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Fundraising through blockchain: Analysis of the opaque relation between Initial Coin Offerings and Money Laundering.

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Ai miei genitori,

a Marzia,

a Marco,

ai miei nonni Maria e Venicio.

ABSTRACT

This master thesis analyses the relation between financing using blockchain and international money laundering. Blockchain has had a serious impact on several fields of business during the last decade but it mostly affected and threatened finance. The financial application of blockchain aims to bypass central banks and financial intermediaries through the introduction of new forms of decentralized capital raising called, in chronological order, Initial Coin Offering (ICO), Security Token Offering (STO), and Initial Exchange Offering (IEO).

Further, this thesis wants to investigate if there is a correlation between capital raising through ICOs/STOs/IEOs and money laundering. To assess that, I created a database which is used to develop a dataset of 17 variables and to calculate the total capitalization by country. The dataset aims to find which are the most favourable and reactive legislations. Instead, the national levels of capitalization are compared with the national GDPs of the countries considered. It emerged that there is no correlation between them, and that tax havens and offshore jurisdictions are the most used locations to launch ICOs/STOs/IEOs. Consequently, I conducted a country-by-country analysis to assess the reasons.

Key words: Blockchain, ICO, STO, IEO, Money laundering, Bitcoin, Ethereum, Crypto regulation

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INTRODUCTION

The theme of this thesis is the blockchain technology and its financial application. In particular, I choose to analyse Initial Coin Offerings, in order to understand the success of this phenomenon that emerged in the last decade.

Specifically, I want to illustrate the underlying reasons of the methods of capital raising introduced thanks to the blockchain, to understand the reasons of success of these types of offerings, to analyze how they work, and why blockchain has become a popular subject on newspapers.

The blockchain is an innovation that was launched across 2008 and 2009. It represents a radical paradigm shift, because it introduced a new way to transfer money, to register transactions making them immutable, but also to record copyrights, licenses, contracts, to track products along supply chains, to raise funds for projects, and may have applications even in healthcare.

This innovation may represent a threat to banks and other financial intermediaries because the idea behind the blockchain and cryptocurrencies is to transfer money without any central or intermediary control, decentralizing the system, making it more transparent and making transactions immutable, but, on the other hand, it may open new perspectives to many other industries.

In the first chapter I illustrate the blockchain technology, which is a chain of blocks within which transactions are registered, and its underlying rationale, which introduced the concept of peer-to-peer (P2P) network in the financial industry. This means that money transfers occur between individuals in the same network without the need of any central authority or financial institution to oversee or to process payments. P2P transactions are possible because there is a restricted group of network's users, generically called *nodes*, who download the blockchain records on their computers, and frequently update their blockchain versions with the most recent one.

Nodes register all transactions in a given period of time within a block, and then they are challenged by the system to solve a mathematical puzzle in order to find a particular code, called *hash*. The hash allows the winning node to add the block to the previous one on the blockchain. The winning node also receives a reward which can be transaction fees, cryptocurrencies or both.

Once a node solved the puzzle and added the block to the blockchain, other nodes are allowed to verify that the hash is the right solution to the challenge.

This mechanism is complex, time and energy consuming, and it creates a strong disincentive to misbehaviours; therefore, it is almost impossible to alter the order of blocks in the blockchain or delete transactions recorded.

Blockchain key features are decentralization, transparency, pseudo-anonymity, and immutability.

The sustainability of the system is possible because a blockchain is decentralized which means that there is no centralized database where all transactions are recorded, but there is a restricted group of network users who manage a shared database.

The blockchain is also transparent because every transaction registered on a blockchain is public to other nodes. Further, this technology guarantees a certain level of anonymity because all users transferring money through the blockchain do not reveal their real identities, but they are identified by an alphanumeric code.

Finally, the blockchain is said to be immutable because, once a transaction is included in a block and that block is added to the blockchain, it is impossible to alter the order of the chain of blocks and to delete transactions encrypted inside it.

In the second chapter I broadly describe the functioning of Initial Coin Offerings which were introduced in 2013, spread out in 2017 and raised more than $20 billion in the last four years. Initial Coin Offerings (ICOs) are an innovative way to raise funds for companies, start-ups or projects, and run on a blockchain. ICOs merged features typical of IPOs and crowdfunding with innovative elements like tokens, white papers and smart contracts, and also specific characteristics of the blockchain technology like decentralization and anonymity.

ICOs can take place and raise money from anywhere in the world without the need of any regulatory procedure or foreign currency exchange. This gave more opportunities to raise funds because everyone around the world may become a potential investor.

Another reason of ICOs' success is the fact that they guarantee anonymity since they run on a blockchain. This gives to teams the chance to hide their real identities and, in some cases, to be able to commit financial crimes.

The innovative elements introduced by ICOs are tokens, white papers and smart contracts. Tokens are issued by ventures to raise funds and grant specific rights, which vary according to the type of token, from rights to use the final product to voting or dividend rights. There are three types of tokens: utility tokens, security or asset tokens, cryptocurrency or payment tokens. After the issuance, tokens can be exchanged on secondary markets.

The white paper is a document issued by ventures to disclose information about the project. It has no standard framework, it is unaudited by third parties, but it is not compulsory. Since it is a technical document, investors may be unable to read it and to understand whether the project is reliable or a scam, and this could create huge information asymmetries.

Smart contracts are so called because they remember conventional contracts even if they are just a string of code. They are self-executing digital contracts created by a computer protocol inside a blockchain; hence they are immutable because certified by cryptography and registered in the blockchain to reduce costs, since the process is automatized by an algorithm.

The combination of high liquidity and information asymmetries generates a high level of volatility, and frauds and projects' defaults occurred largely. As a consequence, some national jurisdictions tried to regulate this phenomenon, as I describe in the end of the chapter.

In the last part of the chapter, I also make a comparison between ICOs, IPOs, crowdfunding and Venture Capital to analyse similarities and differences.

In the third chapter I introduce two evolutions of the ICOs: Security Tokens Offerings (STOs) and Initial Exchange Offerings (IEOs).

In the first part of the chapter, I describe STOs which emerged as a new method of public offering which issue only security tokens because this type of token can comply with national securities laws and guarantee investors' rights; further, STOs allow only qualified investors to participate.

STOs are issued by security issuance platforms on behalf of ventures. Further, securities token platforms perform KYC/AML controls and provide consultancy on the type of

token to choose and on compliance with national regulations. Therefore, STOs are more expensive, and the process is slower than with ICOs, but more secure.

In the second part of the chapter, I analyse IEOs which are launched by centralized platforms, called exchanges. IEO exchanges pass all potential projects through a due diligence phase to assess which are reliable and which are more likely to fail or are scams. IEO exchanges provide their own cryptocurrency and offer consultancy on all bureaucratic aspects and on listing. Furthermore, only investors registered on the exchange's platform are allowed to participate in the IEO. All these aspects contributed to reducing the risk of scams and failures.

In the last part of the chapter, I make a comparison between the three methods – ICOs, STOs, IEOs – to analyse similarities and differences between them.

In the fourth chapter, I analyse how national jurisdictions have reacted to ICOs and their evolutions to STOs and IEOs. I also created a massive database with 5770 operations which raised $24 billion, and I examined it using a dataset of 17 variables.

I found out a singular correlation between countries with opaque financial behaviours and the amount raised through ICOs/STOs/IEOs. Further, there is no correlation between their national GDPs and national levels of capital raised, and neither considering other aspects like technological advancement. To understand reasons behind this evidence, I conducted a country-by country analysis and it emerged that all these countries have been involved in financial scandals, like Panama Papers, and international money laundering, drug trafficking, and terrorist financing.

The reasons to justify these unexpected volumes are several. Firstly, the anonymity granted by the blockchain technology allows individuals to hide their identities and feel protected from national authorities' investigations. Secondly, it results that most of the countries provide offshore vehicles with limited liability, which guarantee owners' anonymity, or companies are owned by a series of other companies to make it extremely hard to discover real owners, or even national business registers accept fake owners' names without any control. Thirdly, considering that these operations run on a blockchain, there is no central authority or bank which can monitor them, and consequently there is no underwriter bank which can smoothen information asymmetries. Fourthly, these operations have a cross-border nature, as it is for the

blockchain technology, hence this feature is helpful to bypass AML/CFT laws, in particular for ICOs which represent 91% of total operations.

CHAPTER 1. Blockchain: the birth of a new technology

1.1 Introduction to Blockchain

Distributed Ledger Technology (DLT), more commonly called blockchain, consists of a shared and distributed database between a network of core users, named *nodes*. Nodes download and constantly update the blockchain every time underlying transactions are validated.

DLT is distributed because all nodes have a copy of the blockchain in their computer, that enables the mechanism to work 24/7.

DLT is based on a combination of cryptography and game theory, using a consensus algorithm and a reward mechanism.

The rules governing the functioning of a DLT are predetermined, fixed and autonomous.

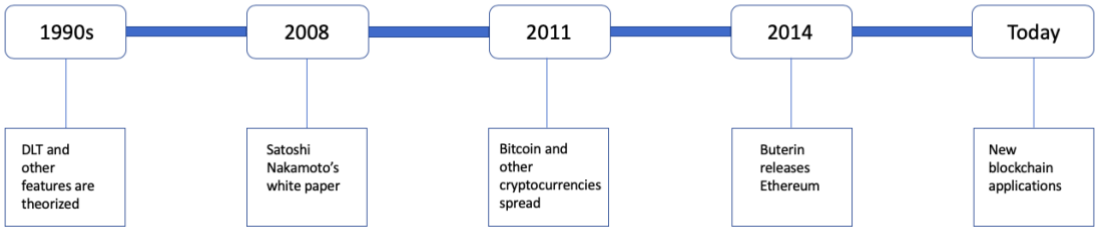
All the components that make up all DLTs (Bitcoin and Ethereum *in primis*) were theorized during the 90s by a group of individuals called *Cypherpunks*. Cypherpunks have libertarian ideals and are afraid of the overwhelming control of central authorities. Their aim is to preserve personal privacy, and they want to achieve it using cryptography and decentralizing the system to a distributed network of people, because centralized systems are more vulnerable to frauds from hackers and to controversial governing bodies' decisions.

A series of unsuccessful attempts to create a digital currency able to bypass the control of central banks and financial institutions followed one each other during the 90s but only in 2008 Satoshi Nakamoto's white paper was issued. This white paper describes the rules of the functioning of first cryptocurrency able to grow and thrive: bitcoin.

From 2011, the use of bitcoin and the creation of new cryptocurrencies have spread and created a flourishing environment for their adoption.

Another crucial event occurred in 2014, when Vitalik Buterin released the first version of Ethereum. This platform has enabled the adoption of DLT to new sectors other than money transfer thanks to the introduction of smart contracts.

Figure 1: Distributed Ledger Technology development timeline.



Source: Own elaboration.

Nowadays, DLTs are able to transfer information, money, contracts and records.

Two core concepts of DLT are anonymity and immutability. The use of cryptography permits individuals involved in transactions to remain anonymous to strangers. Then, transactions are recorded on blocks that are added to a chain of blocks one after the other (hence, the name blockchain). Recorded transactions become impossible to alter or modify, because blocks are continuously added, and a malicious node should recalculate all codes (called *hash*) that link every past block to the previous one. It would take a huge amount of energy, time and resources to recalculate all hashes before a new block is added; further, nodes are rewarded for their work. These two aspects are two tremendous disincentives to malicious activities, so that the immutability of data is guaranteed.

These features, together with the distributed rationale, make DLT extremely more secure than centralized databases in the Internet era where data protection plays a more and more crucial role.

Since registered data are immutable, DLTs have been defined as digital notaries with a wide range of potential applications. DLT can be used in trials to solve disputes because once a record is written on a block of the chain, it is public and cannot be falsified.

The primary application is money transfer in daily purchases, otherwise there would not be the need for a cryptocurrency. The high level of security has been exploited in the development of a new generation of cloud storage, in a sector that has been victim of several cyber-attacks and data theft. Further, the introduction of smart contracts, that is, contracts based on a computer code, has opened up new perspective in supply chain

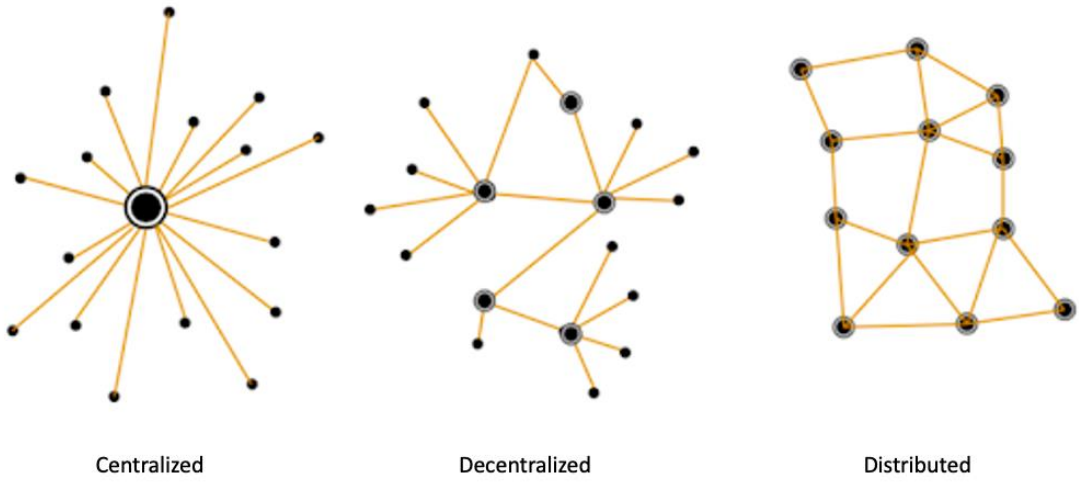
and logistics to track and certify products' origins. For instance, in merchant shipping DLT allows to find inefficiencies and maximize profits because smart contracts are not subject to humans' fallacious behavioural logics. Nevertheless, smart contracts primary purpose is to incentivize businesses to raise capitals using cryptocurrencies, therefore interesting applications have developed in the financial industry in the last five years: Initial Coin Offering, Security Token Offering, and Initial Exchange Offering. These are few applications of DLTs, because these technologies can be already integrated with Artificial Intelligence and Internet of Things, and the potential implementations are illimited.

Skepticism towards DLTs has arose in pair with the most celebrated cryptocurrency: bitcoin. Bitcoin has been demonstrated to be a fantastic store-of-value, especially for early years adopters. Bitcoin's success is due to the growth in its adoption as a mean of payment and the consequent rise in the exchange price with dollars. Bitcoin was first priced at $0.0007639 (that is, USD : BTC = 1 : 1309), while bitcoin price rose up to $124.30 on October 1st, 2013, and sharply rose again to $744.17 on January 1st, 2014 when was on everyone's lips. Finally, it touched a first peak of $19,167 on December 18th, 2017. After that day the price decreased and has gone up and down many times with a significant volatility in day-to-day exchange price. Then, bitcoin touched its highest peak on March 13th, 2021 with a price of $61,283.

Some people compared bitcoin to a sort of digital gold, but many financial personalities hastily marked it as a bubble and a source of scams and refused to invest in it. I think it is short-sighted to speak about DLT considering only bitcoin and other cryptocurrencies for their store-of-value ability, because this is only the tip of the iceberg of a disruptive innovation that will mark our lives in the future.

Among the success of DLT, a critical weakness emerged: scalability. A distributed system runs well with a small number of transactions but when their volume increases the system slows down, because DLT is not able to expand in size hand in hand with the growing of number of transactions. DLTs' developers have realized some brilliant solutions that shift most of the blocks on parallels chains off the main chain, but new problems require to be solved year after year. After all, the journey has just started.

Figure 2: Centralized, decentralized and distributed systems.



Source: Sarmah (2018).

1.2 Blockchain

Blockchain is a disruptive innovation that is expected to change the world and create new industries as Internet, the invention of the airplane and the car did in the past.

The term blockchain currently refers to all kind of distributed ledger technology, but it originally referred to the Bitcoin distributed ledger technology. Bitcoin's creator, Satoshi Nakamoto, published the Bitcoin white paper in 2008 where he described a "chain of blocks"; few years later bitcoin users coined a new term: blockchain.

A blockchain is a distributed ledger of transactions that is managed by a peer-to-peer network that bundles transactions in blocks. This system is decentralized and works with the distributed consensus on the members of the network, called nodes, without the trust in third parties. This because centralized systems are more susceptible to cyber-attacks, instead blockchain is able to prevent frauds because it relies on cryptography. Further, blocks are considered immutable because it is extremely difficult to alter them, hence it appears more secure as I describe in-depth along the chapter.

Since I found a lot of confusion concerning the terms *Bitcoin*, *bitcoin*, and *blockchain*, I use these terms in the thesis as Lai and Chuen (2018):

- **Bitcoin** (uppercase B) refers to the protocol and the network based on a paper written by Satoshi Nakamoto in 2008.

- The **bitcoin** (lowercase b) **cryptocurrency** is implemented using the Bitcoin protocol and released in January 2009.
- The term **blockchain** gained prominence in 2014 when the industry attempted to decouple the technology from its token that is often characterized as a currency of choice for drugs and other illegal trades.

1.2.1 Private, Public and Consortium blockchain

Blockchains provide shared record keeping access to participants in the network and are driven by participants' consensus (Lai and Chuen, 2018). Blockchains can be of three types: public, private, or consortium blockchains. The difference between each type of blockchain depends on the extent of control: public blockchains are decentralized, private blockchains are centralized, while consortium blockchains are hybrids partially decentralized (Pilkington, 2016).

1.2.1.1 Public blockchains

A public blockchain is a decentralized permissionless ledger, that means no approval or authorization is required. A public blockchain is accessible to everyone from Internet and there is no need of providing forms of identification or asking for permission (Lai and Chuen, 2018; Pilkington, 2016).

The best-known examples of public blockchain are Bitcoin and Ethereum. A public blockchain is sustained by members called nodes. Nodes download the entire blockchain on their computers, enforce all the consensus rules of the system, keep the network honest and receive rewards in return.

Transactions are recorded and visible to the public from the network to discourage detrimental activities. Further, the huge number of participants makes it impossible to tamper transactions in a public blockchain, hence transactions in public blockchains are considered immutable (Zheng et al., 2017). Public blockchains use consensus protocols, such as Proof-of-Work or Proof-of-Stake, to incentivize all nodes of the network to verify transactions (Vranken, 2017).

1.2.1.2 Private blockchains

A private blockchain is a centralized permissioned ledger, and it is restricted to a selected group, that means it requires the approval of participation identities and verifies membership. Community members belong to a network and can be personally known and trusted by the central authority, because they can be employees, customers, companies, or departments within a company (Lai and Chuen, 2018).

Unlike public blockchains, private blockchains do not need the consensus protocols because the network presumes accesses controlled by the central authority (Lai and Chuen, 2018). Therefore, private blockchains can offer high level of security and privacy, and reduce compliance costs with regulation, such as Know-Your-Customer (KYC) money laundering regulation (Pilkington, 2016; Yermack, 2017).

1.2.1.3 Consortium blockchains

Consortium blockchains are partially decentralized and are a hybrid version between public and private blockchains (Pilkington, 2016).

In consortium blockchains, transactions can be modified many times until participants have reached an agreement. Records in the blockchain can be read by other users on the network. Transactions are verified by a pre-selected group of nodes, so that there is no need for consensus protocols. As a consequence, this diminishes security but enhances efficiency and lessens energy consumption (Vranken, 2017).

1.2.2 Byzantine Generals' Problem

The decentralized network can generate problems around consensus that must be solved because some nodes can decide to misbehave. The blockchain consensus problem can be easily illustrated using the so-called Byzantine Generals' Problem (BGP). The BGP is a logical dilemma developed in 1982 which describes the situation in which a group of Byzantine generals are besieging a city. They are situated in different locations around the city with their armies, and they have to reach an agreement on the next move, whether attacking or retreating. The Byzantine generals must arrive at a common decision because, if only one of them attacks and the other does not, they will fail. Since the generals are not all in the same place to take the final decision, the only way they can use to communicate is through a message.

