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"Cryptocurrencies vs Regulations: an Analysis of Legal Challenges and Future Perspectives"

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Introduction

Over the past decade, in the period following the 2008 Financial Crisis, technological innovation has played a fundamental role in the remodeling of the financialized economy. Such innovation came in the form of advanced mathematical algorithms, codes, enhanced cryptography tools, and disruptive decentralized platforms. These developments are expected to furtherly expand and are already challenging the current business models, the banking system, and the global legal framework. Cryptocurrencies and Blockchain technology are leading a transformation in the way in which agents invest and consume by implementing a de-bureaucratization of the banking and financing processes, creating new disruptive patterns that regulate the money supply. Discussions about these assets have become extremely popular topics among investors, governments, and the media. Anyways, new waves of opportunities and possibilities come with new fields of complex problems as well.

The decentralized and anonymous nature of cryptocurrencies and blockchains poses massive obstacles to the implementation of regulations and supervision activities. Anyhow, the enthusiasm shown by markets and entrepreneurs is pushing legislators to seriously tackle the current unregulated status of these digital tools. The future developments on the matter are not certain as the intrinsic features of the innovations impede a fast and smooth development of rules. The paper aims to explore the complex relationship between regulations and these new technologies, emphasizing the divergences between the two and the difficulties in the creation of a suitable and complete legal framework. Thus, the research has the goal of exploring the different possible future scenarios of cryptocurrencies and blockchains, trying to establish whether legislations will disclose favorable regulations to support the development of these innovations, will hamper their spread or will remain neutral.

Such an analysis will be developed firstly by understanding the workings of cryptocurrencies and blockchains, underlining the unique features of the technologies and the differences with the traditional organizations and tools. Afterward, the risks embodied by cryptocurrencies, such as wild volatility, criminal activities, and hackers' attacks, will be presented and discussed to show the dangers users might be exposed to and the consequent need for legal protection. The benefits of the blockchains and the ways in which their implementation is ameliorating data collection and supply chain tracking will be investigated as well. After that, a legal assessment of these new objects will be performed to underline the criticalities impeding a clear and immediate regulation. In particular, the paper will focus on the difficulty of defining and classifying cryptocurrencies in any of the already existing categories. In fact, cryptocurrencies result in having many features in common with commodities, securities and money, but do not perfectly fit any of the classifications. To have a

practical idea of the current regulatory gap on the matter, the attitudes of major jurisdictions, such as the European Union, the United States of America, and China, will be highlighted to analyze how some of the most influential countries are dealing with the issue. Lastly, predictions on the development of cryptocurrencies and blockchains will be presented, considering environmental concerns, legal theories, and practical applications of the technologies that are currently being tested on the market.

Chapter 1: The Digital Financial Age

1.1 Cryptocurrencies & Blockchains

The most renewed cryptocurrency is the Bitcoin that was firstly mentioned in a white paper published in November 2008 by Satoshi Nakamoto. Bitcoin was introduced as the first electronic payment system founded on a decentralized peer-to-peer network, without the need for a trusted third party. In such a new system, the traditional trusted third party in a transaction, such as a bank, is substituted by anonymous users who verify the trustworthiness and accuracy of the transactions over the internet. Thus, the process that was previously performed by institutional intermediaries, establishing whether the payers had the amount of the currency that they needed to pay to a certain receiver of the transaction, is replaced by an open-source software. The latter allows decentralized players of the network to express a vote, through their computing power, to establish whether a transaction is valid[1].

Cryptocurrencies are defined as "assets on a blockchain that can be exchanged or transferred between network participants"[2]. It is possible two distinguish two categories: crypto securities and crypto utility assets. The former are assets on the blockchain that offer the prospect of future payments as share of profits, while the ladder are assets on the blockchain that can give access to some pre-specified services or products. Another distinctive characteristic of the crypto securities and utility assets lies in the fact that they are supplied by a public sale, called initial coin offerings (ICOs), that we will analyze in depth in the following chapters[3].

The core technology on which Bitcoin, and cryptocurrencies in general are based, is the Blockchain. In overly concise terms, the latter can be defined as a database that collects all the transactions ever carried out on a peer-to-peer network. It is an enduring and distributed digital ledger, unaffected by interferences and created together by all the nodes of the system. The main transformation introduced by the blockchain is the openness of the network and the fact that users do not have to know or trust each other to interact. In fact, the digital transactions are automatically authenticated and registered by the nodes of the system through the use of the cryptographic algorithms, with no need for human intervention, central authorities or any other third party such as banks, financial institutions or governments. As it will be discussed in the next chapters, some nodes of the network may be malicious and unreliable, anyhow, the system can adequately verify the transactions and offer protection to the ledgers by utilizing a mathematical tool called proof-of-work. The principle behind this mechanism is the trust-by-computation and its relevance lies in the fact that

[1] (Aztori, Pag. 45-62, 2017)
[2] (Giudici, Milne & Vinogradov, Pag. 1-18, 2020)
[3] (Aztori, Pag. 45-62, 2017)

it represents “a shift from trusting people to trusting math”[4], with implications and relevance that go far beyond the introduction of the decentralized digital currencies[5].

Since the blockchain is an irreversible and tamper-proof public repository for contracts, documents, properties and assets, it can be employed to enroot instructions and information, with several different applications. Smart contracts, that are automatized and self-executing actions following the accords of two or more parties, multi-signature transactions and smart properties (digital ownership of both material and immaterial assets present in the blockchain), can all be traced and exchanged on the platform itself. In these circumstances, the blockchain results to be very advantageous because of the removal of the need of a trusted third party utilizing instead the enforcement of the execution of instructions by a cryptographic code, with some degree of protection towards the users against fraud and remarkable mitigation of management overheads. The blockchain can therefore be considered a disruptive innovation because of the valorization of automation, transparency and cost effectiveness regarding contracts and business activities[6].

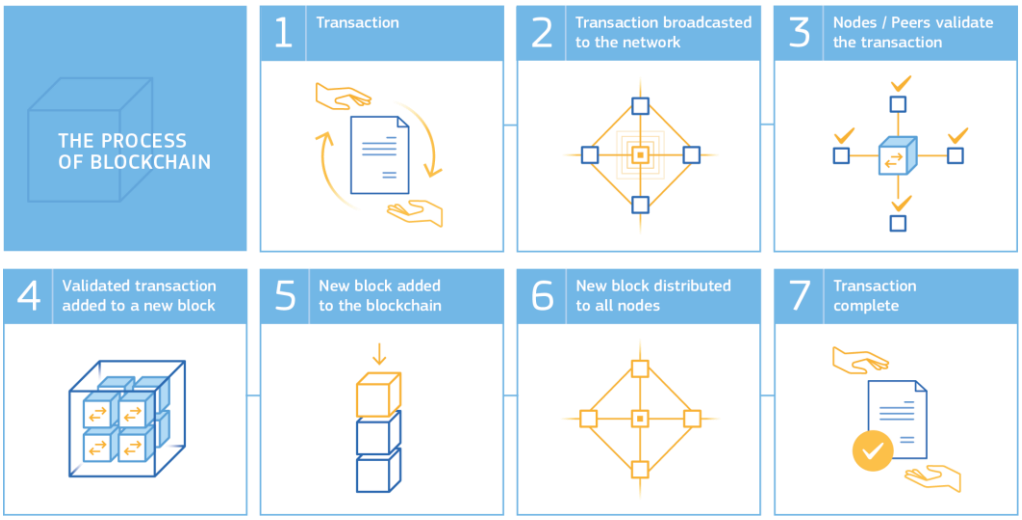

Figure 1: The process of Blockchain[7]

Bitcoins and cryptocurrencies in general are built up on two groups of participants: on the one hand the users who make transactions on the market, and, on the other, the “miners” who vest the function of bookkeepers. The latter update the ledger by adopting complicated algorithms and are remunerated by newly created Bitcoins. Updates are then stored by all users and miners. Anyways, cryptocurrencies are not able to function without the existence of other components such as exchange platforms and digital wallet providers. In fact, participants purchase cryptocurrencies from exchanges

[4] (Antonopoulos, Pag. 1-2, 2014)
[5] (Aztori, Pag. 45-62, 2017)
[6] (Aztori, Pag. 45-62, 2017)
[7] (Nascimento et Al., 2019)

using fiat currencies, or by buying them from another user through a peer-to-peer transaction, or by being a miner who directly receives cryptocurrencies as a result of mining activities[8].

The decentralized digital currencies and the deriving automated financial markets underline the intention of the creators of these technologies of gaining independence from the political authorities and regulatory control. Because of their polyvalent nature and different potential applications, cryptocurrencies and blockchains are likely to expand rapidly and transversally, requiring a rapid response of the legal framework and eventually a re-conceptualization of the mechanisms of intervention of the regulatory state[9].

1.2 The Society of Distrust and the need for Decentralization

While the innovative nature and disruptive characteristics of the aforementioned technologies can easily be recognized, the reasons behind their development seem to be more debatable to identify. Over the last years, the implications of globalization have created a new need for ulterior decentralization from institutions and more inclusive political practices. In fact, control and social coordination have become increasingly complex State's tasks as they involve the sharing of the authority with many other non-state actors such as stakeholders and operative agencies. Such a composite system has increased the need of overcoming hierarchical structures, having more transparency and accountability with respect to decision making processes and the creation of a different platform of dialogue, more accessible and universal[10].

The exponential development of information technology and the increasing digitalization have played a crucial role in the development of blockchains and cryptocurrencies. In fact, removing the barrier of communication costs and developing a multifrontal network has allowed interest groups and social movements to intensify their interactions. The introduction of Bitcoin significantly coincided with the 2008 global financial crisis, anyways, no concrete evidence proves that such technology directly resulted from it. In fact, the main principles and scope of cryptocurrencies do not straightly tackle the causes and the consequences of the crisis. However, the stagnating economic situation that has characterized many countries after the end of the 2008 financial crisis, has substantially provided new grounds for hostile attitudes toward the capability of financial institutions to control and manage the market. Thus, the absence of trust in the governmental authorities and

[8] (Aztori, Pag. 45-62, 2017)
[9] (Aztori, Pag. 45-62, 2017)
[10] (Aztori, Pag. 45-62, 2017)

central banks that rose after the financial collapse, might have been actively exploited by the developers of cryptocurrencies as a tool to back the new technology[11].

Until the creation of cryptocurrencies, the concept of money has been intensively linked to the sovereignty of the state. In fact, money has been traditionally defined as a tool that is accepted by society and used as such, in which the state holds a remarkable position and authority in legitimating such means. Money results to be deeply connected to the state because such an authority is the wielder of fiscal powers and at the same time the sole provider of risk-free assets. After the end of the Bretton Woods system, the value of fiat money has not depended on convertibility commitments with respect to gold anymore, but instead on the monetary policy of the Central Banks. In fact, central banks can regulate the supply of money and ensure price stability by intervening in the financial markets and by altering the interest rates. What appears to be clear from such consideration is that financial markets are intrinsically related to the sovereign and therefore the state retains the right of creating currency and of monetizing debts.

Anyways, many factors have been evidently challenging the role of such central institutions. In fact, rising capital mobility combined with advances in technology and emergence of transnational communities of economic actors are questioning more and more the monetary sovereignty of the state. The intense development of new forms of electronic and virtual money has caused a rise in the number of agents involved in the creation of money and enhanced its supply privatization. These developments have not destroyed monetary sovereignty, but have certainly posed remarkable new challenges to the traditional organization of both the financial regulations and monetary policies. Accordingly, blockchain technology presents an alternative organization of the economic system and proposes a decentralized international scheme in which politics do not hold a significant role. All of the factors mentioned have contributed to enlarging the skepticism towards central banks and have had an impact on the development of digital platforms to enhance the circulation of capital fully controlled by private entities, characterized by independence of intermediaries and auto-sufficiency[12].

1.3 The Challenges of Regulating Crypto-Assets

Cryptocurrencies and blockchains pose a unique set of challenges resulting in the content of regulation being very complex, but not impossible. Their particular nature and their numerous

[11] (Craig & Kachovec, Pag. 1-4, 2019)
[12] (Atzori, Pag. 45-62, 2017)

practical applications urgently require legal classification in order to define clear regulatory policies, ensure legal certainty and rule of law[13].

1.3.1 The Characterization problem

Cryptocurrencies present many odds to regulators, the first being a legal characterization challenge. In fact, they comprise elements of currencies, commodities, payment systems and securities. Concerns arise because the classification of cryptocurrencies in one or in another category determines consequent and diverse regulatory treatments. Anyways, the hybrid nature of cryptocurrencies is not necessarily an issue for legislators, as cryptocurrencies could fit into several categories, with dissimilar regulatory purposes. For instance, in the USA, the Financial Crimes Enforcement Network is treating them as "value" for purposes of Anti-Money laundering and at the same time the Commodity Futures Trading Commission defines them as "commodities" under the Commodity Exchange Act[14]. We will analyze in depth how major legal systems deal with cryptocurrencies in the next chapters, however, at the moment, it is important just to note how the multiple nature of these assets does not necessarily imply the impossibility of regulating them[15].

Cryptocurrency custodial providers play a fundamental role in the functioning of this technology as they have become a new type of intermediaries offering the services that were previously provided by banks (through bank accounts/deposit services). Anyhow, such intermediaries do not have clear rights and duties towards the customers. In this case, the classification of cryptocurrencies becomes crucial with respect to the definition of such rights and duties. Thus, the absence of an explicit legal categorization of cryptocurrencies can potentially lead to differential treatment of the financial authorities and their respective clients. For instance, a payment service provider that transfers 100 dollars on behalf of its client undergoes specific requirements of anti-laundering regulations that impose obligations on both the financial institution and the customer, while an intermediary and an user that employ cryptocurrencies can potentially transfer thousands of dollars without being subject to the aforementioned laws. It is common knowledge that cryptocurrencies are employed on the market for the exchange of goods and services online, therefore, they are considered as units of account and they store a value. Such characteristics may make cryptocurrencies fall under the economic definition of money. Anyways, some scholars claim that it would be opportune to define cryptocurrencies as commodities. The main point of contention on the matter concerns the absence of inherent value of cryptocurrencies even if it may be argued that such

[13] (Gikay, Pag. 1-18, 2018)
[14] (Ligot, Pag. 652-676, 2019)
[15] (Gikay, Pag. 1-18, 2018)

assets do possess value in the sense that they effectively furnish less costly transactions than the traditional three-party transactions and provide great speculative opportunities. In the United States of America, the Federal Commodities Futures Trading Act defines commodities in a broad way: they include all interests, services and rights as long as futures are traded on them[16]. In a different way, the European Union defines commodities attributing tangibility to them, thus removing straightforwardly cryptocurrencies from the definition as such[17].

