money transfers, and the company took care of processing online payments. In auctions or online gaming, the speed with which to make payments was necessary and,

[96] In. Zelizer, *"Economic lives"*, Il Mulino, Bologna, 2009.
[97] http://www.magius.noblogs.org B. Lietaer and G Hallsmith *"Guide to Community currencies"*, 2007

considering that those who participated came from nations or states where different legal currencies circulated, PayPal allowed transactions, even with currency exchange, in real-time.

It was 1998 when money transfers were made exclusively by banks for very long times. On the other hand, PayPal allowed money transfers to be made through the use of the internet. The system also differs from payment by electronic debit or credit card, mainly because it allows to make the currency change in real-time. In addition, it allows users, through its platform, not to share sensitive data of their credit cards or bank accounts during the online payment process.

The success has allowed the company to increase the number of users and expand the service on other online sales platforms.

The issuance of complementary currencies, like any payment system, has costs relating to the design and construction of the infrastructure necessary for its operation. In order to make these costs sustainable, there may be "fixed" fees (quarterly, annual), registration costs, or "commission fees", both as a percentage of the transactions' volume or fixed for each transaction ordered[98].

2.2 Applications

It is appropriate to examine in more detail some types of social money in order to understand its functionality and the reasons underlying its use. For example, five experiences between Europe and America should be taken. Among the various experiences developed in the modern era globally, I have selected five. Some because of their particularity, others because of the spread they have had or are having.

2.2.1 Club del Trueque

An interesting example is the "Red global de trueque", a network of local currencies that had great diffusion in Argentina in 1995, following the great economic crisis that hit that country. In the suburbs of Buenos Aires, the first “Club del Trueque” (barter). For countless people, it has meant the difference between surviving or not, between eating and getting nourishment or not. There is a long history of bartering goods in a business to business commerce after economic collapses in Argentina and many other parts of the world (e.g. Greece). There has been a prevalence of trade in goods and services guaranteed by their intrinsic value. The exchange of services began when people were

[98] F. Manzione, "*Complementary currencies as a tool for reviving local economies*", 28 November 2019.

without money or no longer able to access the money they once owned. People, no longer able to buy goods or services, began to exchange everything, from repairing water pipes or roof terraces to the growing need for medical treatment. Everyone produces a commodity or makes a service available while consuming what others within the network offer[99]. Trades took place with every service imaginable. In some places, services were exchanged, and the two parties decided on the amount of time or type of service that constituted the equivalent value. A high principle of autonomy of the various Clubs characterised the model and the use of their own social currency. Primitive barter was evolving into a form of interchange[100], having a material medium created, distributed and controlled by the users. This model is called **multi-barter with social currency[101]**.

2.2.2 Time Bank

A very unique system is also "**the time bank**", a system through which people mutually exchange activities, services and professionalism. It satisfies, therefore, both material and immaterial needs. There is no circulation of money but of time: the value of the assets exchanged corresponds only to the hours spent to carry them out, with the obligation to balance the account.

2.2.3 Wir

A more successful example of a complementary currency currently in place is the **Wir.** It is a complementary currency in Switzerland, created in Zurich in 1934 as a mutual aid cooperative.

During the economic crisis of 1929, many companies, not wanting to invest their capital, took liquidity from the markets. As a result, a complementary monetary system, the Wir, was created to counteract capital accumulation. A Wir corresponds to one Swiss franc, does not accrue interests, and, until 1948, there was a clause that losses could be expected for the accounts in the event of non-use of the currency.

Subsequently, in 1936, Wir became also a bank (Wir Bank), which manages the Wir monetary circuit in addition to standard banking activity. A pre-eminent function is the promotion of

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[99] http://www.centrofondi.it P. Sanna, "*Money as an instrument of domination and possible solutions to the current monetary system*" 18/12/2007.

[100] D. Graeber, "*Debt. The first 5000 years",* 2012 Il Saggiatore, Milan, 2012 "*... barter seems to be a fortuitous by-product of the use of money: historically it has represented the last resort for those who, accustomed to using money in their transactions, have found themselves for one reason or another without liquidity."*

[101] M. Pittau "*Economies without money. Non-monetary exchange systems in the market economy*" EMI Bologna, 2003.

members, making their respective products or services accessible in Wir currency, keeping them in circulation, and increasing the volume of exchanges between participants. Here, too, the Wir system functions as a circuit of cashless payment institutions between members who, as a means of payment, use the Wir card, mainly used in retail trade; Wir customers can pay in Wir currency partly in Francs or either only in francs. Wir Bank has current accounts opened in Wir currency that cannot be converted into Swiss francs. The bank does not allow the traffic of Wir credits (members are not allowed to exchange Wir for Swiss francs or other currencies) because these activities undermine the system based not on the accumulation of deposits but on the movement of money and goods[102].

However, since the economic and financial crisis of 2008, social currencies have begun to strengthen and expand globally, mainly to deal with low monetary liquidity, job loss, and, more generally, the worsening of a future perspective. All this led to the creation of interchange tools.

There has been a change in the monetary system exercised from the bottom up, aimed at neutralising the scarcity of legal money and stimulating the construction of a new economic model: the **Solidarity Socioeconomic[103].** These are local experiences with a strong social impact that arise as a response to crises and that, when the traditional economy recovers, often tend to fade or disappear. They aim to achieve is to connect unused resources with individual needs not met by the traditional economy.

2.2.4 *Bestätigte Arbeitswerte*

A particular case of complementary currency was tested, between the two world wars (1932-1933), in the Austrian town of Worgl: the Bestätigte Arbeitswerte. The peculiarity of this currency lies in the fact that it is a forward currency.

The Municipality of that city undertook to convert the complementary currencies into as many shillings on request. However, if not used, the currency loses value after a month. Stamp duty was paid to recover the value of the currency. This mechanism was created to encourage the circulation of this currency, avoiding immobility.

[102] E. Grazzini, "*When the official currency does not work, it is time for alternative currencies*", 2017.
[103] "*Social currency as a stimulus to the new economic model*", November 2001 in http://money.socioeco.org.

2.2.5 Sardex

Even the Italian experience of Sardex, born in 2009, represents and is part of an economic model based on trust and community, precisely intending to put the economy at the service of people and as a tool for collaborative and solidarity economy. It is a project of the National Community of the Real Economy and is based on three elements: acquiring new customers, speed of payments and additional liquidity. Territorial communities composed of citizens, workers, and businesses are interconnected. In the context of exchange systems with complementary currencies, the Sardex is considered, internationally, as one of the most successful. It is an example of how a currency can merge social, economic and cultural values and find a balance between economic and social benefits. That is why the Sardex has been able to spread even beyond the territory in which it is established[104].

Studying other foreign experiences, in particular, such as the Swiss Wir, and trying to readapt them to the local reality, it has come to the creation of a network within which goods and services are exchanged, through a unit of account, the Sardex precisely, which by convention corresponds to one Euro.

The initial idea, aimed at facing the deterioration of the economic conditions in Sardinia, was to find solutions for small Sardinian businesses that had great difficulty in accessing bank credit, creating a commercial credit circuit and an exchange network initially aimed at VAT members. Therefore, it was born as a "clearinghouse" of debts and credits whose final purpose is to increase trade between companies: the balances are offset and, therefore, zero-sum[105].

Preliminarily, as specified by one of the creators, it must be said that the Sardex was not established and designed as an alternative currency to the Euro, but to join the official currency, without which it could not even work[106]. Therefore, transactions are all tracked and take place through an online account and an electronic card exclusively in digital form. Being all tracked, they imply an invoicing in Euros and, like any other transaction, are subject to taxation.

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[104] http://esprints.lse.ac.uk L. Sartori and P. Dini, *"From complementary currency to institution: a micro-macro study of the Sardex mutual credit system"*, 2016.

[105] Specifically concerning local clearing systems: "*Alternative monetary and financial institutions can be devised to ensure that money is spent systematically and that debts are systematically paid. The principle of set-off has to do both with the establishment of a measure for trade and for the payment of debts which is not in itself the subject of exchange, and with the re-establishment of a balanced relationship between debtor and creditor.*". S. Lucarelli and L. Gobbi, "*Local clearing unions as stabilisers of local economic systems: a stock-flow perspective consistent*". Camb. J. Eco. 40, 2016, p. 1401.

[106] G. Colletti, "*From Sardinia to the rest of Italy. Sardex invents the complementary currency. "We have rethought the economy", 24 June 2014 on https/www.Repubblica.it: "At the bottom Sardex, it is a complementary and additional currency, able to flank the traditional one. In fact, it has counterbalanced, at least in part, the fall...."*

The system is based on the principle that recognises value already to the goods or services' production as it creates a potential market within the circuit. Its objective is to achieve a very wide coverage of commercial goods and services precisely to allow the local community to purchase a wide variety of goods and services. For this reason, each new member receives an endowment in Sardex that he can use immediately. In practice, the circuit can generate wealth before money materialises. To be part of this network, the participant must do a subscription, pay an entry fee and pay an annual fee that varies depending on the size of the company, receiving in exchange Sardex to be used in the goods or services' exchange that the member can buy within the circuit without using legal tender. The receivables in Sardex have an annual maturity at the end of each year, and credit must be reset. A credit and a corresponding debit are recorded in the two accounts each time a transaction occurs[107]. In this system, there are no liabilities or assets' interests. Initially, only companies could participate in the network; later, the associated companies' directors, employees, and collaborators were also introduced. Since May 2018, the possibility of participating in the network has also been extended to all citizens to make purchases in companies registered.

Fundamental for the system is that people do not accumulate Sardex but exchange them, thus setting the virtuous circle in motion.

Another determining factor is the relationships and the network: the participants choose local companies, thus contributing to the development of the territory by circulating wealth and discouraging any form of accumulation. No type of interest in the treasury is paid. It helps to turn the economy around within the network. A Sardex measures the value of real goods or services and is not subject to speculation. For this reason, it differs profoundly from virtual currencies, in particular from Bitcoin, whose value is determined precisely by speculation because it is subject to fluctuations based on exchanges that take place in real-time.

The Sardex responds to the need to improve access to credit, enhance the local market, create a network among participants[108]. The following figure compares two simplified financial statements

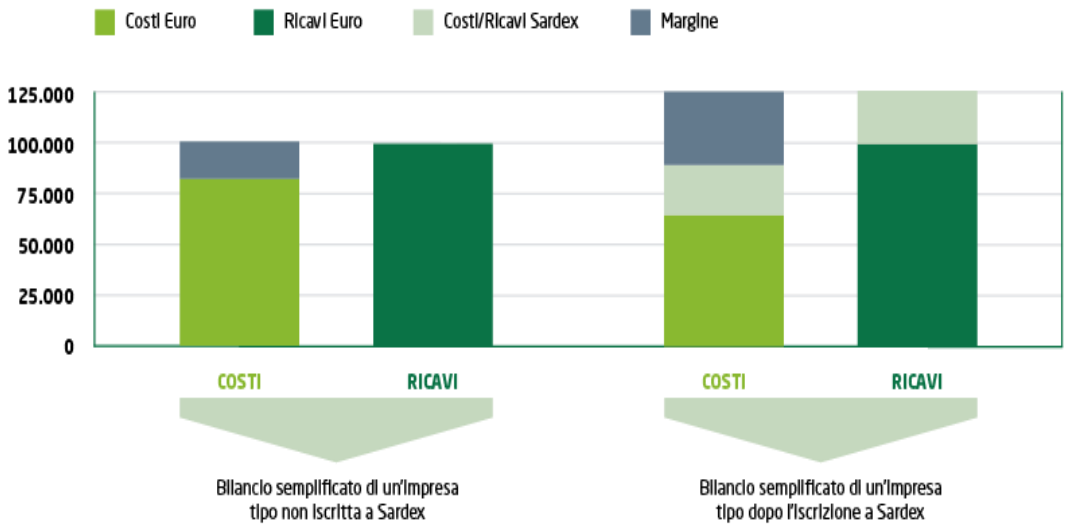
[107] F. Manzione, "*Complementary currencies as a tool for reviving local economies*", 28 November 2019.

[108] E. Corona "*The path of Sardex, the complementary social currency opens up to widespread shareholding*", 22 June 2021 in https://altreconomia.it. "*Since the founding of Sardex.net in 2009, many things have changed. From the first hundred members of 2010 - who were mostly owners of small and medium-sized Sardinian companies - and 100 thousand credits of transactions, we moved on to circuits in other regions such as Lombardy, Veneto, Piedmont and Emilia Romagna, to arrive in 2015 about 100 million receivables transacted. In 2016 "Sardex Srl" became "Sardex spa." with the entry of six new partners and an investment of 3 million euros that were used for the development of the new industrial plan. In 2017 Banca Etica also signed an agreement with "Sardex spa" which has allowed the 10 thousand companies participating in the circuits (both in Sardinia and in the other 14 regions where it is present) to access advantageous conditions for loans and other financial services, including microcredit and crowdfunding. Not only business to business, since 2018 consumers can also use the Sardex.*" "*The crisis caused by the Covid-19 pandemic is helping to open a new phase of the company. In the last year, there has been an increase in registrations to the circuit equal to 86%, with 5 million more transactions than the previous year. According to research on the trend of bank loans in Sardinia, elaborated by the CNA and published at the end of last April, in 2021, 40% of Sardinian companies risk having serious liquidity problems, one of the highest percentages in Italy, second only to that registered in Calabria*".

of a typical company adhering to the Sardex circuit and a non-adherent type; it emerges that the first type of firm experienced increased productivity and revenues. (Figure 7).

From a study presented in 2017[109] at a conference organized by the University of Naples, what emerged following interviews with local companies participating in the circuit are "the *importance of reciprocity, trust, continuous dialogue, transparency of relationships ..... knowing that you can count on the help of the other actors of the circuit, sharing social values, sharing objectives"*, and "*cultural and technological innovation, improvement of the capacity to exploit opportunities, ...technology as a basis for learning".*

FIGURE 7



At the same time, within a few years, it should also be noted that sales, customers base, and financial capabilities have grown significantly.

From a macroeconomic point of view, this kind of network is not comparable to an official currency since the volume put into circulation cannot compete with that of central banks. However, it generates the effect of weakening the capillarity of legal tender within the network boundaries. The

[109] G. Melis, E. Napolitano, A. E. Usai "*The ability to collaborate and learn in the process of co-creation of value in a complementary currency circuit. The case of the ecosystem Sardex"*, proceedings of the Sinergie – Sima 2017 Conference, *Value co-creation: management challenges for companies and society* 15-16 June 2017 University of Naples Federico II.

more goods and services are traded, the greater the increase and flow of the complementary currency[110].

After the Sardinian experience in many other regions of Italy, other complementary coins were born: the Piemex in Piemonte, the Venetex in Veneto, the Liberex in Emilia Romagna, the Tibex in Lazio, the Felix in Campania, the Linx Circuit in Lombardy and the Valdex in Valle d'Aosta and built their network.

The technical objective, common to all, is to connect unused resources to the needs of people that the traditional economy has not been able to satisfy.

Complementary currencies achieve a speed of money circulation that is not satisfied by official systems that often push to immobilism in bank deposits or securities not reinvested and with long-term maturities[111]. It should be remembered that *"a proper function of the currency is the ability to spend it, meaning it should work as a means of exchange and payment. Its improper function, central in the system of modern finance, is to act as a store of value, meaning the ability to be indefinitely kept out of circulation without losing anything of its value"*[112]. In the current financial system that sustains the world economy, the interaction or conflict between these two functions can lead to critical issues, such as inflationary waves or reduced access to credit. Before the global financial crisis of 2008, a phase in which the economy was growing and expanding, productive activities and the real estate market got easily financed without a careful verification of the underlying assets. Later, with the subprime mortgage crisis and negative changes in macroeconomic conditions, those who held money tended to preserve it, causing a "credit crunch" in the real economy due to the thinning of **credit openings** by the banking system. This mechanism creates large-scale economic crises and repercussions both on credit institutions and the economic and social fabric as a whole[113].