Generals have to vote simultaneously to guarantee the success of their next move. Each general has to vote whether to attack or not, but once he took and sent his decision, he cannot change it. Now, some problems can arise because the message can be delayed, destroyed or lost. Further, even though the message is received by the other generals, a general can decide to act fraudulently sending another message to confuse them and lead the army to a failure (Binance; Lai and Chuen, 2018; Zheng et al., 2017).

Now, consider the generals as nodes of the blockchain network. Network nodes need to achieve the consensus on the current state of the system, and the majority of nodes have to convene and execute the same actions in order to prevent failures (Binance Academy). To surely reach the consensus, in decentralized networks there should be at least 2/3 or more of honest network nodes. On the other hand, if the majority (such as 51%) of the network participants misbehave or fail to communicate, the system can be subject to failure or attacks (Ametrano, 2017).

Blockchains can be able to continue operating when some nodes act fraudulently, because they have a property called Byzantine Fault Tolerance (BFT). In computer science, the BFT is the property of a system to withstand to failures or attacks that stem from the Byzantine Generals' Problem.

Many BFT systems can build different consensus mechanisms to solve the Byzantine General's problem, according to the consensus algorithm the system relies on. The most common are the Proof-of-Work (PoW), which is used by Bitcoin blockchain and actually also by Ethereum, the Proof-of-Stake (PoS), that should be adopted by Ethereum in the future years, and Delegated Proof-of-Stake (DPoS).

1.2.3 Sybil Attack

The *Sybil attack* is a problem that occurs when a user runs multiple nodes, called Sybil identities, on a blockchain network for malicious purposes. When attackers outweigh honest nodes and make enough Sybil identities, they can block and subvert the network by refusing to receive or transmit blocks.

The worst scenario is called "*51% attack"*, and it may happen if the Sybil attackers would take control of the majority of nodes (at least 51%). In such situation, they would be able to alter the order of transactions, block the validation process, and even reverse the transactions, leading to double spending (Binance). To prevent the Sybil attack,

cryptocurrency platforms introduce consensus algorithm, like PoW, PoS and DPoS, that make it economically unfeasible to carry out an attack (Lai and Chuen, 2018).

1.2.4 Consensus algorithms

A consensus algorithm is a protocol that contains a set of rules that nodes have to follow to reach the consensus when they are validating transactions. Below, I describe three of the most commonly adopted consensus algorithms.

1.2.4.1 Proof of Work

The Proof-of-Work (PoW) is the first consensus algorithm developed and introduced with the Bitcoin launch in 2009. It is actually adopted by Ethereum and by the most cryptocurrencies.

The Proof-of-Work's purpose is to prevent double spending, that is, the risk of spending twice the same amount of crypto money in two different transactions.

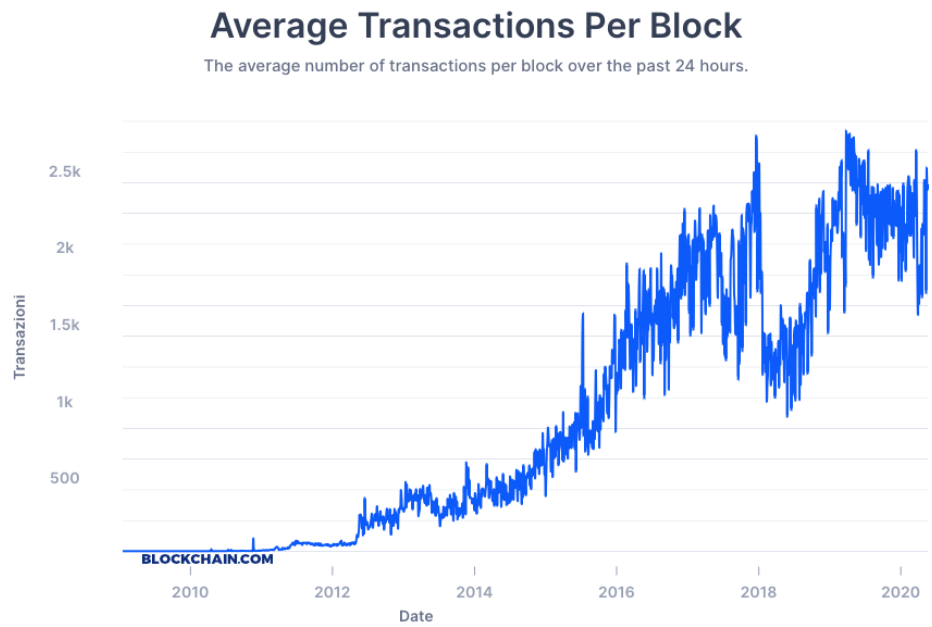
Transactions are considered valid only once the *candidate block* in which they are included becomes a *confirmed block*, that is, when the block is added to the blockchain. This process is made possible by nodes that in PoW are called *miners,* who use their computing power to solve computational puzzles to find a valid cryptographic hash (Crosby et al., 2016; Vranken, 2017).

A miner receives transactions randomly and pools them in a block. Then, he/she competes with all other miners in the network to calculate the *block hash* as quickly as possible. To do that, a miner has to find through trial-and-error the *nonce* (meaning: number only used once), which is an arbitrary number that satisfies given *difficulty* constraints (Ametrano, 2017). The *nonce* combined with data given in the block (i.e., Merkle hash, previous block hash) must be *hashed*, that literally means to be submitted to a hash function, to generate a *block hash*. Bitcoin's hash function is called SHA256. When the result of the combination matches given conditions, the miner finds the *block hash* that enables to add the new block to the blockchain and to broadcast it to all nodes in the network (Gervais et al., 2016; Zheng et al., 2017).

When the miner adds the new block to the blockchain, he/she receives a coin-based reward plus fees from each transaction verified in the block, while other nodes verify the validity of the result.

The block generation process is called *mining* because the coin-based reward evokes the scarcity of gold extraction (Ametrano, 2017; Crosby et al., 2016). Nevertheless, this word may be deceptive because it shifts the attention only on the reward for mining, while the primary purpose of mining is validating random transactions. This validating process ensures the security of the Bitcoin system and enables the emergence of a decentralized network consensus that bypasses the control of centralized third parties (Antonopoulos, 2017).

Figure 3: Average transactions per block of the Bitcoin blockchain.



Source: Blockchain.com.

Calculating the block hash is difficult, and it takes 10 minutes on average, instead it is easy to verify (Ametrano, 2017).

An important concept is the *difficulty,* which is fundamental to keep the block-generation pace constant (Pilkington, 2016). The blockchain network adjusts the *difficulty* of finding the right hash by changing the number of required leading zeros in the hash of the new block (Yermack, 2017).

Most miners built so-called *mining farms* to cope with the increasing difficulty of computational puzzles and the required computing power needed to find the block hash. Mining farms are large factories where computers are stored and try to solve computational puzzles 24/7.

The computing power is measured by the *hash rate.* The higher is the *hash rate*, the larger the chances to find the *block hash*, because the mining farm is able to guarantee greater memory capacity and speed of the integrated circuits. On the other hand, the more *hash rate* there is on the network, the harder the puzzle becomes to solve.

To increase chances even further, miners can come together in the so-called *mining pools*, that combine all pool's participants hashing power and distribute the rewards evenly across everyone in the pool.

Since some thousands of miners are working each second, there is a small probability that in a decentralized network more than one miner finds the suitable *nonce* at the same time, and that two or more blocks are generated simultaneously (Crosby et al., 2016; Zheng et al., 2017). This occurrence is called *forking*, because two or more blocks are added to the previous block, and hence the blockchain forks. This can be also the result of an attempt of a user to double-spend, using the same cryptocurrency to issue two transactions. To solve the fork and the double-spend problem, the network accepts the longest chain of blocks among the two as the only valid one, because the more confirmations a transaction receives, the more likely is that such transaction is secure. (Crosby et al., 2016; Gervais et al., 2016). This solution is adopted because mining new blocks is energy consuming, and miners are not willing to waste resources recalculating the hash. As a consequence, when a block is mined, it is almost impossible to alter the sequence, that's why a blockchain is considered immutable (Antonopoulos, 2017).

1.2.4.2 Proof of Stake

Proof-of-Stake (PoS) is the second most common consensus algorithm. It was introduced in 2011 as an alternative to solve Proof-of-Work problems.

PoS adopts a pseudo random election process to decide which node can validate the next block, PoS systems combine different selection criteria that may vary among different cryptocurrencies. The most common criteria are three: *size of the stake*, *coin age selection*, *randomized block selection.*

In PoS systems block are *forged*, unlike PoW systems that *mine* blocks, and nodes are called *validators*. To participate in the *forging process* the first criterium adopted in the choice of the validator of the next block is the *size of the stake:* validators need to stock

a given number of coins in the network, called *stake*. The bigger the stake, the higher the chance of a node to be selected as forger.

To limit the power in the process of the wealthiest nodes, PoS systems usually mix the *size of the* stake with the *randomized block selection* or with the *coin age selection.*

- When the *size of the* stake is combined with the *randomized block selection*, the system chooses the nodes with a combination of the lowest hash rate and the highest stake. In such a way, nodes can predict who will be the next validator, since the size of the stake is public. This criterium is adopted by Nxt and Blackcoin (Binance; Zheng et al., 2017)
- The *Coin Age Selection* chooses the next validator on the basis of the *coin age*, that is how long the tokens have been in the stake for. To calculate the *coin age* the system multiplies the number of days the coins have been held as stake by the number of coins that are staked. After a block has been forged, the node's coin age is reset to zero and the node must wait at least 30 days to be able to forge a block again (Binance). The older and larger the set of coins, the greater the probability to be selected to forge the next block. This criterium is adopted by Peercoin and aims to limit that nodes with large stake can control the blockchain (Zheng et al., 2017).

Once the validator is chosen, it forges the block by checking if the transactions in the block are valid, signs the block and adds it to the blockchain (Binance).

Unlike PoW miners, PoS validators are rewarded only with the transaction fees from the transactions in the block they forged. Hence, the amount of a PoS blockchain's cryptocurrency rises as more and more rewards are issued for the validators.

PoS systems are considered to be more energy efficient and secure than PoW systems.

First of all, PoS blockchains consume less energy because they do not need the same computational power required to mine, for example Bitcoin, and therefore PoS forgers do not need to group in the so-called *mining pools*.

Second, PoS blockchains are intended to be more secure because it is easy and affordable for users to run nodes. This incentivizes decentralization and makes it useless to group in *mining pools* (Binance). Further, nodes with more cryptocurrencies are expected to be less likely to attack the network because, to launch an attack, an aggressor should need to raise enough digital tokens to succeed. It means that an attack would damage the attacker itself (Lai and Chuen, 2018; Zheng et al., 2017).

1.2.4.3 Delegated Proof of Stake

The Delegated Proof of Stake (DPoS) is a consensus algorithm launched in 2014 with the aim of solving problems that stem from PoW and PoS.

DPoS introduces an elective process and, if compared to PoS, it can be said that PoS is direct democratic, while DPoS is representative democratic (Zheng et al., 2017).

In blockchains that adopt DPoS, network's users are called stakeholders and they have a fixed number of delegates that validate transactions. Delegates are also called *witnesses* and their number may vary from 21 to 101.

Stakeholders are entitled to vote proportionately to the amount of their stake, that is the higher is the number of coins owned, the higher the number of votes. Further, a stakeholder may designate another stakeholder to vote on his/her behalf by sending his/her stake to the other stakeholder.

Unlike PoW, delegates do not have to solve computational puzzles, but they must validate a block every few minutes, and they are scheduled for a specific time slot.

Since DPoS is designed on a representative mechanism, the delegate's reputation is crucial. The higher the reputation, the higher chances the delegate has to be voted and to be able to produce blocks. If delegates act maliciously or constantly fail to produce blocks, they can be expelled and replaced by another delegate.

Delegates are rewarded with the transaction fees from the transactions incorporated in the block and they may share the rewards with the stakeholders who voted him/her depending on the rules of the system.

Some systems require the delegate to deposit a stake to demonstrate their commitments and to minimize the risk that some delegates could possibly misbehave. Therefore, the stake can be confiscated in case of malicious behaviours.

In case of forking, that is the parent block has temporarily two or more children blocks, even DPoS systems adopt the *longest chain rule*. Hence, delegates move on the longest chain to keep producing new blocks and to guarantee that coins are spent only once, avoiding double spending.

If compared with PoW, DPoS provides higher performances and is more energy efficient, because it does not need powerful computers to solve difficult computational puzzles. Consequently, DPoS favours decentralization and make it useless mining pools.

On the other hand, DPoS systems need a sufficient number of delegates to guarantee the reactivity, otherwise the speed of the network slows down (Binance).

1.2.5 Benefits and limitations of blockchain technology

There are numerous benefits and limitations when considering the adoption of the blockchain technology.

1.2.5.1 Benefits

I found seven key characteristics of a blockchain technology:

- *Peer-to-Peer network*. Communications occur directly between users without the need of any intermediary or central authority (Tapscott and Tapscott, 2017). All participants, called nodes, have a copy of the blockchain which is constantly updated as blocks of verified transactions are added to the chain of blocks.
- *Decentralized and distributed*. The blockchain is not controlled by any central authority or intermediary, but all participants can verify the records (Tapscott and Tapscott, 2017). Data consistency is maintained adopting a consensus algorithm.
- *Transparency and pseudo-anonymity*. Transparency is one of the core concepts that distinguish a decentralized blockchain from more commonly used centralized databases. Transactions are registered on the blockchain and are public to the crowd of nodes. Each node has access to the entire history on the blockchain. Every node can assess that the transaction occurred at a certain time. On the other hand, anonymity is guaranteed because each user has an alphanumeric public address generated by the blockchain that does not reveal the real identity of the user, but at the same time it constitutes his/her proof-of-ownership.
- *Immutability*. Blockchain is considered immutable, and therefore when transactions are registered it is impossible to come back. The reason is that once a block is added on the blockchain, it is almost impossible or extremely energy consuming for a hacker to modify the blockchain and recalculate the hash of each block. Moreover, it would be less profitable if compared with the rewards and transaction fees assigned to miners or validators.

- *Security.* A blockchain is considered more secure than a central database because it is a decentralized storage where all participants have a constantly updating copy of the blockchain. Hence, it would be unfeasible to attack each user, and that reduces the chances of a data breach success. Moreover, the immutability plays a critical role in maintaining the high level of security of blockchain.
- *Trustless*. Blockchain removed the trust on third parties like central banks or financial institutions (hence, trustless) for a more distributed consensus. In this peer-to-peer network, users trust on miners who validates transactions.

1.2.5.2 Limits

- *Scalability.* This is the property of a system to handle a growing amount of work by adding resources to the system. Blockchain is not scalable because the size of a block is limited to 1 MB and cannot easily grow.
- *Throughput*. Blockchain has a low throughput rate of 7 transactions per second (TPS) for each block and is not designed to process millions of transactions. For instance, global credit card transaction average throughput (VISA, 2015) is 2000 TPS, with a peak of 56,000 TPS (Lai and Chuen, 2018). Blockchain is faster if compared with money transfer between two countries or during weekends because national legislations put some constraints on international money transfer and blockchain works 24/7. Nevertheless, if compared with daily transactions speed within the same country, blockchain cannot compete.
- *Safety*. I said blockchain is considered secure from external attacks because it is decentralized and hard to strike. However, blockchain could risk of being subject to the so-called *51% attack*, that is the majority of its nodes (at least 51%) should choose to misbehave and attack the system. A *51% attack* is unlikely but should be kept into consideration. Since it is decentralized, verifying and validating transactions look more profitable for the large majority of nodes than subverting the underlying system.
- *High energy consuming*. Even if blockchain allows to cut intermediary costs, the computers where the system runs need an enormous computational power to solve cryptographic puzzles, that wears out the computers. It means that miners have to

pay high electricity bills and to replace computers in few years (sometimes less than 4 years).

- *Private key*. Private key plays a critical role in the blockchain ecosystem, because it is the only way for users to access to their own personal accounts and transact money. If the user loses his/her key, he/she will lose all funds kept in cryptocurrencies. Further, if the user does not effectively hide the private key or communicate it to another user, he/she risks being robbed of every cryptocurrency hold.

1.2.6 Blockchain applications

Blockchain technology can be adopted for multiple uses other than currency. In this paragraph, blockchain applications are divided into financial and non-financial applications to underline that on a blockchain can be registered not only transactions but also digital data. Indeed, blockchain technology can be adopted in all fields where there is the need of more data security that centralized systems are not always able to guarantee.

FINANCIAL APPLICATIONS

1.2.6.1 International Payments

Nowadays, payments between two individuals living in two different countries face inefficiencies and high transaction costs. In such cases, money transfer can take days, and individual can only rely on third party services and financial institutions which place high fees.

Blockchain solved these problems by simplifying money transfer and bypassing unnecessary intermediaries thanks to the introduction of cryptocurrencies. Transferring cryptocurrencies from person to person worldwide require some minutes with significantly lower costs. In the last decade several crypto wallets have been launched to lock cryptocurrencies, send or receive them, and exchange with fiat currencies.

1.2.6.2 Banking

Since 2013, with the birth of Ethereum, blockchain technology enables every kind of company to raise funds from three mechanisms called Initial Coin Offering (ICO), Security Token Offering (STO), Initial Exchange Offering (IEO). These mechanisms are a combination of IPO and crowdfunding and allow to collect billions of dollars in few years. Unfortunately, like most new innovations, ICOs have been characterized by a large percentage of scams (about 20% of total ICOs) or most of the firms failed in few months due to poorly developed projects since almost the entire number of ICOs has been attempted by firms in the start-up, seed, or early stage. On the other hand, there is a high correlation between the success of the project and ICO firms that had been backed by venture capital funds.

To prevent scams and ensure investors' security, ICO has evolved into STO and IEO which submit companies to KYC/AML processes and provide certain standards and likelihood of success. These parameters are checked by exchange platforms where IEOs and STOs run in order to keep a high reputation. These methods will be analysed more deeply in the next chapters.

NON-FINANCIAL APPLICATIONS

1.2.6.3 Notarization

Blockchain technology can play a crucial role in notarization. Documents can be hashed (that is, submitted to the hash function SHA 256 for Bitcoin) generating a cryptographic code, a kind of fingerprint. This code is associated to a Bitcoin transaction for an insignificant amount of bitcoin, and then registered on the blockchain (Ametrano, 2017). Blockchain is an important innovation in the field of notarization for many reasons. It ensures documents' security, privacy and integrity. When files are registered on the blockchain, they are timestamped, therefore the author is able to exhibit the certain time when the document has been filed. Further, blockchain's blocks are immutable, therefore the transactions' data included in the block cannot be tampered, ensuring that the person who authored the document can demonstrate to third parties that he/she did it. Finally, blockchain cuts out expensive transaction costs from ineffective transferring documents (Crosby et al., 2016).

1.2.6.4 Supply chain

Blockchain technology can be effectively used with supply chain networks because it would be able to solve problems due to lack of efficiency and transparency, and it would help companies to significantly reduce costs.

First of all, adopting the blockchain technology enhances transparency because all parties involved in the supply chain network can easily verify and record information about the location and ownership of materials, and know when resources are moving from company to company.

As we have seen, transactions registered in blockchain's blocks are immutable. As a consequence, supply chain documents recorded on the blockchain can be resistant to modifications and immutable as well. The only way to modify documents would require reaching consensus from all parties involved.

Moreover, the adoption of blockchain allows companies to identify wasteful areas in the supply chain and to adopt cost-saving measures thanks to the tracking system and the data transparency.

Finally, using a blockchain eliminates transactions fees charged by banks and payment processors. Blockchain also eliminates the expenses for lawyers due to disputes in case of responsibilities when something goes wrong.

1.2.6.5 Cloud

Current cloud file storage solutions (such as Dropbox, Google Drive or One Drive) adopt centralized systems to store and validate documents, hence they are susceptible to data breaches that put in danger users' privacy. Blockchain can solve this issue, because it is a decentralized system, and it is extremely difficult to attack. Further, blockchain guarantees to anonymously and securely store online documents by providing users with a Proof-of-Existence. This Proof-of-Existence is a cryptographic code of the file that certifies the existence of the document at a certain time, and it makes unauthorized persons unable to read user's protected information.