1.3.2 Decentralization problem

The second challenge that regulators need to tackle is the decentralized nature of cryptocurrencies. Supervisors cannot directly target a specific organization that manages the network and provides for redress. Furthermore, the pseudo-anonymity and the peer-to-peer transactions make it hard, in limited circumstances, to easily identify users. While the regulation of centralized virtual currencies does not present specific strains, as regulations can easily be applied to those who administer the system, the same cannot be asserted about decentralized systems. For instance, the Bitcoin, which is simply a software code existing on the internet, is issued by entities that are not known. Moreover, there is no central organization regulating the network that could be subjected to regulations. As mentioned before, the miners and the developers are the entities in charge of the functions traditionally vested by central authorities.

In the case of cryptocurrencies, these agents are numerous and their identity is unknown, but they still have the task of controlling the operational activities of the system through their proof of work and of validating the transactions, thus, they decide which transactions to accept. Regulators have no means to take part in this process and therefore they are unable to impose any regulatory standards on the agents that operate in the cryptocurrency system. For instance, suppose that "X" transfers one Bitcoin to "Y" in payment of a train ticket reservation and presents a transaction fee that is the equivalent of $ 5 in Bitcoin for the execution of the transaction. Now, assume that the miners refuse to approve the execution in view of the fact that the transaction fee is too low. In such a circumstance, the transaction does not go through and the train reservation is cancelled. Cryptocurrencies do not provide redress in the case of faulty or late execution of payment transaction as there is no centralized authority responsible for the execution of payments. The traditional payment systems instead impute liable the payment service provider if such situations occur. Anyways, in the

[16] (Ligot, Pag. 652-676, 2019)
[17] (Gikay, Pag. 1-18, 2018)

case of cryptocurrencies supervisory agents are not able to oblige miners to execute transactions and to provide a redress mechanism[18].

Thus, we can assert that cryptocurrencies lack of users protection also in case of erroneous transactions because decentralized virtual currencies do not have a central intermediary who can intervene and execute a reverse transaction in the case of errors. By referring to contract law, caveat emptor: the consumer should be aware when using cryptocurrencies. There is no way regulation can modify such a feature. Eventually, regulators could only collect the complaints of users and send warning communications on the problems that emerge. Therefore, they could develop information forums where users can share information and be aware of specific malfunctions, such as technical issues, hackers or malwares that are present in the system[19].

1.3.3 The global nature of cryptocurrencies

An additional challenge posed to legislators lies in the global nature of cryptocurrencies and in their ability to easily cross borders. In such a scenario, universal policies should be designated to ideally avoid regulatory arbitrage. To date, this is not the case, as many legal systems do not have formal positions on the matter, some have banned the use of cryptocurrencies and others have adopted specific regulations instead[20].

1.3.4 Do cryptocurrencies possess inherent value?

By observing the market, it appears to be clear that speculators are willing to purchase cryptocurrencies such as Bitcoin, Ether or Litecoin, but this does not necessarily prove that such assets possess intrinsic value. With reference to this topic, Nicholas Godlove, in his work "Regulatory Overview of Virtual Currency" states that Bitcoin "has more characteristics in common with commodities that with currency, except the most essential: It has no inherent value"[21]. If we consider the intrinsic value as something that can be assessed independently of its monetary use, then the following question arises: would cryptocurrencies still be considered valuable if they were deprived of their ability to transfer funds? Giving a positive answer to this question results difficult, but an exception could be made in the case of certain new cryptocurrencies employed in the investing process of new ventures and digital platforms[22].

[18] (Gikay, Pag. 1-18, 2018)
[19] (Gikay, Pag. 1-18, 2018)
[20] (Gikay, Pag. 1-18, 2018)
[21] (Godlove, Pag. 2-14, 2014)
[22] (Gikay, Pag. 1-18, 2018)

The New Generation Cryptocurrencies (NGCs) created through the Initial Coin Offerings (ICOs) are characterized by the fact that whoever invests money in a new cryptocurrency (token) is given several rights, such as the right of sharing dividends that derive from the investments of the company and the right to participate in voting processes to determine the actions of the company. In the USA, the Security Exchange Commission (SEC) has established that tokens that are sold following different schemes such as the adoption of more mining operation channels qualify as investment contracts. On the other hand, in 2017 the European Securities Market Authority (ESMA) has released an investor warning concerning the structure of the ICOs. In fact, depending on their structure, tokens may fall under different directives (MiFiD II or Alternative Investment Fund Managers directive). Anyways, no specific guidelines were given to fully identify which ICOs may fall under which directive[23].

Cryptocurrencies and blockchains are mostly adopted in trade, but will very likely expand to other fields such as the supply chain management, cloud storage, online music industry and government service. Regulations deeply influence the processes of technological change and its diffusion. Law can be employed as a tool to either facilitate or curtail the spread of the new technology by either eliminating or posing barriers to entry. Thus, the expansion of technologies such as cryptocurrencies and blockchains is to be found profoundly linked to the ongoing regulations. Anyways, these assets come with many new challenges and innovative legal frameworks should emerge in order to consistently respond to them and to protect all the stakeholders involved[24]. The issue is very likely to remain controversial. This is because the legal definition and categorization of cryptocurrencies tends to be grounded not on evidence and objectivity but rather on subjectivity. Such an inclination makes it hard to come to constructive and oriented debates. Anyways, even if the legal debate on the classification is open and still far from being solved, this paper will explore in depth such a contention and the odds that arise when framing new policies on the topic. Despite the decentralized nature and the nuanced definition of value attached to cryptocurrencies and blockchains, these assets are progressively being used in the market and are likely to become primary actors of the global financial system. Therefore, analyzing and examining how the legal framework handles or should handle the regulations of related activities results to be very relevant to understand the current and future trends of the market[25].

[23] (Giudici, Milne & Vinogradov, Pag. 1-18, 2020)
[24] (Gikay, Pag. 1-18, 2018)
[25] (Gikay, Pag. 1-18, 2018)

Chapter 2: Risks and Criminal activities linked to Cryptocurrencies

Cryptocurrencies and blockchains have introduced a new way to conceptualize and organize the economic system, but such innovations did not come without risks. Nowadays, users can encounter many menaces that are either directly linked to the structure of cryptocurrencies functioning, such as non-execution and irreversibility of erroneous transactions, or to the operations of cryptocurrency trading[26].

As mentioned in the previous chapter, cryptocurrency platforms often do not bear responsibility for not ensuring operational continuity, and this results in delays and inconveniences for users. Besides the lack of a consistent defense of customers rights, cryptocurrencies result to be also very risky investments as their high volatility increases the possibility for agents to lose a large part if not all the amount invested. The characteristics of pseudo-anonymity and peer-to-peer organization make the cryptocurrency system optimal to obfuscate information. These features allow the employment of virtual currencies to facilitate illicit actions such as money laundering and tax evasion. In fact, as cryptocurrencies are becoming more widely accepted as payment methods, their use in criminal activity results to be on the rise. Lastly, cryptocurrencies' users are also exposed to potential frauds and hackers attacks and billions of dollars' worth of virtual currency have been stolen on the platform over the years[27].

Therefore, these new technologies appear to expose users to many risks and to provide new tools to perpetuate unlawful transactions. Either way, the intervention of regulators plays a crucial role in safeguarding both the agents active in the crypto market and the society as a whole with respect to illegal practices. The focus of the following paragraphs will be to comprehend the nature of the risks borne by cryptocurrencies and their consequences, as well as the legal status on the matters and the way in which legal frameworks could influence and possibly limit the drawbacks of these innovative instruments[28].

2.1 Absence of legal protection

With a warning notice published in 2018, the three European Supervisory Authorities on the financial markets, ESMA (European Securities and Market Authority), EBA (European Banking Authority) and EIOPA (European Insurance and Occupational Pensions Authority), warned citizens on the risks associated with the purchase of virtual currencies; not only Bitcoin, but also other virtual currencies

[26] (Ligot, Pag. 652-676, 2018)
[27] (Bloomberg, 2018)
[28] (Ligot, Pag. 652-676, 2018)

using distributed Blockchain technology. The warning was very significant as it was a reminder that virtual currencies remained unregulated in the EU and in many other countries. Since both the exchange platforms and the digital wallets that are employed by the agents are unregulated under EU law, whenever an user buys or stores cryptocurrencies, he or she will not be guaranteed and safeguarded by the regulations of the financial system. If a virtual currency exchange platform or a digital wallet provider fails or is victim of a hacker-attack, EU law, as well as other legal frameworks, does not provide legal protection that would cover for the losses suffered or any guarantee that the user will regain access to his crypto holdings[29].

People buying cryptocurrencies may not be able to trade or exchange them for traditional currencies for an indefinite amount of time, resulting in the possibility of suffering losses in the process. The price of virtual currencies is very likely not to be transparent, therefore, users face the risk of not receiving a fair and accurate price when deciding to buy them. In addition to this, cryptocurrencies are characterized by operational disruptions and misleading information. The former have occurred repeatedly over time, not allowing consumers to buy and sell their cryptocurrencies at the moment they intended to and have thus caused losses associated to the price fluctuations held in the period of disruption. For example, Bitstamp, a UK based exchange platform, declared in its website the following: "We do not represent that this site will be available 100% of the time to meet your needs. There are no guarantees that access will not be interrupted, or that there will be no delays, failures, errors, omissions or a loss of transmitted information"[30]. Thus, it can be observed that very little consumer protection is ensured to users. Lastly, another risk consists in the fact that crypto providers usually do not openly and clearly disclose all the risks associated with the trading of cryptocurrencies to the consumers keen to buy them[31].

Thus, the absence of a precise legal framework makes it impossible to guarantee an effective protection to the interests of users by legal and/or contractual means and results in users being exposed to remarkable economic losses. In such a context, distinguished by the absence of information obligations and transparency rules, the exchange platforms are exposed to high security risks: in fact, unlike authorized intermediaries, they are not constrained by any guarantee of service quality, nor do they have to comply with capital requirements or internal control and risk management procedures, with consequent high probability of fraud and exposure to cybercrime. The development of effective regulatory responses in relation to virtual currencies appears to be still at a preliminary stage: it is a complex market area to regulate, set within the competence of both national and global entities at the

[29] (ESMA, Pag. 1-3, 2018)
[30] (Bitstamp, 2021)
[31] (ESMA, Pag. 1-3, 2018)

same time. Regulators have started to address these challenges with a variety of approaches between different countries. Some have assessed the possibility of including virtual currencies within cases that have already been properly regulated, others have issued specific warnings, yet others have completely banned their use as will be shown in the next chapters. Anyways, these are still preliminary policy responses to the challenges posed by cryptocurrencies and it is extremely likely that further developments will follow up in the near future to compensate for the current absence of legal consumer protection[32].

2.2 Volatility

In 2009 a Norwegian man bought 5,000 Bitcoins and spent approximately 150 kroner; an investment that corresponded to roughly US $27.2. The man forgot about it, and, four years later, he discovered that his Bitcoins were worth over eight hundred thousand dollars[33]. Indeed, the value of Bitcoins, and of cryptocurrencies in general, has shown to be wildly volatile over the years. Volatility is referred to as a statistical measure of dispersion of an asset price. Put more simply, volatility represents the extent to which an asset's price fluctuates over time. An investment is evaluated volatile if its prices swing up and down daily, as can be observed in the cryptocurrencies' market. Volatility is usually indicated by the CBOE Volatility Index. Recently, an ad hoc Index has been created to track the volatility of the leading digital currency, called the Bitcoin Volatility Index. The graph below provides a representation of the volatility of the Bitcoin, measuring the standard deviation of its prices, spanning from year 2011 to year 2019. The higher the value of the standard deviation, the higher the volatility of the asset as its prices result to be very spread out over time[34].

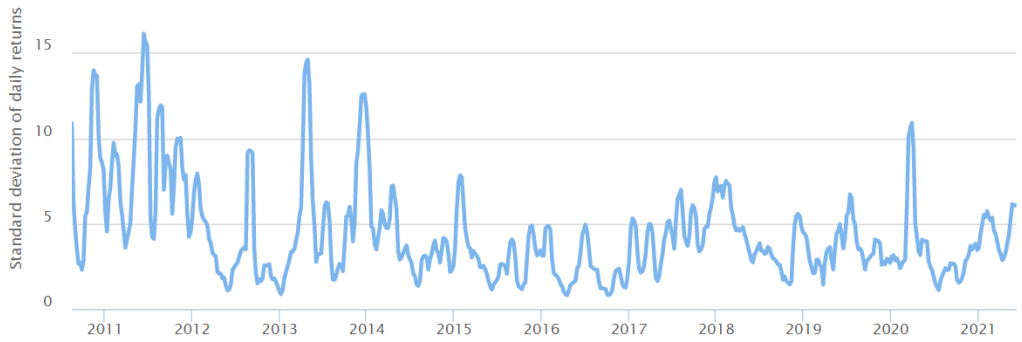

Figure 2: The Bitcoin Volatility Index[35]

[32] (ESMA, Pag. 1-3, 2018)
[33] (Gibbs, Pag. 1-4, 2013)
[34] (MacManus, Pag. 1-10, 2018)
[35] (The Bitcoin Volatility Index, 2021)

Bitcoin and cryptocurrencies in general are quite an unexplored area of research and thus the related fluctuations of the price are still poorly understood. Anyways, some factors have been identified as the causes of such high volatility. Cryptocurrencies fluctuate mainly because of the uncertainty associated with their qualification as viable forms of currencies or of stores of value. Anyways, volatility is not necessarily a negative factor, as it is perceived differently among the agents operating on the market. Investors having a very high tolerance of risk would probably be willing to purchase cryptocurrencies, while those that prefer stability and to preserve their wealth would probably avoid such an investment. It is crucial to note that the level of risk that agents choose to undertake is strictly related to the expected returns of the investment. Thus, greater risk could lead to greater profits. Anyways, huge losses could be a reasonable possibility too. Greatly volatile assets, such as cryptocurrencies, are characterized by either pike in prices or disastrous drops. For instance, in 2018 the cryptocurrency market crashed catastrophically. Indeed, cryptocurrencies lost more than 80% of their value[36].

Besides the evident volatility, some traders do not mind this characteristic of the crypto assets, and exploit Bitcoins and other cryptocurrencies as portfolio diversifiers. This is probably due to the fact that it has been claimed that Bitcoins returns are basically uncorrelated with assets such as stocks and bonds, and thus constitute a remarkable diversification opportunity[37]. Yet, many relevant public figures, such as Warren Buffet, consider the increasing price of Bitcoin as a bubble. Also Jamie Dimon, CEO of JP Morgan, alluded to the bubbles that cryptocurrencies could imply calling them a fraud, and, similarly, Goldman Sachs CEO Lloyd Blankfein agreed on the fact that cryptocurrency is a vehicle for perpetrating fraud. Anyways, cryptocurrencies hold powerful potential and they could become a valid alternative to fiat currency if widely adopted by the public. In fact, the higher the number of people employing Bitcoins and other cryptocurrencies, the higher the associated value and, thus, the higher the chances of a decreasing volatility. If global jurisdictions decided to clearly allow and regulate Bitcoins and the other cryptocurrencies, uncertainty around their usage could potentially drop and lead to a much more extended adoption in different economic sectors[38].