These are new monetary experiences, isolated and with exclusively local impact, but which can offer real possibilities for gradual correction of the excesses and imbalances of the current traditional system.

Despite their variety, complementary currencies should not be confused with virtual currencies, as the former, unlike the latter, do not aim to compete with the official currency, nor to replace it, except partially and for specific purposes and in designated areas. They are used in restricted territorial areas, a city, a region and circulate among a small number of users. On the other hand, virtual currencies are intended for a market that tends to be global, given their ease of transfer

[110] rivisteweb.it L. Sartori, Fr. Dini *"From complementary currency to istitution: a micro-macro study of the Sardex mutual credit system"*, 2016.
[111] Gesell, *"The Natural economic system (The Natural Economic Order) 1862-1930 (Wikipedia- social currency)*
[112] M. Amato and L. Fantacci 2009 and 2012 "*End of a finance. Where does the crisis come from and how can we think of getting out of it"*, Donzelli, Rome, 2012, p. 37.
[113] J.E. Stiglitz, "*Bankruptcy*", Einaudi, 2014.

inherent in digital representation. Therefore, the distinction between complementary and alternative currencies should be maintained. Digital coins fall mainly into the second category; not surprisingly, they are in antithesis with traditional money and are often referred to as "alt-coins" (alt short for alternative).

Nor can complementary currencies be assimilated to electronic money, which consists of a digital representation of fiat currencies.

In addition, virtual currencies do not respond to any social purpose. Exchanges are based on the blockchain, and control takes place only through technology. In particular, bitcoins obey predetermined rigid protocols embedded in an algorithm. However, like official money, they are intended to be treated as an asset and, unlike complementary coins, are more likely to be accumulated and withdrawn from circulation[114].

Also, about the commercial credit circuits (Sardex), the managing entity establishes a payment platform but, towards the members, also provides ancillary services (home banking, ATM, POS card). It achieves a double agreement: plurilateral between all the members and bilateral between the individuals and the managing entity. What differentiates it from banking institutions lies in the fact that it is not an authorized institution[115]. With cryptocurrencies, on the other hand, everything is managed by the blockchain.

Moreover, social or complementary currencies, fulfilling the function of a medium of exchange, but not that of a store of value, as in almost all cases, do not allow hoarding through the mechanisms of expiration dates or the absence of interest production, characteristics that allow, through high circulation, to avoid negative effects on the economic and social balances of the real economy often realized by official systems that push to increase bank deposits or to buy securities with long-term maturities[116]

It is not a savings instrument but a trading instrument favouring the execution of long-term investments. Despite the differences highlighted between complementary currencies and cryptocurrencies, both represent monetary systems that complement traditional ones using different technological systems. However, it should not be excluded that tomorrow also complementary currencies, in their natural development, may use the blockchain as the underlying technology. In this way, while maintaining their own characteristics, both currencies would use the same transaction validation mechanism. It would achieve a transformation of complementary currencies, and cryptocurrencies could take on characteristics of the former.

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[114] M. Amato and L. Fantacci "*For a handful of bitcoins. Risks and opportunities of virtual currencies",* Egea, Milan, 2016

[115] https//www.dirittobancario.it G.L. Greco, "*Virtual currencies and complementary currencies, between technological development and regulatory uncertainties"*, Journal of Banking Law, January/March 2019.

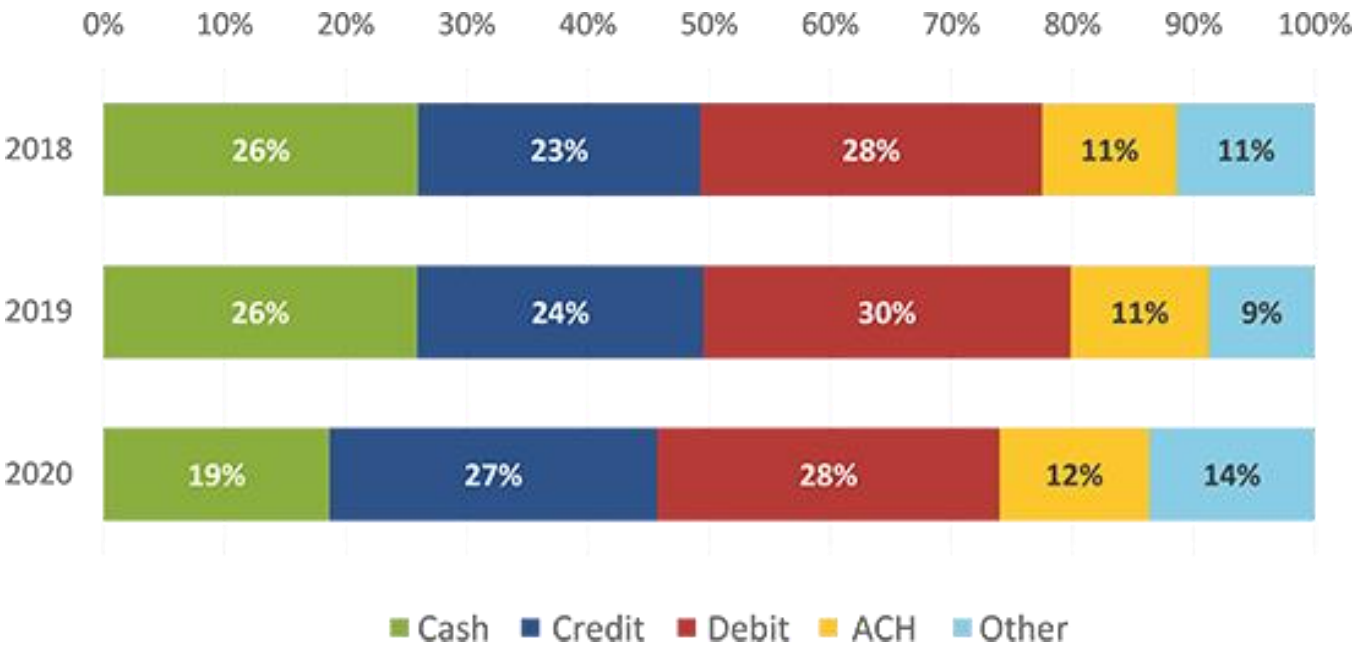
[116] https://it.wikipedia.org "*Complementary currency"*, S. Gesell, *"The Naturliche economic system (The Natural Economic Order) 1862-1930.*

2.3 Le CBDC (central bank digital currency)

2.3.1 Features

The acceleration impressed by Covid in the use of digital payment instruments and the exponential spread of virtual currencies from private individuals is pushing monetary institutions to challenge their mandate to face an unprecedented crisis. The global fight against the spread of the virus and progress in the field of technologies applied to finance are the elements leading towards the sunset of physical money, and the public monetary branch of the FinTech phenomenon originates from the now ten-year rapid spread of cryptocurrencies. Interesting, in this regard, is a study carried out in the U.S.A. that show in two years (2019-2020), the use of cash has fallen[117]: from 26% to 19% (figure No 6). Digital tools are preferred to cash.

FIGURE 8



[117] K. Coyle, L. Kim Shaun O'Brien "*Findings from the Diary of Consumer PayamentChoice"* 2021, CPO Federal Reserve System

From another point of view, it should be considered that the tech sector giants increasingly ensure the provision of financial services thanks to the vast network of data in their possession, access to *mobile* technologies, and interactions with social media. Another concern for central banks is the ongoing stable-coin projects. To preserve their monetary sovereignty and support the global role of their respective currencies, and therefore to contain systemic risk, they are pushed to plan the introduction of their digital currency with the use of the advanced technology of the blockchain also in order not to suffer the competition of private cryptocurrencies.

Moreover, in Europe, there is the example of Sweden where electronic payments are now used permanently in everyday life, and cash is almost extinct: the cost of producing banknotes is beginning to be considered minimizable[118]. Faced with this unstoppable phenomenon that traditional finance cannot ignore, we are getting closer and closer to State digital assets without risk and deposit costs.

Central banks have long launched national digital currency projects precisely to stem the success of cryptocurrencies and try to occupy part of the space that decentralized money occupies. In line with the promotion of alternative payments to cash, this choice is favoured by the financial inclusion policies promoted by the World Bank and the Central Banks[119]. In fact, a CBDC, like physical money, could be made available more widely and guarantee greater financial inclusion, including in the system even those who are currently excluded from banking systems. The primary effect could be the exclusion of commercial banks from transactions, a form of bank disintermediation with structural, permanent or cyclical aspects, therefore associated with economic crises[120].

Another effect will be the end of the international payments system: any Central Bank issuing a digital currency accepted for international transactions would have advantages on financing costs and control of financial transactions, cancelling the difference between "retail" and "wholesale" CBDCs[121]. As a result, the prices of banking operations would be cut, and there would also be a reduction in the time it takes to transfer money within the banking system, with immediate effects for citizens and small and medium-sized enterprises. A CBDC would also be risk-free as it is issued

[118] U. Bindseil e f. Panetta *"Remunerazione in valuta digitale della banca centrale in un mondo con tassi di interesse nominali bassi o negativi"*, 5 Oct 2020 on https://voxeu.org .

[119] https://www.bancaditalia.it "*Tools of payment* "it is stated that "*Il Committee on Payments and Market Infrastructures e la World Bank published a report on Payments aspects of financial inclusion examining supply and demand factors influencing financial inclusion in the context of supply and demand factors influencing financial inclusion in the context of payment systems and services and suggests policy-making measures to promote it."*

[120] U. Bindseil e f. Panetta *"Remunerazione in valuta digitale della banca centrale in un mondo con tassi di interesse nominali bassi o negativi"*, 5 Oct 2020 on https://voxeu.org .

[121] www.bancaditalia.it *"Payment systems"*. "Wholesale" payments mainly concern interbank transactions – money market contracts and foreign exchange transactions – and large commercial payments. For "retail" payments, on the other hand, we mean transactions of an amount equal to or less than 500,000.00 euros.

directly by a central bank and could replace bank deposits[122]. Moreover, customers of commercial banks would have direct access to the accounts managed by the Central Banks. On the other hand, if it were introduced a token-based means of payment, those who do not have a bank account can use CBDCs too: in this way, the money of commercial banks is replaced with that of Central Banks, creating competition between them.

A CBDC (central bank digital currency) will not replace physical money but can be used alongside banknotes, accompany them and make payments safer and more straightforward.

It should, therefore, have the following characteristics;

· The nature of **liabilities** issued by a central bank for an indefinite period and without remuneration;

· The denomination according **to an** existing unit of account;

· The function of **a medium of exchange** and unit of conservation of **value**, as a currency with legal tender.

And the following advantages:

- **streamlining of processes**: as we have already seen, digital currencies, public or private, simplify transactions by significantly reducing time;
- **cost** reduction: digital currencies reduce the costs related to payment systems and reduce the costs of Central Banks associated with the production of banknotes;

To date, in the world, there are many central banks interested in carrying out projects or carrying out in-depth studies on the launch of a CBDC within their jurisdiction, also to reconcile the existence of a parallel financial system due to the presence of a plurality of stable-coins. The push-in in this direction was the announcement of Facebook's Libra, which led to an acceleration in the projects in progress. And in order to be present in the market, an ever-increasing number of Central Banks are also considering "hybrid" or "intermediate" systems. None of the projects is intended to replace cash but completes it[123].

The effect could reduce the attractiveness of similar instruments issued by private entities.

And the first state to move in this direction will have a substantial competitive advantage.

It must be considered that the issuance of a CBDC could also generate alterations in the balance between the international state authorities because, on the one hand, it would increase the

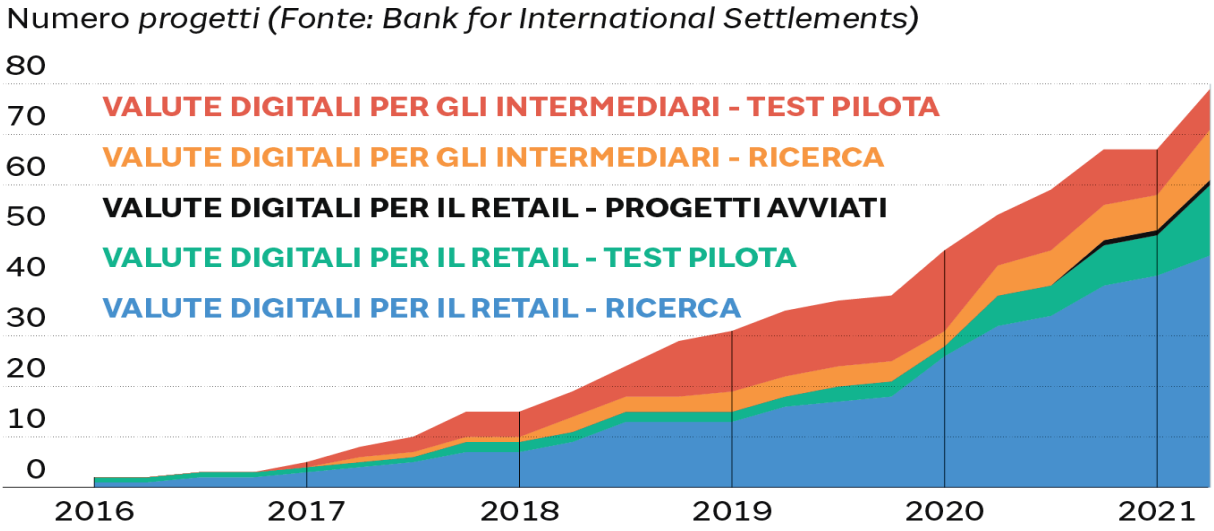
[122] U. Bindseil e f. Panetta *"Remunerazione in valuta digitale della banca centrale in un mondo con tassi di interesse nominali bassi o negativi"*, 5 Oct 2020 on https://voxeu.org .
[123] A. Monaco "*Osservatorio Central Bank Digital Currency*", Oct 2020

competitive advantage over those who issue it. On the other hand, it would decrease the autonomy of the monetary policy of foreign economies.

It could happen because state digital currencies aim to provide a universally accessible, fast, secure and efficient payment instrument also for cross-border transactions. These new currencies w born to be used only in local contexts but are designed, above all, as a tool for international operations.

FIGURE 9

Research and development of digital currencies by Central Banks



There is monetary sovereignty in the field: in the absence of a digital currency of their currency, anyone can decide to adopt the one issued by another state. It could create dysfunctions in the international monetary system, thereby weakening the state's monetary sovereignty to which one belongs[124].

2.3.2 E-Yuan

The most advanced examples include the People's Bank of China with the E-Yuan and the Riksbank of Sweden with the e-crown. The Chinese government is implementing pilot projects in some regions to develop the digital Yuan Coin 2021 to innovate monetary policy radically. In

[124] U. Bindseil e f. Panetta "*Remunerazione in valuta digitale della banca centrale in un mondo con tassi di interesse nominali bassi o negativi*", 5 Oct 2020 on https://voxeu.org .

addition, due to the desire to hold a monopoly on the digital currency, the decision was made to declare illegal all transactions made with cryptocurrencies and activities related to virtual currencies, a decision that the People's Bank of China took on September 24th[125].

It is only needed to have a mobile phone connected to the Internet to use digital systems. Despite being one of the world's largest economies, from the point of view of the financial market, China turns out to be a very underdeveloped country.

According to a survey carried out by the World Bank's Global Findex[126], 225 million people (first place in the world) fall into the category of "unbanked", adults who do not use banks or banking services to any extent. So, they rely mainly on physical money.

There is no capillarity of banks and their branches, and the digital Yuan aims to reach even these small realities, allowing the majority of the population to take advantage of banking services.

Moreover, being centrally managed, such currency would give the government the ability to control money transactions more effectively, which is not possible as long as citizens rely on WeChat Pay or AliPay, private platforms used to make payments and purchases[127].

In 2019 these two platforms handled 94% (FSB 2019) of cashless transactions.

In March 2020, mobile payments were used by 776 million people2. The goal of the People's Bank of China is to propose an alternative to the duopoly of Chinese giants, such as Tencent and Alibaba Group (owners of WeChat Pay and Alipay, respectively).