An example is Storj, a platform that employs a challenge algorithm to incentivize users to properly participate in the network. With such a mechanism, Storj periodically check the integrity and availability of a file cryptographically and rewards users for preserving the file (Crosby et al., 2016).

1.2.6.6 Voting

Voting procedures have been subject to electoral frauds for a very long time and the adoption of the blockchain technology could solve old problems. The voter should connect to its PC or other devices, enter in the system using an open-source code to authenticate themselves (i.e., using biometric data) and prove the voter's identity. The voter has to enter a private key to access to the platform where he/she can exercise the right to vote and then enter the public key to select their preference and confirm it (Foroglou and Tsilidou, 2015).

1.2.6.7 Healthcare

The blockchain technology applied to the healthcare sector could provide significant improvements in the version of a private blockchain which requires permission and should be managed by a smaller number of nodes.

Even here, the crucial feature is the increased security provided by the decentralization of a peer-to-peer network that is less susceptible to failures unlike current centralized systems. Further, a decentralized system would cut costs of maintenance, security, energy and so on. Every node would hold a copy of the blockchain, and all patients' records should be synchronized with one another when the blockchain is updated.

Each node would be able to track prescribed drugs through the supply chain to be aware when they are ready to withdraw. In countries where the healthcare industry is mostly private, blockchain technology would help to prevent frauds moved by insurance companies that try to charge unnecessary services that never took place, since records in the blockchain are public, immutable and easy to check.

Limitations to the spread of the blockchain in the healthcare sector could be the difficulties of physicians and patients to accept this technology, the compliance with national regulatory frameworks, and the initial costs that would slow the adoption.

1.2.6.8 Gaming

The gaming industry has been estimated to produce about $160 billions in 2020, according to Statista, and economic interests go beyond those of the few big companies that control the market, and it means that servers are centralized. I have already said many times that centralized server means to be more likely to be subject to hacker

attacks, nevertheless in the case of gaming industry centralization can also affect other economic interests. Big developing companies can manipulate the game economy, shut down the game at any time, and users complain lack of transparency regarding game mechanics and rates, that damage gamers who have invested lots of money.

Implementing decentralized blockchain-based games enable gamers to have permanent ownership and full control over their in-game assets. Moreover, in-game data and items can be linked to tokens which allow gamers to trade or recycle them between different games. Finally, when developer companies abandon a centralized project, they can shut down the game at any time, instead with blockchain-based games, developers can be substituted, and gamers can continue playing.

However, there are some limitations to the spread of blockchain-based technologies in the gaming industry. First of all, an important problem is scalability that makes blockchain-based games less likely to be adopted because they are slower than those produced by centralized companies. Second, competition could make it difficult to independent developers to create blockchain-based games with the same high graphic quality or elaborate gaming experience. This affects the degree of adoption of blockchain-based games which is still low in an industry that has high barrier to entry and that requires certain level of funds to allow developers to work effectively.

1.3 Bitcoin

Bitcoin is a digital form of currency theorized by Satoshi Nakamoto in 2008 and launched in 2009. It is not the first attempt of digital cash, but it is the first to succeed and thrive. Unlike fiat currencies, bitcoin is not controlled by any central bank, therefore it cannot be censored.

National states are centralized systems and trust on central banks and financial intermediaries to oversight with huge costs for taxpayers, but online frauds remain unavoidable in these systems. Instead, Bitcoin is based on decentralized trust and has introduced the blockchain technology that, combined with the Proof-of-Work consensus algorithm, has made it impossible to spend twice the same amount of crypto money in online transaction.

Nowadays, people use bitcoin with different purposes: some use such digital currency for anonymous payments, others hold bitcoin for the long-term because considered as a kind of digital gold since it is scarce and difficult to produce.

1.3.1 The structure of a block

Antonopoulos (2017) describes a block of the blockchain as "container data structure that aggregates transactions for inclusion in the blockchain". A block is made of two parts:

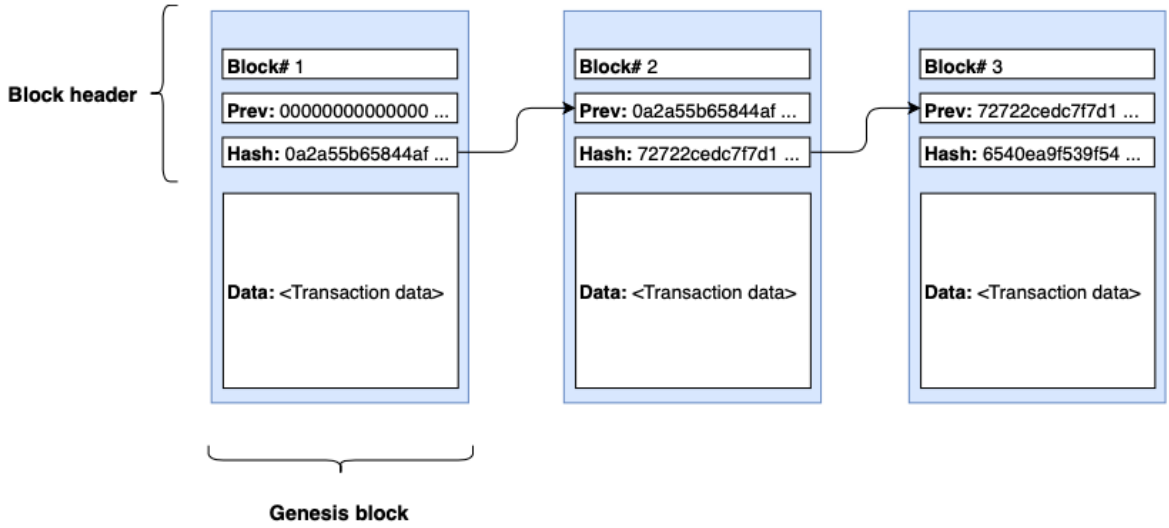
- the block header, that is, the block hash found solving a computational puzzle. The block header is a summary of information contained in the block.
- a bundle of transactions, that in some periods are over 2,000.

The block header contains different sets of metadata:

- the *version*, that is, the version number to track software or protocol upgrades (Antonopoulos, 2017).
- The *previous block hash* that cryptographically links the new block to the previous block in the chain, also called *parent block*, so that we can go backwards till the first block ever created, named *genesis block*. A block can have only one *parent block*, but a p*arent block* can have temporarily more *children block*s because sometimes the blockchain forks (Salvetti, 2020). Attaching following blocks through the previous block hash makes it almost impossible to fraudulently alter the blockchain because a hacker should recalculate retroactively all computational puzzles to find the valid hash and, further, blocks are continuously added to the blockchain by nodes, and hence blockchain can only grow (Vranken, 2017).
- The *Merkle Root*, which is a hash of the root of the Merkle tree of the block's transactions. A Merkle tree is a data structure that summarises and verifies the integrity of a large set of transactions' data and can be considered as a digital fingerprint of the whole set of transactions. The Merkle tree develops branches called Merkle roots (Antonopoulos, 2017).
- *Timestamp*, that is, the approximate creation time of this block (Antonopoulos, 2017). This is the reason why blockchain has being adopted for notary deeds.

- *Difficulty* target, that is, the level of difficulty required for this block to solve the computational puzzle under the Proof-of-Work (Antonopoulos, 2017). *Difficulty* is the measure of how hard is to find a hash below the target value, a 256-bit number, during Proof-of-Work (Aglin, 2016). The *difficulty* changes according the difficulty factor, which is recalculated every 2,016 blocks, about every 2 weeks, to ensure that blocks are found on average every 10 minutes despite increasing *hash rates* over time, where the hash rate is the measure of how many computational calculations a miner's computer can do per second (Aglin, 2016).
- *Nonce*, a counter used for the Proof-of-Work algorithm (Antonopoulos, 2017). It is a unique number that miners must find if they want to solve the computational puzzle.

Figure 4: How the blockchain works.



Source: Hassan et al., 2019.

1.3.2 How does Bitcoin work?

The Bitcoin blockchain uses the asymmetric encryption to transact payments or documents from the sender to the receiver.

Consider an individual (sender) who wants to send bitcoin to another individual (receiver) in the network. Bitcoin transactions follow some steps:

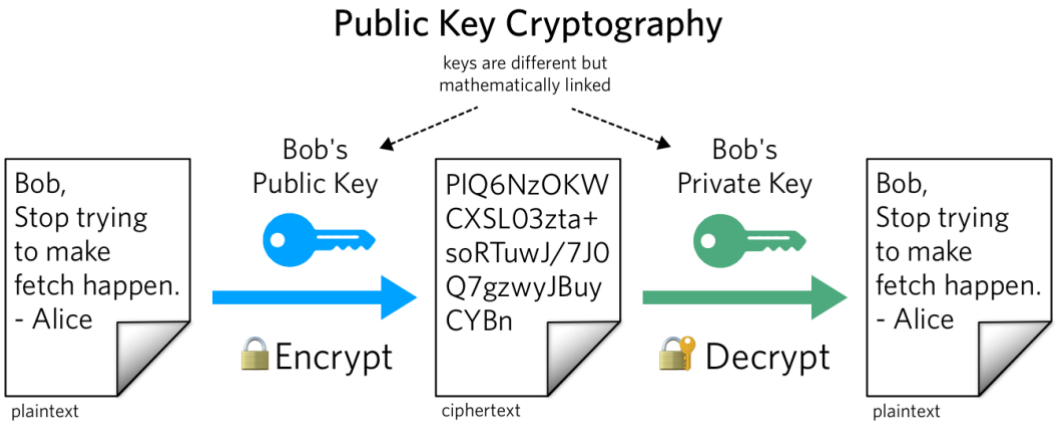
- The sender attaches a private key, a kind of digital signature, to demonstrate that he/she has sufficient bitcoin in the wallet and encrypts them in the transaction to the receiver.

- Then, the sender has to send the transaction to the receiver's public key, a sort of receiver's public address.
- To decrypt the transaction, the receiver has to enter his/her private key which is the only one compatible with his/her public key (Ametrano, 2017).

This mechanism makes it hard to hack a transaction, unless the sender or the receiver share their own private keys with other users in the network (Crosby et al., 2016). Such situation can usually occur in the form of *phishing*, an online fraud that happens when a hacker sends an email to an individual asking sensible information such as the number and passwords of a bank account or of a crypto wallet pretending to be the bank or the crypto wallet managing company. The theft is successful if the email receiver sends his/her personal data to the thief.

Since Bitcoin runs on the blockchain technology, transactions received at a node at the same time are included in the same block and added to the blockchain. Even if transactions are registered on the blockchain, they do not come in the order they were sent, generating a risk of double spending. This risk is removed by blockchain miners, because they register the first arrived transaction, or if two blocks with two transactions using the same cryptocurrencies originate two blockchain, miners accept the longest blockchain as the only valid (Crosby et al., 2016).

Figure 5: How Bitcoin works.



Source: Twilio.com.

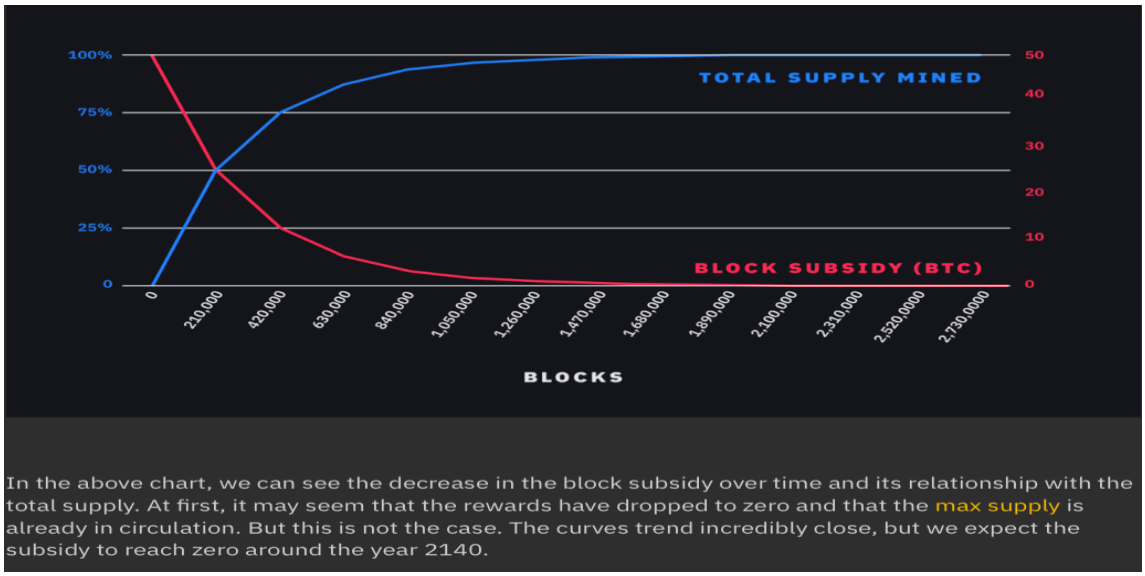
1.3.3 Bitcoin rewarding mechanism

Miners are paid for their job with a coin-based reward plus transaction fees from the transactions in the block they mined. The coin-based rewards are used to introduce bitcoin in the network. The reward halves every 210,000 mined blocks, about every 4 years, with an event called *halving* (Yermack, 2017). The last *halving* occurred on May 11th, 2020. The first issuances of bitcoin began in 2009 when miners were receiving 50 BTC per block, then it became the half, 25 BTC per block, in November 2012, and halved again to 12.5 BTC in July 2016. After the last halving, miners receive 6.25 BTC per block. According to this formula, bitcoin rewards will decrease until about 2140, when no new bitcoin will be issued anymore and the whole amount in the network will be 20.99999998 million (Antonopoulos, 2017).

According to Antonopoulos (2017), as the reward decreases over time and the number of transactions embodied in a block will increase, a greater proportion of bitcoin mining earnings will come from fees. After 2140, miners will no longer receive bitcoin as rewards, but only transaction fees will incentivise the new blocks mining (Yermack, 2017).

Further, as bitcoin issuance halves every 4 years, inflation of money supply of bitcoin decreases as well because bitcoin follows a deflationary monetary rule. Indeed, the inflation rate diminished from 3.5% to 2% after May 2020. Deflation is the opposite of inflation, because the purchasing power of money increases over time, if prices deflate. In conventional markets, deflation is associated with collapse in demand, so it is considered bad per se. Nevertheless, deflation in bitcoin supply is not the result of a collapse in demand, but rather it is caused by a predictably constrained supply that rewards savers (Antonopoulos, 2017).

Figure 6: The total supply of bitcoin compared to the block subsidy changes.



Source: Binance.

1.3.4 Bitcoin Criticisms

Bitcoin has raised conflicting opinions between who consider Bitcoin and blockchain an innovation, like computers during 80s or Internet during 90s, and others who consider it just as a bubble, a speculative mean, a scams producer.

First of all, bitcoin doesn't generate a return, but it is simply an internet token that users can use for money transfer or to store value. Some economists consider bitcoin as digital gold, since bitcoin has no fundamental value from an underlying asset, like gold.

Trust in bitcoin is mostly based on the hope that users have and on the estimates of future larger adoption. Nevertheless, it is complicated to find the right value since bitcoin has no intrinsic value, even though some scholars stated that its nominal value should be of $20 per unit (Adkisson, 2018).

Bitcoin is still raising perplexities, because it is subject to high volatility, as a user can lose or gain 10% from one day to another (Adkisson, 2018).

1.3.5 Blockchain without bitcoin

Blockchain and bitcoin are innovations born closely linked: a permissionless decentralized public ledger and a cryptocurrency whose aim is to avoid central banks' and financial institutions' control.

In the last decade, several times it has been argued to create a blockchain without Bitcoin, or more precisely a private blockchain, that is, a permissioned platform that do not exploit the work of miners. These statements remember the dawn of Internet when authorities wanted to limit and control access in the fear of a wild and unregulated open space. Nevertheless, a blockchain without bitcoin is possible (for instance Ethereum has its own cryptocurrency), but a distributed ledger technology without its cryptocurrency would lose what makes blockchain secure and decentralized at the same time: the existence of miners. Miners have two responsibilities:

- to verify transactions and group them into blocks to add to the blockchain, and
- to introduce into the system new bitcoin, they receive as reward for their job.

Without being rewarded, miners would not find any incentive for mining, that is, a costly activity. Without miners, the blockchain would be vulnerable because the huge computing power and necessary electric capacity work as deterrents and make blockchain almost proof-of-attack.

1.3.6 Bitcoin scalability and Lightning Networks

Lightning Network is a protocol proposed to solve the Bitcoin blockchain's scalability problem. The protocol consists of a 2-layers technology and moves transactions off the blockchain (also called main chain). In this way, transactions can be made instantly and with lower fees by using a parallel channel.

To transact under the Lightning Network protocol, two parties have to create a payment channel and open a wallet, where they have to set up their signatures and put some bitcoin inside the wallet.

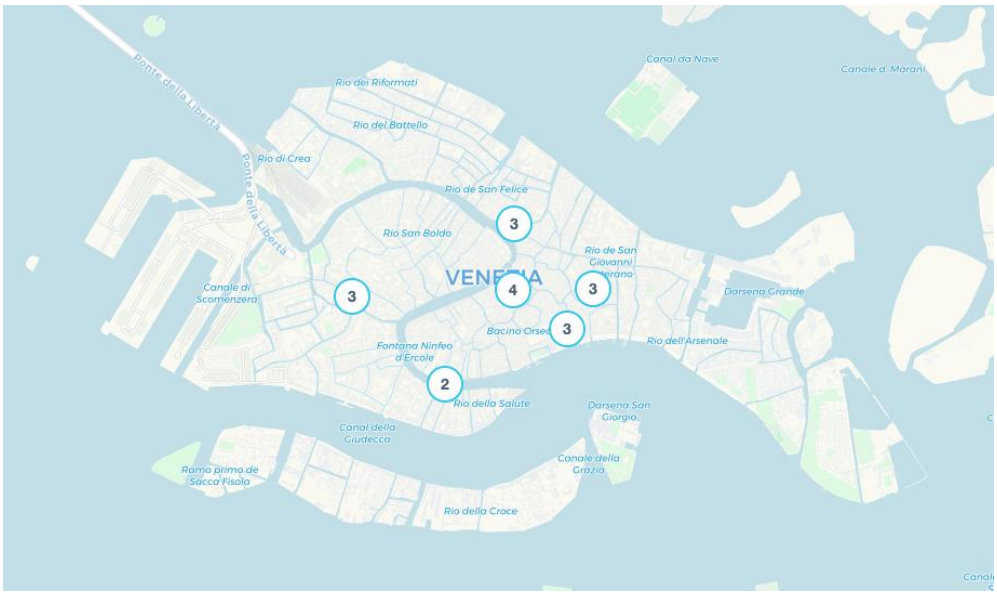
Funds deposited are accessible and can be traded only when both private keys are provided.

Transactions and the remaining funds are recorded on both users' personal balance sheets. Once the transaction is ended and the payment channel is closed, the updated balance sheets are broadcasted to the Bitcoin blockchain.

This protocol does not require the consensus on anyone of the parts, because in the case one tries to cheat, the protocol deletes and punishes the user.

This solution allows to overcome the low Bitcoin blockchain transactions per second rate, to enlarge the Bitcoin system and to move thousands of transactions off the main chain.

Figure 7: Map of businesses in Venice that accept Bitcoin.



Source: Coinmap.org.

1.4 Ethereum

Ethereum is a decentralized online platform developed by Vitalik Buterin from 2013 and launched in 2015.

While Bitcoin blockchain is considered a first generation blockchain focused on financial services, Ethereum is a second generation blockchain that is capable of more functions that enable developers to have a greater degree of programmability and freedom to create and deploy decentralized applications (DApps). DApps have three common characteristics: are open source, decentralized, and cryptographically secured.