2.3 Money Laundering

Money laundering is not a new criminal phenomenon and is an activity persistently changing following the trends and innovations brought by the evolving business models. For criminal enterprises, decent cash-out options are crucial, and, traditionally, this was implemented through

[36] (MacManus, Pag. 1-10, 2018)

[37] (Baur et Al., Pag. 8-11, 2017)
[38] (Conrad et Al., Pag. 1-3, 2018)

money mules, offshore accounts or the acquisition of luxury products. Nowadays, cryptocurrencies are occupying a more prominent role in this field. Europol reports that Bitcoin accounts for approximately 40% of all identified criminal to criminal payments in cybercrime investigations[39].

It is important to note that there are two distinguished ways in which cryptocurrencies can be employed in Money Laundering operations: funds to be laundered either originate from activities outside the blockchain system, or directly come from illegal activities performed on the blockchain. In the first case, cash that was acquired through the performance of illegal activities (such as trafficking, drugs dealing, or weapons sale) is converted into tokens, mainly in countries that do not possess strict anti-money laundering regulations. In such a context, stolen or illegally gained assets may be sold using pseudonyms for the exchange of other tokens. In both cases, tumblers could be used to disguise the origin of tokens and the consequent link with illicit activities. In fact, every token possesses a unique code that is stored in the transaction data on the Blockchain. Thus, the transaction history of a token is usually publicly observable. If some tokens have been used or are the result of criminal activities, competing authorities could potentially retrace the offenders through transaction data. To render such transactions untraceable, the compromised tokens are sent to tumbler services that create a prominent number of transactions by sending the users' tokens from one public key to another. A public key is a tool that enables an agent to receive cryptocurrency transactions, and, while anybody can send transactions there, an agent can only unlock the transactions by using a private key and thus proving to be the owner of the received cryptocurrencies. All the keys are collected and held by the tumbler on the Blockchain, and the data do not result to be observable. This happens because many different people take advantage of the tumbler that mixes all the tokens together. After this process is completed, the service sends other tokens back to the users and collects a fee, alternatively the tokens are sent to a third party. Tumbler services turn out to be very effective as the tokens that go through such a process can hardly be traced back[40].

Despite the calls for adoption of global AML standardized regulations for cryptocurrency trading, uniform rules are still not present. Nonetheless, there has been shared agreement on the fact that crypto payment services should undergo the same obligations of their traditional counterparts. In many countries it has been established that the commercial exchange of cryptocurrency for fiat money should undergo AML obligations (or, in the case of China, be prohibited). Anyways, the global legal status of this matter is still ambiguous and incomplete[41].

[39] (Europol, Pag. 2-3, 2018)
[40] (Conrad et Al., Pag. 1-3, 2018)
[41] (Allen & Overy, Pag. 28-29, 2018)

2.4 Tax Evasion

The FBI declared that "law enforcement faces difficulties in detecting suspicious activity, identifying users, and obtaining transaction records on the blockchain- problems that might attract malicious actors to Bitcoin"[42] and thus, the prospect of an exponential growth of tax evasion due to the employment of this new technology calls for a renewed approach to tax enforcement[43]. Anyways, uncertainty reigns regarding the cryptocurrencies' status under tax regulations.

First of all, confusion arises over which country should apply taxation rights in a complex and international system of online transactions. For instance, Bitcoins are currently not considered taxable gross income until they are "cashed out" from the system and converted into fiat money, real goods or services. This is a de facto rule for the virtual world as it tends to only tax the agents that acquire real-world benefits. In such a perspective, income tax could be intentionally avoided by storing the wealth in the form of Bitcoins. However, Bitcoins and cryptocurrencies in general are not separate entities from the marketplace and therefore the cash-out rule practically lacks application in these cases[44].

It is worth noticing that cryptocurrencies share some features of tax heavens: earnings are not subject to taxation and taxpayers' act anonymously. Since cryptocurrencies are continuing to gain momentum, it is reasonable to expect that tax-evaders, who have traditionally carried out their activities through offshore accounts and banks in tax heaven countries, will consider employing also cryptocurrencies. However, since the volume of the Bitcoin market is currently small, tax evasion related to it is still not considered to be significantly problematic. Anyways, the market for cryptocurrencies is expected to grow remarkably over the coming years. In fact, since its introduction, Bitcoin has kept growing in popularity and is starting to be an accepted form of payment in many businesses and this trend is well known to policymakers that are monitoring the Bitcoin tax evasion potential. Many agents on the Internet are already using Bitcoin wallets as "saving accounts", and many of them are employed to only receive but never send Bitcoins[45]. The earnings accumulated in such wallets, can be voluntarily reported, but if this is not the case, such accounts remain unnoticed to tax authorities. Some users adopt "fork and merge" approaches, consisting in the split of large amounts of cryptocurrencies into different smaller accounts, owned by the same individual. In such a way, many tax evaders attempt to hide both the destinations and sources of funds. The real challenge

[42] (Slattery, Pag. 4-8, 2014)
[43] (Slattery, Pag. 4-8, 2014)
[44] (Slattery, Pag. 4-8, 2014)
[45] (Ron & Shamir, Pag. 5-9, 2013)

for regulators is therefore to implement a way to unmask illicit hidden funds[46]. Countries like the USA, EU and China potentially have the means to identify and track most of the cryptocurrency transactions and thus avoid the occurrence of tax evasion. Anyhow, the tracing activity could be eased if agents were encouraged to personally declare their crypto movements. Nonetheless, since cryptocurrency transactions do not carry any special tax classification, users are still not provided with incentives to report their crypto income to the authorities[47].

2.5 Hackers' Attacks

On the Blockchain system it is impossible to steal or copy digital assets unless the user is in possession of the 'private key' that unlocks the cryptographic protection of a given asset. A private key is a crucial component of cryptocurrencies, as it is a sophisticated form of cryptography that enables an agent to access his or her cryptocurrency. Thus, while the blockchain technology protects data in transit within the system, private keys are subject to theft if displayed on disks, memory or in the cloud. This vulnerability has pushed the majority of people active on the market to adopt digital wallets to keep their keys safe.

Unfortunately, even if these solutions were designed to provide a higher level of security, they are still vulnerable to potential hacks. In fact, as soon as a private key is stolen, the relative security of a blockchain is not relevant anymore: the thief can monetize and exploit the assets as he pleases, and the illicit transfers of value are usually irreversible. Nowadays, cyberhackers operating on the blockchain have two main courses of action: they either target private key storage services or they directly infect network users to obtain the private key. For instance, in August 2016, $72 million USD worth of Bitcoin were maliciously stolen from the Hong Kong crypto-currency exchange Bitfinex as two private keys held on a multi-signature wallet were compromised. This hack resulted in the loss of millions of dollars for participants[48]. Cryptocurrency history is filled with similar events, and in the next paragraph, the DAO case will be described to plunge into the mechanisms of the hacks and risks faced by users.

2.6 The DAO

The DAO was a decentralized anonymous organization launched in 2016 on the Ethereum blockchain. Its aim was to collect funds to finance investment projects through the Ether currency by giving DAO tokens in return. The agents receiving tokens were entitled to collect the earnings in case

[46] (Marian, Pag. 1-4, 2013)
[47] (Molloy, Pag. 4-7, 2019)
[48] (Boireau, Pag. 8-11, 2018)

of successful investments or sell the tokens on other secondary markets. Every user possessing a token was assigned a pseudonym, by doing so, the real identities were not revealed. A particular feature of the DAO was that the agents had the possibility of proposing investment projects. These propositions were then scrutinized by the DAO curators and the most valuable ones were voted by all the agents purchasing the tokens. Because of this specific organization, the DAO was thought to have an automated governance. At the end of the offer, in May 2016, $150 million USD worth of Ether were raised through the token sale. The offer had been a success: the greatest ICO crowdfunding ever realized at the time[49].

Anyways, after the sale of the DAO tokens, but before the financing of the projects, a hacker attacked the platform and stole approximately one third of the total amount collected. Later on, a bug (technical defect) of the platform was identified. Specifically, the bug was located in the DAO's wallet smart contracts, and that would have allowed any hacker to drain the wallet completely. However, at a certain point, the hacker stopped transferring funds to himself even if he could have continued for a long time. Despite the occurrence of the hack, the founders managed to create a parallel platform on which they were able to transfer the funds that had been stolen. In the end, the token holders did not suffer any damage. Anyways, the hack and the response of the curators, undermining irreversibility, shook the Ethereum community to its core and gave rise to major doubts on the functioning of the emerging technology[50].

This case had also a remarkable legal impact and was drawn to the attention of the SEC. The object of discussion regarded the possibility of applying the Securities Act 1933 and the Securities and Exchange Act 193, and therefore the obligation to publish the prospectus, the supervision of the SEC and the registration and identification of the issuers. Firstly, the SEC tried to assess whether tokens could be classified as financial tools. It is important to report that the Sec. 2(a)(1) SA and Sec. 3(a) (10) of the Securities and Exchange Act 1934 define a financial instrument as something that includes an investment contract. The investment should be made in money and to a common enterprise with a reasonable profit expectation deriving from managerial or entrepreneurial actions performed by others. Thus, also agents offering virtual currency, in this case Ether, for the exchange of tokens, could be defined as investors under US jurisdiction. Indeed, the curators were identified as managers as they had the authority to select investment projects, control the voting process and take care of the safety of the system. This is why the DAO was finally qualified as an "issuer of financial instruments" (tokens) by the SEC and was expected to behave accordingly. Thus, ever since that

[49] (Bruno, Pag. 286-288, 2018)
[50] (Bruno, Pag. 286-288, 2018)

moment, ICOs have been reserved, by the SEC, to financial intermediaries. On the other hand, in 2017, the ESMA (European Securities and Markets Authority) released two informative warning documents on the risks for investors and enterprises employing ICOs, while, always in 2017, China prohibited them as these tools had been mainly used to avoid the limits imposed on the export of capital and because of the fact that the tokens were not currency emanated by the central government[51].

[51] (Bruno, Pag. 286-288, 2018)

Chapter 3: How to benefit from Cryptocurrencies and Blockchains?

Besides the remarkable speculative and risky aspects of cryptocurrencies which deeply concern regulators and markets, the positive and advantageous features of these technologies cannot be denied. Cryptocurrencies and blockchains are filled with valuable qualities that have the potential to meaningfully ameliorate the operations of small to large businesses, the transactions of private agents and the economic and social organization as a whole. The potential applications in different sectors are countless, nevertheless, practical experiments have been limited because of the constantly evolving legal status and the immature stage of the technology itself. In the next paragraphs, the main positive attributes of cryptocurrencies and blockchains will be highlighted and their potential beneficial contribution to the health sector and to the supply chain of cobalt will be analyzed[52].

3.1 Benefits

The main benefits for the agents in the employment of blockchains and cryptocurrencies are: disintermediation, transparency, traceability, auditability, elimination of banking fees and accessibility[53].

3.1.1 Disintermediation

The core value of Blockchain, already explored in past chapters, resides in the fact that databases can be directly shared with all the participants without the need for central authorization from an entity. Disintermediation results in great efficiency because of decreased bureaucratization of the transaction processes. Therefore, the time lapse for processing the transactions is remarkably shortened[54].

3.1.2 Transparency

One of the most inviting benefits of the blockchain is the degree of transparency it can provide. In fact, through the necessary encryption and control protocols, the blockchain technology promotes transparency by the storage of information in a way that cannot be modified without keeping track of the changes effectuated. Thanks to the capacity of the technology to demonstrate, in a cryptographic way, that data is immutable, blockchain can potentially make payments and systems more transparent and accountable. For instance, the transparency degree adopted on cryptocurrencies' blockchains allows users to check the history of all transactions recorded. In fact, in entirely public blockchains, any user can have access to all the data stored as the terms of each transaction are irrevocable and therefore they can be subject to inspection. Improved transparency through blockchain may become a new way to reward best behaviors of the firms, in fact, valuations can be

[52] (Agrawal & Al., Pag. 1-4, 2021)
[53] (Agrawal & Al., Pag. 1-4, 2021)
[54] (Psalia, Pag. 3-8, 2017)

placed explicitly on a business's ability to responsibly conduct its operations, debt and equity, giving investors a trustable look into the company's actual situation. Anyhow, transparency on the blockchain is neither absolute nor unconditional and various nuances of transparency are offered. In the case of permissionless ledger, such as the one of Bitcoins, there is shared public transparency. On the other hand, with permissioned blockchain, users need permission to transact with other agents present on the network and transactions occur in a closed system, therefore data remain confidential[55].

3.1.3 Traceability

Tracking raw materials and goods has emerged to be a prime requirement for multi-site production and for customers that desire to pursue ethical buying or to verify products authenticity. Nowadays, it is challenging for stakeholders to acquire reliable knowledge on the stages of production and on the materials employed in the creation of goods. With blockchain technology, the information related to components can be communicated to and from the new owner required for the possible action. The blockchain, operating on a decentralized network structure, offers appropriate solutions to stakeholders to have greater visibility on the information shared by the different organizations[56].

3.1.4 Auditability

On the Blockchain network, each transaction detail is recorded subsequently on the system and it provides an audibility for the asset in between two parties. This feature is especially beneficial for the operations in which data source is needed in order to authenticate the assets. Indeed, blockchain can be employed as a source of verification for recorded transactions. For instance, instead of requesting documents from the banks or sending confirmation requests to third parties, agents operating in the audit sector could simply verify the data on the public blockchain ledgers. Thus, the automation of the verification process may result in remarkable costs reduction and time efficiency. In fact, on the blockchain, transaction possessing low value traditionally take 10 minutes to be validated as a single block while a high value transaction will typically take 1 hour prior verification. In contrast to this, in traditional financial transactions information take greater amount of time to be cleared. Moreover, by using the blockchain, auditors would be able to continuously conduct assessment operations by disposing of the online information, instead of conducting only end or mid-year assessments[57].

3.1.5 Elimination of Banking fees

Standardized procedures in cryptocurrency exchanges include charging the "maker" and "taker" fees, as well as occasional withdrawal and storage fees. Anyhow, several baking fees applied on fiat

[55] (Kritikos, Pag. 2-6, 2018)
[56] (Agrawal & Al., Pag. 1-4, 2021)
[57] (Psalia, Pag. 3-8, 2017)

currencies, do not affect cryptocurrency users. Although there might be some fees and exchange costs for international purchases and wire transfers, crypto transactions are exempted from them due to the absence of government or intermediary institutions involvement. This setting keeps the cryptocurrencies' transaction costs very low, which can be a remarkable advantage for agents[58].