Therefore, the initiative is entirely part of a financial project: crypto coins – such as Bitcoin – issued by the government.

The currency in question has been tested in four pilot regions: Shenzhen, Hong Kong, Chengdu and Suzhou. To date, the trial has affected almost one million people, for a total of 150 million digital Yuan in circulation[128].

The digital e-Yuan is very different from other cryptocurrencies. Although it uses the blockchain system, it is highly centralized controlled, that is, by the People's Bank of China and integration with the current Chinese banking system. The official issue is expected in 2022 on the occasion of the next Olympics that will take place in China.

[125] C. Palleschi "*La Cina ha vietato le transazioni in criptovalute*" on www.agi.it del 24 settembre 2021. ; "*La Cina dichiara illegali le criptovalute: la digitalizzazione dell'economia?"*, 30 Set 2021 su www.cesi-italia.org .
[126] Global Financial Inclusion (Global Findex) Database on http://www.worldbank.org/overall index
[127] NFCA, "*China's digital currency app looks like Alipay and WeChat pay",* 2020 on: https://ncfacanada.org/chinas-digital-currency-app-looks-like-alipay-and-wechat-pay/
[128] NFCA, "*China's digital currency app looks like Alipay and WeChat pay",* 2020 on: https://ncfacanada.org/chinas-digital-currency-app-looks-like-alipay-and-wechat-pay/

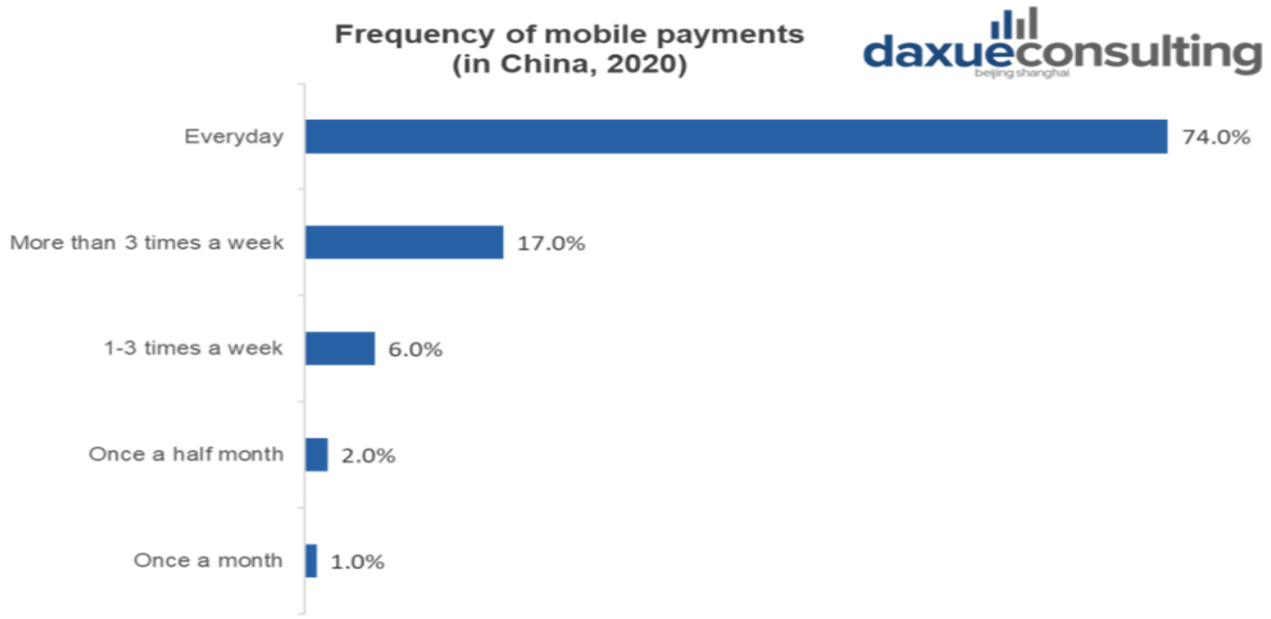
The project is divided into three levels: the People's Bank of China at the top that will provide for the issuance, the various commercial banks that will put it into circulation, and the commercial users who will use it[129].

In this way, the commercial banks are included in the system, and there would be no competition problems. The only challenge facing the People Bank of China is against other companies that provide payment systems over which it has no control[130].

The Central Bank can act as a guarantor, and the digital e-Yuan can be exchanged for other fiat currencies.

FIGURE 10

Source: daxueconsulting, July 4, 2021. Payment methods in China: How China became a mobile-first nation su: https://daxueconsulting.com/payment-methods-in-china/



Popularity of payment platforms in China (2020)

The "New Silk Road" project and Chinese investments in many of the countries involved will also facilitate the use of the new digital currency. Many, in fact, are the countries that have bilateral agreements with Beijing to proceed with mutual payments in national currencies without having to

[129] A. Kharpal, *"China has given away millions in its digital yuan trials. This is how it works"*, 2021 in: https://www.cnbc.com/2021/03/05/chinas-digital-yuan-what-is-it-andhow-does-it-work.html

[130] A. Kharpal, *"China has given away millions in its digital yuan trials. This is how it works"*, 2021 in: https://www.cnbc.com/2021/03/05/chinas-digital-yuan-what-is-it-andhow-does-it-work.html

resort to the dollar. Thus, the digital currency regulated by the Central Bank of China would be Beijing's answer to defend itself from the risk of being with a foreign currency used within the country.

It should also be added that, in parallel with the e-yuan, China is developing with Thailand and the United Arab Emirates a system that connects different digital currencies in order to improve international money transfers called Multiple CBDC (mCBDC) Bridge as an alternative to the SWIFT system (Society for Worldwide Interbank Financial Telecommunication), also called "international transfer". The aim is to overcome some current inefficiencies and reduce transaction costs by increasing transparency. Moreover, by virtue of the distributed ledger used, transactions will take place in real-time.

2.3.3 Digital dollar

The Digital Dollar Project is the result of a collaboration between the Digital Dollar Foundation and Accenture, and the current trials are expected to end in May 2022. The Federal Reserve (FED) will regulate it, and there will be no self-managed community of users, as is the case with all other altcoins. The first phase involves the "unbanked" and the "underbanked", the second the consumers holding a bank account, the third will include business users and finally, the operators of the financial markets[131]. There will also be the partnership of the Federal Reserve Bank of Boston with the Massachusetts Institute of Technology (MIT) for the study and development of American CBDC. No decision will be made on the issuance of the digital dollar until doubts about the risks associated with CBDC are resolved, in particular cyber attacks, financial stability, privacy and security[132]. It is also aware that most U.S. citizens oppose the idea of digital currency. According to a survey carried out by cryptocurrency mining firm Genesis Mining research[133], in 2020, "less than *25% of respondents* agreed *that the U.S. government should adopt a central bank digital currency over traditional paper money."*

In this perspective, the United States analyses the potential benefits of a CBDC and its risks, mainly because the U.S. dollar is the global reserve currency.

The main goal for the United States would be to determine "whether and *how a CBDC could improve an internal payment system that is already dynamic, secure, and active. Unlike some*

[131] Digital Dollar Project, 2021. Exploring the United States Central Bank Digital Currency, Proposed Pilot Programs su: http://static1.squarespace.com/static/5e16627eb901b656f2c174ca/t/5f848c188da760453f6960fc/1602522137441/Pilot+Scenarios+10_12_20.pdf

[132] Speech of 19 October 2020 of the Fed Chair to the International Monetary Fund.

[133] Quoted by A. Monaco "*Osservatorio Central Bank Digital Currency*", October 2020.

jurisdictions, we continue to see strong demand for cash in the United States. We also have a strong and international financial and credit sector as well as a population well integrated into the banking system, so that many, although not all, already have access to an electronic payment system." [134].

Even in this reality, any potential CBDC would serve as a complement and not a cash substitute.

An acceleration in the project came with the coronavirus pandemic. In March 2021, a bill was presented to the U.S. parliament to introduce a digital dollar, held in a digital wallet called Fed Account, available to consumers through local banks and post offices. Digital wallet holders would have to receive debit cards, online access to the account, automatic bill payment features, and use of ATM features.

Therefore, it has been proposed to use a possible digital currency to quickly reach citizens in need of economic aid who do not have bank accounts without commissions on the account or minimum or maximum balances.

2.3.4 Digital Euro

The creation of a European currency has been planned for several years now and, according to the ECB, "would serve *to give greater meaning to the idea of European unity and to strengthen the role of the euro at the international level, making it usable also by non-European citizens in transactions between different currencies[135]".*

A digital euro would combine the efficiency of a digital means of payment with central bank money security. It would help manage situations where cash is no longer the chosen solution and avoid reliance on digital means of payment issued and controlled outside the euro area, undermining the ECB's financial stability and monetary sovereignty.

On July 14 2021, the Governing Council decided to start the analysis phase of the project for a digital euro[136]. The first phase of the investigation began last October, which will last two years, and they are currently working to examine how a digital euro could be configured, how to distribute it to businesses and citizens, the impact it will have on the market and any necessary changes to be

[134] Fed Chairman in an interview of 19 October 2020 at the International Monetary Fund.

[135] F. Panetta "*We must be prepared to issue a digital euro*" October 2, 2020, on https://www.ecb.europa.eu/press/pr/date/2020/html/.

[136] Press release of July 14, 2021 "*Eurosystem launches project for a digital euro*" your https://www.ecb.europa.eu/press/pr/date/2021/html/ecb.pr210714~d99198ea23.it.html

made to European legislation[137]. The digital euro will also be a complementary currency to the euro, as it is not planned to replace it but to support it.

As early as 2020, the ECB published a report, prepared by the Eurosystem Task Force, composed of the 19 national central banks of the euro area and experts in advanced digital technologies, to identify the reasons for adopting a digital euro[138]:

- increased demand for electronic payments in the euro area;
- significant decrease in the use of cash as a means of payment;
- introduction of private means of payment with global scope;
- dissemination of experimental digital coins issued by foreign central banks.

In the same period, 12 October 2020 - January 12, 2021, a survey was also carried out to assess the interests of citizens, professionals and businesses in using a state digital currency. Participants qualified for 94% as citizens and 6% as professionals, of which a third as technology companies; Part of the contributions come from three countries: Germany (47%), Italy (15%) and France (11%); Citizens and professionals put privacy first (43%); there is a preference for integrating a digital euro into existing banking and payment systems[139].

[137] *"A digital euro"* his https://www.ecb.europa.eu/paym/digital_euro.

[138] Press release of October 2 2020 "*ECB steps up activities for a digital euro" on* https://www.ecb.europa.eu/press/pr/date/2020/html/ecb

[139] Press release of April 14, 2021 "*ECB publishes the results of the public consultation on a digital euro*" your https://www.ecb.europa.eu/press/pr/date/2021/html/ecb.pr210414~ca3013c852.it.html

CHAPTER 3

PRIVATE ENTITIES AND CRYPTOCURRENCIES: APPLICATIONS

3.1. Introduction

The purpose of this study is to understand if the impact that cryptocurrencies have on the financial system can intensify the financial relationships of a network, also allowing the inclusion of unbanked, as well as the reason behind the choices that many companies that develop payment platforms make in allowing the exchange of cryptocurrencies as well.

In the previous chapters, I have prepared the theoretical foundations for the treatment of this thesis.

In the first, I tried to define as clearly as possible the concept of cryptocurrency understood in its various meanings and uses, describe the functioning of the underlying blockchain system and identify the advantages offered in terms of greater efficiency and security of transactions.

In the second chapter, however, I deepened the theme of complementary currencies, a parallel made because, like cryptocurrencies, they represent payment instruments that flank legal currencies. In addition, I explained how the 'social' purpose of complementary currencies manages to stimulate productivity within a geographically located network.

From these premises, the study starts to understand if cryptocurrencies, like social currencies, can intensify the financial relations within a network.

To verify the relationship between cryptocurrencies and the intensity of financial transactions in a network, I analysed the performance of eight companies: American Express, Mastercard, Visa, Discover financial services, Coinbase, Fidelity National Information Services (F.I.S.), PayPal, Fiserv.

The choice was made between companies operating in the financial services sector and, more precisely, in the development of software and payment services by creating and developing payment platforms and services related to them.

They are joint-stock companies listed on the American stock exchanges New York Security Exchange - NYSE (American Express, Mastercard, Visa, Discover financial services) or Nasdaq (F.I.S., PayPal, Fiserv, Coinbase), with the obligation to report to the Security Exchange Commission (S.E.C.).

This has allowed me both to have a greater amount of information to be analysed, in consideration of the information obligations required of listed companies, and to be able to compare

the prospectuses provided because they are all processed according to the standardised model of presentation K-10, which has the task of summarising, annually, these data. Comparing it to Italy is the year-end balances papers in practice.

In addition, I also considered that, to date, cryptocurrencies are generally still not used for transactions aimed at buying and selling goods and services of the real economy given the high volatility of the most famous currencies that prevents the representation of the value of a real asset.

Therefore, the volume of this use does not appear to be large enough to be able to analyse its benefits. In acknowledging that the major companies in the technology sector are trying to implement payment platforms in their networks, also with cryptocurrencies, I chose to analyse the business of payment systems. It should be noted that many companies that already use large e-commerce platforms (Amazon, F.B., etc.) could also use cryptocurrencies as a payment instrument in the near future. Therefore, in this way, it would allow those who already carry out payment activities to have the role of pioneer in this vision, closely linked to their operation.

I excluded banks from this analysis because, although they obviously create payment infrastructures, they offer many other services that, in the representation on the information documents, could skew the values I am looking for because they are not distinct or differentiated from payments.

However, before analysing the payment systems sector, I think it is necessary to make some clarifications. The phenomenon of cryptocurrencies has been born for over ten years now. However, it is only since the beginning of the Covid 19 pandemic that there has been a genuine interest on the part of credit institutions in developing cryptocurrency exchange platforms and accelerating the implementation of all ongoing projects. While in other industries, the use of blockchain has been implemented faster, in the payments industry, this has not happened.

On the one hand, central banks worldwide have only recently approached this new scenario that was opening up. At first, even in the awareness of the great innovation that the blockchain system would have created, they limited themselves to considering cryptocurrencies with distrust, worrying only about stating that they are not reliable currencies and highlighting only the speculative aspect and the use in the field of recycling. Today, they are trying to accelerate the exit of central bank digital currencies so as not to stay out of innovation.

On the other hand, private companies initially offered purely speculative services, then tried to understand the principles of using coins capable of complementing legal ones.

From this premise follows a scarcity of data to be found on the specific sector of cryptocurrencies. The number of companies operating in this sector, alternative but still located in the financial services one, as well as being small, also for regulatory reasons, is characterised by companies established in the form of Limited Liability. Thus, access to documents useful for analysis

is also limited. Few are the companies listed on the major stock exchanges that have embraced cryptocurrencies in their business vision in an attempt to reach an increasingly large client-base and often operate in remarkably different sectors.

Of the eight companies chosen, four operate in the payment services sector, allowing the use of cryptocurrencies (Pay Pal, Coinbase, F.I.S., Finserv), while the others (American Express, Visa, Mastercard, Discover financials services) exclusively fiat currencies.

In addition, I tried to analyse the phenomenon also in a perspective of sustainability, not only economic but also considering social and environmental issues given the critical role that these two additional components have assumed within the most advanced companies.

In the E.S.G. evaluation, I considered it appropriate to compare the two samples of selected companies and then also compare them with a sample made by credit institutions operating in the banking industry (belonging to the NASDAQ Global Sustainability 50 INDEX), therefore not only in the payments sector and therefore in transactions. The comparison could highlight or not specific critical issues in the payment industry.

3.1.1. presentation of sample companies

PayPal Holdings is a U.S. company offering digital payment and internet money transfer services founded in 1999 by Confinity. It allows you to make payments, send money and accept payments quickly, easily and securely. The system is mainly used to make purchases on millions of websites worldwide, in over 200 markets and in 25 different currencies, but it is also possible to make payments in local stores or charities.

It allows linking the data of a bank account or a card to the account PayPal[140].