Ethereum's cryptocurrency is called Ether (ETH).

Ethereum is similar to Bitcoin in the use of a blockchain technology, but it is different in the way data are stored. Ethereum adopts the mining process, the Proof-of-Work consensus protocol, and has a reward mechanism for miners, while, unlike Bitcoin, transactions trigger smart contracts, which set the rules that control DApps. Smart contracts based on Ethereum rely on an infrastructure called Ethereum Virtual Machine

(EVM). The EVM is responsible for the execution of smart contracts and converts transactions' inputs into outputs.

Nick Szabo theorized the concept of smart contract in the late 1990s and described their functioning with an effective example. According to Szabo, a smart contract can be viewed as a vending machine that executes a simple contract. A user chooses a product and inserts coins, while the machine gives the chosen product in return.

An Ethereum's smart contract is simply code, which is neither smart, nor a contract with legal validity, however the code contains the conditions that must be matched to produce the output. The code is read by the EVM and then executed.

The EVM is a *quasi-Turing complete machine.* A *Turing complete machine* is a program written that will surely find an answer, instead the EVM is defined '*quasi*' because programs are bound by the amount of *gas* available for that programs (Antonopoulos and Wood, 2018). *Gas* is set in the smart contract and I describe it more broadly in the paragraph 1.8.3.

1.4.1 Decentralized Autonomous Organization

Decentralized autonomous organizations (DAOs) are an innovative solution enabled by Ethereum through the use of smart contracts. DAOs are based on open-source code and their activities are executed completely decentralized and automated. Since DAOs are governed by complex smart contracts, they don't have any kind of board of directors or single entity in charge, but the power is completely decentralized. According to Binance, DAOs will revolutionize a large number of industries that will move to decentralized governance powered by smart contracts in the next years.

The first example of decentralized autonomous organization was "The DAO", launched in 2016 through an Initial Coin Offering (ICO, is broadly analysed in chapter 2) on Ethereum. The DAO consisted of complex smart contracts running on the top of Ethereum and introduced a series of innovative concepts in its business model: an automated fundraising campaign (called ICO), the issuance of digital tokens, and tokenization of assets. Further, tokens were distributed during the ICO and entitled token holders with ownership stake and voting rights.

The DAO business model introduced a more efficient system that relies less on the need for human inputs, therefore it cut costs and risks associated with human behaviours.

Unfortunately, the DAO did not last long, because malicious actors attacked its weaknesses after the launch and stole one third of the total funds raised; consider that in 2016 the DAO was funded with 14% of the total supply of ether.

It was a shocking event, and it was followed by the decision of hard forking the chain into two chains: one chain with the malicious transactions that were "*reversed"* to restore the funds (that is called the Ethereum blockchain) and a second in which transactions were not reversed (now called Ethereum Classic).

The DAO case underlined the risks of this innovative technology, on the other hand it outlined the new challenges of an open environment and the potential of smart contracts.

1.4.2 Mining ether

The mining process has the crucial role to secure and update the blockchain, and it avoids the centralization into the hands of a single actor. Ethereum follows the same principles of Bitcoin, because mining is costly, and the system provides miners with a coin base rewards in ether.

While Bitcoin set a deflationary money rule and fixed a cap of bitcoin supply to BTC 21 million, Ethereum developers left intentionally unscheduled the ether emission with the purpose of incentivizing the foundation of DApps.

Ethereum started with an initial supply of 72 million ether, of which 50 million were issued through an ICO, a public token sale where participants could buy ether in exchange of bitcoin or other cryptocurrencies.

Further, since the mining process has a crucial role to secure and update the blockchain, miners are rewarded in a similar way to Bitcoin. The reward consists of two parts: the fees from all the transactions in the block, plus 2 ether instantly produced by the system. Moreover, the average time that Ethereum miners take to mine a block is about 12-19 seconds, considerably lower than the average 10 minutes for Bitcoin. Nevertheless, Ethereum announced that the system will change the consensus protocol and will move from the Proof-of-Work to the Proof-of-Stake in order to faster the mining time even further.

1.4.3 Gas

Ethereum aims to raise the number of smart contracts enforced and transactions in the network potentially to tens thousands and more. Nevertheless, the system would risk collapsing because too many resources would be wasted. To mitigate this risk, Ethereum introduced the concept of *gas*. Gas can be defined as the fuel that allows the smart contracts to be executed, just as fuel allows cars to run.

Gas must not be confused with ether:

- Ether is the cryptocurrency which allows transactions in the Ethereum network.
- Gas is a unit of measure of how much work is necessary to fulfil a specific task, and it is a fee to be paid to miners for sending a transaction or performing smart contract functions.

Since gas can be seen as a fee, miners will be more likely to execute smart contracts which pay higher gas first, while they will ignore smart contracts with lower gas.

The gas price is a fraction of ether, called *gwei*, which is one billionth of ether. The gas price fluctuates and is determined by miners. Gas price rises when the number of transactions is high and decreases when the activity is low.

Further, while gas price can change, the amount of gas required for certain operations remain fixed, because gas is a measure of computational power. Remember the example of the car, if you need 20 litres of fuel to make 400 kilometres with your car, you will always need 20 litres to make the same distance, but the price of the fuel will vary from time to time.

Moreover, smart contracts require a gas limit to be posed. The gas limit is the maximum amount of gas a user is willing to pay for a transaction to be validated quickly by miners. Once the miner exceeds the gas limit fixed in the smart contract, the operations will stop.

The gas limit is usually setup by crypto wallets' services, but sometimes it can be handled manually by users.

The amount of ether to be paid to miners is the result of multiplying the gas price for the gas limit. High gas price and high gas limit means that transactions will take place quickly, but the fee will be high.

1.4.4 Ethereum scalability problem

As we have already seen, blockchains lack of scalability, that is, the property of a platform to grow in size (i.e., the number of data servers) as the number of users increases. Hence, Ethereum is facing this inefficiency which is a huge problem for a platform that aims to become the leader in the so-called Web 3.0, characterized by decentralization, lack of intermediaries, focus on privacy, ownership of one's own data. Moreover, Ethereum has actually 12 transactions per second (TPS), a tremendously low number if compared with the 2000 TPS of VISA.

Analysing this problem, Buterin theorized the *Blockchain Trilemma* that illustrates the fragile balance a blockchain must maintain between its main three characteristics: scalability, security, and decentralization.

According to Buterin, a blockchain platform cannot handle the three characteristics simultaneously, but it will focus only on two of them and miss the third. Hence, three combinations are possible:

- **Security** and **decentralization**. Prioritized by Ethereum and Bitcoin, this combination establishes its success on the consensus algorithm, with miners who download the blockchain on their computers and start validating transaction. This solution can guarantee security through decentralization and a rewarding mechanism, but the system is slow.
- **Security** and **scalability.** This scenario could be feasible if the gas block limit would be turned up. As a result, the number of transactions in a block would increase and the block would get bigger. This would require the nodes to have much more powerful computers to guarantee the ability to download and periodically update the blockchain. Hence, it would end up with a more scalable and secure network, but with less nodes able to guarantee the decentralization.
- **Decentralization** and **scalability.** This solution would enable a faster and decentralized platform, but it would be achieved giving up on the consensus algorithm, and therefore on security.

Figure 8: The Blockchain Trilemma: Scalability (1), Security (2), Decentralization (3).

Source: Binance.

1.4.5 Ethereum solutions to scalability

Ethereum developers proposed three solutions to cope with the problem of scalability, because reducing the amount of data that nodes must store is vital to Ethereum's successful scaling.

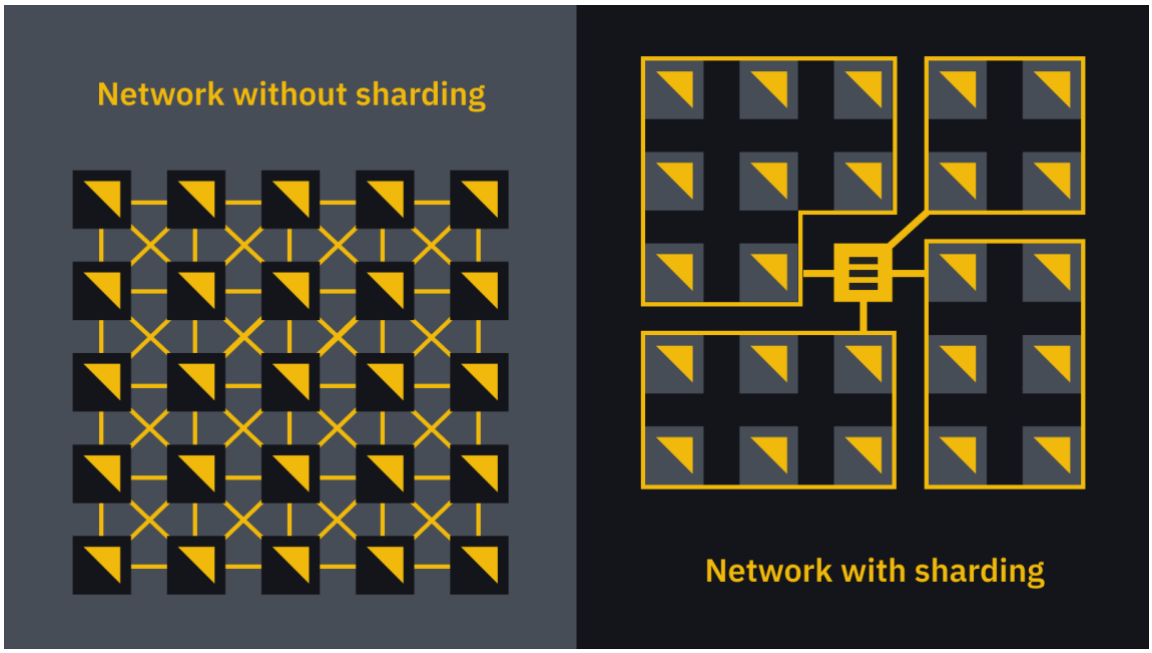
1.4.5.1 Sharding

One of the problems generated by the limit to scalability stems from the nature of a blockchain. In a blockchain, nodes download and store a copy of the entire blockchain, and maintain it updated. This system is consuming in terms of bandwidth and available memory.

A proposed solution to this problem is *sharding.* In computer science the *sharding* is the process of dividing the network into subsets of nodes, called *shards*.

In this way, the blockchain network would be split in *shards,* composed of smaller groups of nodes. Nodes would keep validating only transactions of their shard independently, without the need of updating all transactions from other shards. Nevertheless, nodes could communicate with other nodes in other shards.

Figure 9: Ethereum without sharding (on left) compared to Ethereum with sharding (right).



Source: Binance.

1.4.5.2 Ethereum Plasma

Ethereum Plasma is an alternative open-source project developed in 2017 to solve the scalability problem. Ethereum Plasma proposes an *off chain/secondary chain* that enables to push transactions off the blockchain, also called the main chain.

The project wants to build a hierarchical tree with numerous smaller chains, called *Plasma chains* or *child chains.* The number of child chains is unlimited because the idea should be implemented through the use of smart contracts and Merkle trees. The use of smart contracts allows each child chain to be customized and created on different needs, so that the child chain can operate independently and towards specific goals.

Each child chain should be able to communicate and interact with the main chain.

Ethereum Plasma is aimed to enhance the efficiency of the Ethereum network and reduce the congestion of the main chain, in order to incentivize developers to build decentralized applications.

1.4.5.3 Ethereum Rollups

Rollups is an innovative solution to the scalability problem that shares some features with Plasma. Rollups and Plasma are similar in the way they use a 2-layer technology,

shifting transactions off-chain, rather than on the main chain. The 2 layers are: layer 1, the main chain, here called mainnet, and layer 2, named sidechain or child chain.

On the other hand, the two solutions differ in the method of submitting state transitions. With Rollups, nodes, called *aggregators,* pack (or roll up) a huge number of transactions in a block named *Rollup block*, while users pay aggregators to send their transactions to the main chain.

Rollups are able to scale Ethereum smart contracts and decentralized applications from 100 to 2000 TPS.

There are two types of rollup: ZK Rollup and Optimistic Rollup.

- **ZK Rollup** adopts a Zero-Knowledge proof system called ZK-SNARK. *Binance glossary* describes a zero-knowledge proof system, as a system where "the prover is able to prove to the verifier that he/she has the knowledge of a particular piece of information (such as the solution to a mathematical equation) without revealing the information itself". With ZK Rollup, a smart contract is created on the main chain (mainnet smart contract). Then, ZK Rollup submits ZK-SNARK proofs to the mainnet smart contract. The mainnet smart contract verifies and accepts only valid proofs. The most significant advantage of this system is speed because the process occurs almost instantly, and it allows the blockchain to scale tremendously.
- **Optimistic Rollup** uses a virtual machine named Optimistic Virtual Machine (OVM) which enables smart contracts to run on two layers (main chain and child chain), cutting user's transaction costs. Optimistic Rollup gives up some scalability in exchange for more flexibility, because it does not adopt any cryptographic proof to assess whether the state of transition submitted to the main chain is correct. To minimize this issue, transactions are transmitted with a delay. During this period of time users are challenged to find and reject invalid blocks submitted to the main chain. When a user finds an invalid block, he/she cuts the aggregator's bond and the bond of any aggregator, then built on top of the invalid block. To be clear, a bond is the link between the main chain and the child chain, while aggregators are those who create these links called bonds. It may happen other aggregators link new blocks to the invalid child chain, this is the reason why users cut not only the aggregator's bond, but also the bond of any aggregator, then built on top of the invalid block. Afterwards the winner user earns a portion of the cut bonds.

1.4.6 From PoW to PoS: Ethereum Casper

Ethereum is developing a project to change its consensus protocol from PoW to PoS. This project is called Ethereum Casper, and it is expected to start in the future, and maybe from 2020. Nodes will shift from mining to staking; hence they will be no longer called miner, but validators because they will stake ether to be eligible for validation. Validators will be randomly chosen to validate a block according to the amount they staked.

This change will produce a shift in the disincentive mechanism that assures the security of the network. Indeed, while miners face a disincentive to cheat due to the risk of wasting electricity and losing rewards, dishonest validators risk to lose funds they staked.

The minimum amount to stake will be 32 ether per validator. This extremely high amount is thought to discourage a 51% attack. Dishonest validators will be quickly removed and punished with the confiscation of their stake.

The number of rewards to assign to validators is not yet clear, but it will probably depend on the amount staked by the validator, the total amount of ether staked in the network and the inflation rate. In any case, the reward will consist of only transaction fees, rather than new ether.

The minimum withdrawing time will be 18 hours, but it will vary depending on how many validators are withdrawing at a given time.

The adoption of the PoS model has been considered because it consumes much less electricity since nodes will no longer be required to mine in order to secure the blockchain. Therefore, Ethereum will become more environmentally friendly.

CHAPTER 2. Initial Coin Offerings

2.1 Introduction to Initial Coin Offerings

An Initial Coin Offering (ICO) is an innovative fundraising mechanism that uses the blockchain technology and allows firms to raise capital by issuing tokens to investors on the Internet without any financial intermediary intervention needed (Fisch, 2019; Adhami et al., 2018). Tokens can be used to obtain products, services (on a platform), or profits, and can also be traded on secondary markets between investors (Adhami et al., 2018). The relationship between the issuer and token holders can be regulated by smart contracts that are usually provided by platforms, such as Ethereum.

All kinds of companies can undertake an ICO, but it is almost always used by start-ups and projects (Joo et al., 2019).

There are two main reasons that justify the spreading of ICOs: the guaranteed anonymity to investors and venture teams, and the decentralization of the activities thanks to the blockchain technology. Furthermore, ICOs lead to bypass any regulatory compliance posed by central authorities and to have close-to-zero transaction costs from intermediaries (crowdfunding platforms, banks, credit card circuits) (Adhami et al., 2018).

ICOs are globally accessible and allow investors worldwide to take part in start-ups and projects in another country without the need of any regulatory procedure or foreign currency exchange (Joo et al., 2019). On the one hand, ICOs add more opportunities for start-ups to raise funds successfully with an enlarged crowd of worldwide investors, but on the other hand, they have a higher risk of frauds and scams than other forms of capital raising.

The first ICO took place in 2013 for a cryptocurrency named Nxt and raised only US$ 6,000. The outbreak of the ICOs phenomenon occurred in 2017 with more than US$6 billion raised according to Coinschedule.com, considered one of the most reliable data sources for ICOs statistics.

ICOs have become more and more attractive to investors because tokens can be exchanged on secondary markets (Adhami et al., 2018) and offer the option to exit from the investment in any time thanks to their high liquid nature (Momtaz, 2018).

However, one of the main problems of ICOs is the information asymmetry that characterizes the relationship between token issuers and token investors. Indeed, there is no specific protection for investors because ICOs allow ventures to bypass any regulation without providing financial documents or official prospectus, or complying with corporate governance rules (Adhami et al., 2018; Fisch, 2019; Goergen and Rondi, 2019).

2.2 Tokens

A token is a digital medium cryptographically secured and implemented on a blockchain (Fisch et al., 2019; Jackson, 2017; Fisch and Momtaz, 2019). Tokens are issued by ventures to raise funds to set up an online platform where all transactions are allowed with the use of their issued tokens only and without intermediaries (chi and Kostovetsky, 2018; Jackson, 2017).

Tokens are entries on a blockchain. The blockchain records all transactions made with tokens or cryptocurrencies chronologically and publicly. The token holder is provided with a key that enables him to build new entries on the blockchain to transfer the token ownership to another individual (Momtaz, 2018).

A token is a representation of an underlying contract. Tokens are not currencies. So, a firm does not need to create its own blockchain to issue tokens but can use existing platforms that provide all services needed, such as Ethereum. A blockchain is necessary only if a firm needs to issue a cryptocurrency (Cointelegraph.com).

A venture usually distributes 40-50% of the tokens during the ICO, 10-20% are reserved for the venture's team, while 20-30% are put aside for future goals (Swammy et al., 2018).

There are several categories and often there is no clarity about tokens' names and purposes. Different authors (Benedetti and Kostovetsky, 2018; Felix and von Eije, 2018; Fisch et al., 2019; Jackson, 2017; Joo et al., 2019; Fisch and Momtaz, 2019) and national authorities (US SEC and Swiss FINMA) have identified a different number of categories with various definitions. SEC (Securities and Exchange Commission) and FINMA (Financial Market Supervisory Authority) are the two most important institutions that tried to regulate ICOs, and they defined three categories:

- Utility tokens,

- Security/Asset tokens,
- Cryptocurrency/Payment tokens.

2.2.1 Utility Tokens

The vast majority of ICO tokens are utility tokens and entitle the holder of future participation in projects on the platform or gives access to the venture's products or services. They do not give any ownership right.

The Cointelegraph describes utility tokens like tickets that you receive when you enter in the amusement park. You can use that tickets only inside the park to enjoy carousels and shows, or to buy candies and hot dogs, but outside the park they are worthless.

An example of utility token is the Timicoin, a token developed by the Timi Group Inc. company. The project operates in the healthcare industry and aims to facilitate the exchange of clinical information and gathering data, because medical institutions actually hide and encrypt information for fear of losing competitive advantage.

The Timicoin provides users that invest in the company with a future access to the products and services offered by the company.

2.2.2 Security/Asset Tokens

Security/Asset tokens represent about 3% of all ICO tokens. They are similar to tradeable assets, and they can be considered as real means of investment. The SEC calls them *Security tokens* because their nature is similar to traditional securities, and so they should be subject to the so-called Howey Test[1]. On the other hand, *Asset tokens* is the name accepted by the FINMA because this type of token should be subject to Swiss asset laws. In any case, security/asset tokens can grant a share of ownership or control, dividends, interest payments, or other financial benefits.

[1] The Howey Test assesses whether an asset meets the conditions that defines a security, consequently it must be subject to specific registration and disclosure requirements. The Howey Test considers four criteria that assess whether: the security involves an investment of money or some assets tangible in the real world; the investment expects profits; the investment is in a common enterprise; the profit is not determined by the investor but by third parties' efforts.