3.1.6 Benefits for Businesses

Cryptocurrencies can contribute to growing customer base by adding an alternative and innovative payment system. Small businesses can expand to foreign markets for whom their services or products were once not accessible. This new method of payment has removed several cash flow obstacles on a global scale-waiting time for processing international transactions and high costs associated with exchange rates. Accepting crypto payments is also a way for businesses to distinguish themselves from competitors and stand out in the market[59].

3.2 Blockchain in the Health Care Sector

The blockchain technology could lead to a new way of exchanging health information by placing the patient at the center of the healthcare system, providing greater security and allowing the interoperability of data. Blockchain could play a crucial role as it may help centralize research data and reduce administrative overheads. This tool has already been employed to discreetly share sensitive information regarding individual patients records and their relative medical practitioners. A comparison between the key benefits of the technology with the most common distributed database management systems (DDBMS), such as Structured Query Language systems, may show how the distributed ledger technology may be feasible for medical applications. First of all, one of the most relevant benefits of blockchain lies in the previously mentioned decentralized management feature. In fact, being a peer-to-peer organization, interested stakeholders such as patients, hospitals and payers can collaborate and interact without transferring control to a central management intermediary.

Another advantageous feature of blockchain in the medical applications is the immutable audit trail. In contrast with the DDBMS that like any other database systems create, read, update and delete functions, the blockchain only performs the create and read functions, as it is very hard to erase data because of the irreversibility characteristic. Therefore, blockchain could be very helpful to register critical information such as insurance claim records. Another benefit lies in data provenance as on the traditional database systems, the ownership of digital assets can be altered by the central supervisor, while on the blockchain, the ownership can only be modified by the owner, observing specific cryptographic protocols. The traceability of the transactions is possible on the blockchain and thus, the sources of records can be confirmed and this increases the reusability of verified data.

[58] (Psalia, Pag. 3.8, 2017)
[59] (Deloitte, Pag. 2-4, 2021)

Additional advantageous features lie in the robustness and availability typical of the technology. In fact, being composed of nodes that possess whole copies of historical data records, the blockchain is a useful tool to preserve records and continuously make them available. Lastly, the blockchain technology presents advanced security and privacy features because of the employment of cryptographic algorithms. For instance, the Bitcoin blockchain adopts the 256-bit Secure Hash Algorithm that is utilized to generate user addresses for anonymity improvement. Bitcoins also uses 256-bit Elliptic Curve Digital Signature Algorithm, that is an asymmetric cryptographic algorithm to create and verify secure public and private keys and digital signatures, and to ensure the owner of the digital assets, as well as with patient records. Summarizing, the main benefits in adopting the blockchain include: decentralized management, immutable audit trail, traceability of data provenance, availability and security[60].

Even if the technology is not at a mature stage, it is still a promising opportunity to support the integration of healthcare information across the stakeholders. Firstly, organizations could adopt blockchain to verify the digital identity of a patient, as well as the genetics data and the medical prescription history. In a more advanced stage, blockchain could be employed in decision-making processes, by implementing smart contracts that would automatically execute whenever the necessary conditions subsist. This would happen by using algorithms to fully customize the conditions that regulate the transfer of value and of information. Currently, the healthcare records usually appear to be disjointed because of a lack of shared architectures and standards that, if present, would allow smooth and secure movements of sensitive records.

Nowadays, health care workers update the clinical record of a patient each time a service or a prescription is provided as well as personal data referring to the individual patient. Traditionally, the information is stored in a database within a specific hospital or organization. Data on the care plans, procedures and notes could be organized in a standardized blockchain where information about patients are kept nationwide. By doing so, the information present could be specifically available to the interested parties through the use of the private keys, while research organizations could easily access the public information available by employing the public keys. This could be a great opportunity to simplify procedural transactions, anyways, policy makers should first regulate the implication of the distributed storage nature of the blockchain, the issue of the ownership of records and establish in detail how access could be granted using the technology[61].

[60] (Kuo & Al., Pag. 3-9, 2017)
[61] (Kuo & Al., Pag. 3-9, 2017)

3.3 Blockchain and the traceability of Cobalt

At first sight this combination might appear unusual. Anyways, blockchain may be one of the best ways for automotive firms and big tech companies to achieve their sustainability objectives. The revolution of the electric car could not come to life without referring to the Democratic Republic of Congo. This is because electric cars' lithium batteries need cobalt as well as millions of smartphones and electric appliances and more than 60% of the global production of this material comes from the DRC and there is no other material with such a geographical concentration. Anyhow, the extraction process of the material was characterized by many violations of human rights that have been reported over the years[62]. Minors were exploited to extract cobalt from the mines and a Class Complaint was presented to the judicial district of Columbia, in the USA, against the major Tech companies (Alphabet, Apple, Dell, Microsoft and Tesla) involved in the operations. The plaintiffs asserted claims for forced child labor in violation of the Trafficking Victims Protection Reauthorization Act ("TVPRA"), 18, U.S.C. § 1595[63]. Workers were forced to labor under unregulated conditions, in dangerous mines without efficient protective equipment. The big tech companies were all purchasing the material coming from the exploited children. Blockchain could be implemented in the supply chain management of physical and digital goods by tagging the goods with a digital value (scannable code for goods and a tracker for digital ones), that are transferred across the different users. All the transactions can be added to the blockchain so that all the users have the possibility of tracking the disposition of the goods, from creation to distribution and potentially to end users. Blockchain could play a fundamental role in supervising the movements of cobalt, from the mining sites to the firms purchasing them to build batteries. This technology has already been used to fight the human right violations in the supply chain for the "blood diamonds". By employing blockchain, issues such as obscure supply chain operations, corruption and illicit intermediary activities may be limited. The database and registration of transactions that cannot be modified makes the operations more transparent, automatizes bookkeeping activities and makes it possible to trace raw materials from the extraction sites to the final buyers.

Many African start-apps based on blockchain are taking foothold such as the Nigerian Agrikore and the Ghanese BitLand. The former is a digital platform based on the blockchain technology that organizes and digitizes the Agricultural value chain so that the various stakeholders involved can create and capture economic value in a sustainable and transparent way. The latter is an app that has the goal of providing services that allow users to survey land and record title deeds

[62] (Bongiorni, Pag. 1-4, 2019)
[63] (Collingsworth, Pag. 3-7, 2019)

on the BitLand blockchain to build a permanent and auditable record to avoid land thefts that are very common in the country[64].

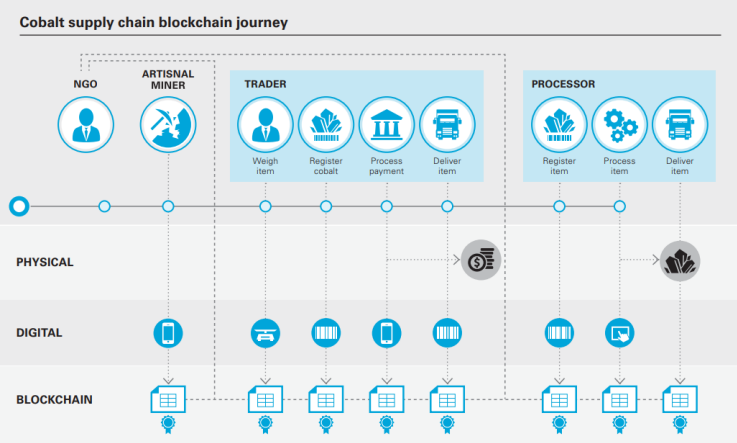

Figure 3: Cobalt supply chain blockchain journey[65]

Anyways, tracking cobalt results to be extremely challenging. For diamonds, a 40-point record known as a thumbprint is linked to each piece, while cobalt goes from the mine to a multiple steps production process before being employed in a battery for an electric appliance. Thus, incorrect data could be inserted into the blockchains defeating the purpose of traceability. To limit this from happening, the means to collect data should be standardized, therefore, both the downstream and upstream users should agree on a set of input data for identification and align registration points. The feasibility of blockchain technologies to trace cobalt mining depends on different factors such the very high rates of corruption in the DRC government and rule of law. Without effective institutional support, companies operating in the market are left with a disjointed and opaque supervisory system.

Despite the challenges, some companies have already invested in the Blockchain to implement ethical supply chains. For instance, the carmaker Volvo has invested in Circulor (a British blockchain developer) to trace the cars' battery supply chain by implementing a system bolstered by a program of audits that guarantees ethical sourcing standards of cobalt are fulfilled by its providers[66]. Volvo was one of the first to employ a decentralized digital ledger to achieve global traceability of raw materials and try to be part of a more sustainable business. Anyways, companies very often have limited knowledge about the provenance of the materials that they employ and the blockchain technology cannot prevent unlawful situations from happening. Nevertheless, it could be

[64] (Aitken, Pag. 2-5, 2016)
[65] (White & Case LLP, 2018)
[66] (Autovista, Pag. 1-2, 2020)

implemented as an innovative tool to supervise the movements of trade and hopefully fight the occurrence of unethical supply chains[67].

[67] (Abeyratne and Monfared., Pag. 2-6, 2016)

Chapter 4: Legal Analysis of Cryptocurrencies

All significant new technologies, as far as they are an incentive for change in society, will intersect and eventually collide with existing legal and regulatory frameworks. In the case of cryptocurrencies, legal categorization is still evolving, and, when carrying on an analysis of their current legal status, two different approaches emerge: on the one hand, cryptocurrencies are equated with the already existing objects of legal regulation by creating certain new sections that cover specifically the characteristics of cryptocurrencies as a variant of the corresponding objects. On the other hand, the concept of "cryptocurrency" is introduced into the legislation as a new object of legal regulation by creating new rules from scratch. Most countries are trying to regulate the new technology focusing mostly on the problems related to licensing operations with cryptocurrencies, taxation and criminal transactions, and, in most cases, cryptocurrencies are referred to as one of the already known and regulated objects of civil turnover, such as commodities, securities or foreign currencies. Anyhow, there is not a global and uniform position on the nature of cryptocurrencies, resulting in inhomogeneous regulations[68].

4.1 Cryptocurrencies as Commodities

From certain perspectives, cryptocurrencies can be considered as commodities, since they are claimed to possess real value deriving from the costs of production and of electricity employed in their production. Commodities are defined as "goods, wares and merchandise of any kind; movables, articles of trade or commerce"[69]. The new category under which some countries classify cryptocurrency is the one of "digital/virtual commodity". For example, in the USA, the CEA (Commodity Exchange Act) states that a "commodity" includes "all…goods and articles…and all services, rights, and interests…in which contracts for future delivery are presently or in the future dealt in"[70]. In December 2014, the CFTC (Commodity Future Trading Commission) affirmed that cryptocurrencies were contained under the legal definition of a "commodity" in the CEA, and therefore subject to its jurisdiction. This happened in response to a Bitcoin Exchange offering derivative contracts and options on the value of the cryptocurrency[71]. Later on in September 2015, the CFTC carried out the first enforcement against an unregistered Bitcoin option trading platform declaring that "Bitcoin and other virtual currencies are encompassed in the definition and properly

[68] (Bolotaeva et Al, Pag. 2-4, 2019)
[69] (The Law Dictionary, 2021)
[70] (Securities Exchange Act, 1934)
[71] (Hecht, Pag. 1, 2021)

defined as commodities"[7273]. Anyhow, the extension of the real rights framework to such an object results to be difficult as cryptocurrencies are intangible. From a civil law perspective, only a tangible asset can be alienated, while intangible objects of civil rights are not transferable, only the rights they bear can be alienated[74].

4.2 Cryptocurrencies as Securities

From another point of view, cryptocurrencies can be considered as uncertificated securities as they, while fixing a certain value, certify some owners' rights to receive a specific amount of money (right of claim). A financial instrument in fact, can be regarded as an "investment contract" and thus a "security" when there is an investment: of money (of fiat currency or of cryptocurrency), in a common enterprise, with an expectation of profit derived from the managerial or entrepreneurial efforts of others[75]. Thus, overall, if an individual decides to invest money in a common enterprise and is guided to expect profits only from the actions of other people, this can be considered a "security". The latter refers to a functional, negotiable financial tool that holds some type of monetary value. It represents an ownership position in a publicly-traded corporation via stock; a creditor relationship with a governmental body or a corporation represented by owning that entity's bond; or rights to ownership as represented by an option[76].

When analyzing what a security is, Initial Coin Offerings (ICOs) seem to fit the definition better than cryptocurrencies. In fact, according to the International Organization of Securities Commissions (IOSCO), ICOs, "typically involve the creation of digital tokens – using distributed ledger technology – and their sale to investors by auction or through subscription, in return for a crypto-currency"[77]. In the United States, under the Securities and Exchange Commission (SEC) and with reference to the DAO case, it has been reported that the ICOs tokens are to be considered securities[78]. Anyhow, the opponents to the definition of cryptocurrencies as securities argue that cryptocurrencies do not bear liability rights and are not monetary obligations[79]. They claim that the relations contained in cryptocurrency transactions could be more relatable to those of barter agreements, which consist in the trade of goods or services without the use of money[80].

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[72] (Commodity Futures Trading Commission, 2015)
[73] (Chernin A., Moran N. and Mola S., Pag. 2-7, 2020)
[74] (Bolotaeva et Al, Pag. 2-4, 2019)
[75] (Bolotaeva et Al, Pag. 2-4, 2019)
[76] (Kenton, Pag. 1, 2021)
[77] (International Organization of Securities Commissions, 2018)
[78] (Demchenko, Pag. 5-12, 2017)
[79] (Cvetkova, Pag. 133-136, 2018)
[80] (Kenton, Pag 1, 2021)

4.3 Cryptocurrencies as Money

Money is a tool that has three main functions within the economic system: it is a medium of exchange, a store of value, and an unit of account.

Medium of exchange: A medium of exchange is an intermediary tool or instrument that eases the sale, purchase and trade of goods and services between parties. To serve as such, it is widely accepted in the market for goods, services and financial capital[81].

Store of value: Money is considered a store of value as it can be used as a means of saving and allocating capital. Money is considered as a store of value as it can be saved and exchanged in the future without degenerating in value. To be defined as a store of value, an asset should, over time, either maintain the same value or be worth more[82].

Unit of account: A unit of account is something that can be employed to value good and services and record debt. It can be defined as a measurement for value. Agents can quote prices for items and then compare the prices of goods and services, thus, money is the ruler by which other values are measured[83].

While Bitcoins and other cryptocurrencies may have some evident similarities with what is commonly referred to as "money", remarkable differences arise. In fact, even if cryptocurrencies might be exchanged for goods and services (only by certain businesses), their value remains uncertain, and since there are no central issuing authorities, no stabilization policies take place to keep the value stable. The Financial Crimes Enforcement Network of the U.S. Department of Treasury has underlined that the Bitcoin, as well as the other virtual currencies, are a medium of exchange and operate as a currency under specific circumstances, but they do not possess all the attributes typical of money. Cryptocurrencies may be better compared to electronic money, a monetary value stored electronically, that is issued on funds receipt for payment transaction purpose and is a claim on the issuer[84]. Anyways, since the payment power of cryptocurrencies is supported only by the recognition of the participants in the system, in the Virtual Currency Schemes issued by the EU Central Bank, European authorities stated that Bitcoin cannot be defined as "electronic money" as the latter is a different form of the traditional fiat money, which substantially differs from virtual currencies. Always in the Virtual Currency Schemes, the same authorities defined cryptocurrencies as digital representation of a monetary value that is not issued by a central bank or credit institution[85].