Coinbase is a digital asset exchange company based in San Francisco, California, founded in June 2012 and operates in 32 countries worldwide. It ensures the purchase, management, storage and sale of cryptocurrencies through a web platform. It is enough to have a bank account or a debit card. Over 98% of cryptocurrency is stored offline securely, while the rest is protected through industry-leading online security measures[141].

Fidelity National Information Services (FIS), a company rounded up in 1984, specializes in financial services and digital banking. Financial management is 100% digital all-in-one that meets

[140] https://www.paypal.com
[141] https://www.coinbase.com

the needs of SMEs and professionals. In March 2019, it acquired Worldpay, which specializes in services that allow merchants to make digital payments. In reality, more than one acquisition is a merger operation between the two groups. The goal pursued is to support online commerce's growth, helping companies start, manage, and grow their businesses. The company's clients include banks, credit companies and cooperatives, securities brokers, leasing companies, financial companies and retailers[142].

Fiserv Inc. is an American multinational Fortune 500 company headquartered in Brookfield, Wisconsin that provides financial technology and financial services. The company's clients include banks, thrifts, credit unions, securities broker-dealers, leasing and finance companies, and retailers[143]. Inoltre, consente lo scambio e la gestione anche di criptovalute.

American Express is a diversified U.S. company that is a global leader in financial and travel services. Founded in 1850, it has its current headquarters are in New York, in the borough of Manhattan. It is the leading credit card issuer by purchase volume and operates through a network capable of handling millions of business transactions every day in the world.

Through a diversified offer of products and services for individuals and companies (small, medium, large), it responds to the multiple needs of customers; at the same time, American Express takes care of the relationship with the affiliated businesses that accept the cards through initiatives and services aimed at increasing the business and the satisfaction of partners and customers[144].

In 2002 it entered the online and digital payments service, quickly establishing itself as a leader in the sector while remaining, always far from the acceptance of cryptocurrencies[145].

Visa Inc. is a joint venture of 21,000 financial institutions and governments in more than 200 countries and territories that issue products under the Visa brand, primarily debit and credit cards under the V Pay brand, currently headquartered in Foster City, California. The company aims to connect billions of cardholders to millions of merchants by creating a level playing field for those who have always been excluded from financial services. They focus on the needs and challenges of small and medium-sized enterprises and provide underserved communities and populations without banking services with access to innovative financial solutions using the power of networks. "*When individuals and small businesses succeed, communities thrive*."[146].

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[142] https://www.fis.com
https://www.fiserv.com "*Fiserv: Financial Services Technology, Mobile Banking*".
[144] https://www.americanexpress.com/
[145] B. Sozzi, "*American Express CEO: cryptocurrencies aren't a currency"*
in https://finance.yahoo.com/news/american-express-ceo-cryptocurrencies-arent-a-currency-180155548.html,
[146] https://www.visaitalia.com/our-purpose/supporting-communities.html

Mastercard Incorporated was founded in 1966 and is headquartered in Purchase, New York. It is a technology company that provides transaction processing and other payment-related products and services internationally. It facilitates the processing of payment transactions, including authorization, clearing and settlement, as well as providing related products and services. The company offers integrated products and services for account holders, merchants, financial institutions, businesses, governments, and other organizations, such as programs that allow issuers to provide credits to consumers to defer payments; payment products and solutions that allow its customers to access deposit funds and other accounts.

It also offers prepayment programs and management services and products and solutions for credit and commercial debt payment. It also provides value-added products and services that include IT and intelligence products.

Discover Financial Services (NYSE: DFS) is a digital banking and payment services company with one of the most recognized brands in U.S. financial services. Since its founding in 1986, the company has become one of the largest card issuers in the United States. The company issues the Discover card, the American pioneer of prize money. It offers private student loans, personal loans, home loans, checking and savings accounts, and certificates of deposit through its banking business. It manages the Discover Global Network composed of Discover Network, with millions of points of sale and cash access; PULSE, one of the nation's leading ATM/debit networks; and Diners Club International, a global payment network with worldwide acceptance[147].

It must be specified that for the companies Visa Inc., Mastercard Incorporated and Discover financial, projects are underway for the development of payment platforms on which cryptocurrency can also circulate, as will be said later. Therefore, they can only be valued for payments with fiat money to date.

3.2 ESG

3.2.1 ESG Policies

The years 2020 and 2021 have seen a surge in the use of cryptocurrencies, but also a greater awareness of the impact that investing in cryptocurrencies can have on the environment, society and corporate governance, a theme that, for the investment and transaction management sector, can only be addressed by ensuring that they meet the criteria relating to the improvement of the environment,

[147] discover.com

the management of social concerns and the improvement of corporate governance (Environmental, Social and Governance). The issue to be addressed is whether ESG and cryptocurrency require compatible strategies. First of all, it is necessary to break down and elaborate on ESG criteria.

ESG (Environmental, Social and Governance) policies are business activities that voluntarily integrate environmental and social performance with entrepreneurial objectives. These are policies that also impact reputation, given the correlation between reputation and performance in terms of higher revenues or more efficient cost structure (stakeholder theory)[148].

The ESG approach was born in the 2000s based on CSR (Corporate Social Responsibility) theories already present in authors of previous years. In turn, the latter theories (CSR) are based on the more remote dichotomy between shareholder theory and stakeholder theory[149].

In fact, several supporters of the former argue that: "*There are no "social" values, no "social" responsibilities in any sense other than the shared values and responsibilities of individuals. Society is a collection of individuals and the various groups they voluntarily form. The doctrine of "social responsibility" taken seriously would extend the scope of the political mechanism to every human activity. It does not differ in philosophy from the most explicitly collectivist doctrine.*[150]" considering a possible functional corporate social responsibility only within the limits of the maximisation of profit for the shareholder[151].

Stakeholder theory also takes into account the interests of other actors outside the shareholders[152] by creating a three-dimensional corporate performance model: economic, environmental and social[153].

Some understand ESG as a luxury good[154], stating that the companies with the best performance can make investments in sustainability by virtue of greater economic resources[155]. And those who say that the benefits must be evaluated in the long term as they are greater than the costs

[148] P. W. Roberts, G. R. Dowling "*Corporate reputation and sustained superior financial performance*" September 19 2002.

[149] A. B. Carroll, "*A Three-Dimensional Conceptual Model of Corporate Performance"* 1979; K.E. Aupperle, A. B. Carroll and J. D. Hatfield "*An Empirical Examination of the Relationship between Corporate Social Responsibility and Profitability",*1985.

[150] M. Friedmann, "*The social responsibility of business is to increase its profits*", September 13, 1970.

[151] M. C. Jensen, "*Value maximisation, stakeholder theory, and the corporate objective*", 2001; P. M. Ferrando, "*Theory of value creation and corporate social responsibility*", 2010.

[152] E.Merrick Dodd Jr., "*For whom are corporate managers trustees*?", 1932.

[153] A. B. Carroll, "*A Three-Dimensional Conceptual Model of Corporate Performance"* 1979; R. Bènabou, J. Tirole, "*Individual and corporate social responsibility*", 2010.

[154] D. P. Baron, "*Managerial contracting and corporate social responsibility*", 2007.

[155] S. A. Waddock, S. B. Graves, "*Quality of management and quality of stakeholder relations are they synonymous?*", 1997; M. Orlitzky, F. L. Schmidt, S. L. Rynes "*Corporate social and financial performance: A meta-analysis*", 2003.

faced, as companies that voluntarily invest in sustainable business models do not suffer either any tax regulations of constraint to emissions or the increase in costs due to a late adjustment[156].

However, it is from the 90s to today that there has been a gradual but constant increase in studies that reveal a positive correlation between performance and ESG generated by an increase in reputation and therefore by an increase in cost efficiency[157], in consideration of the best relationships with suppliers, the reduction of transaction costs and the higher quality of management also for an increased ability to attract and retain talent.

This evolution of thought relies on the greater awareness of the environmental damage occurring and the costs associated with them[158]. It is no coincidence that it is in the most recent literature that a long-term benefit of ESG performance policies is most highlighted[159]. Also, according to this perspective, ESG policies should be interpreted not as other activities to be pursued but as a necessary condition for survival in a competitive environment in evolution as a result of climate change. ESG factors are constantly gaining attention on the one hand for exponential social concerns, on the other for the constant commitment put in place to improve corporate governance.

The signing of the Paris Agreements in 2015 represented a turning point in the fight against climate change in progress, based on the awareness that the physical impacts of climate change are compromising the activity of companies and economic development. However, like companies, investors and consumers orient their preferences towards sustainable investments, so demand in recent years is also changing. It has undoubtedly also influenced the strong growth towards sustainable finance.

Concerning cryptocurrencies, the origin of the sustainability problem is that the process of validating transactions used by those mainly in use (Bitcoin, Ethereum, Litecoin, Monero) generates large amounts of carbon anhydrite and uses very high quantities of electricity that is not always renewable.

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[156] J. Crane, "*Climate change and fossil fuel: An examination of risks for the energy industry and producer states*", April 18 2017; F. Moliterni, F. Amone "*From climate risk to sustainability. A strategic factor for value creation*" September 2018.

[157] M. Tsoutsoura, "*Corporate social responsibility and financial performance*", 2004.

[158] N. Comincioli, L. Poddi, S. Vergalli "*Corporate social responsibility and firms' performance: A stratigraphical analysis",* 19/08/2012; F. Moliterni, F. Amone "*From climate risk to sustainability. A strategic factor for value creation*" September 2018.

[159] I. Ioannou, G. Serafeim, "*The impact of corporate social responsibility on investment recommendations*", 2010.

3.2.2. Studies in the cryptocurrency industry

Specific studies in the cryptocurrency sector began in the year 2018 with a report published by the Bank for International Settlements (BIS)[160] in which it was stated, taking into account the Bitcoin system, that, "*to pursue decentralized trust, an environmental disaster could be generated*". Another problem highlighted is the fact that most of the mining facilities in the network under consideration are located in regions (mainly in China) that are heavily dependent on coal-based energy[161].

This study was refuted by some later ones who questioned the findings of Digiconomist[162].

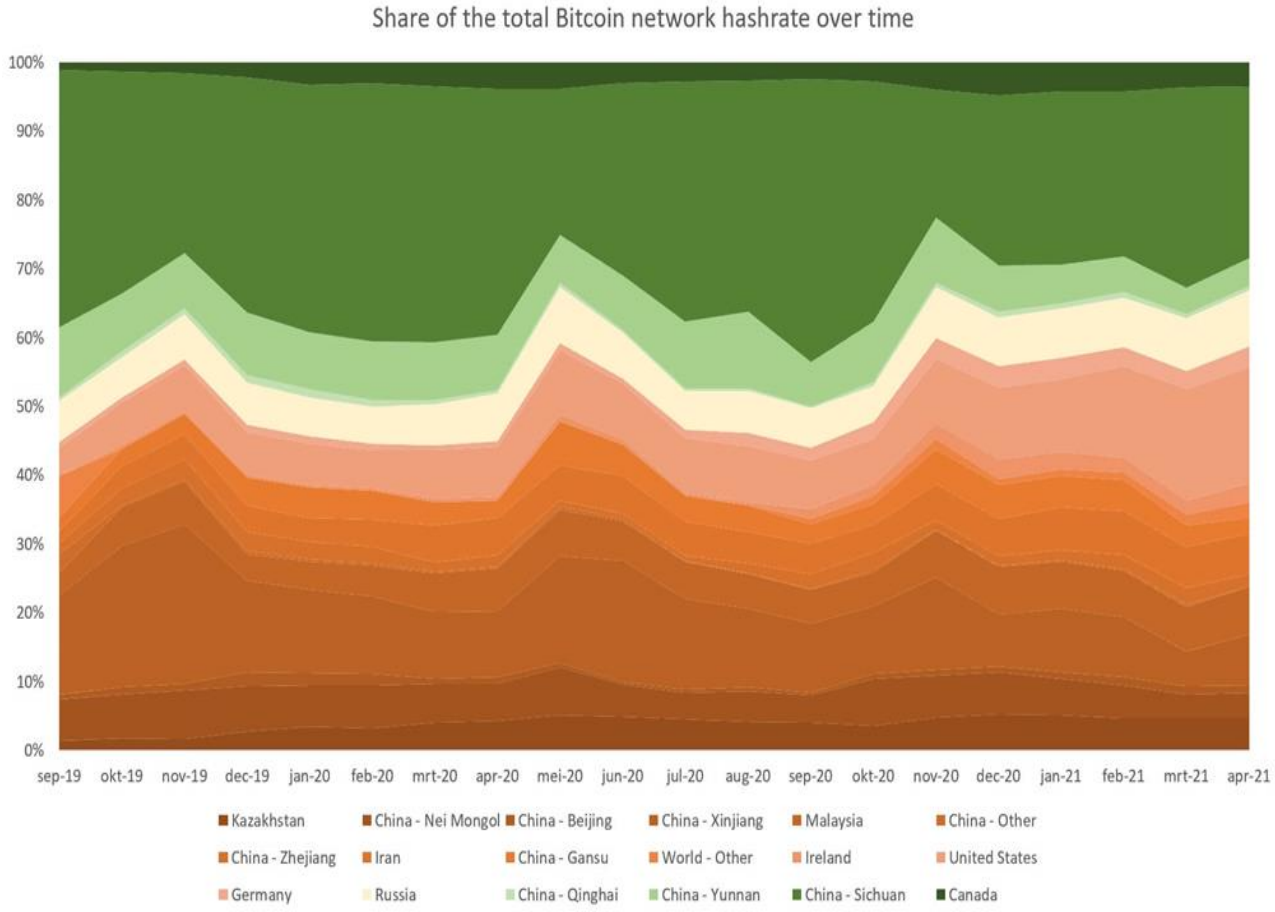
Even China[163], given the launch of its digital currency, in 2018 carried out studies examining the Monero, aimed at quantifying the energy used for the validation of transactions with cryptocurrencies, concluding that "*the mining efficiency is relative to the algorithm"* used in the various blockchains, and that "*the experimental results of five computers were not sufficient to prove the energy impact",* in consideration of three factors: the actual number of cryptocurrencies in circulation changes almost daily; any computer equipped with adequate software can participate in mining; cryptocurrencies are designed not to be traceable.

These unknown factors escape any form of analysis, making it unreliable and leading to highly different estimates.

On the one hand, it is stated that the growth of bitcoin mining alone could result in a two-degree Celsius increase in global temperatures[164]; on the other hand, however, such estimates are inflated as miners increasingly move towards low-cost renewable energy sources, such as hydropower[165]. Today, almost all miners are stabilized near dams in places like the Pacific Northwest and New York state and hydrothermal plants in Iceland. CoinShares has estimated that about 74% of bitcoin mining is powered by renewable energy, and therefore this constitutes an incentive to develop more environmentally friendly forms of energy production[166].

[160] M. Bevand, "*Electricity consumption of Bitcoin: a market-based and technical analysis*", 2018
[161] C. Stoll, "*coal is powering Bitcoin",* 2019
[162] S. Imran "*The positive externalities of bitcoin mining*", 2018; M. Bevand, "*Electricity consumption of Bitcoin: a market-based and technical analysis*", 2018
[163] J.Li, N. Li, J Peng, H. Cui, Z. Wu "*Energy Consumption of Cryptocurrency Mining: A Study on Electricity Consumption in Cryptocurrency Mining",*2018 in https://doi.org/10.1016/j.energy.2018.11.046
[164] C. Mora, R. L. Rollins, K. Taladay, M. B. Kantar, M. K. Chock, M. Shimada end E. C. Franklin "*Bitcoin emissions alone could push global warming above 2°C*", October 29 2018.
[165] A. de Vries "*Renewable Energy Will Not Solve Bitcoin's Sustainability Problem"* March 14, 2019.
[166] A. de Vries "*Renewable Energy Will Not Solve Bitcoin's Sustainability Problem"* March 14, 2019.