2.2.3 Cryptocurrency/Payment Tokens

Cryptocurrency/Payment tokens are tokens that are mined on a blockchain by the entrepreneur, for this reason payment token is a synonymous of cryptocurrency. Coin is another term used to call cryptocurrencies, hence the denomination “initial coin offering”. Not all cryptocurrencies can be tokens, but only those that are purchased during an ICO.

Payment tokens can work as ordinary currency only inside the venture’s ecosystem. However, these ventures can sell tokens and other cryptocurrencies as payment, such as Bitcoin or Ether.

Payment/cryptocurrency tokens fall under the asset laws and so are subject to the Howey test (Momtaz, 2018).

These are the three most relevant definitions that I found in the literature but boundaries that define these categories of tokens are not always clear. Some authors try to provide definitions of other types of tokens that can be called *hybrid tokens* because they combine the characteristics of two categories of tokens. Other tokens do not grant any particular right except for the community membership (Giudici and Adhami, 2019).

All types of tokens, even utility or hybrid tokens, can be traded on a secondary market against other tokens or against traditional currencies after the conclusion of the ICO (Benedetti and Kostovetsky, 2018). The secondary market is open to any type of investor. The high volatility of tokens’ prices and the ease of access to the secondary market have attracted speculators and short-term investors looking for high risk return investments (Fisch, 2019; Joo et al., 2019).

2.3 White Paper

A white paper is a document in which a venture discloses necessary information for investors. There is no standard framework, and the information provided are unaudited by third parties.

The white paper is not compulsory for a venture, but when it is provided it is a sort of certification of the project value (Giudici and Adhami, 2019), and the chances of success of the ICO campaign increase exponentially. A white paper should disclose:

- the problem that the venture wants to solve and the possible solution;
- a description of the product, IT protocols, its architecture, adopted public blockchain;
- information about the quantity of tokens supplied their pricing and distribution mechanism;
- how the venture will use the funds raised;
- information about the venture's team like their skills, experiences, backgrounds, and how they will fulfil goals;
- a roadmap or a business plan.

White papers usually do not disclose details about the board of directors, or on the supervisory body, or stakeholders' meeting (Adhami et al., 2018).

Successful ICOs are often characterized by white papers that describe in depth venture's technology and infrastructure, and how the team wants to develop them. Successful technical white papers are observable, because they are issued to the public, and costly, because it means that the venture has high technological capabilities difficult to acquire in a short time. Projects that do not provide technical information or focus more on the description of team members or on the business model are usually more likely to fail or could even be scams (Fisch, 2019).

2.4 Smart Contracts

Smart contracts are self-executing digital contracts created by a computer protocol inside a blockchain. Since the blockchain is a distributed ledger technology, a smart contract relies on a distributed consensus.

Smart contracts are certified by hashing cryptography and registered in the blockchain backed by algorithms that make the process faster and more efficient (Cong et al., 2017; Giudici and Adhami, 2019; Joo et al., 2019).

Algorithms reduce costs, complexity and uncertainty, enhance contractibility and make it easier exchanging money, ownership, shares, services, and facilitate cross-border operations of venture teams (Cong et al., 2017; Giudici and Adhami, 2019).

Smart contracts are self-enforceable, because they rely on a distributed consensus protocol. It means that a smart contract embodies a range of negotiating conditions to be met before a smart contract can be implemented (Cong et al., 2017; Joo et al., 2019).

The distributed consensus allows to avoid third parties' participation and possible monopolies.

Smart contracts are irreversible. It means that the contract cannot be nullified or corrected coming back to the previous stage, after the contract is enforced (Joo et al., 2019).

Smart contracts have an address and a code that is located within the blockchain. They store addresses of the token owners, number of tokens, and an amount of virtual coins. Transactions can occur when the user sends a private key associated to the contract address. If the transaction is accepted by the blockchain, all participants in the contract execute the contract code, and the operation is fulfilled (Chu et al. 2016; Fenu et al., 2018).

2.5 The Lifecycle of an ICO

The process that brings to the ICO launch is made up of several steps. The phases I describe below are the most common described in the literature. Since the ICO phenomenon is constantly evolving and unregulated, there is not a common followed process, and sometimes some steps could not correspond to those I listed below.

2.5.1 Choosing a Blockchain Platform

The first important decision that a venture team has to undertake is the choice of the blockchain platform where to prepare the project, develop the smart contracts, and tokens, consequently, how to set up the ICO infrastructure on the features of the chosen platform.

Ethereum is by far the most common blockchain platform, with more than 80% of ICOs designed to comply with it. Ethereum's success is mainly due to the fact that it was one of the first blockchain platforms created specifically for ICOs and providing a cryptocurrency called Ether (Joo et al., 2019), its own coding language called Solidity to write smart contracts, a standard token called ERC-20 that can be exchanged on Ethereum, and finally Ethereum Virtual Machine (EVM) handles smart contract and transaction on behalf of the company.

There are numerous platforms that supply their blockchain infrastructure, like Poloniex, and others that also provide some guidelines to follow before the ICO launch date, such

as Bittrex (Kaal and Dell'Erba, 2018). In any case, the venture team has to choose the cryptocurrencies to pair with tokens and that are accepted as payment for tokens.

2.5.2 Announcement on Cryptocurrency Fora

A crucial step in the preparation phase for the ICO is the announcement on cryptocurrency fora, like Bitcoin Talk, Cryptocointalk, Reddit. The announcement should contain an executive summary that describes the project to investors in order to receive back comments and critics useful to draft the white paper (Kaal and Dell'Erba, 2018). This phase is useful to create awareness towards potential clients and receive feedbacks to fix the business plan. At this stage the target investors are usually early adopters who may participate in the Pre-ICO (Ackermann et al., 2020).

After the announcement on cryptocurrency fora, there starts a phase during which the team prepares the smart contract, drafts the white paper and releases the source code.

2.5.3 Creation of the Smart Contract

The creation of the smart contract is a critical moment in the preparation of the ICO because the smart contract has to be set up according to the features of the chosen blockchain platform. According to the Ethereum glossary "the term *smart contracts* refer to immutable computer programs that run deterministically". Here, we can find three features of smart contracts. First, they are immutable, it means that once deployed, it is impossible or very difficult to modify the code of a smart contract. Second, they are computer programs, it means that smart contracts have no legal validity, even if they are commonly called "*contracts"*. Third, they are deterministic, it means that the outcome of the execution of a smart contract is the same for everyone who runs it.

Moreover, smart contracts reduce transaction costs that could normally occur between issuers and investors (Giudici and Adhami, 2019).

Finally, a smart contract let an ICO to have more rounds of token sales: a private sale, presale, and crowd sale (Joo et al., 2019).

2.5.4 Drafting of the White Paper

There is no fixed scheme about what kind of information should be included in the white paper. The list below concerns the variables that had been found most frequently in white papers:

- the number of tokens to be issued;
- the price of tokens and any discount system related to each round of sales;
- the rules of allocation of tokens and eventual rights of first refusal among entrepreneurs, advisors, special categories and the general public of crowd-investors;
- the management of the issuing process of tokens,
- how to handle the issued but not sold tokens;
- any presale before the ICO launch (Giudici and Adhami, 2019; Joo et al., 2019).

Often, venture teams fix a funding target before the public tokens' sale. Joo et al. (2019) highlighted three scenarios:

1. the token issuer establishes a target, so the new tokens are sold at a fixed price. It means that, prior to the ICO launch, the issuer can know the total amount that's going to be raised and the total amount of tokens to be issued.
2. Another scenario occurs when the total amount of supplied tokens is predetermined, but the funding target is flexible. The issuer can know the number of tokens allocated to each investor only after the conclusion of the ICO period and, as a consequence, also the total amount of capital raised.
3. In the last scenario the price of tokens is fixed, but the total amount of tokens is determined on the total amount of funds raised after the conclusion of the ICO period.

2.5.5 Release of the Source Code

Publishing the source code is seen as a way to look more transparent, and at the same time it allows the crowd to find out bugs and improve quality, avoiding additional overhaul costs to the projects. Github is a popular web-based warehouse hosting service for computer code, and it is widely used for token contracts since more than 50% of the total ventures release their source code here (Howell et al., 2018).

2.5.6 Publication of White Paper

The publication of the white paper on the project's Website or on other platforms is one of the crucial phases that precedes the ICO launch because it is the most frequent or the only way to disclose information to public investors. Almost all teams decide to write one with the aim of appearing more transparent to investors. ICO teams that publish the white paper are more likely to succeed achieving the target capital to be raised. This document synthetizes core elements, purposes, specifics and outcomes of the project, the amount of expected funds and of the tokens to be issued, what cryptocurrency is adopted and length of the ICO period (Kaal and Dell'Erba, 2018; Joo et al. 2019). The white paper is not a legal document because it is unaudited and not reviewed (de Filippi et al., 2019).

2.5.7 Marketing Campaign

The marketing campaign, together with the white paper release, is an important phase to advertise the ICO to the public. Here, the goal is to reach a potential crowd of investors as large as possible in order to enhance the brand awareness. The size of the network heavily influences the value of the new tokens (Kaal and Dell'Erba, 2018; Joo et al., 2019).

The ICO is advertised on cloud-based messaging applications and social network platforms like Telegram, Twitter, Facebook, Linkedin, and YouTube. Telegram and Twitter are prevailing over others social media channels. Howell et al. (2018) found out that 83% of the ICOs have a Telegram group, while 97% have an official Twitter account.

2.5.8 Pre – ICO

In many cases a presale of tokens can anticipate the ICO launch. This solution is adopted by more than 40% of ventures, and it is seen as a mechanism to prove the effectiveness of the ICO. There are some motives behind a Pre-ICO: to finance costs from the advertising campaign and hiring staff; to define total amount and price of the token; to validate the issuer reliability (Kaal and Dell'Erba, 2018; Howell et al., 2018).

2.5.9 ICO Launch

The ICO launch is the conclusive but the most decisive phase of the ICO process. Here, the public tokens' sale starts, and it is open to all potential investors. There are no limits of duration, so an ICO can be closed within few days or less, or to last for a year or more (Kaal and Dell'Erba, 2018). ICOs are launched from the project's website.

A token can be generated in few minutes by downloading the code by the ICO's platform. Then, the code can be manipulated according to some variables: the number of tokens, the speed of the mining process, or to add options to freeze the contract to prevent emergencies, such as a hacker's attack.

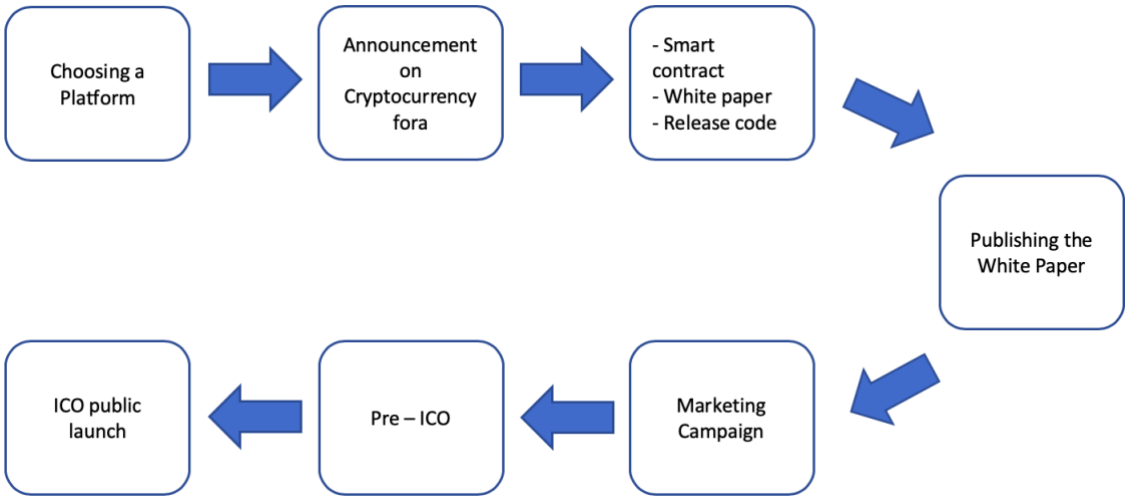
Investors send funds to the address attached to the smart contract only using the paired currencies. Then, they receive in exchange the correspondent number of tokens (Kaal and Dell'Erba, 2018).

There are two possibilities after the conclusion of an ICO: the listing or the ICO failure.

If the ICO is followed by the listing on a token exchange, tokens start to be traded on a secondary market (Fisch and Momtaz, 2019).

If the ICO fails, it means that the raised funds didn't exceed the minimum target to raise and returned to investors. The majority of ICOs ends with a delisting (Kaal and Dell'Erba, 2018; Joo et al., 2019).

Figure 10: Illustration of the ICO process.



Source: Own elaboration.

2.6 Risk Factors

In the past paragraphs, I analysed the ICO phenomenon from the firms' point of view. Now, I want to move on to the investor's standpoint and to scan which risk is taking with ICOs.

The first risk to consider is the industry risk. The ICO is a financing method mainly used by ventures in the seed or start up stage, which have no track record. These firms may have a project just outlined in the white paper but without practical implementation when they are admitted on an exchange platform (de Filippi et al., 2019). Nevertheless, they are provided with unprecedented liquidity for start-ups without giving sufficient or appropriate information to investors, who may be unable to clearly understand it. This situation originates so-called information asymmetries (that I described more in-depth in the paragraph below) that arise when the token issuer has more information about the project than the token buyer. Token holders often bet in a future promise of the idea associated with the platform. Information asymmetries combined with high liquidity for a start-up generates high volatility of the tokens and of the entire cryptocurrency market (Kaal and Dell'Erba, 2018).

A second risk is the legal risk generated by the lack of a regulatory framework and the consequent uncertainty. Unlike IPO proponents, ICO ventures just provide investors with the white paper, a document unaudited and not reviewed. In addition, there are few and young rating agencies to evaluate the reliability of each ICO, such as ICORating.com, and investors prefer to bypass authorities that could intervene to remediate potential problems (de Filippi et al., 2019).

A third risk is the risk of disintermediation due to the lack of established intermediaries. Since ICO is based on the blockchain technology, two pillars of this financing method are anonymity and decentralization. The desire of ICO teams and many investors to remain anonymous led them to trust more on a decentralized technology like blockchain, rather than on relied institutions (i.e., a bank) or on a certifier (i.e., a notary) (Kaal and Dell'Erba, 2018). This behaviour causes the loss of the risk mitigating mechanisms developed by the domestic authorities until now.

Finally, there is a credit risk that arises in the case of bankruptcy of the ICO promoters, because token holders usually do not have any right of first refusal. Indeed, after the

debt holders and outside creditors are satisfied with the liquidation value of the corporation, token holders do not have any right of recourse (Kaal and Dell'Erba, 2018).

2.7 Information Asymmetries

Information asymmetries characterizes the relationship between firms and investors in business, and this argument has been broadly analysed in the last decades.

As Leland and Pyle (1977) stated information asymmetries introduce inefficiencies because investors often lack necessary information. In the case of the ICO, entrepreneurs take advantage of investors by disclosing partial or very few information and investors are unable to find a way to assess a venture's true quality (Fisch and Momtaz, 2020).

The ICO market has been characterized by huge uncertainties that increase the riskiness of this innovative financing method. Risks arise mainly for retail investors because they do not have the same means and understanding to deal with information asymmetries as institutional investors have (Fisch and Momtaz, 2019).

Fisch (2019) sums up the sources of information asymmetry that affect ICOs. First of all, ventures that undertake an ICO live in a technologically complex environment. These firms are highly innovative, often backed by blockchain technology, and consequently the investor is required to a have appropriate technical knowledge.

ICOs investors are usually more risk-takers than other investors because information provided is opaque, non-audited, and disclosed by anonymous ventures or projects' teams that increase the investment risk.

Other aspects that enhance uncertainties are that ventures are typically in the early stages of their life cycles, have no track records, and frequently issue tokens that have no counter value in the real world but only run-on ventures' platforms.

Then, another cause is anonymity. Anonymity has been one of the pillars of blockchain backed crypto transactions since its very beginning (Nakamoto, 2008), and has paved the way to scams. Especially for what concerns scams, having technical knowledge allows the investor to find out potential frauds from reading the white paper. Indeed, white papers written by scammers are very poor about what concerns technological aspects.

Finally, ICOs have always been distinguished for the low amount of available information due to the absence of regulation and formal disclosure. This aspect has led some firms to implement Know Your Costumer (KYC) frameworks, that have met many criticisms by the ICO community that wants to maintain its anonymity (Fisch, 2019).

Under this uncertain scenario, white paper is the main or the only one way to provide information. Ventures may overemphasize information provided in the white paper with the aim of maximizing gross proceeds. Then, ICO ventures usually shift investment risks to diversified investors, while the entrepreneur can preserve control rights without the risk of diluting it (Momtaz, 2018).

2.8 Signalling Theory and Underpricing

Fisch (2019) has also empirically analysed ICOs under the signalling theory perspective to help investors to reduce the moat created by the information asymmetry. He started from the assumption that a signal should be observable and costly to be reliable. He found that the presence of a technical white paper and a high-quality code are useful to enhance the investors' knowledge about the venture.

A white paper is observable, because it is published as a standard for ICOs since it allows investors to understand ventures' features and goals, and it is costly, because editing a high-quality white paper requires a remarkable amount of technical expertise and time. High-quality codes are observable, because they are published on open-source community platforms, like GitHub, and costly in terms of competence, because they need the programmer to have well-developed technical skills to write the code properly. High-quality codes also increase the likelihood of success of an ICO (Adhami et al., 2018). Another signal can be fixing a maximum limit on the token supply, that makes the venture more credible and gives more probability to succeed in fundraising than not fixing any limit to token supply (Momtaz, 2018).

The lack of regulation generates the desire for investors to fill the information gap in the ICO market. To cope with information asymmetry and to appear more reliable, ventures try to apply a signalling strategy used for IPOs: underpricing.

Underpricing should be seen as a reliable signal that the venture is able to raise enough capital to cover the cost of underinvestment, and it underlines a platform growth prospect. Underpricing tokens increases tokens' demand which enhances tokens' value.

Liquidity from underpricing tokens increases users' adoption of the ICO platform. A larger number of platform users is crucial for ICO ventures that usually issue utility tokens for two reasons. First, utility tokens do not have any underlying counter value in the real world, but only a value based on the size of the network of users (Howell et al., 2018). Second, utility tokens do not provide investors with any ownership right, so ICO issuers are able to keep the control of the firm (Momtaz, 2018).

Felix and von Eije (2018) observed that the number of underpricing of US ICOs is larger than the number of US IPOs at the beginning of the dot.com bubble in 1999. Here, there is a twofold explanation. First, ICOs are characterized by a high degree of information asymmetry, and so there are more possibilities for scammers to fraud by raising liquidity through underpricing (Felix and von Eije, 2018). Second, many entrepreneurs lack of expertise in determining market demand for the token and the platform, and there is greater uncertainty to determine the value of a start-up (Benedetti & Kostovetsky, 2018). Moreover, Chod and Lisander (2018) described the ICO market as a "market for lemons", because investors may face difficulties to discriminate between high quality ventures and low-quality ventures (Akerlof, 1970). Low-quality ventures can imitate high quality ventures' underpricing strategy, but they will be unable to recoup the cost and will fail. This result highlight that ICO is an optimal financing method for low quality ventures that cannot cover costs.

To cope with these problems, Pre-ICOs (token presales) have become more popular over time, and the number of underprices have diminished (Benedetti & Kostovetsky, 2018).

2.9 ICO Reasons of Success

Among the growing literature towards ICOs, some scholars have analysed many factors that are associated to the success of an ICO project.

First of all, the availability of the programming code source is positively related to the success of the ICO process, because it reveals the funders' technical expertise and it works as an assurance for investors (Adhami et al., 2018).

The so-called Pre-ICO, the presale of tokens, is highly correlated to the success of the final output, because it is a mechanism to prove the effectiveness of the ICO to assess the entire strategy, to test the market, to define the total amount and the price of the

token to validate the issuer reliability (Adhami et al., 2018; Kaal and Dell'Erba, 2018; Howell et al., 2018).