[81] (Chen, Pag. 1, 2020)
[82] (Downey, Pag. 1, 2020)
[83] (Matke J., Maier C. and Reis L., Pag. 28-29, 2020)
[84] (Demchenko, Pag. 5-12, 2017)
[85] (Demchenko, Pag. 5-12, 2017)

To sum up, even if limited, the usage of cryptocurrencies as medium of exchange is possible as some businesses are accepting bitcoins and other cryptocurrencies as payment options. Unit of account concerns the possibility of goods and services to be priced, and, since there are some existing businesses using bitcoins to price their services and goods, cryptocurrencies do fall under this category. Lastly, with regards to the store of value, there is no common agreement on the virtual currencies' possession of intrinsic value[86]. As countries have overcome the gold standard, the majority of currencies are classified as fiat, meaning that these currencies are issued by a state and not supported by a commodity, but rather by the trust and faith that individuals and governments have in the acceptance of the currency by other parties. Therefore, also under this perspective, the nature of cryptocurrencies results to be extremely diverse from the one of fiat currencies[87].

4.3.1 Other Money Qualifications

There are other qualifications that need to be met for successfully fitting the definition of currency: scarcity, divisibility, utility, transportability and durability[88].

4.3.2 Scarcity

Supply of money is strictly linked to a currency's value. Most of the governments print money as means to control scarcity and operate with a predefined level of inflation which is utilized to drive the value of the fiat currency down. This differs from cryptocurrencies, as many have a fixed supply. When Bitcoin was launched, it was stipulated in the protocol that the supply of tokens would be capped at 21 million, resulting in it being very scarce. Monetary policies adopted by governments consist in the control of the supply of currency in circulation by making adjustments in response to economic factors, and so far this is not the case for bitcoins[89].

Traits of Money	Fiat Currency (US Dollar)	Cryptocurrency (Bitcoin)
Scarcity (predictable supply)	Moderate	High
Divisibility	Moderate	High
Transportability	High	High
Durability	Moderate	High
Sovereign (Government issued)	High	Low
Interchangeability	High	High

Table 1: Traits of money with respect to fiat currency and cryptocurrency

[86] (Demchenko, Pag. 5-12, 2017)
[87] (Kelleher, Pag. 1, 2021)
[88] (Kelleher, Pag. 1, 2021)
[89] (Kelleher, Pag. 1, 2021)

4.3.3 Divisibility

Currencies should be divisible in smaller incremental units in order to successfully and precisely indicate the value of every good or service available on the market. For instance, the Bitcoin is divisible up to 8 decimal points and its smallest unit is called "Satoshi", corresponding to 0.00000001 Bitcoin. This cryptocurrency has a much greater divisibility than the U.S. dollar as the dollar can only be divided into cents[90].

4.3.4 Transportability

To be efficient, currencies need to be easily transferred from one individual to another, both within and outside national borders. While transferring fiat money may take days and be costly, through the use of cryptocurrency exchanges and wallets, virtual currencies can be moved fast, incurring in low fees. Anyhow, they can be subject to hacks, scams and frauds[91].

4.3.5 Durability

Currencies need to be durable to be effective. Money made of materials that easily deteriorate and become unusable are not considered to be effective. Physical currencies can simply be rendered unusable. Cryptocurrencies as well can go lost, anyways, virtual currencies themselves cannot be easily destroyed[92].

To summarize, even if cryptocurrencies share some characteristics with money and appear to have some advantages over fiat currencies, the issue of their status as store of value remains prominent and hard to overcome since it is difficult to establish whether cryptocurrencies do possess intrinsic value. Some consider cryptocurrency to be basically just encrypted information that records the transactions and denotes a certain value. Thus, the similarities with the existing objects of law, do not provide sufficient ground for their fitting into any of the aforementioned categories since they only possess certain characteristics of the several objects without completely falling in the definitions of any. Therefore, because of their unique nature, cryptocurrencies cannot be precisely attributed either to commodities, securities or money. They are fundamentally new objects of law that should be regulated accordingly[93].

[90] (Kelleher, Pag. 1, 2021)
[91] (Kelleher, Pag. 1, 2021)
[92] (Kelleher, Pag. 1, 2021)
[93] (Kelleher, Pag. 1, 2021)

4.4 Legal Analysis of Blockchain

The structure of the blockchain, already analyzed in previous chapters, makes it difficult to establish and assess legal responsibility across the agents operating on the system. In fact, permissionless blockchains are by nature open to anyone, meaning that people from very distant locations can interact and exchange goods and services. Since blockchains reach numerous stakeholders all around the globe, they become a complex issue for territoriality. Each network node might be subject to different regulations, but it could also be the case of blockchains only acting within one jurisdiction, such as private and permissioned blockchain. Anyways, when dealing with open permissionless blockchains, cross-jurisdictional harmonization should become crucial. Lawmakers should therefore collaborate and be coordinated when establishing regulatory frameworks. This would contribute to a creation of an aligned mechanism. Anyhow, synergism among regulators could be very challenging and effortful to achieve. Moreover, the issue of legal validity arises. In fact, just because it is possible to prove that transactions on the blockchain have been executed in the right way and it is feasible to trace who owns which data on the system, this does not automatically mean that the blockchain transactions are legally binding. To make that happen, there should be legal recognition of blockchain-based signatures (the agents that made the transaction), timestamps (when it was carried out), validations (the miner that validated the transaction) and "documents" (that are all the data associated with either a contract or a transaction)[94].

User protection is another sensitive and remarkable theme linked with the legal status of the blockchain. Liabilities aim at providing the damaged person with an opportunity to obtain compensations for the damages suffered. Regulations for establishing liability vary depending on: who, to whom, what for, on what kind of consequences a person is liable. In the case of blockchains, important liabilities could be placed on core developers. They are potential access points for the enforcement of regulations as they cover the role designing, developing and maintaining tasks in the blockchain system. The debate is whether and when the developers of open source codes should be considered liable. Should they be responsible if illegal exchanges are made through their codes? Should they be considered liable if their codes do not present safety features that prevent them to be used for unlawful activities?[95]

Usually the developers are also founders of profitable businesses activities/projects. They gain profits not only from the fees on transactions but also from the increase in the value of tokens financing the development of a business. Core developers and founders usually retain part of the tokens to themselves, so that their own profits depend on the success of venture projects. Therefore,

[94] (Lyons, Courcelas and Timsit, Pag. 11-17, 2019)
[95] (Lyons, Courcelas and Timsit, Pag. 11-17, 2019)

if considered also as entrepreneurs, the scope of their responsibility might become much broader. On the other hand, such developers and entrepreneurs operating in an open permissionless blockchain may completely lose the influence on the project/business as many participants add up and therefore, they could have a very limited influence on the overall transactions that take place in the system. Besides core developers, there are other actors involved in the blockchain operations that need to be object of regulation. These players are owners of additional servers running the distributed ledger code for validation purposes (such as node owners), "qualified users" such as exchanges, miners and lending institutions, "simple users" that own cryptocurrencies, and, lastly, third parties affected by the system such as clients of brokers that hold virtual currencies for them[96]. Decentralized digital environments result to be particularly tricky objects of regulation as they make it difficult to ascertain who "owns" the network and the data contained into it, and who is legally responsible as well. In such a scenario, it is hard to understand where and when data were processed and so to certainly assess the agent responsible for it, the jurisdiction to apply in disputes or who is in charge of the security and integrity of the information stored[97].

Legal systems are just beginning to grapple with deciding what rights and liabilities are appropriate when disputes arise from the blockchain's transactions. Blockchain ventures and participants are likely to experience an uncertain period of theorizing and experimentation before a consensus on the definition of legal rights and liabilities agents will face when interacting on the system[98]. In fact, regulations are still evolving on the matters, and, in the next chapter, it will be analyzed how some of the major jurisdictions, European Union, USA and China are dealing with the legal status of both blockchain and cryptocurrencies.

[96] (Arner, Buckley and Zetzsche, Pag. 1382-1283, 2018)
[97] (Lyons, Courcelas and Timsit, Pag. 11-17, 2019)
[98] (Arner, Buckley and Zetzsche, Pag. 1382-1283, 2018)

Chapter 5: Current Legislations in the EU, USA and China

In previous chapters, the main risks associated with cryptocurrencies and blockchains as well as the legal issues in providing appropriate and uniform regulations on the matter have been exposed. In the next paragraphs, the practical regulations and approaches adopted by three of the main jurisdictions, the EU, USA and China will be analyzed to better understand how major countries are classifying and dealing with the new technology.

5.1 EU

To date, crypto-asset users, issuers and service providers do not completely reap the benefits of the European Union internal market because of the absence of regulatory certitude on the legal approach towards the new technology and due to the lack of appropriate and uniform supervisory guidelines at an international level[99]. Some countries have implemented tailor-made frameworks to cover some crypto-assets legal issues, but the majority of the states operate without specific regulatory regimes. Anyhow, the implementation of differentiated regulations could hamper the chances of service providers to scale up their activities in the EU area, as they would be obliged to adapt to the different single state legislations. This would create some barriers resulting in higher costs, increased legal complexity and major uncertainty. Therefore, in addition to the absence of legal clarity, an uneven EU legal framework increases the risks investors and users would be exposed to[100]. Even if different forward-looking rules have emerged across the countries of the Union, the EU has repeatedly shown its intention and effort to harmonize the European legal framework concerning cryptocurrencies and blockchains[101]. Because of this, over the years, European authorities have been disclosing new guidelines and warnings in an effort to regulate and provide greater clarity on the matter[102].

5.1.2 Payment Services Law

Cryptocurrencies can be employed as means of exchange and are effectively regarded by the participants of the blockchain as assets, in the sense of "something of value" even if they do not match the liability of and claim on any party[103]. Because of this, under the EU jurisdiction, cryptocurrencies result to be practically differ from the existing forms of financial claims and their electronic representation, such as electronic money. With reference to the latter, the Second Electronic Money Directive (EMD2) stated that e-money is monetary value stored electronically as represented by a

[99] (European Commission, 2020, Pag. 1-8)
[100] (European Commission, 2020, Pag. 1-8)
[101] (Gikay, 2018, Pag. 13-29)
[102] (Gikay, 2018, Pag. 13-29)
[103] (European Central Bank, 2019, Pag. 7-9)

claim on the e-money issuer, which is issued on receipt funds, aiming at releasing payment transactions that are accepted by both natural and legal persons other than the electronic money issuer[104]. The EU does not include cryptocurrencies neither under this categorization nor under the one of scriptural money that consists in commercial bank liabilities taking the form of deposits held at a commercial bank[105].

In 2012, the EU has introduced a legal framework supervising the Euro Area Payment (SEPA regulation) that has the goal of providing uniform electronic payment systems all over the European Union[106]. The SEPA comprises "rules for credit transfer and direct debit transactions denominated in euro within the EU, where both the payer's payment service provider and the payee's payment service provider are located in the EU, or where the sole payment service provider (PSP) involved in the payment transaction is in the Union"[107]. This regulation provides universal regulations for credit transfer and debit transaction comprising the conditions of payment and fees, and underlines the rights and duties of the payment service providers and users. SEPA does not undertake cryptocurrencies as they are not considered to be credit transfer or debit transactions. Under the Payment Services Directive (PSD2) a transaction is defined as "an act, initiated by the payer or on his behalf or by the payee, of placing, transferring or withdrawing funds […]"[108], whereas funds are "banknotes and coins, scriptural money or electronic money"[109] and thus, does not comprise crypto-assets as disclosed and defined by the Internal Crypto Asset Task Force. In fact, the latter defined cryptocurrency as a "new type of asset recorded in digital form and enabled by the use of cryptography that is not and does not represent a financial claim on, or a liability of, any identifiable entity"[110]. Moreover, under the PSD II, to acquire an authorization, a payment service institution must possess all of the following: a diligent management, strong governance arrangements, clear and precise organization structure, transparent and well defined lines of responsibility. Anyhow, cryptocurrencies' structure results to be inimical to the aforementioned requirements as transfer of funds can be effectuated directly from the payer to the payee, with the confirmation of miners on the blockchain, but without the intervention of any central authority. Finally, there are no lines or responsibility nor an organizational structure that obliges miners to engage in mining operations or impositions of obligations regarding the confirmation of transactions[111].

[104] (European Parliament, 2009, Pag. 1-8)
[105] (European Commission, 2020, Pag. 1-8)
[106] (European Parliament, 2012, Pag. 1-9)
[107] (European Parliament, 2012, Pag. 1-9)
[108] (European Commission, 2019, Pag. 1)
[109] (European Commission, 2019, Pag. 1)
[110] (European Central Bank, 2019, Pag. 1)
[111] (Gikay, 2018, Pag. 13-29)

Therefore, crypto-assets would not be inherent to the scope of payment services regulation. In fact, the ECB clarified in the 2015 report on cryptocurrencies that "in the European Union, virtual currency is not currently regulated and cannot be regarded as being subject to the current Payment Service Directive"[112]. Only cryptocurrencies exchanges may comply with the SEPA regulation if users deposit Euros in their digital wallets to acquire cryptocurrencies or to withdraw their cryptocurrencies in Euros[113].

5.1.3 Anti-Money Laundering and Counter Terrorist Financing Law

The 5th Anti-Money Laundering and Counter Terrorist Financing Directive aimed at contributing to worldwide security, enforcing integrity of financial systems and creating a legal perimeter to better capture cryptocurrencies and the entities dealing with the new technologies[114]. Under the 5AMLD, cryptocurrencies businesses have been considered to be "obliged entities", as traditional financial institutions are. Thus, firms based on crypto have to align to the same Anti-Money Laundering, Combating the Financing of Terrorism, Know Your Customer and data sharing requirements[115]. Therefore, the entities involved in the crypto exchange and in crypto wallet services are required to list their business with the local authorities in the EU and implement transparently the aforementioned requirements as well as providing identifiable user information to Financial Intelligence Units when asked to do so[116].

Moreover, in 2018, with the FinTech Action plan, the European Commission mandated the European Banking Authority (EBA) and European Securities and Markets Authority (ESMA) to issue an advice on the appropriateness of the existing financial services regulations to crypto-assets. In January 2019, the issued advice claimed that while some crypto-assets may be included in the scope of the EU legislation, an effective application of the regulations to the assets would still be challenging. Meanwhile, the EBA and ESMA noted that besides the EU legislation aim at fighting money laundering and terrorism financing, most crypto-assets do not comply with the scope of the EU financial services regulations and thus are not contingent to the provisions on customer and investor protection and market integrity, although they do give rise to these risks[117].