FIGURE 11



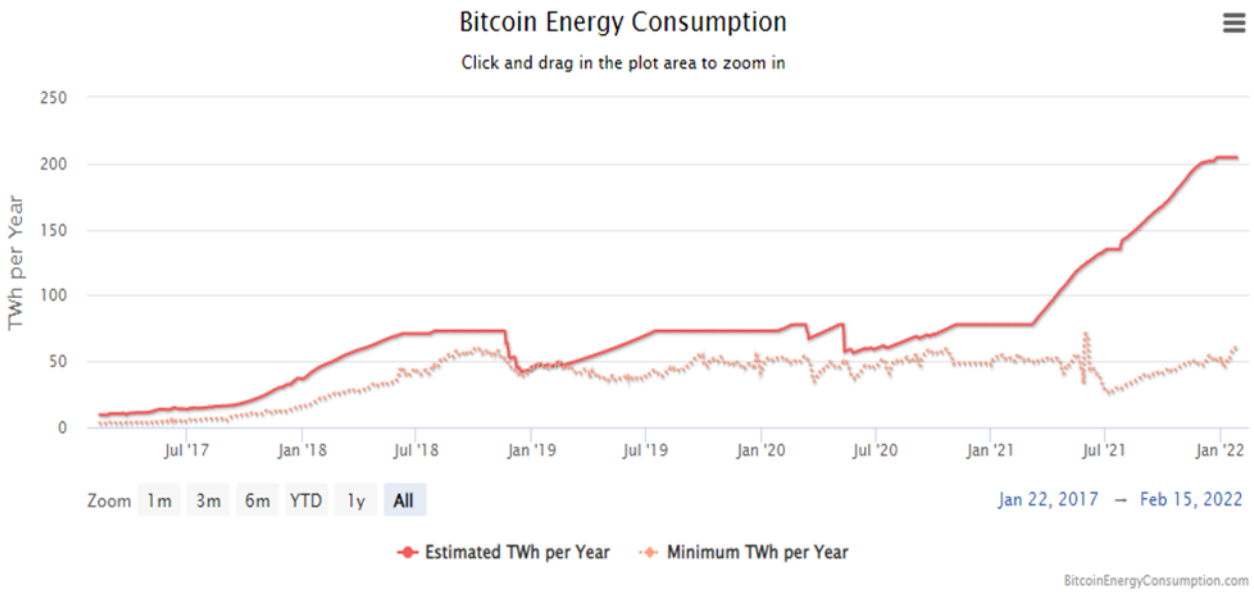
According to a study by the Swiss National Bank[167], considering the role and the actual constant growth of the use of distributed ledger technology, blockchain will make sustainable development projects international as this system reduces the complexity of financial transactions. The blockchain ensures greater efficiency in the management of high numbers of transactions while also ensuring speed in execution. Therefore, the amount of energy used for cryptocurrencies should be compared with that used by all banking systems that carry out transactions and with that needed to print and distribute the coin around the world. It should be remembered that Switzerland, considered the "Crypto Valley", has created a worldwide reputation for all-new blockchain business ideas. In fact, Zug was the first place in the world to accept the bitcoin cryptocurrency for every type of payment. In addition to Zug, Zurich, Geneva, Ticino, Bern and Lucerne have also created and introduced their blockchain systems in their credit institutions[168].

[167] "*Inquiry on digitalization and fintech in the Swiss banks 2019*" of the Swiss National Bank, 27 August 2019, its https://www.snb.ch/it/mmr/reference/fintech_20190827.
[168] Switzerland Global Enterprise, 2020 in https://www.swissbiotech.org.

Even today, however, it is not possible to quantify the true impact that cryptocurrencies have on the environment.

Below, in figure No 10 The latest estimate of the total energy consumption of the Bitcoin network is provided by the Bitcoin Energy Consumption Index published in digiconomist.net.

Figure 12



It is, however, an absolute value that, having no terms of comparison, can hardly be analyzed.

Turning to the social aspect of ESG, reference must necessarily be made to consumer protection, human rights and financial inclusion. As pointed out in the previous chapters, the anonymous or pseudo-anonymous nature of cryptocurrencies, on the one hand, certainly protects those who are made vulnerable by oppressive regimes; on the other hand, they favour financial inclusion as it allows anyone with an Internet connection and a smartphone to own cryptocurrencies. However, it should also be considered that in the poorest parts of the world engaged in finding solutions to survive, having a network or a smartphone could represent a luxury or an illusion.

The last criterion for assessing ESG is governance, i.e. the set of principles, rules and procedures that relate to the management and governance of a company or corporation. Recent studies[169] have shown that companies that adopt ESG policies are more organized, think about the future with long-term strategies and have a higher quality than those who do not adopt them. In

[169] Luce, Babe, Hillman, "*The effect of corporate social responsibility on the firm's financial performance*", 2001; J. Crane, "*Climate change and fossil fuel: An examination of risks for the energy industry and producer states*" April 18, 2017; G. Horse, "*SRI and COVID-19 funds: can ethics and performance coexist?*", 2020.

addition, they allow companies to better cope with times of crisis and, in the long term, to have better performance than competitors who do not adopt these criteria. The example of the Volkswagen emissions scandal shows that, after the adverse events, ESG values have fallen. In fact, according to the MSCI, Sustainalytics, RobecoSAM's ratings, it has gone from BBB to CCC after harmful emissions[170].

Conceptually, however, it is complicated to apply corporate governance notions to cryptocurrencies as they are decentralized, meaning no central party has control over them. Therefore, they have an extremely low rate on any governance measure.

3.2.3 Analysis of ESG risk ratings of the sample companies

From this premise starts an analysis that I carried out to understand the relationship between the sector in which companies that develop payment platforms operate and the E.S.G. report. I sampled a number of global technology companies in the payments industry and verified the E.S.G. risk rating provided by Sustainalytics: a company that calculates the degree of risk to a company's business value and assesses the sustainability of companies based on their environmental, social and corporate governance performance. Specifically, the E.S.G. Risk rating measures the degree to which E.S.G. issues are putting a company's enterprise value at risk. In addition, it measures the magnitude of unmanaged risk. They represent an absolute measure of risk making them comparable across different issues, companies and industries. Finally, E.S.G. Risk rating is accompanied by an analyst view that provides deeper insight into the company's most material E.S.G. risks. The E.S.G. Risk ratings are composed of two main dimensions: Exposure and Management. The first one represents the vulnerability or susceptibility to E.S.G. Risks. It also considers the company's industry and the specific E.S.G. issues. The management dimensions refer to actions taken by a company to manage a particular E.S.G. issue, including the company's program and policies. Combining Exposure and Management Sustainanalytic's E.S.G. Risk rating measures a company's unmanaged risk for each material E.S.G. issue. These scores are rolled up to arrive at the company's overall E.S.G. Risk Rating. The lower a company's E.S.G. Risk Rating, the lower their overall risk of experiencing material financial impact due to E.S.G. factors. Sustainalytics has created five risk categories that indicate the level of risk to the company's enterprise value: negligible (0-10), low (10-20), medium (20-30), high (30-40) and severe risk (40+).

[170] Schroders 2017. Sustainable investment report, March 6 2018.

Combining and comparing Exposure and Management scores for different issues, it grouped all the different issues in three macro-categories: Social risk, Environmental Risk, and Governance Risk.

Final E.S.G. risk ratings, on the other hand, measure unmanaged risk on an absolute scale ranging from 0 to 100 and the highest score indicates unmanaged E.S.G. risk. In the Controversies Research column, Sustainalytics lists companies involved in incidents and events that can adversely affect them. Controversies can negatively impact a company's management score because they act as signals that management initiatives are insufficient or ineffective.

Controversies are evaluated on a scale of 1 to 5, where five indicate the most complex disputes with the most significant potential impact.

The Exposure scale is: weak, medium, high;

The Management scale is: low, average, strong.

I also point out that I have compared three types of companies: credit institutions that operate in multiple financial sectors, companies that carry out transactions exclusively with legal coins, and those also engaged in transactions with cryptocurrencies. In the study sample, in the third category, I excluded Coinbase because, given the very recent listing, it has not been evaluated by Sustainalytics.

Below are the table reporting the E.S.G. scores for the three segments analyzed:

TABLE 1

	Exposure	Management	Total ESG Risk score	Environment Risk Score	Social Risk Score	Governance Risk Score	Controversy level
Traditional credit institutions							
UBS	Medium	Strong	22,2	0,9	12,3	9	3
State Street Corporation	Medium	Strong	21,3	1,6	12,4	8,5	2
Deutsche Bank	Medium	Strong	27,4	1,6	13,5	14,9	4
The Toronto-Dominion Bank	Medium	Strong	20,3	1,2	11,1	7,2	3
Royal Bank of Canada	Medium	Strong	18,3	1,2	10	5,9	3
Average			**21,9**	**1,3**	**11,9**	**9,1**	**3**
Software and Payment Services no crypto							
American Express	Medium	Strong	20,3	0,1	11,2	8,5	2
Visa	Low	Strong	16,1	0,7	7,8	7,5	3
Mastercard	Medium	Strong	17,2	0,3	8,1	8,8	4
Discover financials services	Medium	Average	20,9	0,1	11	9,8	1
Average			**18,6**	**0,3**	**9,5**	**8,7**	**2,5**
Software and Payment Services with crypto							
Pay Pal	Low	Strong	16,4	0,7	9,4	6,1	2
Coinbase *			N/A	N/A	N/A	N/A	N/A
Fidelity National Information Services	Low	Average	18,2	1,3	11,1	5,8	1
Fiserv	Low	Average	18,3	1,2	10,7	5,8	2
Average			**17,6**	**1,1**	**10,4**	**5,9**	**1,7**

*not taken into account as not subject to evaluation

Analyzing the three tables shows the following:

it is mainly noted that traditional credit institutions have greater exposure than those working only in the payments industry. Although American Express, Mastercard, and Discover financials services are not credit- institutions but Software and Services companies, exposure to E.S.G. risk are equivalent. The same turns out to be Medium. Such equalization could be caused by the broader range of services these companies offer, unlike Visa, PayPal, F.I.S. and Fiserv, which are limited to ensuring

payment solutions. This suggests that this last sector has a low level of criticalities compared to the average level of those who offer and ensure more financial services.

Regarding management, on the other hand, it emerges that traditional credit institutions, such as software and payment services without cryptocurrencies, have a higher score – Strong – (with the sole exclusion of Discover financials services - Average) than that recorded for software and payment services with cryptocurrencies - Average -.

It is possible to deduce a correlation between exposure and management. It is no coincidence that low exposure also results in a lower management valuation than those operating in a sector with higher Exposure to E.S.G. risk factors. In the latter case, the management, having to face problems that put a more significant share of company value at risk, is incentivized to perform better.

In addition, it should not be underestimated that the companies that have recorded a high management value among those that offer payment services (Mastercard, Visa, American Express and PayPal, similarly to credit institutions) are highly structured also for the historical tradition they have.

Passing **E.S.G. risk environment** (environment), a sector where there is the lowest risk among those taken into account, there is a narrow margin of action in the management of these risks in the financial sector. In particular, the best performing companies are mainly those in software and payment services without cryptocurrencies, with an average of 0.3 points, followed by those software and payment services with cryptocurrencies, 1.1. The difference could express a less sustainable environmental impact of the latter companies. Therefore, the hypothesis recurs that the management of cryptocurrencies can create more significant problems that have an impact on the environment.

On the other hand, the **social risk** is the one that obtained the highest score of the three indicators. It confirms the trend that companies in the financial sector, in general, are leaning towards greater exposure to social risks.

Evaluation that concerns all three categories compared. There is no greater commitment of software and payment services with cryptocurrencies companies than those that do not allow cryptocurrencies.

Below average, however, are the companies that still transact exclusively with fiat currency.

Moving on to examine the **Governance Risk** is recorded on companies in the payments sector also with cryptocurrencies, a different trend from that recorded in the other categories. The risk turns out to be much lower: 2-3 points below the other categories of companies. The reason is perhaps to be found in the size and structure of the companies compared: the more structured have more articulated governance also according to the vastness and variety of services they offer.

In addition, the low risk recorded in the industry of software and payment services with cryptocurrencies highlights a propensity, given the object of the service they render (transactions with cryptocurrencies), which could also be caused by the corporate culture oriented towards innovation and able to influence governance positively.

Therefore, overall the **E.S.G. risk** is lower in the software and payment services with cryptocurrencies that detaches the software and payment services without cryptocurrencies by one point and the traditional credit institutions by more than four points. It is in line with the sector's assessment of E.S.G. risk exposure. However, it is not demonstrable that software and payment Services with cryptocurrencies will perform better than software and payment services without cryptocurrencies.

In the "**Controversy level**" sector, less complex disputes with a lower potential impact are recorded for companies that make payments with both fiat currency and cryptocurrencies. This data aligns with those related to exposure. This correlation highlights the highest number of E.S.G. issues of those companies with the highest exposure score.

In conclusion, the analysis carried out and the E.S.G. rating attributed to the companies' categories that deal exclusively with services related to payments do not reveal significant differences as both fall within the same E.S.G. risk class (low). On the other hand, for the reasons already explained, both differ from credit institutions that have an E.S.G. medium risk score.

It could lead to a general greater sustainability of the payments sector. But, on the other hand, there is no evidence of greater sustainability of companies that also deal with cryptocurrencies, neither overall, social nor environmental.

In fact, there is a significant amount of unmanaged risk in both factors.

3.3 Performance Analysis

3.3.1 Methodology and calculation

The part of the analysis related to performance consists in evaluating more properly the economic aspects of the sample companies.

First, I analysed the market returns to get insights into the perceptions of the world of investors.

I calculated three indicators: mean, variance, correlation and the Beta of each company with the three leading cryptocurrencies (Bitcoin, Ethereum and Litecoin) and the principal market idexes(Nasdaq,S&P500, Dow Jones).

The time interval taken into account is as follows: 1 November 2021 – 9 February 2022.

My initial intention was to choose a wider time frame (1 June 2019 - 7 February 2022) to achieve more conclusive results.

Deepening the studies and knowledge, however, I realised that the real adoption of cryptocurrencies to make payments had exploded recently for the reasons already highlighted in the previous chapters: for almost ten years, bitcoin has often raged even without rivals. However, bitcoin uses an outdated blockchain because it is obsolete and inflexible, so it is not suitable for payment. Precisely because of this rigidity of the system, other cryptocurrencies have been born with more streamlined blockchains and characterised by the proof of stake that creates greater scalability. Furthermore, the effect generated by the recent pandemic that has amplified the use of digital tools to make payments should not be excluded. The birth, almost uncontrollable, of stabilised altcoins that, due to this feature, are more suitable for generalised use in recent years is also added to these reasons. In addition, the extension of the "D.A.O." (decentralised autonomous organisation) organisations governed by codes and computer programs that have reinterpreted the organisational model of society. While traditional organisations function according to a hierarchical structure with different levels of bureaucracy, D.A.O.s have no hierarchy: they are decentralised and autonomous.

Transaction rules and records are stored transparently on a blockchain. Instead of a central entity coordinating participants, governance rules are automated and guide participants to the most network-beneficial outcome[171]. The birth and expansion of this consideration of belonging to a group also increase the use of cryptocurrencies.

For these reasons, I have scaled down the analysis, which otherwise would have been misleading, focusing on the period mentioned above: 1 November 2021 – 9 February 2022. From that initial date, many of the sampled companies have included cryptocurrencies in their platforms (PayPal, Coinbase, Fiserv and F.I.S.).

I relied on the python 3.0 programming language to carry out the calculations.

- The market return data was imported from yahoo finance, an online financial information site that reports data on publicly traded companies[172]. I chose the "closed" prices that is the raw price, which is just the cash value of the last transacted price before the market closes.

I calculated the correlation to make a screening of the companies that operate with cryptocurrencies in order to understand which ones to pay attention to.

Moreover, it could also represent the level of exposure of the sampled companies to digital assets, and therefore, this could represent an indicator of their investment in cryptocurrencies.