Then, the larger is the size of an ICO venture team, the higher is the probability that the capital raising will succeed. At the same time, the presence of a large advisory committee is favourably correlated as well (Adhami et al., 2018).

The quality of the management team is related to a higher chance to achieve the funding goal. Higher quality teams correspond to reduced agency costs when team members have past managerial experiences and are more likely to include a pre-ICO in their strategy to analyse the market in advance. The education level (Master of Science or PhD) and the entrepreneurial background are not as significative as it could be expected (Giudici & Adhami, 2019; Momtaz 2018).

A positive but weaker correlation has been found with reference to the retention rate of a portion of the total tokens supply, because tokens are often utility tokens and so they do not provide any control right (Giudici & Adhami, 2019).

It is important to point out that the presence of the white paper is not correlated to the success of an ICO project, even if it could be supposed to be. The reasons are that this document is voluntarily disclosed with no standards about the length and the content, in the absence of an auditing authority that can certify its validity (Adhami et al., 2018). Indeed, even scammers or low quality ICO projects can write a white paper.

2.10 Why an ICO Could Fail – Failed ICOs Reasons

ICO has been an innovative financing method with a frenetic growth as high as the probability that a project fails at its very beginning. Joo et al. (2019) reported a survey published by Bitcoin.com that analysed a sample of 902 ICOs at the early stage and found out that 16% of the total attempted ICOs failed at the funding stage, while 31% failed after the funding stage. It means that an enormous percentage fails in the very first stages of lifecycle or before, and this dramatic figure need to be analysed to understand the causes. First of all, I want to describe which is the underlying scenario in which these projects fail, and then I move on to the reasons why they fail.

As I said above, ICO ventures are often in the early stages of their lifecycle when the project is not yet set, and they often do not follow all the steps I listed previously. Further, ICOs are launched on independent platforms that do not provide any screening

phase to the projects, but sometimes they only give some guidelines. Hence, platforms give the possibility also to low quality projects and scammers to launch their ICO that will surely fail, without refunding token holders. Some platforms tried to solve this problem providing an evolution of the ICO, as I will describe in Chapter 3.

Another problem is that platforms rely on the blockchain technology bypassing any intermediation or payment agent (i.e., banks). So, ICOs are unaudited and unregulated because no authority can investigate on potential cases of money laundering or moral hazard (Giudici & Adhami, 2019; Joo et al., 2019). Moreover, we have to remember that cryptocurrency accounts are anonymous, and transactions are irrevocable. This situation has led to an increasing frequency of theft and scams, because investors have become indifferent to the lack of regulation and protective measures (Adhami et al., 2018; Benedetti & Kostovetsky, 2018).

In the literature, I found four reasons as to why ICOs fail.

First, one of the most frequent reasons is the low demand for their tokens (Adhami et al., 2018). This occurs when ventures' teams fail to promote properly the project and do not provide the public with as much information as possible (Joo et al., 2019).

The second reason happens when the ICO project is unable to achieve the minimum funding goal (Adhami et al., 2018). This situation usually occurs because projects do not have a minimum cap and often there isn't any underlying product. Uncapped ICOs are perceived as riskier by investors since ICOs promoters are seen as greedy and there is uncertainty in the valuation of the underlying product. However, since 2017 ICO proponents understood that capped sales enhance the probability to raise the minimum funds and to be oversubscribed. As a consequence, the number of capped ICOs raises significantly (Kaal and Dell'Erba, 2018).

Third, some ICOs fail because they face security issues (mainly hacker attacks) that force proponents to retire sold tokens, or to suspend the planned distribution (Adhami et al., 2018).

Fourth, a portion of all ICOs is composed by scams, and when the investors community recognize an ICO as a scam the raised funds will be zero or closed to zero (Adhami et al., 2018). This type of ICO is characterised by a strategy that aim to fraud investors by hiding or faking information about the financing, the team, and the location of the company (Joo et al., 2019).

2.11 Comparison Between ICO and Conventional Financing Method (IPO, VC, Crowdfunding)

In this paragraph, I compared the main features of the ICO with other more used financing method. To make the analysis easier I found thirteen common variables.

2.11.1 ICOs vs IPOs

The ICO is a fundraising method that shares some features with the IPO. On the one hand, there are some similarities but, on the other hand, there are many differences among these two financing methods.

Type of firm – Lifecycle. Even if the ICO is a way of fundraising that could be used by every type of firm, it has been more and more applied to finance seed stage, early stage, and start-up firms. The IPO is known to be a conventional capital raising method applied to large or established private companies (Joo et al., 2019; Momtaz, 2018).

Participation characteristics. ICO firms issue tokens (security, utility and/or cryptocurrency tokens) that provide the investors with ownership rights only in the 25% of the cases according to Adhami et al. (2018), and that are sold via unregulated exchange platforms (Kaal and Dell'Erba, 2018). Instead, IPO companies sell stocks/shares via regulated exchange platforms, called stock exchange (Joo et al., 2019) and these shares usually confer ownership rights, voting rights, and dividends.

Moreover, another important difference concerns the access to newly issued shares or tokens. The ICO enables any individual or institutional investor to have direct access to tokens purchase as long as he or she has Bitcoins, Ethers or any other specified fiat currency allowed by the exchange. Diversely, with the IPO public investors cannot directly purchase shares at the IPO price, but only an investment bank, the so-called *underwriter,* can buy shares directly from the firm at the IPO price and then distributes them to individual investors (Joo et al., 2019).

Type of investors. IPO investors can be divided into institutional and non-institutional investors, but it has been observed that firms backed by institutional investors are more likely to outperform (Field and Lowry, 2009). ICOs are open to all types of investors such as early adopters, altruistic investors, and even institutional investors. It can also happen that a venture capitalist participates in a firm, and then brings the firm until the ICO as we will see shortly (Momtaz, 2018).

Motives. Motives behind investors change between IPO and ICO, because IPO investors are almost always motivated by financial reasons, while ICO investors can be driven by both financial and non-financial reasons. Financial reasons are due to the possibility to sell most tokens in a secondary market after the ICO's conclusion. Non-financial reasons are twofold: ideological motives, when the investor is moved by social motives or the willingness to disrupt established structures and/or industries, and technological motives, when the investor is moved by personal enthusiasm for the technology of the ICO venture and/or for the business model/idea (Fisch et al. 2019; Momtaz, 2018).

Financial requirements. ICO firms are not asked to meet any kind of financial requirement, so that anyone willing to create a company is suitable to file for an ICO. On the other hand, an IPO corporation is required to maintain a track record above a minimum earning threshold for a specific period of time before the IPO and must meet financial requirements established by the exchange authority where the firm plans to be listed. For instance, the SEC requires a firm to have three years of audited financial statements before its registration for an IPO. These financial requirements need to be met to confirm the credibility and financial stability to minimize the risk of bankruptcy and financial distress on investors (Joo et al., 2019).

Non – Financial Requirements. IPO firms are required to provide other legal documents in addition to the audited financial statements, while ICO firms are not. IPO firms are usually asked to write down a legal document, called *prospectus*, that needs the involvement of many lawyers in its preparation in order to meet the recommended standards of format and clarity. US IPO firms must be examined by an independent committee, and then must pass the Exchange Act reporting obligations and the Sarbanes-Oxley Act. Afterwards, IPO firms must submit an application for the initial listing with the exchange where they require to be listed. Finally, IPOs need the support of a reputable banking institution, an investment bank, called firm's *underwriter*. To this purpose the firm and its underwriter determine together the pricing of the IPO (Joo et al., 2019).

ICO firms do not have to go through such a complex filing process. They may only provide the white paper, which is neither mandatory nor a legal document, but only a good practice to make the venture more credible and enhance the probability of success of

the ICO. To notice that in most countries the white paper is not considered a legal document, hence ICO investors are not juridically protected (Joo et al., 2019).

Bankruptcy. In the case of bankruptcy, problems could arise for ICO investors, or token holders, because they have no right on the liquidation value of the firm, whereas shareholders have some claims on the assets of the company (Kaal and Dell'Erba, 2018).

Costs. Since there is no third party (neither investment banks nor lawyers) involved in this sort of filing process together with the absence of standard regulatory constraints and procedures, ICO firms face dramatically lower costs than conventional IPO capital raising (Kaal and Dell'Erba, 2018; Joo et al., 2019). According to Joo et al. (2019), an ICO should cost between US$100,000 and US$500,000, while PWC estimated that the expenses for an IPO are on average US$3.7 million, excluding underwriter fees that are usually 5-7% of the total proceeds, but it can vary from US$ 80,000 to US$ 300,000 for small and medium-sized enterprises.

After market liquidity. According to Fisch and Momtaz (2020), the trading of tokens in the aftermarket resembles the post-IPO trading of newly issued shares.

Exit option. Both ICO and IPO investors can exit from the investment at any time thanks to the liquidity that respectively tokens and shares guarantee, since they are listed in the open market (Momtaz, 2018).

Supervisory bodies. An important observation concerns the presence or not of government authorities. As we saw the ICO is a decentralized financing method that relies on the blockchain technology. To make this system work, the ICO phenomenon grew largely unregulated and without any kind of central authority to supervise it (Felix & von Eije, 2018). On the other hand, the IPO is designed to be centralized and ruled by the government organizations, like SEC or CONSOB, and to meet the requirements of financial solidity in order to minimize the risk of bankruptcy (Joo et al., 2019).

Duration. The duration of the two processes depends on some variables. An IPO requires from 3 to 6 months to be completed plus the 3 years for the track records. Instead, the duration of the process to end an ICO can vary according to the nature of the project because there is no legal procedure or requirement to fulfill. Anyway, the duration is on average of 2 months (Ackermann et al., 2020; Joo et al., 2019).

Location. To conclude this analysis, I want to consider the locations where the ICOs and IPOs are launched. For what concerns IPOs, the corporation that wants to raise

capital in a country must be listed on the local stock exchange of that country. Moreover, there is a positive correlation concerning geographical proximity between funders and IPO firms due to the home bias (Joo et al., 2019; Stuart and Sorenson, 2003).
Unlike IPOs, ICOs are globally accessible and can be launched on an online blockchain platform. In this situation, worldwide investors can take part in an ICO in a foreign country without incurring in legal restrictions and in the exchange rate risk, thanks to the use of cryptocurrencies (Joo et al., 2019).

2.11.2 ICO vs Venture Capital

ICO shares less features with Venture Capital (VC) than with other financing methods here analysed. Furthermore, it may happen that a VC backed firm undertakes an ICO. First of all, I want to start with the analysis of the differences between VC and ICO, then move on to the description of VC-backed firms that undertake an ICO.

Type of firm – Lifecycle. VC can intervene during all stages of a firm's lifecycle until that firm goes public, while ICO may be adopted during all funding stages.

Participation characteristics. For what concerns participation in the firm, VC investors may use some instruments. Firstly, convertible promissory notes are issued by the company and are convertible into company stock in its next round of financing. Second, an alternative to convertible notes are SAFEs (Simple Agreement for Future Equity). SAFEs are not debt instruments because they have no maturity and do not bear interest. The SAFE cash investment can be converted into company's stock in the next round of financing. Finally, there is the convertible preferred stock investment, that confers rights, preferences and privileges over common shareholders on a sale of the company (Harroch, 2018). On the other hand, ICO investors may obtain equity shares (security tokens), products or services (utility tokens), or mediums of exchange (cryptocurrency tokens). Consequently, with ICOs the type of right may vary according to the type of token, because not all convey voting rights.

Type of investors. VC investors are sophisticated, whereas ICO are open to all types of investors such as early adopters, altruistic investors, and even institutional investors. It can also happen that a venture capitalist participates in a firm, and then brings the firm until the ICO as we will see shortly (Momtaz, 2018).

Motives. Motives behind IPO investors are similar to those of VC investors (Momtaz, 2018), that is financial motives, consequently the rationale under their choices is different than what happens with ICOs.

Financial Requirements. Since VC belongs to the private equity industry, there are no specific financial requirements to be met imposed by the legislator. Seed/early stage/ start-ups / Series A rounds, or later stage rounds are usually made by the due diligence analysis by the Venture Investors. Due diligence involves both financial and non-financial analysis (Harroch, 2018).

Non – Financial Requirements. The most important document during the negotiation with the VC investors is the "*term sheet*", which is prepared by the VC firm and presented to the entrepreneur. The *term sheet* is not binding, but it underlines the VC firm's interest in the investment and the willingness to finalize due diligence and to draw up definitive legal investment documents. Moreover, the *term sheet* signals higher probability to successfully complete the financing process (Harroch, 2018).

Bankruptcy. VC backed firms are less likely to fail than ICO firms because they are submitted to a long period of analysis and negotiation. In any case, the terms concerning the bankruptcy scenario of a VC backed firm should be set in the *term sheet* or in other legal documents written by VC investor's lawyer during the negotiation phase (Harroch, 2018). Instead, ICO firms do not make such a use of legal lawyers, if they consider legal aspects in the white paper.

Costs. As it happens for IPO, even VC is more expensive than ICO due to higher transaction costs during the negotiation, while an ICO faces close to zero transaction costs (Momtaz, 2018).

After market liquidity. ICOs are able to provide an after-market liquidity because some types of tokens can get listed on a token exchange platform and traded 24/7 online during the three months after the ICO ends, as Momtaz (2018) stated. VC is not able to provide similar levels of liquidity (Momtaz, 2018).

Exit option. The exit option for the VC is not realizable in the short term as fast as for the ICO, but it requires the achievement of a specified maturity stage to be exercised. Instead, ICOs benefit from a decentralized network of users that supports the product prototype or service before it is developed, and that guarantees a certain liquidity of tokens to be able to exit from the investment at any time (Momtaz, 2018).

Supervisory bodies. During the negotiation VC investors and aspiring VC firms are subject to the private firms' legislation.

Duration. According to Vacca (2013) the average duration of VC is 2.4 years. The length of time of the investment varies according to the stage in the lifecycle of a firm: seed/early/start up stage firms have a funding duration shorter than expansion/late-stage companies (Li, 2008).

Location. Unlike ICOs, geographical proximity between entrepreneurial firms and backer funds has a stronger correlation in VC. The explanations may be that the existence of social interactions between executives may allow better information exchanges and that local media are more likely to focus on information on local firms enabling local market actors to be more informed about them (Bengtsson and Ravid, 2009). On the contrary, ICOs give the possibility to investors in other countries to finance ventures and projects, where such investors were unable to participate in the past decades due to the limited cross-border accessibility and the amount of funds they can afford to provide (Joo et al., 2019).

In the past few years, venture capitalists have increased their interest for ICO because this type of investment guarantees higher profits and liquidity in the short run than a typical VC investment, such as in unicorns (Kastelein, 2017).

The consequence of the VC participation in some ICO projects has been outlined by the results obtained by VC-backed firms that undertake ICOs. Indeed, VC-backed firms perform better post-ICO results than those that hadn't previously raised venture capital finance from institutional investors (Fisch & Momtaz, 2020; Jackson, 2017). The reasons of this success are twofold. Venture capitalists have developed the ability to select portfolio firms with a higher future performance and less time-to-market needed, reducing information asymmetries. Moreover, VC funds are able to exploit portfolio firms' potentials by offering bundles of value-adding services, such as providing professional coaching and enabling access to the VCs' networks, helping firms reduce the time-to- market (Fisch & Momtaz, 2019).

2.11.3 ICO vs Crowdfunding

Crowdfunding is the financing method that shares most features with ICO among the three conventional methods considered. The most important similarity between crowdfunding and ICOs is the internet-based nature, indeed crowdfunding collects funds for product ideas or entrepreneurial initiatives via Internet-based crowdfunding platforms.

Type of firms. Unlike ICOs, Crowdfunding has been conceived to be adopted by early stages (Ackermann et al., 2020).

Participation characteristics. As the ICO has different types of tokens, crowdfunding has developed four different categories.

Reward-based crowdfunding was the first type to be used. Here, a crowd of investors provides funds for projects or entrepreneurial initiatives in exchange for the product or another form of reward.

Donation-based crowdfunding is the most known, in which the crowd gives money to support product developments or projects they are interested in without expecting something in return.

Lending-based crowdfunding. Investors fund projects and in exchange they receive short-term debt instruments with the right to be paid back with interest according to the terms of the contract as with conventional debt instruments. This form of crowdfunding is used to limit influences on firms' governance.

Equity-based crowdfunding is the most similar to real investing methods. Here, investors are granted with stakes of ownership. Some legislations limit equity-based crowdfunding, and projects usually provide profit participating loans, cooperative certificates or silent partnerships (Ackermann et al., 2020).

The types of crowdfunding are often combined with equity crowdfunding limiting or excluding voting rights. Moreover, with crowdfunding, firms and backers can exchange promised products/participation in the firm directly on specialised crowdfunding platform without the intervention of banks (Ackermann et al., 2020).

Type of investors. The crowd of investors varies according to the purpose of the crowdfunding project. For example, reward crowdfunding attracts early adopters because they are willing to test products, while equity crowdfunding is usually funded by angel investors (Momtaz, 2018).

Motives. As in the case of ICOs, individuals invest in crowdfunding projects for both financial and non-financial motives. People who invest in reward and donation-based crowdfunding are motivated by non-financial motives, because there may be relatives and friends, or have personal interests in the projects. People who invest in equity and lending-based crowdfunding are mostly driven by financial motives (Ackermann et al., 2020; Momtaz, 2018).

Financial Requirements. Donation- and reward-based crowdfunding are not interested by regulation. Lending crowdfunding has been limited by some legislation due to its competitiveness with the largely regulated banking sector, such as in the United Kingdom. Only equity crowdfunding and hybrid forms that enable voting rights are restricted by national legislations in some countries. In France, Italy, the United Kingdom, and the United States equity crowdfunding platforms must be registered with the national licensing authority, as they would be brokers (Gabison, 2015).

Non – Financial Requirements. Specific requirements are mostly asked for equity crowdfunding platforms (Ackermann et al., 2020). In Italy, the crowdfunding platforms must be attached to a financial institution. In the United Kingdom and in France, equity crowdfunding platforms must submit an "*appropriateness test*" to each investor in order to certify that he or she understands risks involved with investing in crowdfunding. In the USA, equity crowdfunding platforms must perform a minimum due diligence towards fund-seekers to assure that the project is not a fraudulent scheme (Gabison, 2015).

Bankruptcy. Bankruptcy risk involves both equity-based and lending-based crowdfunding. Even if lending-based crowdfunding has a marginal role if compared with other types of crowdfunding, a credit risk is still real. Instead, equity-based crowdfunding may be more likely subject to a bankruptcy risk because it is more broadly used and because this type of crowdfunding was developed specifically for early-stage companies that are more likely to fail. Bankruptcy is regulated by national laws that may vary from country to country.

Costs and after market liquidity. Crowdfunding shares the same ability of ICOs to keep costs low and being largely unregulated, but at the same time ICOs enable projects to collect funds as large as VCs and IPOs can reach, but that crowdfunding cannot obtain (Momtaz, 2018).

Exit option. As in the case of VC, the exit option for crowdfunding is not realizable in the short term as fast as for the ICO, but it requires the achievement of a specified maturity stage to be exercised (Momtaz, 2018).

Supervisory bodies. Crowdfunding was born as a worldwide phenomenon and it still is. Crowdfunding is usually not restricted by legislations like ICO, with the exemption of equity crowdfunding that has faced certain restrictions in some countries (Ackermann et al. 2020; Bruton et al. 2015).

Duration. Crowdfunding has a duration similar to that of ICO, because crowdfunding stands from 40 to 80 days with a recommended duration of around 30 days, while ICO duration is about 2 months on average (Ackermann et al. 2020).

Location. Crowdfunding is worldwide accessible, and a crucial role is being played by social networks that allow to create online communities. Nevertheless, unlike ICOs, crowdfunding projects' success is more strongly related to the geographic proximity between creators and funders. For example, it is more likely that a crowdfunding project concerning music and based in Nashville has a larger portion of its investors living in Nashville or around it than the percentage of investors outside Tennessee or USA. The explanation is that personal networks, relatives, friends, and friends of friends are still playing a critical role in crowdfunding (Mollick, 2014).