Lastly, in September 2020, the EU Commission Markets in Crypto-Assets (MiCA) has stated its intention to create and harmonize the overall European regulatory framework concerning digital

[112] (European Central Bank, 2019, Pag. 7-9)
[113] (European Central Bank, 2019, Pag. 7-9)
[114] (Arendt & Medernach, Pag. 1-2, 2018)
[115] (European Commission, 2020, Pag. 1-8)
[116] (European Commission, 2020, Pag. 1-8)
[117] (European Commission, 2020, Pag. 1-8)

assets and their service providers. This comprehends any activity, from issuance to provision, both to businesses and individuals operating on the system. The resolution implies rules of trading, marketing campaigns and supervisory activities regarding digital assets as well as the governance of token issuers and crypto service providers and lastly, the implementation of customer protection rules to safeguard market integrity. When complete and widely adopted, the MiCA should promote standardized definitions for the new technology that are currently missing and hindering regulators' policies across EU states. In the end, MiCa should replace individual countries' laws and deliver greater certainty to the legal framework of cryptocurrencies[118].

5.1.4 Conclusion EU

Despite the lack of a universal and complete legal framework regulating cryptocurrencies, the president of the EU commission Ursula Von Der Leyen has stressed the urgency of "a common approach with Member States on cryptocurrencies to ensure we understand how to make the most of the opportunities they create and address the new risks they may pose"[119]. The European Parliament has been putting effort into the realization of a report on digital finance with great emphasis on crypto-assets, and on a proposal concerning a clarification of the current definition of 'financial instruments' to include financial instruments based on a distributed ledger technology as it is the case for cryptocurrencies[120]. The proposal has 4 main objectives. The first one is to deliver legal certainty. In fact, to let crypto assets thrive in the EU, there is the necessity for a coherent legal framework that clearly defines the regulatory treatment for each crypto asset. The second is to promote innovation through a wider use of the blockchain and an efficient adoption of cryptocurrencies. To do so, a safer and proportionate legal framework is necessary to support innovation as well as fair competition. The third objective is to support appropriately consumer and investor protection as well as market integrity given that cryptocurrencies present many risks similar to the ones of the traditional financial instruments. The last objective is to guarantee financial stability.

As stated by the president Von Der Leyen in her Political Guideline, reaping all the benefits of the digital age while ensuring safe and ethical boundaries is crucial for the European Union. The other crucial point highlighted by the president, is the provision of a common approach within the member states to make the most of the available opportunities while decreasing the risks that these technologies might bear. The European Parliament aims to position Europe at the forefront of blockchain innovation and exploit all the advantages of both cryptocurrencies and blockchains[121].

[118] (European Commission, 2020, Pag. 1-8)
[119] (Von der Leyen, 2019, Pag. 6)
[120] (European Commission, 2020, Pag. 1-8)
[121] (European Commission, 2020, Pag. 1-8)

5.2 USA

In the USA, cryptocurrencies have been the object of discussion mainly on administrative and agency levels. The authorities involved in the legal categorization and placement of cryptocurrencies and blockchains are the Securities and Exchange omission (SEC), the Commodities and Futures Trading Commission (CFTC) and the Department of the Treasury. Overall, American policymakers have praised the new technology as a remarkable opportunity for the infrastructure of the US and for the compelling will of the country to maintain a leading position in the technological sector[122].

5.2.1 Government Attitude and Definition

Several state governments have either submitted or approved laws regarding blockchain technology and cryptocurrencies, applying mostly two approaches to regulation. The first one consisted in states attempting to propose very encouraging regulations exempting cryptocurrencies from state security laws and money transmission statutes. The states adopting this approach aim at stimulating local economies through the investment in the technology. For instance, Wyoming has passed a legislature that allows the creation of a new type of bank that permits businesses to hold digital assets securely and legally. The state of Colorado, has approved a bipartisan bill that exempts cryptocurrencies from state securities regulations while Ohio has become the first American state to accept taxes in cryptocurrencies. Oppositely, the second approach, consisted in the enhancement of limits in the application of the technology. For instance, Iowa has passed a bill prohibiting the state from accepting cryptocurrencies' payments and other states, such as Hawaii and Maryland, have released warnings regarding investments in cryptocurrencies[123].

5.2.2 Securities Law

The SEC supervises the issuance or resale of any type of token or other electronic asset that is considered a security. The latter is referred to under the U.S. law as "an investment contract" that is defined as an investment of money in a common enterprise with reasonable expectation of profits derived from the entrepreneurial or managerial efforts of others by the U.S. Supreme Court[124].

To determine whether a token can be considered as an "investment contract" the SEC refers to the substance of the transaction rather than to its form. This is because in 1943, the U.S. Supreme Court has argued that "the reach of the [Securities] Act does not stop with the obvious and commonplace" and also that new and non-conventional devices can be reached if there is proof of the

[122] (Dewey, 2021, Pag. 1-7)
[123] (Dewey, 2021, Pag. 1-7)
[124] SEC v. W.J. Howey Co., 328 U.S. 293, 301 (1946)

fact that they were offered or dealt in such a way that denoted their character in commerce as 'investment contracts'[125]. The SEC has established that also a token issued as an ICO has "utility" and thus, the token can be considered as a security[126]. If a digital asset is defined as a security, then the issuer has to register the security with the SEC or present an exemption from registration requirements. Anyways, to date, there are not many digital tokens trading on the market, probably because of the difficulty encountered in harmonizing traditional securities laws and peer-to-peer networks[127].

5.2.3 Money Transmission Laws and Anti-Money Laundering Requirements

In March 2013, the FinCEN (Financial Crimes Enforcement Network) released guidelines that concerned Money Services Businesses (MSBs), underlining that virtual currency exchanges and administrators of centralized deposit who have authority to issue and redeem the cryptocurrency would be considered MSBs[128]. Thus, under the FinCEN's regulations, an entity that exchanges and accepts a convertible virtual currency or purchases and sells the convertible virtual currency is considered a transmitter (unless limitations or exemptions apply). A Money service business has to perform a risk assessment of its potential exposure to money laundering practices and conduct anti-money laundering programs accordingly[129]. Moreover, cryptocurrency fund managers investing in crypto future contracts, contrary to "spot transactions" in cryptocurrencies, have to subscribe as a commodity trading advisor and commodity pool operator with the Commodity Futures Trading Commission and the National Futures Association, or, satisfy an exemption. Even if the SEC has not provided specific guidance on the classification of individual cryptocurrencies as either securities or commodities, each cryptocurrency fund manager is to be exposed to fraud provisions of the CFCT and/or the SEC. In fact, in September 2017, the CFTC declared its first anti-fraud enforcement action involving Bitcoin. Later in July 2020, the Office of the Comptroller of the Currency announced in an interpretive letter that national banks and savings associations could operate as keepers for cryptocurrencies. The banks could also deliver linked services such as cryptocurrency-fiat exchanges, transaction settlement, trade execution, valuation tax services and reporting[130].

[125] SEC v. C.M. Joiner leasing Corp. 320 U.S. 344, 352 (1943).
[126] (Dewey, 2021, Pag. 1-7)
[127] (Dewey, 2021, Pag. 1-7)
[128] (Department of the Treasury Financial Crimes Enforcement Network, Pag 1-6, 2013)
[129] (Department of the Treasury Financial Crimes Enforcement Network, Pag 1-6, 2013)
[130] (Dewey, 2021, Pag. 1-7)

5.2.4 Taxation

In March 2014, the Internal Revenue Service (IRS) stated that "virtual currencies" such as Bitcoins and the other cryptocurrencies were to be taxed under the IRS authority as "property" and not as currency[131]. As a consequence, each agent or business that owns cryptocurrencies should keep account of crypto purchases and sales, pay taxes on potential gains that may result from the sale of cryptocurrency for cash as well as on gains resulting from the purchase of goods/services with cryptocurrencies. Lastly, they should pay taxes on the fair market value of mined cryptocurrencies, as of the date of receipt. On Form 8949[132], the IRS also requires the following details to be released for each cryptocurrency transaction: 1) a report of the amount and type of cryptocurrency sold 2) date of acquisition 3) date of the sale of the cryptocurrency 4) amount of proceeds deriving from the sale 5) the cost 6) amount of gains/losses. For transactions executed on or after January 1, 2018, the IRS code requires taxpayers to recognize taxable gains or losses in the moment in which any cryptocurrency is converted into another[133].

5.2.5 Conclusion USA

The USA have a generally positive outlook with respect to the adoption of cryptocurrencies and the different competent authorities hold different definitions of cryptocurrencies adapting to several contexts. While the FinCEN does not define cryptocurrencies as legal tender it does evaluate exchanges as money transmitters that fall under its jurisdiction. Meanwhile, the IRS considers cryptocurrency as property and has started to disclose taxation rules accordingly. Anyhow, the Federal Government has not exploited its constitutional preemptive power to regulate cryptocurrencies and blockchains, conferring individual states the freedom to introduce their own regulations[134].

5.3 China

China has assumed a restrictive attitude towards cryptocurrencies and related operations and activities. The most recent restriction has been disclosed on the 18th of May 2021, causing Cryptocurrency markets to swing in chaotic trading. As a result, Bitcoin has tumbled as much as 30% to a low of US $30,101[135]. Also the other main cryptocurrencies such as Ethereum were hardly hit by the news. The PBOC has released a warning to financial institutions about accepting cryptocurrencies

[131] (IRS Notice, Pag. 1-6, 2014)
[132] (IRS, Pag. 1-2, 2020)
[133] (Dewey, 2021, Pag. 1-7)
[134] (Morton, Pag. 1-4, 2019)
[135] (Xueqiao, Pag. 1-3, 2021)

as payment options or offering linked services and products, increasing investors' concerns exponentially. Additionally, the PBOC has affirmed that cryptocurrency "is not a real currency" and "should not and cannot be used as a currency in the market"[136]. The latest warning issued by the Chinese institution does not result to be unexpected as it is consistent with the decisions taken over time on the matter[137].

5.3.1 Ban on ICOs

In September 2017, seven of the government agencies of China jointly disclosed the "Notice regarding Prevention of Risks on Token Offering and Financing"[138]. The notice implied the ban of all ICOs in the country and commanded any entities or participants who had formerly completed ICOs to return the token assets to the ones that had invested in order to protect investor rights. In the same notice, ICOs were defined as a process through which fundraisers distribute digital tokens to investors that make financial offerings in the form of cryptocurrencies and thus, the notice furtherly underlined that they were by nature an unauthorized and illegal public financing activity. The distribution of tokens, the issuance of securities and the fundraising were all deemed illegal and part of a financial fraud. Such a strict attitude towards ICOs can find its roots in China's economy and financial markets. In fact, in the past years, China has been developing its economy fast, which some believe, was also due to high leverage of the financial system and accretion of financial risk. This is why control of financial risks and stabilization have become increasingly important for the PBOC (People's Bank of China). This explains why ICOs, due to their increase both in number and amount of funds collected, received the ban from the PBOC.

It should be underlined that also ICOs outside of the territory may be subject to the regulation if they attract Chinese investors[139]. In fact, according to Article 6 of the PRC Criminal Law, if criminal activities or the results of such activities occur in China, the crimes are conceived to have taken place in the country's territory[140]. So, if ICOs are linked to financial crimes, based on China's criminal law standards, the organizers of the ICO could potentially be subject to Chinese criminal liabilities if they are Chinese citizens. Moreover, even if the organizers do not hold a Chinese citizenship, but their ICOs have involved Chinese investors, they could still be subject to Chinese criminal liabilities[141].

[136] (Xueqiao, Pag. 1-3, 2021)
[137] (Xueqiao, Pag. 1-3, 2021)
[138] (Wenhao, Pag. 1-4, 2021)
[139] (Wenhao, Pag. 1-4, 2021)
[140] (Article 6, PRC Criminal Law)
[141] (Wenhao, Pag. 1-4, 2021)

5.3.2 Ban on Cryptocurrencies Exchanges

The Notice divulged on September 2017, has also discussed cryptocurrency exchanges and has claimed that the fundraising and exchange platforms shall not: 1) offer exchange services between fiat currency, cryptocurrencies and tokens 2) purchase or sell tokens or cryptocurrencies as well as providing price determination or information for tokens or cryptocurrencies[142]. After the notice, most of the cryptocurrency traders closed their platforms in China but kept going on with the business through platforms registered in other countries. Anyhow, they could still be prosecuted by Chinese authorities because of the long-arm jurisdiction of the Chinese criminal laws. For instance, in October 2020, there was a report concerning the fact that the founder of OKEx, one of the major cryptocurrency exchanges worldwide , had been detained by Chinese authorities for undisclosed reasons. To furtherly limit the possibility of Chinese investors getting involved in the purchase and trade of cryptocurrencies on other countries' platforms, the Chinese government has blocked internet access to the websites of several foreign exchanges from China[143].

5.3.3 Discouraging Bitcoin Mining

In January 2018, China's Leading Group of Internet Financial Risks Remediation demanded local governments to remove existing policies for Bitcoin mining companies in terms of taxes, electricity prices and land use, and commanded the withdrawal of such companies from the Bitcoin Mining Business[144]. Additionally, all the Chinese localities need to regularly submit reports on the ongoing Bitcoin mining operations in their jurisdictions[145], and, because of the strengthening of mining regulations, many Bitcoin mines have stopped working in China[146].

5.3.4 Conclusion China

Despite the ban on ICOs and crypto exchanges, as well as the further recent restrictions, the POBC has repeatedly shown great interest toward the adoption of the blockchain technology within the Chinese financial system to modernize and become a global leader with respect to this innovation. Anyhow, the PBOC aims at employing the blockchain and cryptocurrency with the only goal of better serving the real economy of the country[147].

[142] (Wenhao, Pag. 1-4, 2021)
[143] (Wenhao, Pag. 1-4, 2021)
[144] (Zhang, Pag. 1-5, 2018)
[145] (Yujian et al., Pag. 1-3, 2018)
[146] (Song, Pag. 2-7, 2018)
[147](Wenhao, Pag. 1-4, 2021)

Chapter 6: Perspectives on Cryptocurrencies and Blockchains

In 2020, cryptocurrency has become accessible to a wide spectrum of retail investors thanks to the availability of digital assets on popular payment systems such as PayPal and Square. The diversification of access points and the more user-friendly interfaces have contributed to a rise in the number of participants in the cryptocurrency system. The number of global crypto users has been growing in recent times, reaching 106 million[148] in January 2021. The worldwide spending on blockchain solutions, instead, was 4.5 billion USD in 2020 and is expected to grow to 19 billion USD by 2024[149]. Besides the projections depicting increasing trends in the adoption of cryptocurrencies and blockchain investments, there are many unsolved issues on which the future of these technologies depends on. In the next paragraphs, the current adoption status of cryptocurrencies and blockchains will be analyzed, considering also behavioral attitudes and environmental concerns towards them. Then, forthcoming practical solutions and legal perspectives will be reported in an attempt to assess the future developments of the technologies.