[171] https://ethereum.org/en/dao/

[172] www.yahoofinance.com

Having acquired the information relating to the value of the share capital, I calculated the daily percentage change in this value of the securities taken into account by applying the following formula:

(Pi,t/Pi,t-1) – 1

Subsequently, I calculated the average of the result obtained with the relative python 3.0 function, finding the average daily return of the securities in question; this result was multiplied by the number of trading days present within the chosen time interval (69 days).

Similarly, I calculated the covariance of returns, always with the appropriate function of python 3.0. Along the covariance matrixs' diagonal, the variance of each enterprise is highlighted, indicating the degree of risk of the individual companies belonging to the sample.

I computed the correlation between both of the sample companies and the correlation between them and a basket of the three cryptocurrencies indicated in the epigraph. To do this, I imported, again, the list of returns of the sample companies integrating it with that of the selected cryptocurrencies and, therefore, like the average and covariance, I used the appropriate python 3.0 function. Finally, at the end of the analysis on the market prospects**,** I computed the risk factor Beta to isolate systemic risk.

Below are reported four tables representing the average return and the correlations.

TABLE 2: Average percentage return between 01/11/2021 and 09/02/2022.

AXP	0.126453
COIN	-0.405779
DFS	0.084891
FIS	-0.008373
FISV	-0.012978
MA	0.134989
PYPL	-0.601024
V	0.087003

The return was computed by importing on python the data from yahoo finance and using the mean function. The chart shows this result multiplied by 69 wich represents the number of the observations.

TABLE 3 Correlation Matrix[173]

(correlation between sample companies and cryptocurrencies)

	AXP	BTC-USD	COIN	DFS	ETH-USD	FIS	FISV	LTC-USD	MA	PYPL	V
AXP	1.000000	0.298105	0.291966	0.738467	0.246154	0.379297	0.298774	0.235957	0.479490	0.201529	0.514134
BTC-USD	0.298105	1.000000	0.633553	0.234523	0.864954	0.105112	0.006404	0.813157	0.106614	0.278954	0.170088
COIN	0.291966	0.633553	1.000000	0.277942	0.653014	0.232212	0.180724	0.576440	0.175940	0.415276	0.209369
DFS	0.738467	0.234523	0.277942	1.000000	0.159894	0.431520	0.297918	0.183833	0.401558	0.216149	0.380578
ETH-USD	0.246154	0.864954	0.653014	0.159894	1.000000	0.163887	0.086743	0.747640	0.142807	0.269884	0.220228
FIS	0.379297	0.105112	0.232212	0.431520	0.163887	1.000000	0.747340	0.218175	0.692863	0.372630	0.651269
FISV	0.298774	0.006404	0.180724	0.297918	0.086743	0.747340	1.000000	0.085905	0.687593	0.353829	0.592601
LTC-USD	0.235957	0.813157	0.576440	0.183833	0.747640	0.218175	0.085905	1.000000	0.097589	0.120961	0.102465
MA	0.479490	0.106614	0.175940	0.401558	0.142807	0.692863	0.687593	0.097589	1.000000	0.314487	0.863376
PYPL	0.201529	0.278954	0.415276	0.216149	0.269884	0.372630	0.353829	0.120961	0.314487	1.000000	0.339310
V	0.514134	0.170088	0.209369	0.380578	0.220228	0.651269	0.592601	0.102465	0.863376	0.339310	1.000000

The matrix was computed using the correlation function on python.

The charts below 2a,2b and 2c represent respectively: correlation between companies that do not operate with crypto, correlation between companies that operate with crypto, correlation between sample companies.

TABLE 3a (Correlation between companies that do not operate with crypto)

	AXP	V	MA	DFS
BTC-USD	0,298105	0,170088	0,106614	0,234523
LTC-USD	0,235957	0,102465	0,097589	0,183833
ETH-USD	0,246154	0,220228	0,142807	0,159894
	0,260072	0,164260	0,115670	0,192750

TABLE 3b (Correlation between companies that operate with crypto)

	PYPL	COIN	FIS	FISV
BTC-USD	0,278954	0,633553	0,105112	0,006404
LTC-USD	0,120961	0,576440	0,218175	0,085905
ETH-USD	0,269884	0,653014	0,163887	0,086743
	0,223266	0,621002	0,162391	0,059684

[173] www.yahoofinance.com

TABLE 3c (Correlation between sample companies)

	AXP	V	MA	DFS	PYPL	COIN	FIS	FISV
AXP	1,000000	0,514134	0,479490	0,738467	0,201229	0,291966	0,379297	0,298774
V	0,514134	1,000000	0,514134	0,380578	0,339310	0,209369	0,651269	0,592601
MA	0,479490	0,863376	1,000000	0,401558	0,314487	0,175940	0,692863	0,687593
DFS	0,738467	0,380578	0,401558	1,000000	0,216149	0,277942	0,431520	0,297918
PYPL	0,201529	0,339310	0,314487	0,216149	1,000000	0,415276	0,372630	0,353829
COIN	0,291966	0,209369	0,175940	0,277942	0,415276	1,000000	0,232212	0,180724
FIS	0,379297	0,651269	0,692863	0,431520	0,372630	0,232212	1,000000	0,747340
FISV	0,298774	0,592601	0,687593	0,297918	0,353829	0,180724	0,747340	1,000000

TABLE 4: beta

	^DJI	^GSPC	^NDX
AXP	1.735635	1.066603	0.452265
COIN	2.066793	2.335260	1.729348
DFS	1.636321	1.048650	0.477002
FIS	1.107967	0.856092	0.472124
FISV	0.879990	0.686881	0.360898
MA	1.770384	1.333871	0.695083
PYPL	1.333806	1.240807	0.911905
V	1.543535	1.167013	0.613165

TABLE 5: market return (respectively Nasdaq-NDX-,Standard and Poor500-GSPC- and Dow Jones-DJI)

```
-0.0684349963414482
-0.016676025954300615
-0.010184659419419755
```

3.3.2 Analysis

The examination of the previous prospectuses shows a positive correlation of returns between all the sample companies with the three cryptocurrencies. On the other hand, there is no clear difference between the companies that deal with cryptocurrencies with the others, which ranges from 0.1 to 0.3.

The reason could be found in the fact that all the companies sampled are directly involved in ongoing projects (Mastercard, Discover Financial Service and Visa). There is also a lack of correlation between Fiserv, which contrasts with the fact that it operates with cryptocurrency payments. So, this may depend on external variables not considered.

The most correlated company turned out to be Coinbase precisely because of the greater involvement in the world of digital assets.

The anomaly is because this company immediately began to operate with a vision of a future in which cryptocurrency and blockchain are integrated into everyday consumer-facing financial services. In fact, most of their reserves are crypto or digital assets, thus making the value of the enterprise linked and influenced by the value of cryptocurrencies.

Concerning risk and return analysis, in the last quarter, companies that do not yet operate in cryptocurrencies have had better and less risky returns, unlike the others. In fact, even from the analysis of the beta, it emerges that Visa, Mastercard, D.F.S. and American Express, all companies that do not operate with cryptocurrencies, have recorded an increase in performance in a context in which the economy, represented by market indices, slowed down. Among companies that operate with cryptocurrencies, on the other hand, the decrease in Fis and Fiserv can be explained in the general context of the performance of the economy. Otherwise, for PayPal and Coinbase, there are sharp reductions in market value. This result may have been affected by the constant fall in the prices of cryptocurrencies. It could be the motivation behind Coinbase's negative performance, which is particularly correlated with criptocurrencies performance. In part, this may have also affected the performance of PayPal, which is correlated with Bitcoin and Ethereum.

However, the best performances are recorded for American Express and Mastercard.

In conclusion, the superior performance recorded for American Express, Mastercard, D.F.S. and Visa could indicate that the market, so far, rewards companies that have more cautious positions towards cryptocurrencies.

At the same time, the lack of difference between correlations and their relatively low values indicates that companies that generally operate in the payments sector are facing an initial phase in which a strong link with cryptocurrencies has not yet been created while maintaining the same level of progress.

3.3.3 Opereting performance: methodology and calculation

To analyse the operating performance, I selected the data relating to the volumes of transactions

carried out by the sample companies, as this can represent an indicator of the intensification or decline of financial relationships within a network. The reference period considered is the period 2019-2022. The starting year was chosen to understand the trends over a more extended period, mostly considering the imbalances caused by the Covid 19 pandemic dating back to the beginning of the year 2020. This choice was made to isolate common exogenous factors capable of altering the study.

The data was extrapolated from the annual financial statements published on each company's website. Below is the summary of each company for each year taken into consideration; the data refer to the transactions growth trends made with debit cards, credit cards or other methods**,** and the total transactions volume expressed in billions.

The comparison between each quarter with that of the previous year was also carried out to identify and isolate seasonal factors. Finally, the change in transaction volumes was also calculated as a percentage.

I specify that, with regard to 2021, as of February 14, 2022 the date of the last survey, the 10K models of some companies (DFS, American Express and FIS) have not yet been published. So, I used the 2021 quarterly presentations to look for the information.

In addition, Coinbase can be the partial subject of this analysis as it was only listed on the stock exchange in April 2021.

American Express[174]:

- **Transactions volume (billions of dollars) and growth trend Y2019**

1 Q 2019	2 Q 2019	3 Q 2019	4 Q 2019	Total
6,2	**6,6**	**6,6**	**6,8**	**26,17**

- **Transactions volume (billions of dollars) and growth trend Y2020**

1 Q 2020	2 Q 2020	3 Q 2020	4 Q 2020	Total
5,8 (-5%)	**4,0 (-38%)**	**5,0 (-24%)**	**5,5 (-19%)**	**20,40 (-22%)**

- **Transactions volume (billions of dollars) and growth trend Y2021**

1 Q 2021	2 Q 2021	3 Q 2021	4 Q 2021	Total
5,2 (+5%)	**6,3 (+56%)**	**6,7 (+33%)**	**7,5(+36%)**	**25,72 (+26%)**

[174] Dati estrapolati dal sito https://www.americaexpress.com

Discover Financial Service[175]:

- **Transactions volume (billions of dollars) and growth trend Y2019**

1 Q 2019	2 Q 2019	3 Q 2019	4 Q 2019	Total
0,72	**0,81**	**0,82**	**0,85**	**3,21**

- **Transactions volume (billions of dollars) and growth trend Y2020**

1 Q 2020	2 Q 2020	3 Q 2020	4 Q 2020	Total
0,74(+2%)	**0,67(-17%)**	**0,80(-3%)**	**0,86(+1%)**	**3,07 (-4%)**

- **Transactions volume (billions of dollars) and growth trend Y2021**

1 Q 2021	2 Q 2021	3 Q 2021	4 Q 2021	Total
0,82(+10%)	**0,99(+48%)**	**1,05(+30%)**	**1,10(+28%)**	**3,96 (+29%)**

Mastercard[176]:

- **Transactions volume (billions of dollars) and growth trend Y2019**

1 Q 2019	2 Q 2019	3 Q 2019	4 Q 2019	Total
4,79	**5,10**	**5,47**	**5,49**	**20,85**

- **Transactions volume (billions of dollars) and growth trend Y2020**

1 Q 2020	2 Q 2020	3 Q 2020	4 Q 2020	Total
5,1(6%)	**4,01(-21%)**	**4,79(-12%)**	**4,99(-9%)**	**18,9 (-9%)**

- **Transactions volume (billions of dollars) and growth trend ANNO 2021**

1 Q 2021	2 Q 2021	3 Q 2021	4 Q 2021	Total
5,08(-0,3%)	**5,74(+43%)**	**6,26(+31%)**	**6,53(+31%)**	**23,62(+25%)**

[175] Data source https://www.discover.com
[176] Data source https://www.mastercard.com

Visa[177]:

- **Transactions (billions of dollars) volume and growth trend Y2019**

1 Q 2019	2 Q 2019	3 Q 2019	4 Q 2019	Total
6,64	**7,04**	**7,48**	**7,44**	**28,61**

- **Transactions volume (billions of dollars) and growth trend Y2020**

1 Q 2020	2 Q 2020	3 Q 2020	4 Q 2020	Total
7,17(7%)	**6,04(-14%)**	**6,44(-13%)**	**7,16(-4%)**	**26,80(-6%)**

- **Transactions volume (billions of dollars) and growth trend Y2021**

1 Q 2021	2 Q 2021	3 Q 2021	4 Q 2021	Total
7,33(+2%)	**7,85(+30%)**	**8,46 (+31%)**	**8,98(+25%)**	**32,62(+21%)**

Pay-Pal[178]

- **Transactions volume (billions of dollars) and growth trend Y2019**

1 Q 2019	2 Q 2019	3 Q 2019	4 Q 2019	Total
3,73	**3,87**	**3,95**	**4,53**	**16,10**

- **Transactions volume(billions of dollars) and growth trend Y2020**

1 Q 2020	2 Q 2020	3 Q 2020	4 Q 2020	Total
4,21 (+13%)	**4,94 (+28%)**	**5,07 (+28%)**	**5,68 (+25%)**	**19,91 (+24%)**

- **Transactions volume (billions of dollars) and growth trend Y2021**

1 Q 2021	2 Q 2021	3 Q 2021	4 Q 2021	Total
5,62 (+33%)	**5,79 (+17%)**	**5,60 (+10%)**	**6,37 (+12%)**	**23,40 (+17%)**

[177] Data source https://www.visa.com
[178] Data source https://www.paipal.com

Fiserv[179]

- **Transactions volume (billions of dollars) and growth trend Y2019**

1 Q 2019	2 Q 2019	3 Q 2019	4 Q 2019	Total
0,89	**0,90**	**2,16**	**2,87**	**6,86**

- **Transactions volume (billions of dollars) and growth trend Y2020**

1 Q 2020	2 Q 2020	3 Q 2020	4 Q 2020	Total
2,65 (+197%)	**2,46 (+173%)**	**2,73 (+26%)**	**2,69 (-6%)**	**10,53 (+53%)**

- **Transactions volume (billions of dollars) and growth trend Y2021**

1 Q 2021	2 Q 2021	3 Q 2021	4 Q 2021	Total
2,64 (-0.3%)	**2,94 (+19%)**	**2,97 (+8%)**	**2,98 (+11%)**	**11,53 (+9%)**

FIS[180]

- **Transactions volume (billions of dollars) and growth trend Y2019**

1 Q 2019	2 Q 2019	3 Q 2019	4 Q 2019	Total
1,37	**1,40**	**2,08**	**2,40**	**7,36**

- **Transactions volume (billions of dollars) and growth trend Y2020**

1 Q 2020	2 Q 2020	3 Q 2020	4 Q 2020	Total
2,36 (+72%)	**2,23 (+59%)**	**2,49 (+18%)**	**2,50 (+4%)**	**9,59 (+30%)**

- **Transactions volume (billions of dollars) and growth trend Y2021**

1 Q 2021	2 Q 2021	3 Q 2021	4 Q 2021	Total
2,48 (+5%)	**2,69 (+20%)**	**2,69 (+8%)**	**N.A.***	**7,86 (+11%)***

*the total refers to the first three quarters as at 14 February 2022 the reports were not published

[179] Data source https:www.fiserv.com
[180] Data source https:www.fis.com

Coinbase[181]

- **Transactions volume (billions of dollars) and growth trend Y2020**

1 Q 2020	2 Q 2020	3 Q 2020	4 Q 2020	Total
0,17	**0,17**	**0,27**	**N.A.***	**N.A.***

*the total refers to the first three quarters as at 14 February 2022 the reports were not published

- **Transactions volume (billions of dollars) and growth trend Y2021**

1 Q 2021	2 Q 2021	3 Q 2021	4 Q 2021	Total
1,54 (+806%)	**1,93 (+1035%)**	**1,09 (+304%)**	**N.A. ***	**N.A.***

*the total refers to the first three quarters as at 14 February 2022 the reports were not published

3.3.4 Analysis

A first view of the data shows that between January 1 2019, and December 31 2021, the volume of transactions increased for 7 of the 8 sample companies both on an annual and quarterly basis, and there is a general increase in transactions carried out. The only exception is American Express.

The examination also reveals the impact that the pandemic in the year 2020 has had on the volume of transactions. In particular, American Express in this year stood at -22% compared to the previous year, with the most significant decrease compared to the other sample companies.