Table 1: Comparison between ICO, IPO, VC, and Crowdfunding.

	ICO	**IPO**	**VC**	**CROWDFUNDING**
T*ype of firm – Lifecycle*	Adoptable during all funding stages, but in practice used by firms in seed/early/start-up stages	Used to acquire high-volume growth capital by established start-ups or private companies	All stages of a firm's lifecycle until the firm goes public	Adopted to fund early stages
Participation characteristics	3 types of tokens that not all convey voting rights, plus hybrid forms. Any individual or institutional investor can have direct access to tokens purchase	Shares confer the ownership rights, voting rights, and dividends. Investors cannot directly purchase shares at the IPO price, but it is the underwriter that distributes the shares to individual investors	Stocks in exchange for their participation in the firm	4 types of crowdfunding with potential hybrid forms. Equity crowdfunding provides voting rights. Firms and backers can exchange promised products/participation in the firm directly on specialised crowdfunding platform without the intervention of banks
Type of investors	All types of investors such as early adopters, altruistic investors, and even institutional investors	Both sophisticated institutional and non-institutional investors, but the former are the majority	Sophisticated institutional investors	- Early adopters attracted by reward crowdfunding - Angel investors for equity crowdfunding
Motives	Both financial and non-financial motives	Financial motives	Financial motives	Both financial and non-financial motives
Financial requirements	Not needed	Required to maintain a track record above a minimum earning threshold for a specific period of time before the IPO	Not required by the legislator, but VC investors make the due diligence that includes both financial and non-financial analysis	Regulations change from country to country and concern equity crowdfunding platforms

Non – financial requirements	- Non – compulsory white paper - No bank underwriter needed	- Required a *prospectus*, and complex filing process - Investment bank underwriter needed	VC investors provide entrepreneurs with the *term sheet* that includes all negotiating and legal clauses	Regulations change from country to country and concern equity crowdfunding platforms
Bankruptcy	Token holders have no right on the liquidation value of the firm	Shareholders have some claims on the assets of the company	Bankruptcy scenario is regulated by the term sheet or by other legal document draft during the negotiating phase	Bankruptcy is regulated by national laws that may vary from country to country.
Costs	Low, between 100k – 500k, close to zero transaction costs	On average US$3.7 million, excluding underwriter fees that are usually 5-7% of the total proceeds. Between US$ 80,000 - 300,000 for small and medium-sized enterprises	High, mainly related to the negotiation and analysis phase	Low
After market liquidity	Some types of tokens can get listed on a token exchange platform and traded 24/7 online during the three months after the ICO ends	High post-IPO trading of newly issued shares	Not able to provide levels of liquidity equal to ICO	Not able to provide levels of liquidity equal to ICO, due to the lack of efficient secondary market for equity-based crowdfunding
Exit option	Exit from the investment at any time	Exit option not realizable in the short term as an IPO needs to be prepared	Exit option needs to achieve a specified maturity stage to be exercised, and not realizable in the short term as a potential acquirer needs to be identified	Exit option needs to achieve a specified maturity stage to be exercised, and not realizable in the short term as a potential acquirer needs to be identified

Supervisory bodies	Decentralized and unregulated	Designed to be centralized and ruled by the government organizations (i.e. SEC)	No. VC is subject to the private firms' legislation.	Only equity-based crowdfunding is subject to national supervisory bodies
Duration	2 months on average	From 3 to 6 months to be completed plus the 3 years for the track records	On average 2.4 years, but it can vary according to the firm's lifecycle stage	From 40 to 80 days and a recommended duration of around 30 days
Location	Worldwide accessible by foreign investors	Corporation must be listed on the local stock exchange	VC investors and entrepreneurs are usually geographically close	Worldwide accessible, but crowdfunding's success is still strictly to geographical proximity between funders and creators

Source: Own elaboration based on Adhami et al., 2017; Ackermann et al., 2020; Bengtsson and Ravid, 2009; Bruton et al., 2015; Kaal and Dell'Erba, 2018; Felix & von Eije, 2018; Field and Lowry, 2009; Fisch & Momtaz, 2019; Fisch and Momtaz, 2020; Fisch et al., 2019; Gabison, 2015; Harroch, 2018; Kastelein, 2017; Jackson, 2017; Joo et al., 2019; Li, 2008; Mollick, 2014; Momtaz, 2018; Stuart and Sorenson, 2003; Vacca, 2013.

2.12 Geographic/Industry Distribution of ICOs

In less than a decade, ICOs have spread all over the world as a new innovative and more economic financing method for firms. According to Icobench.com, one of the most reliable Websites that provides statistics about ICOs, more than 5,000 Initial Coin Offerings have been registered since 2013.

Issuers are located all over the world, but the most involved countries are placed in North America, Europe (Russia comprised), Australia, and Asia, even if here some restrictions have been established during last years.

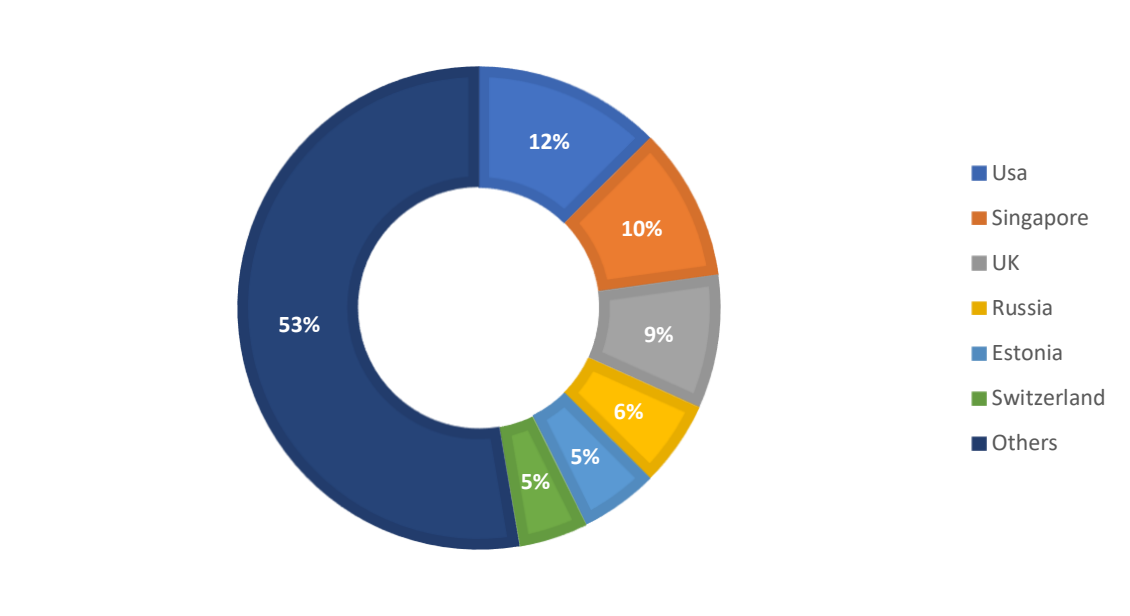
Six countries have catalysed almost 50% of all ICOs occurred. The most ICO-friendly country are USA with more than 731 launches, about 12.7% of the total, and Singapore with 574, that is almost 10%. They are followed by four European countries, firstly UK

with 512 ICOs, about 9%, and then Russia, Estonia, and Switzerland, with respectively 328, 298, and 265 ICOs launched, between 5.5 and 4.5% of the total.

For what concerns the amount of funds raised, the USA is by far the best country, with US$7.77 billion, followed by Singapore and Switzerland with respectively US$2.42 billion and US$1.51 billion. In Europe, ICOs launched in UK US$1.5 billion, in Estonia US$927 million and in Russia US$ 578 million. Instead, ICOs launched in Cayman Islands raised US$ 1.25 billion.

The reasons of this geographic concentration must be sought in the favourable and soft security regulation of these countries that attracted lots of ICOs during these years (Howell et al., 2018).

Graph 1:Distribution of ICOs by country.



Source: Own Elaboration based on ICObench.com data.

Industry sectors that benefited the most from ICO are almost always those that can run on a blockchain technology, thanks to the contribution provided by the digitalization exploited after 2010.

The industries that raised more funds have been cryptocurrency sector and blockchain platform providers with respectively US$14.8 billion and US$12.6 billion raised, and then banking and finance raised more than US$7 billion. Other important industries for ICO are also commerce, social networks and communications, drugs and healthcare, according to Icobench.com.

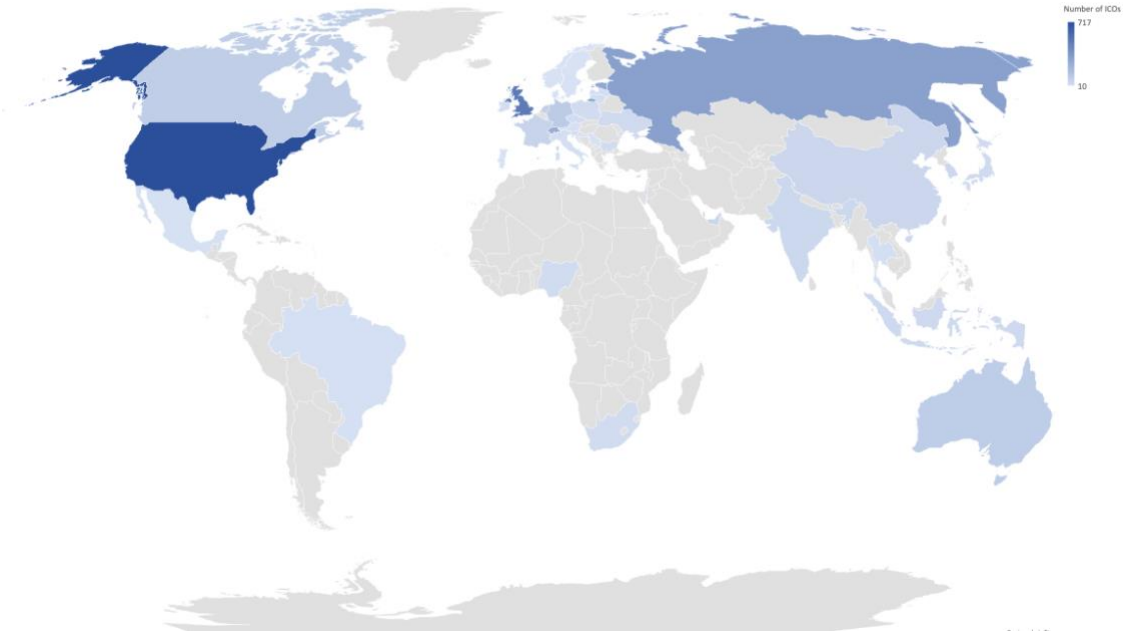
2.13 National Regulations

Countries all over the world have faced the problem of producing appropriate frameworks that rule the emerging ICO market. Countries can be divided into three categories: those that banned ICO, such as China and South Korea in 2017, those that placed a clear regulatory framework, such as Switzerland and the USA, and those that are still discussing about it, such as in Italy.

Among those that already ruled the ICO market few countries emerged to be those with the most favourable legislations to allow ICO launches, and that registered the highest number of ICO launches. These countries are the USA, UK, Switzerland, Singapore, Estonia and Russia. In the map below, we can observe graphically the strong relationship between ICO-friendly regulations and countries with the highest number of ICO, indeed, the countries I listed are darker.

A common denominator in national authorities' statements and guidelines has been the messages of warning to investors who intend to consider investing in ICOs, due to the riskiness of this investment.

Figure 11: ICOs distribution in the world.



Source: Own Elaboration based on ICObench.com data.

2.13.1 USA

In December 2017, the US SEC released a statement concerning tokens with features similar to securities. The SEC identified different types of tokens: utility tokens, cryptocurrency tokens and security tokens. In the statement it is specified that tokens with features similar to securities must be assessed under the Howey test. If tokens meet the four elements of the Howey test (an investment of money, expected profits from the investment, the investment of money being in a common enterprise, and any profit derived from the efforts of a promoter or a third party), they must be subject to the US securities regulation (Joo et a., 2019). Moreover, ICO tokens identified as securities must be registered by the SEC (Custers and Overwater, 2019). Since 2017, a growing number of ICOs has been registered with the SEC as security offering (Diemers et al., 2018).

2.13.2 UK

In UK, the Financial Conduct Authority (FCA) stated that ICOs may be regulated as securities, but they should be considered case by case depending on the different aspects and rights the coin holder obtains through holding them. Moreover, the UK government agency admitted that there is a lack of jurisdiction among ICOs based overseas (Custers and Overwater, 2019).

2.13.3 Switzerland

Switzerland rapidly developed one of the most ICO friendly regulations, and the Canton of Zug is named Crypto Valley after the high number of activities and organizations towards the crypto industry (Benedetti & Kostovetsky, 2018; Joo et al., 2019). The FINMA published guidelines about how ICOs may be regulated under Swiss laws and affirmed that the application of these laws may vary according to the design and structure of the ICO. The FINMA guidelines identified at least three types of tokens, that I better described in the beginning of this chapter: payment tokens, utility tokens, and asset tokens. ICOs are considered as securities and are administered under the securities legislation and the Anti Money Laundering Act, while the trade of asset tokens is regulated by both the securities legislation and the civil law under the Swiss Code of Obligations. Payment tokens must comply with the Anti-Money Laundering Act and to

meet a kind of Know-Your-Customer (KYC) obligation. ICOs that break banking laws are subject to severe enforcement proceedings by the Swiss authorities (Custers and Overwater, 2019).

2.13.4 Singapore

Singapore has differentiated in respect of other countries by having the most open legislation in Asia and one of the most favourable in the world towards ICO issuers. The Monitory Authority of Singapore (MAS) issued some guidelines on the Singaporean. According to the MAS, tokens can be regulated only if they fall under the Securities and Futures Act and grant the holders with ownership rights or security interests in the ICO issuers assets or property (Custers and Overwater, 2019).

2.13.5 European Union

The European Supervisory Markets Authority, the European Supervisory Authorities, the European Commission have released statements many times aiming to warn investors of the market risk, fraud and cybersecurity risks created by investing in crypto assets, and that structures and features of ICOs may be governed by existing EU legislation (Joo et al., 2019).

2.13.6 Estonia

Estonia has emerged in the last two years as the first EU country for number of ICOs with 298 launches (Icobech.com).

According to the EFSA, each ICO should be assessed case by case depending on its characteristics.

In Estonia, ICO tokens that provide rights similar to those of securities must be considered as securities under Estonian laws. For this reason, ICO issuers are obliged to produce a *prospectus* registered by the EFSA before legally issuing an ICO. Moreover, according to the Investment Funds Act, ICOs are required to indicate a fund manager to manage the capital raised via the ICO and authorized by the EFSA, when ICO projects raise capitals with the aim of benefiting the investors and 'in accordance with a determined investment policy' (Custers and Overwater, 2019).

2.13.7 Russia

In Russia, ICOs are still unregulated because the Central Bank of the Russian Federation stated that regulating this technology is premature, while some Russian Federation Ministries have produced regulations to control ICO's, cryptocurrency, or DLT. The scenario is constantly evolving (Custers and Overwater, 2019).

2.13.8 Italy

In Italy, the regulatory process is still progressing. CONSOB (the Italian Companies and Exchange Commission) began a process to develop an appropriate regulatory framework towards ICOs in the shortest possible time. On January 2nd, 2020, the CONSOB published the final document that sums up all opinions of experts and people interested in the ICO market. Here, the issue is whether or not to consider security tokens under the TUF[2] and MiFiD regulation or not, and how to manage the case of non-security tokens (Consob, 2020).

[2] The TUF (Testo Unico sulla Finanza) regulates the matter of financial intermediation, and it is the main regulatory source of financial market law in the Italian legal system.

CHAPTER 3. Security Token Offerings and Initial Exchange Offerings

3.1 Introduction

The ICO represents a disruptive innovation in the fundraising industry because it satisfies a need for financing start-ups and more mature companies that private equity, bank lending, or IPOs can't fill, and because it enlarges the limits of funding from national borders and moves them out on a global scale using blockchain technologies. Nevertheless, as other innovations, ICOs have been victims of speculations and scams, because investors' rights were not guaranteed as in regulated financial markets. To cope with this problem, ICOs evolved into STOs, which aim to comply with national securities laws and provide greater investors' rights, and then into IEOs, which base their success on the recognized reputation of centralised exchanges that conduct a stringent selection process on the aspiring IEO companies which, consequently, gain legitimacy directly from the exchange credibility.

This chapter provides a description of STOs and IEOs, and a comparison between ICOs, STOs, and IEOs.

3.2 Security Token Offering

Security Token Offerings (STOs) have spread as a solution to ICOs prevailing use of utility tokens. The vast majority of ICO projects were characterized for the heavy adoption of utility tokens that provide neither rights, nor dividends, nor compensation to investors in case of bankruptcy. As a consequence, investors started funding STO projects that adopt security tokens. Security tokens are not always tied to shares, but they provide holders with other rights such as ownership of shares, dividends, cashflows, payments of debts, right to vote, etc. Security tokens are managed by smart contracts (Myalo and Glukhov, 2019).

Another important feature is that security tokens have a value outside the crypto ecosystem, while utility tokens may not have it (Macy, 2019).

Since STOs are considered an investment, they must comply with national regulations inside and outside the USA (Sameeh, 2018). STOs have the advantage that security tokens are created to comply with national Know-Your-Customer (KYC) and Anti-Money-Laundering (AML) regulations because they are built on the top of the blockchain layer

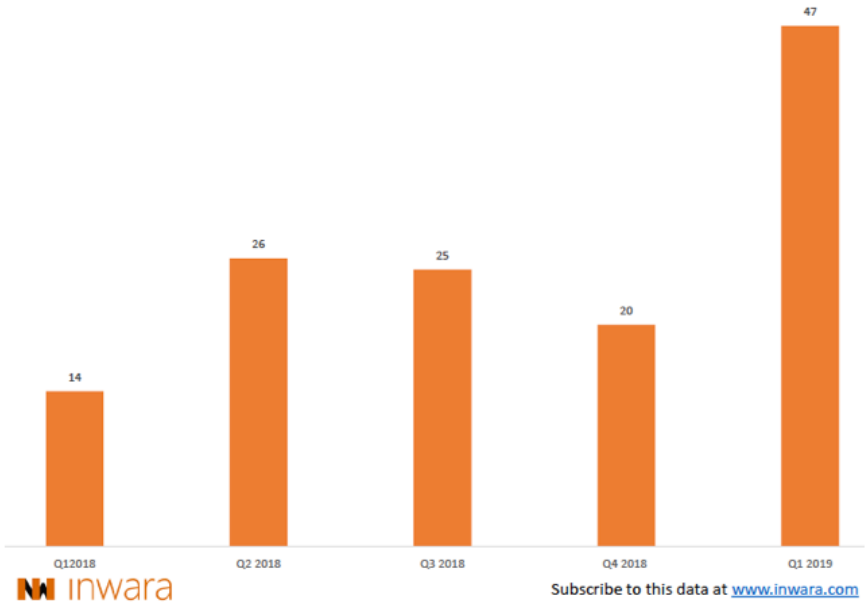
on a country-by-country basis. This cross-border nature improves security tokens liquidity and pushes cross-border transfers (Sameeh, 2018). Further, STOs enable tokenization of real-world assets, because they divide assets in smaller units, hence making it easier to transfer their ownership and reducing transaction costs (Sameeh, 2018).

Nevertheless, there is a negative note that has to be highlighted: STOs are less democratic than ICOs because only qualified investors can participate due to the misuse of the ICO system.

STOs are more expensive than ICOs because costs include the compliance with the regulations of different national jurisdictions, but on the other hand this process allows the project to have a larger amount of liquidity without being considered outlaw by national regulators (Sameeh, 2018).

According to the Inwara report, 47 STOs had been launched in the first quarter of 2019 against the 20 STOs of the fourth quarter of 2018. STOs launched in the first quarter of 2019 raised $122 million.