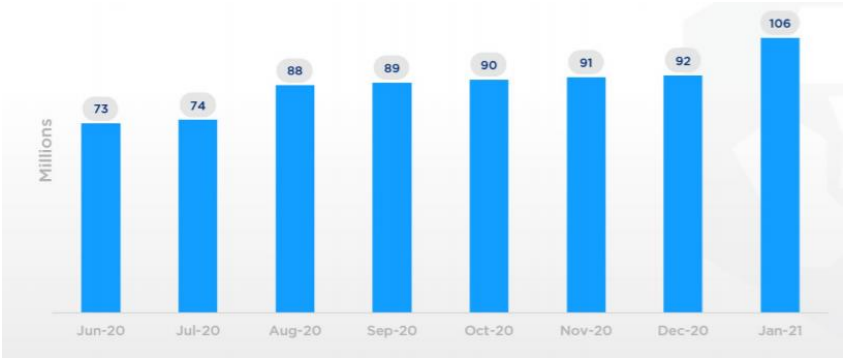


Figure 4: Global Crypto Market Size Over Time[150]

6.1 Use of Cryptocurrencies and Blockchains

While retailers have started to respond to the cryptocurrency market, the degree of participation from individuals still appears to be low. Reason for this is that the acceptance of the new technology by a skeptical public that is not comfortable with the workings of cryptocurrencies needs to be encouraged by massive education and assurance. Moreover, the issue of volatility has been repeatedly reported by the media, the most recent example being the swinging of cryptocurrencies' prices in response to the Chinese authorities' ban and the withdrawal of Bitcoin payments by the major electric carmaker Tesla. These events keep casting doubts on the performance of the

[148] (Wang, Pag. 5-9, 2021)
[149] (Wang, Pag. 5-9, 2021)
[150] (Wang, Pag. 9, 2021)

technology. Without trust and adoption from a larger public, cryptocurrencies do not result to be a functioning alternative to traditional payment systems.

Decentralization, the element characterizing and distinguishing cryptocurrencies the most, is also keeping the technology to experience a wide spread. In fact, the transition from a traditional centralized system to an innovative decentralized one is encountering many odds spanning from regulatory to reliability issues. A remarkable opportunity for the expansion of the technology emerged in 2019, when Facebook announced the intention of launching its own global digital currency named "Libra". The tokens issued by Libra were originally thought to be tied to baskets of sovereign currencies such as the US dollar or the Euro, anyhow, regulators were extremely concerned about the implications of such a large platform launching a global currency, to the point that they feared it could menace the monetary stability of the US dollar itself. Because of legal concerns, the major backers of the project such as Visa and Mastercard decided to withdraw. Nevertheless, after confrontations with regulators and policymakers, Facebook intends to propose its project again, now under the name of "Diem". The latest idea consists in launching a stable coin pegged to the US currency. Anyhow, concerns on the matter persist because of the vast reach of Facebook's platform, which counted 2.85 billion monthly active users just in the first quarter of 2021, and of the consequent implications of a global currency adopted by such a prominent number of persons. Thus, the near future of cryptocurrencies seems to be uncertain. On the one hand a wider involvement of users in the system could make the new technology thrive and could form an affordable financial network, on the other hand, policymakers are hampering this process as they fear that a currency like "Diem" could threat monetary stability and have dangerous implications for money laundering activities and users' privacy[151].

The Blockchain, differently from cryptocurrencies, is likely to encounter success more easily in the early future. Because of its traits, suitable in the operations of different sectors, blockchains are starting to be adopted both from private and public organizations. Currently, the USA is leading the market of blockchain technology, but China as well, with major blockchain companies such as Ant Group and JD Digits, is advancing in the fintech sector[152]. In 2020, the financial sector accounted for 30% of the global market value of the blockchain, anyhow, the technology has spread nearly to every industry[153]. In fact, blockchain services have already been adopted in supply chain management, health care, global trade, real estate, governmental services, retail and insurance activities. Permissioned blockchains, which consent to single entities to access the system and supervise it, are

[151] (Taskinsoy, Pag. 1-4, 2019)
[152] (Shanhong, Pag. 1, 2021)
[153] (Taskinsoy, Pag. 1-4, 2019)

enjoying wide success in private sectors. In this respect, the luxury blockchain Aura came to life in April 2021, with the contribution of LVMH, Prada Group and Louis Vuitton, with the goal of verifying the authenticity and provenance of luxury goods[154]. While permissioned blockchains are already experiencing a diffused usage in the market, permissionless blockchains, like the one of Bitcoin, seem to run into more obstacles. In fact, the complete openness and transparency may improve the trust in the system, but the disclosure of content may lead to serious privacy leaks and the absence of regulatory frameworks is preventing businesses from massively getting involved[155].

6.1.1 Tesla & Bitcoin: Behavioral Economics and under/over-Reaction to Information

When trading on the market, investors find themselves fighting against unquantifiable risk and ambiguity. The latter can be referred to as the impossibility to assign probability values to the events that may or may not take place. With reference to cryptocurrencies, this kind of uncertainty may emerge because of: 1) the complexity and opaqueness of the technology that only sophisticated traders are likely to understand, and 2) concerns about the intrinsic value of cryptocurrencies[156].

Overall, when it is hard to find reliable information, investors tend to rely on the attitudes of other investors considered as better informed, and this process results in herding. Investors commit systematic irrational errors such as under and over reactions to information that consequently can cause market trends, and, in extreme cases, bubbles or market crashes. Such actions of investors are due to limited attention, overconfidence and mimicry trading attitudes that find roots in Kahneman and Tversky's prospect theory, which argues that decision makers evaluate outcomes from the perspective of their current endowments and revise the probability of outcomes of their decisions mainly by overweighting probabilities of bad circumstances and underweighting those of good ones[157].

Over the last months, the news have repeatedly reported the name of Elon Musk, CEO of Tesla, SpaceX and The Boring Company, when discussing cryptocurrencies. In fact, Musk, with over 55 million followers on Twitter, has been sharing his considerations on the matter and markets have been responding accordingly. In 2019, Musk started considering Bitcoin as a potential component of his business model, and, later on the 8th of February 2021, Tesla announced in a filing with the SEC that the company had bought US $ 1.5 billion worth of Bitcoins to diversify and maximize returns on cash. Moreover, the company also announced its willingness to accept payments in Bitcoins. After

[154] (McDowell, Pag. 1-3, 2021)
[155] (Taskinsoy, Pag. 1-4, 2019)
[156] (Giudici et Al., pag. 1-18, 2020)
[157] (Giudici et Al., pag. 1-18, 2020)

the announcement, prices surged to new highs reaching a price of $44,200. Anyways, later on, Musk started to backtrack on his previous comments.

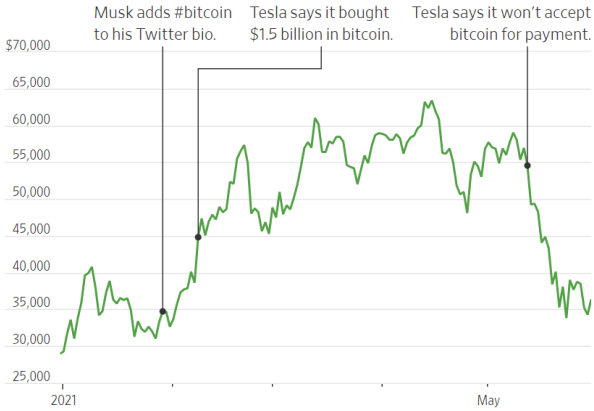


Figure 5: Bitcoin's Price Swings and Tesla Activities[158]

In April 2021, Tesla sold 10% of its Bitcoin holdings and later on the 13th of May, Musk announced that he was increasingly concerned about the use of fossil fuels for the Bitcoin mining process and transactions, and being Tesla an electric carmaker, they would not use Bitcoins anymore, at least not before mining processes would shift to more sustainable energy sources. Musk's comments are not the only factors influencing recent price swings in cryptocurrencies, in fact, as analyzed in chapter 5, the statement released by Chinese authorities claiming that financial institutions should not be accepting virtual currencies for payment hardly hit the market as well. Anyhow, because of its influential position, Musk certainly has had an impact on the movements of the market and on the attitudes of several investors dealing with cryptocurrencies[159].

6.2 Environmental Concerns

The negative impact of cryptocurrencies on the environment was a well-known fact even before Elon Musk's statement. Indeed, it is common knowledge that cryptocurrencies are created by miners through the use of high-powered computers resulting in a remarkably energy-intensive process that often relies on fossil-fuels energy, in particular coal. It is crucial to note that as of April 2021, China accounted for 65,08% of Bitcoin mining[160], heavily relying on cheap fossil fuels as sources of energy[161]. To quantify the footprint of cryptocurrencies it is sufficient to consider that the estimated energy footprint of one Bitcoin transaction corresponds to 600 KWT, which is estimated to be equivalent to 300,000 contactless transactions (with credit cards). Just Bitcoin's annual electricity

[158] (Otani, 2021)
[159] (Hoskins, Pag. 1-3, 2021)
[160] (Cambridge Center for Alternative Finance, 2020)
[161] (Hoskins, Pag. 1-3, 2021)

consumption adds up to 45.8 TWH and the annual carbon emission ranges from 22.0 to 22.9 MtCo2, corresponding to the levels produced by the nations of Jordan and Sri Lanka annually[162]. The whole working processes of the system result to be energy-intensive. In the proof of work system, every miner individually confirms whether transactions adhere to the rules and can be deemed as valid.

Every miner is constantly working on preparing the next batch of transactions to add on the blockchain. Once a miner manages to create a valid block, he or she informs the rest of the network and other miners will accept the new block if it regularly complies with the rules. The miner that completes the valid block is rewarded with a fixed amount of coins and transaction fees. Then the cycle starts again. As the continuous mining process results to be a profitable work, miners are willing to run very energy-intensive machines to solve the algorithms and generate blocks. As can be observed in the figure below, if Bitcoin were to be considered a country it would be the 30th for energy consumption in the world. Despite the argument on the increasing employment of renewable sources of energy in the processes, their use is still relatively small and cryptocurrencies result to be detrimental for the environment[163].

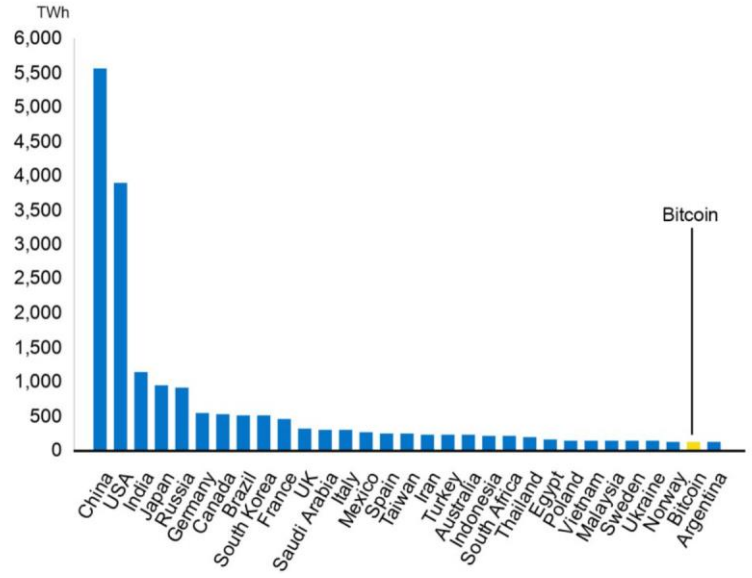


Figure 6: Bitcoin's Energy Consumption as a Country[164]

Anyways, some crypto-supporters argue that physical currencies as well have a remarkable environmental impact because of the printing and storage activities. Anyways, the environmental impact of Bitcoins does not only reside in the mining activities but also in the activities executed

[162] (Stall et Al., Pag. 1647-1661, 2019)
[163] (Corbet and Yarovaya, Pag. 150-152, 2020)
[164] (Criddle, Pag. 1-2, 2021)

through Bitcoins and other cryptocurrencies, as every transaction requires the usage of electric power[165].

6.3 Future Perspectives on Cryptocurrencies' Evolution

Many of the complexities typical of cryptocurrencies constitute unsolved issues both for regulators and for agents active on the market. Anyways, many hypotheses on how to overcome these criticalities are starting to be released. The most convincing theories involve the implementation of stable coins and of central banks' digital currencies.

6.3.1 Stable Coins

Stable coins can be considered as second generation cryptocurrencies, as they aim to maintain a stable value with respect to fiat currencies. The most notorious example is "Libra" (now "Diem"), the cryptocurrency announced by Facebook in 2019. In order to limit the volatility that characterizes the new technology and that hindered its diffusion on a large scale, stable coins have come into play. They could overcome this pitfall by providing a virtual cash equivalent pegged to a national currency or to a basket of assets. Therefore, stable coins would combine some advantages of conventional fiat money, such as the stability of value, with advantages of cryptocurrencies, such as minor bank intermediation and lower transaction costs. They could be issued either by private entities or by central banks (in this case they would fall under the categorization of central bank cryptocurrencies). According to a study published by the European Central Bank, privately issued stable coins can be classified into four categories[166]:

1) **Fiat tokens:** this type of stable coins would be fully backed by official currencies, in the form of either electronic money, cash, or reserve deposit. They consist in a sort of "tokenisation" of the official currency. Tokens would be issued after the deposit of an equivalent amount of official currency and could be converted back into official currency at any time. This system calls for an issuer or a custody for the safekeeping of the funds, resulting in a very centralized organization[167].
2) **Off-chain collateralized stablecoins:** stable coins would be backed by a portfolio of assets different from cash. Again, a central party is needed for the custody of the assets as well as for the management of the portfolio. "Off-chain" means that the underlying assets are financial instruments traded on regulated markets[168].

[165] (Corbet and Yarovaya, Pag. 150-152, 2020)
[166] (Bullman et Al., Pag. 3-9, 2019)
[167] (Bullman et Al., Pag. 3-9, 2019)
[168] (Bullman et Al., Pag. 3-9, 2019)

3) **On chain collateralized stablecoins**: these stable coins would be backed by crypto-assets registered on the same DLT. Therefore, there would be no need for third parties. Anyhow, cryptoassets are more volatile than traditional financial assets, resulting in the need for stable coins to be overcollateralized to attempt keeping their value stable[169].
4) **Algorithmic stable coins**: these stable coins would not rely on collaterals. Stability would be achieved through the use of an algorithm coded in the blockchain, that would adapt automatically to the supply of tokens in response to changes in the demand. These stable coins would not rely on any form of backing, anyhow, the coins could be bought and sold in the exchange for crypto-assets, thus, their value would stabilize in relation to the latter[170].