In addition, the figure contrasts the companies that ended the year with lower performances, managing, however, to mitigate the losses (D. F. S.- 4%, Mastercard -9% - mainly driven by the decline in international transactions -, Visa -6%). The reason is that the Covid 19 pandemic has led to a great crisis in tourism and mobility in general. The emergence of variants, and the related restrictions imposed by governments, have weighed heavily on international travel. The general decline in travel demand has also dragged American Express into particular exposure to the airline end travel sector. For a generalized recovery of all companies that do not deal with cryptocurrencies, we must wait until 2021.

Different speech, however, must be made for PayPal, Fiserv and Fis, which, on the other hand, seem not to have been affected by the crisis resulting from the pandemic. For PayPal, the

[181] Data source https://investor.coinbase.com/

volume of transactions increased (+24%) in 2020, a trend that continued in 2021 with a further +17%. The reason could be found in the fact that, despite the restrictions, e-commerce has been one of the sectors that have expanded the most, also determining the increase in the volume of transactions.

In addition, it should also be noted that Pay-Pal was already historically structured for online payments, an activity that is particularly intensified.

On the other hand, particular considerations must be made for Fiserv and FIS, companies for which was recorded a growth in transaction volumes in 2020 that was purely higher than the average of the sample companies: +53% the first +30% the second.

In this regard, the information taken from the annual reports emerged that Fiserv, on July 29, 2019, formalized the acquisition of First-data, participating for about 65% in processing revenues.

Therefore, from this information, it emerges that even the 53% increase at the end of the year may not be considered a striking result because the realized merger inflates it. Therefore, it is possible to affirm that the pandemic's impact, like other companies, has also been suffered by Fiserv. An indicator is given by the 7% decrease recorded between the 1st and 2nd quarter of 2020 after the acquisition. After a temporary recovery (3rd quarter), we must wait for April 2021, a period from which a constant recovery begins that determines a close of the year with an increase in the volume of transactions equal to + 9% compared to the previous year.

In the years of reference, Fis has also had a path very similar to that of Fiserv, as, on July 31 2019, the acquisition of World Pay took place, contributing about 40% of revenues from transaction processing end services. However, even in this case, the data are inflated. Also, for this company, the Covid-19 impact emerges from a decline in volumes throughout the first half of 2020 despite the acquisition. Only then did a steady recovery begin, which stands at $.2.7 billion in revenues from transaction processing end services.

After the overview of the trends recorded overall in the world of payment systems, we can face the analysis of the possible role of cryptocurrencies on the recorded growth of transaction volumes. To understand this, we must focus on the year 2021 as both Fiserv and Fis have enabled payments with cryptocurrencies in the third quarter, while Pay-Pal in the fourth. Changes in transaction volumes between the second and third quarters and the third and fourth quarters of 2021 showed that companies that do not yet use cryptocurrencies detected the most significant changes. Among all, American Express stands out, whose higher values can also be explained by the greater decline suffered in 2020 and the slow recovery of the entertainment industry and airline & travel. In addition, it should be noted that the same companies that operate with cryptocurrencies, Pay-Pal, Fiserv and Fis, did not present more significant variations than their competitors in the period examined and reported values in line with those recorded in previous years.

In conclusion, even in this analysis, no results have emerged to support the thesis that implementing payment systems with cryptocurrencies determines an increase in transaction volumes within a network.

Finally, the last indicator to consider is that Coinbase, a company specialising in transactions with cryptocurrencies, has seen its volume increase exponentially from $ 0.61 billion recorded at the end of the 3rd quarter of 2020 to $ 4.56 billion the end of the 3rd quarter of 2021. It is a fact not to be underestimated because it indicates the current trend of using cryptocurrencies to make transactions. In fact, the trend recorded tends to increase but is strongly conditioned by the value of cryptocurrencies.

3.4 Ongoing projects

3.4.1 Facebook: libra association

Facebook introduced the Libra project for the first time on June 18, 2019, publishing the White Paper An Introduction to Libra. "*Libra's mission is to enable a simple global currency and financial infrastructure that empowers billions of people*." At the same time, Facebook announced that Calibra, a subsidiary in charge of developing an electronic wallet and financial services. The launch of this new cryptocurrency was initially scheduled for the first half of the year 2020, and the management remitted to the Libra Association, an independent non-profit organisation, to oversee the operation of the outgoing cryptocurrency. The goal identified by Mark Zuckerberg was to create a new decentralised blockchain, a low-volatility cryptocurrency and a platform for smart contracts that together could create new opportunities for the development and innovation of different financial services.

It aimed to collaborate with the financial sector, including regulators and experts from all branches of the economy, to ensure that a secure, sustainable and reliable framework could underpin this new system. The goal of the Libra Blockchain was to provide a solid foundation for building complex financial services, including a new global cryptocurrency, that could meet the financial needs of billions of people.

The two most important requirements that blockchain will have to meet are:

• High scalability to ensure a high number of low-latency transactions.

• High level of security to ensure the protection of funds and sensitive information.

Compared to standard blockchains, such as Bitcoin and Ethereum, Libra will be a "permissioned" blockchain meaning that the validator nodes will be chosen with prior authorisation. On the other hand, anyone with the requirements can participate in the validation process (table).

The ultimate goal of Libra will, in any case, be to become permissionless within five years of launch.

Features	Permissioned (Libra)	Permissionless (Bitcoin and Ethereum)
Access	Only to approved members	Open and transparent
Performance	Fast	Slow
Transaction costs	Low	High
Scalability	Potentially unlimited	Limited
Identità	Note	Unknown or partially obscured
Trust	Trusted environment	Trust-free

Chart: Permissioned vs Permissionless blockchain.

3.4.2 Funding members

Initially, in addition to Facebook, there were 27 Founding Members, the companies that chose to support the project.

- Companies operating in the financial sector and in the management of payments:
  - MasterCard
  - PayPal
  - PayU
  - Stipe
  - Visa

FIGURE 13

(*In red are marked the partners who over time have abandoned the project*)

- Aziende operating in the technology and marketplace sector:
  - Booking Holdings
  - eBay
  - Facebook Calibra
  - Farfetch
  - Lift
  - Mercado Pago
  - Spotify
  - Uber

- Companies operating in the telecommunications sector:
  - Iliad

- Vodafone

- Companies operating in the blockchain sector:
  - Anchorage
  - Bison Trails
  - Coinbase
  - Xapo

- Companies operating in the field of investments and capital management:
  - Andreessen Horowitz
  - Breakthrough Initiatives
  - Ribbit Capital
  - Thrive Capital

- Non-profit and multilateral organizations, academic institutions that operate:
  - Creative Destruction Lab
  - Nice
  - Mercy Corps
  - Women's World BanKing

Facebook and its partners intended to make this cryptocurrency a reliable and universally accessible tool for payments or economic transactions, therefore for moving money between users and making online purchases through already existing platforms, Facebook, Instagram, and WhatsApp. It could also be used for real-world retail purchases[182].

Subsequently, on July 16 and October 23, 2019, the banking and finance committees of the U.S. House of Representatives and Senate held two hearings, respectively with David Marcus, CEO

[182] Jamal Bouoiyour, Refk Selmi "Beyond the Big Challenges facing Facebook's Libra" October 9 2019.

of Calibra, and Mark Zuckerberg, CEO and founder of Facebook, on Facebook's introduction of the Libra cryptocurrency.

In his hearing, Marcus immediately framed the geopolitical scope of the introduction of Libra: "*I believe that if America does not lead innovation in the field of digital currencies and payments, others will, and we may soon see a virtual currency controlled by other interests and other values*." Zuckerberg was even more explicit: "*China is launching a similar idea. Libra will be pegged primarily to the dollar, and I believe it will be able to extend American financial leadership in the world, as well as our values*[183]."

Marcus and Zuckerberg define Libra as a tool of U.S. hegemony in the fight with China to manage digital payments. In fact, China was already on the way to launching its sovereign cryptocurrency, and the central banks of Sweden, England, France, Singapore and Canada had similar plans[184].

The nascent cryptocurrency would be backed by bank deposits and government bonds in central bank currencies in order to ensure the stability of its value and avoid the fluctuations typical of other cryptocurrencies[185]. Libra would have been stabilized by the Libra Reserve, a dedicated body and, contrary to what happens in other stablecoins, not linked to a single asset but to the main national currencies.

Transactions are entrusted exclusively by "validators", "Founding Members", the only ones authorized to modify the system database. All other users would be granted read-only access to the database. The validators would have been exclusively members of the Libra Association, which was renamed Diem Association on December 1, 2020, which manages both the network and the reserves of the system[186]. This architecture, over time, would have been subject to changes to allow the opening to all those in possession of this cryptocurrency[187]. The programs defined on the Libra blockchain are called Move bytecode, and the transaction fee due to validators by customers, whose unit of measurement is called a gas fee, is anchored, as for Bitcoin, to the computing power used to carry out the transaction itself.

In view of the immediate sovereignty risk posed by the creation of Libra, Central Banks quickly took obvious positions against the project and asked many questions to the project manager focusing on regulatory aspects and national sovereignty[188]. Facebook was forced to radically change

[183] Speech reported by M.Pennisi on October 24, 2019 by M. Pennisi on "*Libra, six important things Zuckerberg said to the U.S. Congress*"
[184] G. L. Greek "*Virtual currencies and complementary currencies, between technological development and regulatory uncertainties"* on "Rivista di diritto bancario January/March 2019".
[185] L. Abraham and D. Guègan "*The other side of the Coin: Risks of the Libra Blockchain*" January 27 2020.
[186] Press release of the Libra Association May 14, 2020 on diem.com.
[187] L. Abraham and D. Guègan "*The other side of the Coin: Risks of the Libra Blockchain*" January 27 2020.
[188] L. Abraham and D. Guègan "*The other side of the Coin: Risks of the Libra Blockchain*" January 27 2020.

the architecture of this currency, given opposition from governments and regulators, which raised concerns about the new currency's ability to alter financial stability and erode the main power over money. Moreover, The U.S. Congress considered that the risks associated with the introduction of a private currency by a Giant of the Web were too high not to intervene, despite Libra's professed commitment to serve the values and interests of the United States[189]. And in the months following the presentation of the launch (the year 2019), some of the organizations that had initially supported Libra pulled back (Visa, Vodafone, eBay, Stripe, PayPal, Booking Holdings and Mercado Pago).

From a global currency and infrastructure, Libra had to be restructured into five currencies, each pegged to a different sovereign currency: dollar, yen, Swiss franc, pound, euro. To this end, the Association turns to a Swiss Authority to obtain authorization to issue a series of stablecoins supported by individual traditional currencies and a token-based on stablecoins pegged to the currency. An authority that has never issued authorizations in this regard.

3.4.3 Diem Dollar

In November 2020, a further downsizing happened when the launch of the Libra cryptocurrency with the support of the dollar alone was announced. The name changed: the structure that manages the project, the Libra Association, will now be known as **the Diem Association,** based in Geneva**,** and the currency will be called **Diem Dollar.** The idea of issuing a series of stablecoins backed by individual traditional currencies is also postponed to a later date. It was expected to debut in January 2021.

The reason for the rebranding is to be found in a manifestation of autonomy and independence from Facebook with the aim of convincing the regulatory authorities, who had blocked the Libra project in the bud, to approve Diem.

Central banks and other authorities on a global scale are always concerned about the possibility of financial instability, erosion of monetary policy, privacy risks and possible money laundering scandals. Obstacles that did not even promote Diem.

According to the Wall Street Journal and the Financial Times, assets held by Facebook could end up in the hands of Silvergate Bank[190]. As Cristian Catalini, chief economist at Diem, said,

[189] www.sciencedirect.com J. Taskinsoy "Facebook's Project Libra: Will Libra Sputter Out or Spur Central Banks to Introduce Their Own Unique Cryptocurrency Projects?", May 15 2019.

[190] https://www.ansa.it/sito/notizie/tecnologia/tlc/2022/01/27/facebook-abbandona-ambizioni-pagamenti-digitali-chiude-diem "*Facebook abandons digital payment ambitions, closes Diem*", January 27, 2022.

"Facebook's *Diem stablecoin project, in the new version no longer in conflict with institutions, is available to central banks to implement their digital currency (CBDC) projects"*.

3.4.4 Mastercard Project

Mastercard is a global technology company in the payments industry. Its "*mission is to connect and power an inclusive, digital economy that benefits everyone, everywhere by making transactions safe, simple, smart and accessible…. With connections across more than 210 countries and territories, we are building a sustainable world that unlocks priceless possibilities for all.*"[191].

A global pioneer in payment innovation and technology connecting billions of consumers, issuers, merchants, governments & businesses, already has been engaging with the digital currency ecosystem since 2015. Il 27 giugno 2021 ha annunciato un nuovo programma di criptovaluta e blockchain per le startup globali, dal nome **Start Path**[192] , dedicato al supporto di asset digitali, blockchain e società di criptovaluta in rapida crescita . On June 27, 2021, it announced a new cryptocurrency and blockchain program for global startups named Start Path, dedicated to supporting digital assets, blockchain, and fast-growing cryptocurrency companies. With the collaboration of seven global cryptocurrency startups (GK8, Domain Money, Mintable, SupraOracles, STACS, Taurus, and Uphold), a market for non-fungible tokens (NFTs) is being created, as well as the construction of a cold vault to enable new sustainable digital assets. They are trying"*to expand and accelerate innovation around digital asset technology and make it safer and easier for people and institutions to buy, spend and hold cryptocurrencies and digital assets*".

Among the participants in the program, there is:

· GK8, an institutional cryptographic custody platform created in Israel that can create, sign and send secure blockchain transactions without receiving input from the Internet, thereby eliminating any potential cyber-attack vector;

· Domain Money (USA) tasked with building a next-generation investment platform, bridging the gap between digital assets and traditional finance for retail investors;

· Mintable[193], a Singaporean non-fungible token market (NFT) whose platform is packed with new features designed to allow ordinary people to get involved in NFTs without any prior knowledge of encryption or encryption;

[191] https://www.mastercard.com.

[192] https://www.mastercard.com/global/en.html.

[193] Through the platform Mintable, non-fungible token market (NFT), users can create, buy, and sell blockchain-backed digital and physical assets such as digital collectables, cutting-edge artwork, and even music.

· SupraOracles (Switzerland) is a leader in building blockchain systems to be made available to companies to connect real-world data to public and private chains. They specialize in building interoperable smart contracts to automate, simplify and protect the future of financial markets;
· STACS, another Singapore-based company, which provides blockchain infrastructure for the financial sector "*to unlock tremendous value and enable effective, sustainable financing"; "brings together business lifecycle management and reconciliation, post-trade automation and ESG finance in a single, interoperable DLT-based platform at the industry level.*[194]" Currently, customers and partners are small and large global banks, national stock exchanges, asset managers and companies;
· Taurus Software, based in Lugano (Switzerland), is a leading company in the field of software that manages any digital asset with a single platform: crypto assets, digital currencies and tokenized assets. The platform can manage issuance, custody, asset maintenance and trading;
· Uphold (USA) is a crypto multi-asset digital currency platform that offers payment and investment services to consumers and businesses worldwide. The platform it offers specializes in Uphold's "Anything-to-Anything" trading and allows clients to trade directly between asset classes with embedded payments, facilitating a future where everyone has access to financial services.

All startups participating in the new Start Path program, crypto, digital asset and blockchain companies aim to provide protection and security to consumers by addressing and resolving several weaknesses in the system, including asset tokenization, data accuracy, digital security, and seamless access between the traditional and digital economies. Mirano "*to forge the future of cryptocurrency, and we're doing that by bridging mainstream financial principles with digital assets innovations*"[195].