Overall, the prefixed ambition of stable coin to create a completely disintermediated system while assuring the stability of the value of the coins seems far from occurring: the first two categories may achieve the stability requirement, but they lack the disintermediation feature, while the second two achieve decentralization at the expense of stability[171].

6.3.2 Central Bank Digital Currencies (CBCDs)

Stable coins by central banks are very likely to be developed in the near future. They are essentially fiat currencies transformed into tokens, issued and managed directly by the same central authority that supplies fiat money. Because of this, CBCDs cannot be strictly defined as stable coins (cryptocurrencies that try to peg their value to an official currency), indeed, they result to be official currency. In practical terms, CBDCs would cover the role of broadening the instruments at banks' disposal, strengthen transmission channels of monetary policies and provide a direct link with businesses and households[172]. The benefits that states are aiming to collect from the development of digital currencies are several: reducing the cost of cash transferring, easing and making safer access to money while improving the efficiency and the velocity of monetary policy[173].

6.4 Predictions of Legal developments

While Bank's Digital Currencies would encounter fewer regulatory issues as they do not incur in the problem of addressability, original cryptocurrencies still present this complication. In fact, the latter possess *sui generis* characteristics implying the impossibility of regulation of the system itself, but not a legal void[174]. As observed in previous chapters, regulations on the matter keep evolving and

[169] (Bullman et Al., Pag. 3-9, 2019)
[170] (Bullman et Al., Pag. 3-9, 2019)
[171] (Bullman et Al., Pag. 3-9, 2019)
[172] (Fantacci and Gobbi, Pag. 2-7, 2021)
[173] (Fantacci and Gobbi, Pag. 2-7, 2021)
[174] (Capaccioli S.,et Al., Pag. 264-270, 2015)

legal systems are trying to adapt to the peculiar nature of the new objects of law. The solution of centralization either by banks or by private authorities coupled by mandatory obligations to safeguard investors and guarantee legal practices, might ease regulatory practices, but would go against the original structure and values of cryptocurrencies.[175]

To expand in the future, cryptocurrencies' systems will probably be linked with real world agents, entities and people. These agents will cover the role of interacting with both realities, digital and actual one, in an effort to guarantee respect of the rules[176]. Most plausibly, a future regulatory regime will be on the providers of cryptocurrencies services. In fact, providers constitute the link between the real and the digital dimension, and therefore might be the channels through which regulations will be applied. To protect investors, exchanges and traders will likely be asked to set up adequate governance and organizational arrangements to ensure operational resilience as well as effective management. They should be able to ensure the continuity of services if there happens to be a failure in the trading system, and they should establish procedures to compensate for delayed trades and platform suspensions. Moreover, they should also make arrangements to protect investors against risks that the virtual currency in their custody might be subject to and set up adequate complaints and redress policies. Furthermore, they will probably undergo specific conduct of business obligations, which may include requirements for disclosures about the risks linked to crypto-investments and information rules protecting against misleading marketing campaigns. Exchanges should also be subject to capital adequacy regimes, consisting in limiting excessive risk taking. Lastly, providers of cryptocurrencies services will probably be asked to maintain a trust account with a qualified custodian in fiat currency to ensure protection to customers in case of loss of cryptocurrencies by exchanges, failure or insolvency. Regulators should be able to deliver investor protection taking into account the business model size and global reach of the new system[177].

Anyways, besides investors' protection, regulators need to deal with the issue of cyber-criminal activities, and, to do so, an international legal framework becomes crucial. There have been some international initiatives to promote collaboration to combat tax crimes such as the Joint Chiefs of Global Tax enforcement, practiced by the USA, Australia, Canada, UK and the Netherlands[178]. By participating in this agreement, countries will be able to share information to reduce the occurrence of tax evasion activities. This is just an initiative, but regulators should follow this path to properly regulate cryptocurrencies, which, as highlighted in previous chapters, are characterized by a global

[175] (Gikay, Pag. 34-35, 2018)
[176] (Capaccioli S.,et Al., Pag. 264-270, 2015)
[177](Ligot, Pag. 15-16, 2019)
[178](Internal Revenue Service, Pag. 1-2, 2019)

reach. An international agreement on the matter would set common standards and then allow single states to integrate with additional domestic frameworks. Regulation is needed not to necessarily change the decentralized nature of cryptocurrencies, but to increase the security levels at a global scale.

The future perspective of blockchains is complex as well. The solutions that have emerged to exploit this technology comprise the combination of permissioned and permissionless traits of the blockchain, in which the transactions require some degree of intervention from third parties, such as compliance with know your client standards. Thus, all the participants in the blockchain entering in smart contracts should independently comply with all the data protection requirements. On the other hand, all the users managing the nodes of the blockchain can be considered as data processors and should comply with the relevant provisions. Another solution could be to have contracts stored off chain but linked to the smart contract so that users can benefit of the timestamping capability of the blockchain and be assured of the fact that the agreed version in the one being relied on.[179]

Initiative to promote safety and legal enforcement on the blockchain have emerged as well. The most prominent is the no-profit "Blockchain Alliance", founded in 2015, that serves as a forum between industry leaders and legal authorities to promote information, combat criminal activity on the platform, and to foster the development of this transformative technology. The Alliance comprises over 100 blockchain and crypto companies as well as regulatory agencies all over the world. The alliance works through regular conferences to discuss the trends of the industry and the tools for combating illicit activities. A pro-innovation approach is necessary to promote the safeguard of customers and the prevention of money laundering and tax evasion activities. The collaboration between private and public entities should be encouraged and strengthened at an international level to foster rule-making and law enforcement as well as the full development of the potential of blockchain technology[180].

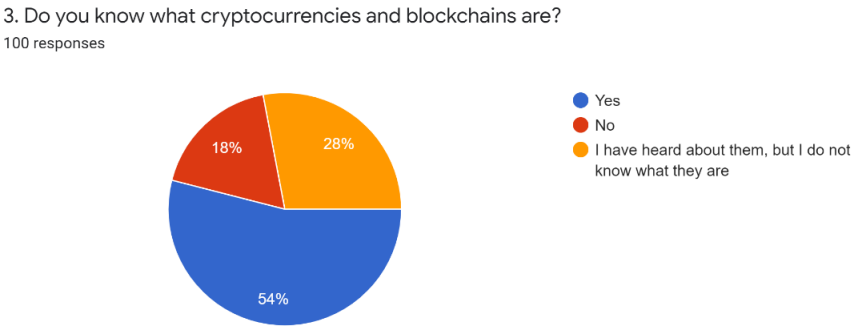
6.5 Survey Results

Cryptocurrencies and blockchains have repeatedly hit the news and have been the object of conversations of legal authorities, prominent investors and renewed entrepreneurs. To have an idea of common people's knowledge, opinions and predictions on the topic, below will follow the results of a sample sent to 100 persons of different age ranges. In particular, 1% of the respondents were

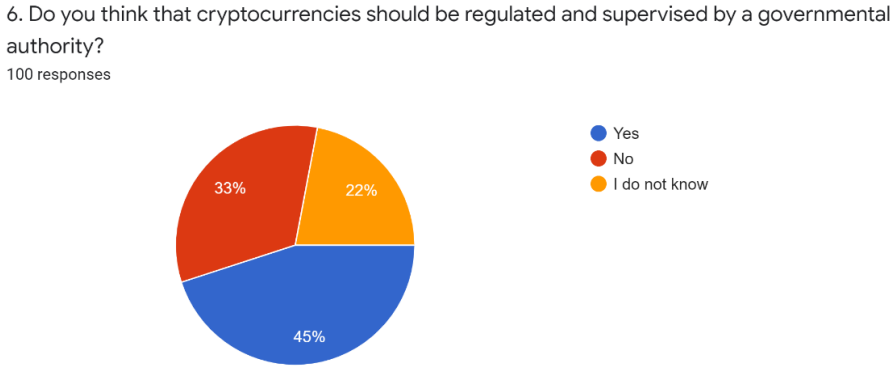
[179] (Hereen, Pag. 1-16, 2018)
[180] (Dewey, Holland & Knight LLP, Pag. 1-15, 2019)

under the age of 18, 40% between 18-24, 18% between 25-34, 8% between 35-44, 14% between 45-55 and 19% over 55.

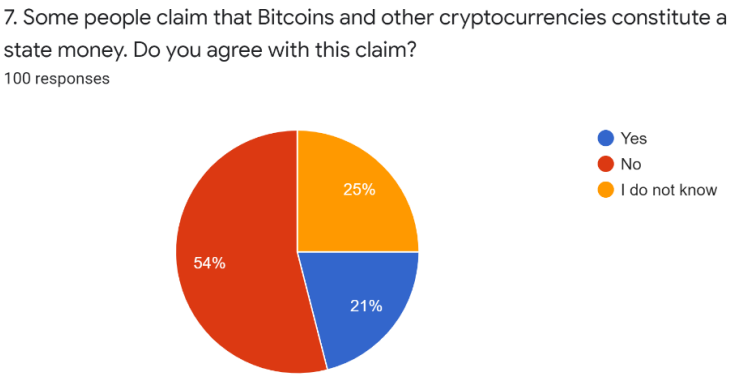
To test the knowledge of the respondents on the matter, they were asked if they knew what cryptocurrencies and blockchains were: 54% of the respondents answered in an affirmative way, 28% said that they had heard about the technologies, but did not know what they were about, and 18% confessed to be unaware of what cryptocurrencies and blockchains were. Overall, the majority of people that have answered results have knowledge on the matter, but a consistent number of respondents has no familiarity with the innovations.



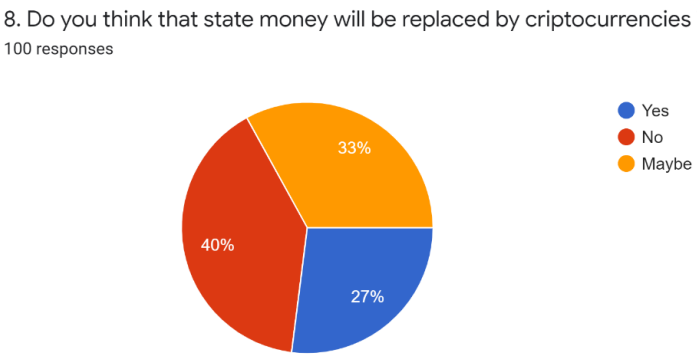
What emerges from the graph below is quite a positive propension towards the regulation of the crypto -system from a governmental authority, in fact, 45% of the people that participated in the poll affirmed that cryptocurrencies should be supervised by a governmental authority, while 33% affirmed that they should not, and 22% did not have an opinion on that.



When asked if cryptocurrencies could be a plausible alternative to state money, the majority of the respondents (54%) have denied this possibility while only 21% have answered in an affirmative way. The rest of the respondents have said that they did not know.



With reference to the use of cryptocurrency, as can be observed from the graph below, 40% of the respondents said that they do not think that state money will ever be replaced by cryptocurrencies in the future, while 27% of the participants think that it is a possible scenario and 33% do not exclude this possibility.



The survey reports the opinions of a very limited sample and because of this it would not be appropriate to extract conclusions from such results. Anyways, considering all the limitations of the sample, what emerges from this poll is that the majority of the surveyed people knows about the new technologies or at least has heard about them. Overall, the respondents seem to be skeptical over the possibility of cryptocurrencies replacing state money in the future and being an alternative to traditional money.

Conclusion

By analyzing the nature of cryptocurrencies and blockchains and by detecting the risks and the benefits born by the technologies, this research has highlighted the urgency of an international legal framework that can protect the agents operating on the market and foster the development of the innovation itself. A complex relationship between technologies and regulations has emerged: the latter have the power to ease or hamper the spread of cryptocurrencies and blockchains, while, because of their innovative and disruptive traits, these new systems are penetrating in the market in such a way that is difficult for regulators to keep track and adapt immediately. This research has explored the dynamic relationship between the aforementioned innovations and their legal status to understand the reciprocal influence and to consequently formulate plausible future evolutions on the topic.

The analysis has shown how crypto-assets have been developed with the aim of building a new trusted financial network that can provide services in an affordable and fast way, accessible from every part of the world. Moreover, the paper has highlighted the multifunctionality of the blockchain database that has been scaling up to almost every sector of the market, bringing enhanced information storage possibilities and improved supply chain tracking. Anyhow, substantial barriers to the development of blockchains and cryptocurrencies persist: the intensive levels of energy consumption, the lack of technical knowledge as well as the absence of legal expertise. The new objects conflict with law in several ways, in fact, inconsistencies with privacy law, fears over cybersecurity and the ambiguity of liability remain crucial obstacles resulting in a cautious involvement of investors and entrepreneurs in the system. Moreover, fears over money laundering and potential tax evasion activities remain consistent threats that regulators need to handle.

It has been discussed how legal authorities in the EU, USA and China have been working on the matter over time, either by trying to provide rules to achieve legal clarity or by prohibiting the usage of the technology. Anyhow, to date, regulations remain fragmented both at a national and at an international level, contributing to slowing the adoption process of the technologies as ambiguous regulations stifle confidence in industry participants. The research has clearly illustrated how cryptocurrencies and blockchains hold the potential for revolutionizing the financial systems and the organization of every economic sector, but it has also raised the issue of how such potential could remain unexploited if the legal industry does not come together in the creation and implementation of innovative frameworks able to ensure legal protection without compromising the innovative structures of the technology.

Regulators are vested with a challenging task when establishing the right degree and form of laws that have important implications for the process of technological progress. They need to assess and evaluate potential risks, the yielded benefits in terms of costs and efficiency, while safeguarding fair market transactions and users protection. Since cryptocurrencies and blockchains have not reached maturity yet, regulations result to be still in an developing stage. The main difficulty in the regulation process of the technologies lies in the global nature of the systems, requiring harmonization of laws across all countries. Even if difficult to achieve, legal experts should pursue greater compatibility among rules to comply with the issues of addressability and territoriality posed by the peer-to-peer and dispersed structure of the innovations.

The future developments on the matter could include the centralization and privatization of the technologies, with the creation of Central Banks Digital Currencies and the use of permissioned blockchains, neglecting the traits of complete decentralization and openness. Alternatively, the permissionless and decentralization features might be kept by establishing precise rights and obligations for exchangers and users. Lastly, cryptocurrencies and blockchains' use could be restricted or limited. It is hard to predict what will occur, anyways, all scenarios share the centrality of regulations' role. In fact, laws will have a decisive impact on the expansion or marginality of the phenomena. Favorable regulations could let cryptocurrencies and blockchains gain a prominent role in the organization of the financial and economic system. By doing so, the potentialities of the innovations could be exploited to the fullest inaugurating a new technological era for banking and finance. On the other hand, an adverse legal attitude may leave the new technologies to the use of few enthusiasts, with relatively insignificant practical importance.

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