3.2.5 VISA project

Visa is also developing a particular kind of smart contract that aims to create a universal hab that allows making transfers of value even on different blockchains, thus allowing to make payments and transfers of digital assets between different protocols and wallets, whether they are cryptocurrencies, stablecoins or CBDC (Central Bank Digital Currency)[196]. The elaboration of the project began in 2018 and focused on emerging technologies to develop a framework for interoperability that would work on different blockchain networks and be independent of the underlying blockchain mechanisms. In the official announcement made in September 2021, there is

[194] www.stacs.io.
[195] Thus, Yes is expressed Jess Turner, executive vice president of New Digital Infrastructure and Fintech "*Mastercard. A global payment technology solutions company*", https://www.mastercard.com.
[196] https://usa.visa.com, 29/09/2021

talk of a "**Universal Payment Channel**", an interoperability system between blockchains, but no information is provided on any partners.

The announcement reads: "*Imagine sharing a check with friends, when everyone uses a different type of money – some a CDBC like the Swedish eKrona, others a private stablecoin like USDC. It may very well be a reality in the not too distant future. Ultimately, the UPC solution aims to act as a network of blockchain networks, adding value to multiple forms of money movement, regardless of whether they come from the Visa network or other networks*."

Visa is trying to make a universal payment channel. Therefore, it will be necessary to solve the problem of cross-chain interoperability that mainly concerns CBDCs to do this project.

FIGURE 14

In recent years, central banks worldwide have shown, as highlighted in the previous chapter, a growing interest in developing CBDC, that is, a new form of digital currency of Central Banks that can be used directly by consumers, traders, companies and financial institutions. Necessarily they will have to consider factors such as governance, market requirements, technology providers, compliance standards and specific priorities to be pursued dictated by the reference nations. Suppose CBDCs are also put into use alongside cryptocurrencies. In that case, the possibility of making and

receiving payments will have to be created, regardless of the currency, channel or platform used by consumers, businesses and merchants.

In this context, Visa's UPC concept comes into play: to create a single network capable of dialoguing with any blockchain network by establishing dedicated payment channels, either to connect CBDC networks between countries or to connect CBDC networks with controlled private stablecoin networks.

The study of the project also includes implications for the speed of transactions in digital currencies to handle tens of thousands of transactions per second (today, some of the largest existing blockchain networks can handle only a fraction of these volumes).

Smart contracts will guarantee the system's high speed, security, and reliability. "*While UPC would exist in the background for most users, it would provide the kind of cross-chain interoperability that makes CBDC useful and attractive to consumers and businesses globally.*[197]"

3.2.6 I.B.M.

In April 2019, IBM announced the launch of a new global payment network that supports payment and currency exchange services in more than 50 countries through the use of the **Stellar Protocol**: Blockchain World Wire.

"*By creating a network where financial institutions support multiple digital assets, we expect to create innovation and improve financial inclusion services around the world*"[198].

For the first time, public blockchain technology is being used to manage cross-border payments. These are transactions that involve the purchase or sale of financial instruments traded in different markets.

With traditional systems, transactions between different currencies necessarily involve numerous intermediaries and are expensive and laborious.

Using IBM's blockchain, it is possible to improve efficiency and reduce transaction costs for businesses and consumers. "IBM's *new solution not only promises to speed up the process but above all to withstand any kind of tampering. It also integrates a Liquidation and Clearing system, i.e. the settlement of transactions concerning financial instruments stipulated on different markets*"[199].

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[197] https://usa.visa.com/visa-everywhere/blog/bdp/2021/09/29/making-digital-currency-1632954547520.html

[198] https://www.ibm.com/support/pages/ibm-blockchain-world-wire-revolutionize-cross-border-payments, "*IBM Blockchain World Wire revolutionizes cross-border payments*".

[199] https://www.ibm.com/support/pages/ibm-blockchain-world-wire-revolutionize-cross-border-payments, "IBM Blockchain World Wire revolutionizes cross-border payments.

The system is capable of carrying out transactions between cryptocurrencies and fiat currencies. However, in the future, it will also contemplate digital coins issued by central banks, securities, bonds and structured financial assets and can reduce the validation time of operations from days to seconds. Initially, 11 banking and financial institutions were involved in the project:

- Bank Danamon Indonesia,
- Bank Mandiri, Bank Negra Indonesia,
- Bank Permata,
- Bank Rakyat Indonesia,
- Mizuho Financial Group,
- National Australia Bank,
- TD Bank, Wizdraw (HK) of WorldCom Finance.

FIGURE 15

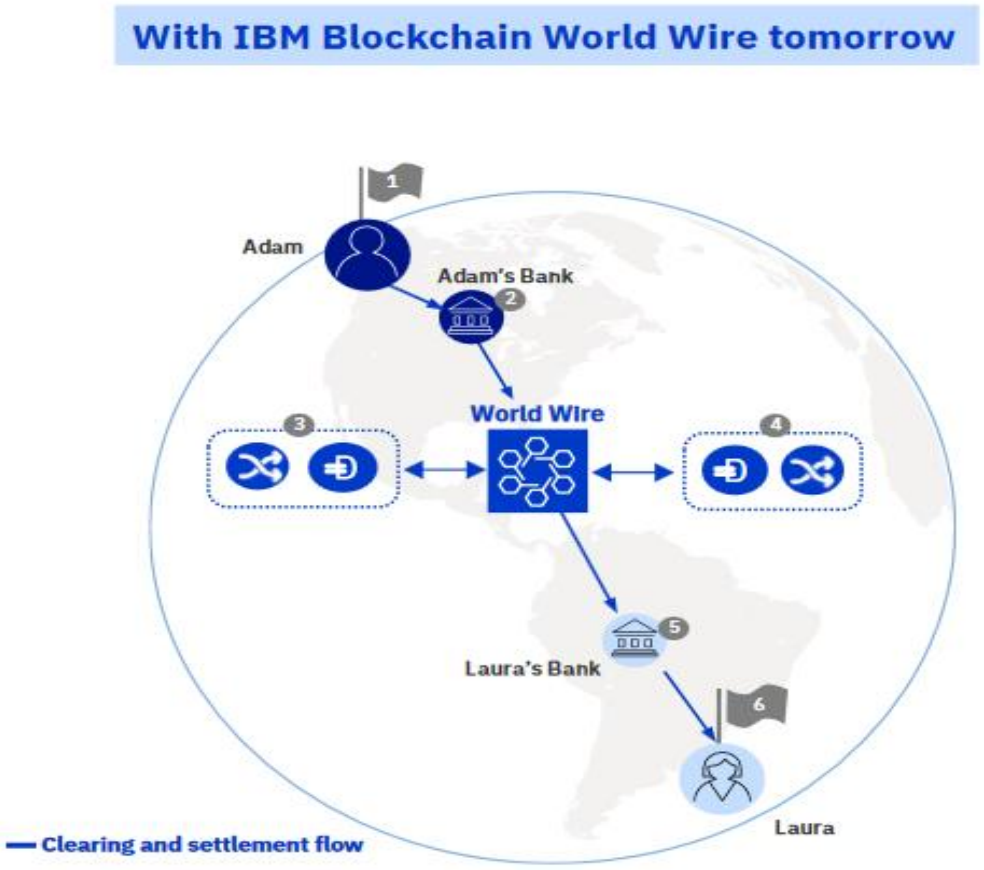
source

I.B.M.

Today, however, World Wire allows making payments in 72 countries, using 47 different currencies and 44 endpoints to revolutionize the payment method between banks using Stable Digital Currencies (exchangeable with a ratio of 1 to 1 with traditional currencies).

The blockchain in question, in addition to carrying out transactions in real-time, also allows it to be used differently: to record the agreement of a contract between two parties, to manage commercial documentation, to issue credit securities credit cards in a comfortable and secure environment. It is one of the many applications of the blockchain that we are trying to carry out at this propitious moment for the technology.

FIGURE 16



source I.B.M.

CONCLUSIONS

ARE CRYPTOCURRENCIES ALREADY INFLUENCING THE REAL ECONOMY?

The last two years have seen an exponential increase in the popularity of cryptocurrencies. However, considering that they are characterized by very advanced technology, the public has had difficulty in framing their nature and how to use them. Initially, on the one hand, cryptocurrencies were presented as a threat by traditional financial institutions that advised against the use of such instruments because of the high volatility.

From another point of view, however, cryptocurrencies were considered a tool to free themselves from political and financial Central Authorities and allow those who did not have access to financial services to provide for their needs independently.

In reality, cryptocurrencies are digital assets, such as N.F.T. which, precisely because they can be divided, have been assimilated to money and therefore structured in such a way as to assume even the most typical characteristics: store of value, unit of account and payment instrument.

A digital asset is a form of "digital property" that, thanks to the blockchain protocol, cannot be counterfeited and, in case of transfer, there is no need for a third-party guarantor to participate in the transaction, as the protocol guarantees the same. Such platforms work if there is participation in the network; therefore, they are structured in such a way as to reward the first participants with the issuance of a new digital asset that can be either a cryptocurrency or a N.F.T. For example, Bitcoin protocol is structured so that miners receive, in addition to receiving a commission when validating a transaction, a fraction of the new bitcoin created by the system.

It is expected that this last reward will end up when it reaches the issuance of 21 million bitcoins.

With the evolution of this new digital tool's consideration and the rapid progress of technology, the awareness of the possibility of having an alternative, and therefore complementary, instrument to legal currencies has been created.

However, this concept for society is not new because in various parts of the world and various historical periods and different triggers events, it already existed through social currencies.

The latter's foundation is "solidarity" and the close connection between money, land and work. This currency creates a benefit for geographically circumscribed local communities by representing an alternative form of purchasing power. Characteristic is always the presence of a reference community that recognizes and accepts it as a means of payment.

At the same time, we can say that cryptocurrencies are also born and proliferated thanks to a community that uses the reference network. While the social currency community is geographically circumscribed, the cryptocurrency community has a potentially global extension as it uses a technological tool that hypothetically is able to reach any part of the world: it travels on a widely used internet network.

Moreover, whenever an alternative or complementary currency to the official ones is used, we are witnessing the creation of an economy capable of stimulating productivity in the markets.

If on the one hand it can be hypothesized for the future the use of a blockchain platform by the social currencies of future minting to expand their geographical horizons, on the other hand, it is an already consolidated reality the birth of numerous initiatives that link ESG objectives to the rewards of the blockchain protocol through smart contracts.

Like indipendent private entities, Central banks have also begun to design alternative legal digital currencies: Central Bank Digital Currencies (CBDC).

In this context, my study is inserted in which I tried to understand how much cryptocurrencies currently impact the real economy and if the benefits of this innovation are already evident. It is necessary to adopt, to quantify the aforementioned benefits, an economic perspective, which is also fundamental for the sustainability of any innovation, and a perspective that deepens the topic in E.S.G. terms since they have become a factor no longer secondary in the evaluation of any economic activity.

The analysis carried out and the E.S.G. risk ratings attributed to the companies' categories that deal exclusively with services related to payments did not reveal significant differences as both fall within the same E.S.G. (low) risk class. They differ, however, from credit institutions that, because of the complexity of the financial services they offer, have an E.S.G. medium risk score.

It could lead to a general greater sustainability of the payments sector. But, on the other hand, greater sustainability of companies that also deal with cryptocurrencies has not emerged, neither overall, nor social nor environmental.

In fact, there was a significant amount of unmanaged risk in both factors.

To understand the impact of these new payment instruments is necessary to analyze the volume of trades made with the latter to purchase goods or services (real or digital).

Research has shown that these volumes are not yet so large that they can clearly be distinguishable from other types of transactions such as currency exchange (which makes up most of the transaction volume of cryptocurrencies). However, both the interest of major lenders in the subject has also been noted and the growing number of businesses that accept cryptocurrencies. From these findings, I concluded that the phenomenon is still too young to be studied directly. So I hypothesized that the benefits of spreading a cryptocurrency mentioned above could emerge, albeit marginally,

from the performance and disclosures of companies operating in financial services firms given their increasing involvement in blockchain platform development projects.

More precisely, the electronic payments sector was chosen because, compared to other companies that offer financial services such as banks, they have their own core business focused on efficiency in the money movement process and, therefore, a more detailed description of the revenues and costs related to transactions. While it is true that almost all industry participants are involved in this innovation, the approaches have been different. In fact, on the one hand, some immediately tried to integrate it into their operations; on the other, some have been more prudent and are developing these projects outside their own brand.

Choosing the sample of eight companies, American Express, Discover Financial Service, Mastercard, Visa, Fiserv, F.I.S., PayPal and Coinbase, I started the analysis from the information on market prices.

In the period 01/11/2021 and 09/02/2022, I calculated the percentage return, variance, correlation and beta with the main cryptocurrencies (Bitcoin, Ethereum and Litecoin) and market indices. From this analysis, it emerged that companies that have not adopted cryptocurrencies had achieved better performance than those who operate in cryptocurrencies and compared to the market indexes.

For the period 01/01/2019 and 31/12/2021, it was then carried out an in-depth analysis of the operations of these companies, paying particular attention to the last half of 2021. From the information reported in the annual and quarterly reports on returns, the revenues from processing and services were also studied. A growing trend in the volumes of electronic transactions has emerged, despite the slowdown imposed on the economy by Covid 19 in the year 2020. The most remarkable growth was recorded by PayPal, probably due to its more significant online presence. However, the information obtained in the last half of the year did not reveal a greater growth in revenues from processing end services for companies that have adopted cryptocurrencies. In addition, it was noted that two of the companies that have enabled payments with cryptocurrencies, Fis and Fiserv, have made acquisitions in the last three years to increase their competitiveness and accelerate the implementation of new technologies such as blockchain by highlighting a tendency in the sector to concentrate.

The work closes with an overview of the ongoing projects. The first taken into consideration is the one announced by Facebook carried out by the Libra association, a revolutionary project that has alarmed many Central Banks and many government authorities in America, Europe and Asia.

The initial intent was to make the outgoing cryptocurrency, Libra, a reliable and universally accessible tool for payments or economic transactions, therefore for moving money between users, but also to make online purchases through already existing platforms, Facebook, Instagram and

WhatsApp, or retail purchases in the real world. It would be backed by bank deposits and government bonds in central bank currencies in order to ensure the stability of its value and avoid the fluctuations typical of other cryptocurrencies. As a result of the obstacles encountered, the idea was scaled down and in 2020, transformed into Diem Dollar with the support of the dollar alone. Recently, in January 2022, Facebook's Diem stablecoin project was made available to central banks to implement their digital currency (CBDC) projects as it was sold to Silvergate Bank.

On June 27, 2021, Mastercard also announced a new cryptocurrency and blockchain program for global startups, called Start Path, aimed at making it safer and more accessible for people and institutions to buy, spend, and hold cryptocurrencies and digital assets.

On the other hand, in September 2021, Visa announced that it is developing a particular type of smart contract that aims to create a universal hab that allows making transfers of value even on different blockchains: Universal Payment Channel. The idea is to create a universal payment channel, although, to make this project current, will be necessary to solve the problem of cross-chain interoperability that mainly concerns CBDCs.

The I.B.M., since April 2019, has announced the launch of a new global payment network to support payment and currency exchange services in over 50 countries thanks to the use of the Stellar Protocol: Blockchain World Wire. It is a network where financial institutions support multiple digital assets. For the first time, public blockchain technology is being used for the management of cross-border payments, i.e. transactions involving the purchase or sale of financial instruments traded in different markets.

It is easy, therefore, to imagine, mainly in light of the extraordinary increase in the volumes of transactions in cryptocurrencies recorded by Coinbese between 2020 and 2021, that soon, there will be universal payment systems that will travel through platforms that will allow the exchange of both private and legal digital coins.

The evolution of cryptocurrencies lies precisely in this: initially considered alternative private currencies to those issued by Central Authorities, in the near future, they will constitute alternative currency like those issued directly by Central Banks and with which, through unified platforms, it will be possible to make not only monetary exchanges but also purchases and payments in the real economy. Moreover, solved the problem of stability through stablecoins, linked to individual fiat currencies or a basket of them, they will no longer have that high volatility that did not allow cryptocurrencies to be recognised as units of account.

Morover, private individuals, who are already structured to guarantee online payment systems, will intensify, as we have seen through the overview of ongoing projects, increasingly their activity including fiat currencies or cryptocurrencies and therefore achieving maximum social inclusion, chased by banks not always successfully.

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