Figure 12: Number of STOs between 2018 and Q1 2019.



Source: Inwara report.

The top three jurisdictions whose investors can participate in STOs include the United States with 11 STOs, the United Kingdom with 8, and Switzerland with 4.

Notwithstanding, only 2% of the STOs were from the United States, against 56% from United Arab Emirates, 13% from Estonia and Switzerland.

In addition, the top four industries performing STOs were:

1. apps for stocks trading and investing with 7 STOs.
2. the energy sector with 6.
3. financial services with 6.
4. healthcare with 5.

Nevertheless, the number of STOs launched in 2019 decreased after June, according to the Pwc 2020 Report.

3.2.1 Types of Security Token

Since security tokens represent real-world assets, they can be distinguished into three types of tokens:

- Equity tokens, which consist of the value of shares issued by a company on a blockchain, and which differ from traditional stocks because equity tokens are registered on an immutable blockchain.
- Debt tokens, which are debt instruments like corporate bonds and real estate mortgages.
- Real assets tokens, which include the ownership of assets like commodities, real estate, etc. Since blockchain technology is transparent and publicly observable, this facilitates transactions record-keeping and reduces the risk of frauds (Macy, 2019).

3.2.2 The STO Ecosystem

The ecosystem of STO consists of six fundamental parts:

- **Teams.** Unlike ICO teams, which have to conduct all stages until the launch on their own, STO teams can focus more on core capabilities (such as technology development, product roll-out) because the listing of the STO is done by the issuance platform, and in some cases, it can happen that the platform can help the team in developing the smart contract and the token.

- **Legal advisors**. Since STOs are thought to comply with national regulatory frameworks, the legal advisor plays a crucial role to avoid that a regulator ousts non-compliant projects, as SEC did with many ICOs and that would be detrimental to the project because the US market is a critical source of investments (Bourgi, 2019).
- **Issuance platforms** are fundamental when a STO project wants to reach a larger range of potential investors. Further, these platforms help projects to comply with legal procedures and regulation of the country jurisdiction, such as SEC's regulations, and also to properly conduct KYC/AML verification. Some of the most popular STO issuance platforms include Polymath, Swarm, Securitize, Harbor, and Securrency (Bourgi, 2019; Sameeh, 2018).
- **Regulated exchanges** are the place where companies can list their tokens to be traded after the STO launch. Some of the most popular exchanges are tZero, Blocktrade, currency.com, Lykke, Open Finance.
- **Custodians** support issuing companies by storing their digital tokens. Even issuance platforms and regulated exchanges can offer custody services (Bourgi, 2019).
- **Investors** intending to invest in a STO must be accredited and compliant with national rules. Since the STO is now launched by an issuance platform, they go through the KYC/AML process only when they register on the platform, instead of passing through multiple KYC processes every time when they want to enter in an STO, like it happens with ICOs.

3.2.3 The STO Process

The process can be divided into four major stages that group several steps.

3.2.3.1 Preparation:

- **Choice of legal advisor**. A legal advisor helps the company to make sure that an STO is the right choice to raise capitals to fund the business idea, because STO is thought for companies that have or aim to have a global audience, and it could not be the most appropriate method of fundraising for every company.
- **Choice of the jurisdiction**. This is a crucial step because some countries have more friendly and flexible jurisdiction to STOs (i.e. Malta and Switzerland), while others totally banned all forms of blockchain-based fundraising. Further, the company has to take into consideration that different countries have different

regulatory requirements, while in some cases jurisdictions can be more alike and allow to reach a wider range of customers.

- **Choice of the security token issuance platform**. This is a critical step because a security token platform can help the company to connect to smart contracts developers to create the right technical solutions to securitize the bonds, assets, and stocks on the blockchain, to perform KYC/AML on both fiat and cryptocurrency wallets, to comply with regulations, to tokenize assets (like real estates, agriculture, tech companies, and renewable energies).
- **Writing the white paper**. The white paper is an important document because it will be read by investors and will be used to determine the value of the STO. It should include legal disclaimer, product details, industry overview, technical architecture, business model, assets and other type of security associated with the token, tokenomics and token usage details, team members and advisory, and under which regulation a security token is classified (Takyar, 2019).
- **Building the team**. The team helps the company in the most technical aspects such as smart contracts development or the creation of the white paper. The team must be made up of many professionals including accountants, developers, salesmen, marketers, and lawyers. In particular, lawyers play an important role in this process and not all lawyers are suitable to be member of a STO team because they must have knowledge of specific regulatory requirements (Takyar, 2019).
- **Creating of the website**. The website should give information to convince customers to invest in company's tokens.

3.2.3.2 Pre-STO

- **Announcement of the STO to the market**. The company should announce the future STO launch on websites specialized in listing ICOs and STOs to reach the audience willing to fund crypto investments.
- **Choice of the right partner exchange**. The team has to analyse whether the exchange meets the regulatory requirements of the countries of origin of the potential investors.

- **Consultancy of the custodians to collateral assets for security tokens**. At this point, the company has to find a third-party, called custodian, that tokenizes the assets and preserve them under its custody.
- **Creating the security token**. This is the moment in which all collected and summarized information are used in practice to create the security token. This is the mean that allows the company to raise funds in its crypto wallet (Takyar, 2019).
- **Marketing the STO.** The company now has to actively reach the trust in the crowd of crypto investors running ads, using social media accounts (i.e., Twitter), or messaging apps like Telegram or Slack to communicate with specific groups.

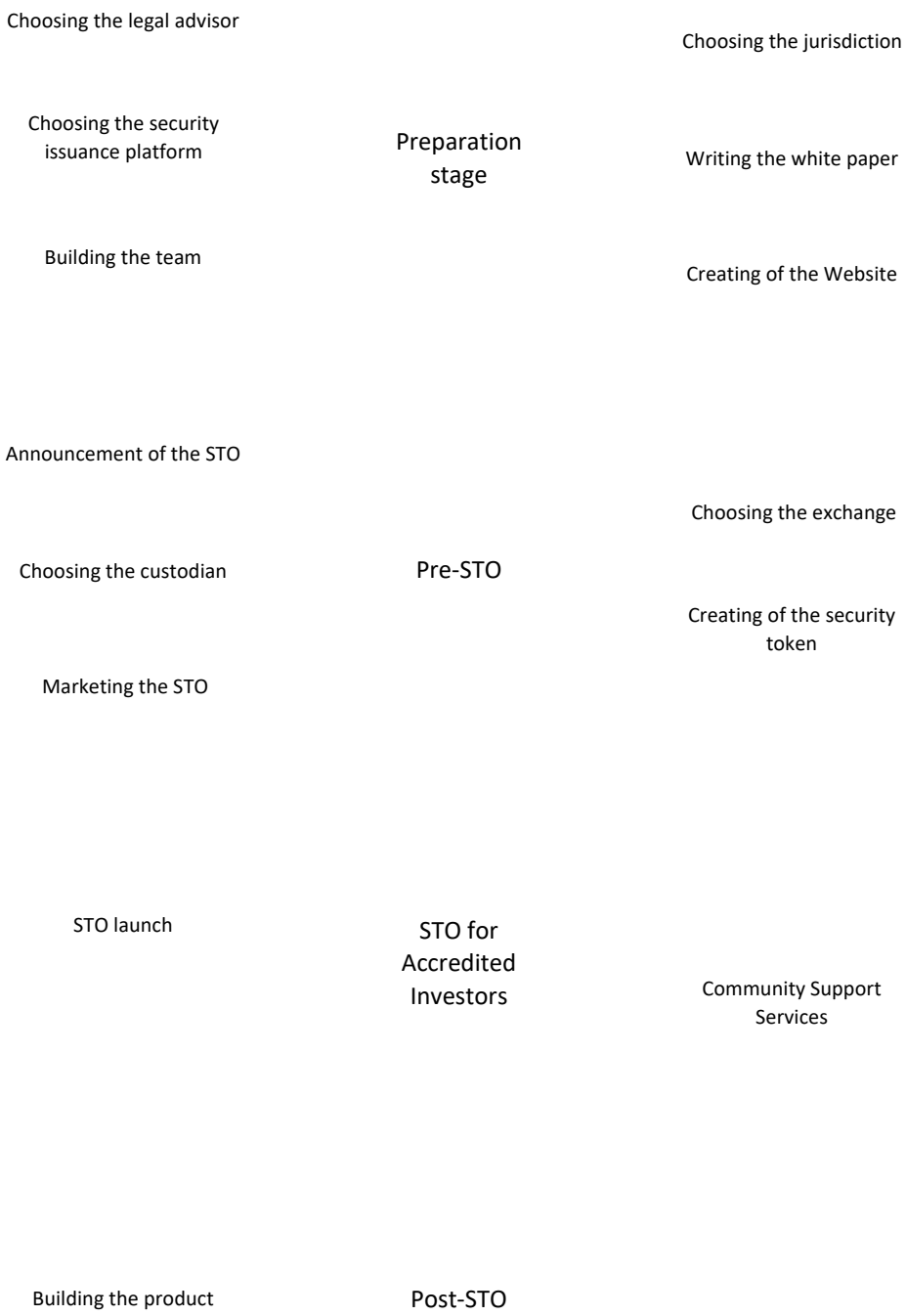
3.2.3.3 STO for accredited investors

- **STO launch**. The crowd sale of security tokens to investors on the website has to be as simple as possible and must allow only those who passed the KYC/AML checks.
- **Community Support Services**. After the STO launch, the company has to create a service to support customers if they would face issues (Takyar, 2019).

3.2.3.4 Post-STO

- **Building the product**. After the STO, if the company raised enough funds, it is the moment to build the product. This is the showdown because, if the product will support the value of security tokens, they'll generate profits or pay dividends (Takyar, 2019).

Figure 13: The STO process.



Source: Own elaboration based on Macy (2019).

3.2.4 Advantages

- **Transparency**. There are two types of transparency.

  The first is information transparency that is due to the adoption of corporate disclosure that reduce the likelihood of frauds and offer protection of investors' rights in case of company bankruptcy (Myalo and Glukhov, 2019).

  The second type is the blockchain transparency. Considering that data registered on a blockchain are immutable and publicly observable, this increases security transparency, then government oversight will become much easier, and token-based fundraising will gain more credibility (Sameeh, 2018).

- **Minimized cost.** Since security tokens are backed by smart contracts that work only when conditions written in their codes are met, it is expected that the massive adoption of security tokens across equity markets will minimize the overall cost of administration of current paper-based financial systems, saving up to $6 billion each year (Sameeh, 2018).

- **Simplified legislative compliance.** Smart contracts simplify the job to do with several complex and different national securities laws, that normally make it hard to comply with them for those looking to transfer their securities, because the code is written in order to meet regulatory requirements. Further, smart contracts set on national securities laws will protect companies and investors against securities frauds (Sameeh, 2018).

- **Greater liquidity.** The use of smart contracts and blockchain technology enables the market to dispose of a greater liquidity than before as long as cross border transfers are easier, faster, and more affordable (Sameeh, 2018). Moreover, the tokenization of real-world assets will contribute to the increase of liquidity.

3.2.5 Disadvantages

- **Higher cost.** As STO projects need to meet legal requirements, it generate higher costs than ICOs due to required legal compliances to make token eligible for financial investments (Myalo and Glukhov, 2019).

- **Slower process**. For the same abovementioned reason, the procedures for legal compliance need more time to be met. This is a reason why STO phenomenon has not repeated the same boom of ICOs (Myalo and Glukhov, 2019).

- **Restricted crowd of investors**. Since STO projects must be registered with the national authorities, only qualified investors can participate in a STO. Therefore, investors should have considerable private capitals or be highly active in financial markets for a specified period. For instance, in the US investors must have an income of $200,000 in each of the last two years[3] (Myalo and Glukhov, 2019).

3.2.6 STO Regulatory Framework

Since ICOs have been under the lens of national regulatory authorities, STOs have evolved to allow higher protection to investments and investor's rights. Below I described the best country jurisdictions to launch a STO.

3.2.6.1 Switzerland

As we have already seen in Chapter 2, the Swiss FINMA was one of the first authorities in the world to provide a clear regulatory framework to ICOs and consequently to STOs, and this qualifies Switzerland as one of the countries with the best jurisdictions to launch an STO.

In the Guidelines[4] published by the FINMA, security tokens (there called asset tokens as seen in Chapter 2) are considered as conventional security, thus STOs have to comply with the same security laws. Within the same vein, STOs have to comply with KYC regulations, the Anti-Money Laundering Act (AMLA), the Stock Exchange Act, the Swiss

[3] https://www.sec.gov/news/statement/spch121714laa.html#_edn5

[4] FINMA. Guidelines for enquiries regarding the regulatory framework for initial coin offerings (ICOs). 16th February 2018.

Code of Obligations, the Financial Services Act.

The speed in giving regulatory certainty proposed Switzerland as a hub for token-based offerings.

3.2.6.2 Malta

Malta confirmed to be one of the friendliest countries to token offerings. The Maltese Parliament passed three acts to set a clear and defined legal framework:

1. The Malta Digital Innovation Authority (MDIA) Act[5] provided legal and technical definitions to users on blockchain based platforms in Malta. Furthermore, it established the Malta Digital Innovation Authority with the purpose to promote and develop solutions and services adopting innovative technologies.
2. The Innovative Technological Arrangement and Services (ITAS) Act[6] provides guidelines towards registering, certifying and auditing blockchain-based start-ups, DAOs, smart contracts, and cryptocurrency exchanges.
3. The Virtual Financial Asset (VFA) Act[7] provides a regulatory framework to regulate individuals, DLT exchanges, cryptocurrency wallets providers, portfolio managers, brokerages, and custodians. Further, it defines license requirements and conditions to be applied to individuals and entities who issue virtual financial assets (VFAs – that is, security tokens).

3.2.6.3 Estonia

Estonia is another European country that clarified the regulations applicable to token-based offerings as soon as possible and demonstrated to be one of the friendliest together with Malta and Switzerland.

According to the Estonian Financial Supervision Authority (EFSA) security tokens are considered as traditional securities and are regulated under the Securities Market Act (SMA) and the Law of Obligations Act (LOA).

Furthermore, Estonia implemented the Regulation (EU) 2017/1129 from the European Union, hence STO projects are required to provide a Prospectus including "*a registration*

[5] Malta Digital Innovation Authority (MDIA) Act. 15th July 2018.
[6] Innovative Technology Arrangements and Services (ITAS) Act. 1st November 2018.
[7] Virtual Financial Asset (VFA) Act. 1st November 2018.

document which describes the issuing company, a security note that describes the details of the security, and a prospectus summary. Projects that intend to launch an STO in Estonia must respect some quantitative parameters that are more broadly described in the paragraph on European Union regulation"[8].

3.2.6.4 Lithuania

Lithuanian government has expressed the intentions to turn Lithuania into a world security token hub. Hence, the Bank of Lithuania published some guidelines to give regulatory certainty to projects and investors. The Guidelines[9] require the obligation to publish a prospectus, to disclose information on the issue of tokens that have features of securities, the obligation to draw up an information document, and to comply with the Market Abuse Regulation.

With the goal to propose Lithuania as one of the best jurisdictions to launch an STO, the Ministry of Economy and Ministry of Finance endorsed DESICO, a blockchain based platform offering STO related services.

3.2.6.5 European Union

The European Union did not propose a specific regulation for token-based offering, nevertheless a still existent and recent regulation can be applied. This is the Regulation (EU) 2017/1129[10], and it aims at harmonising requirements when securities are offered to the public or admitted to trading on a regulated market in an EU Member State.

Notwithstanding, companies can be exempted if they meet the requirements described below:

- an offer of securities is addressed solely to qualified investors, or
- an offer of securities is addressed to fewer than 150 persons per Contracting State, other than qualified investors, or

[8] EFSA (2018). Information for entities engaging with virtual currencies and ICOs. Available at: https://www.fi.ee/en/investment/aktuaalsed-teemad-investeerimises/virtuaalraha-ico/information-entities-engaging-virtual-currencies-and-icos. [Last Accessed: 20 July 2020]

[9] Bank of Lithuania. GUIDELINES ON SECURITY TOKEN OFFERING. 17 October 2019. Available at: https://www.lb.lt/uploads/documents/files/GALUTINIS_Guidelines%20on%20Security%20Token%20Offering.pdf

[10] Official Journal of the European Union. REGULATION (EU) 2017/1129. 14 June 2017.

- an offer of securities is addressed to investors who acquire securities for a total consideration of at least 100,000 euros per investor, for each separate offer, or
- an offer of securities with the nominal value or book value of at least 100,000 euros per security, or
- an offer of securities with a total consideration of less than 8,000,000 euros per all the Contracting States in total calculated in a one-year period of the offer of the securities.

Furthermore, STO projects launched in an EU Member State can benefit from a larger crowd of potential investors from other EU countries, just complying with the EU regulation.

3.2.6.6 Singapore

Singapore has been established as a hub for the nascent crypto industry. In order to incentivize growth, Monetary Authority of Singapore (MAS) has allowed a certain degree of regulatory flexibility.

Even though security tokens are normally ruled by the Securities and Futures Act (SFA), the MAS released the "Guide to Digital Token Offerings"[11] which allows some exemptions to STO issuers. According to the Guide, the prospectus is not required to STO issuers when:

1. the Offer is a small offer that does not exceed $5 million (or its equivalent in a foreign currency) within any 12-month period;
2. the Offer is a private placement offer made to no more than 50 persons within any 12-month period;
3. the Offer is made to institutional investors only, or to accredited investors.

3.2.6.7 USA

US regulation has been the most stringent among countries that did not ban ICOs and STOs, however the US market has been established as a leader in the token-based fundraising. To operate in the US market, STO projects have to meet all requirements of

[11] MAS. A GUIDE TO DIGITAL TOKEN OFFERINGS. 26th May 2020.

the SEC and have to be registered with the SEC in order to issue securities (Myalo and Glukhov, 2019).

Security tokens are passed through the Howey Test that assesses whether an asset meets the conditions that defines a security, consequently it means that security tokens must be subject to specific registration and disclosure requirements (Sameeh, 2018). The Howey Test considers four criteria that assess whether:

- the security involves an investment of money or some assets tangible in the real world.
- the investment expects profits.
- the investment is in a common enterprise.
- the profit is not determined by the investor but by third parties' efforts (Macy, 2019).

After the Howey Test and before launching a STO, the company, which wants to accept investments from US investors, must be compliant with one of the following regulations:

- **Regulation D** allows a STO to be exempted from the obligations of being registered with the SEC, if 'Form D' has been filled by the creators; the form filling has to be done after the securities have been sold. The party who offers this security might solicit offerings from investors in compliance with Section 506C.
  Section 506C requires that the investors are accredited, and the solicitation is "free from misleading or false statements" (Macy, 2019; Sameeh, 2018).

- **Regulation A+** allows the creator of the token to offer SEC-approved security tokens to non-accredited investors via a general solicitation. Nevertheless, the investment limit is set at $50 million (Macy, 2019; Sameeh, 2018).

- **Regulation S** is applied to STOs launched outside the USA; hence they are not required to meet US registration requirements, but they have to comply with regulatory requirements of the country where they are supposed to be launched (Macy, 2019; Sameeh, 2018).

3.3 Initial Exchange Offering

Initial Exchange Offering (IEO) is the ultimate evolution of the ICO that was born to answer to the request for higher security from scams and failed projects (Athanasiou, 2019). Even though some national regulators proposed regulatory frameworks to overcome this uncontrollable phenomenon, the number of ICOs reduced after 2017. Some platforms, called *exchanges*, proposed the IEO as an alternative solution: a token-based offering secured by a due diligence process conducted by the exchange itself.

Exchanges help projects in all necessary aspects to succeed and raise enough funds to pursue their goals, while projects pay this service with listing fees and a small portion of tokens sold through IEO (Comandini, 2020). Unlike ICOs which are launched on the project's website, exchanges are directly involved in the process: they provide their own cryptocurrency, and the IEOs take place on the exchange's platform, even though benefits from decentralization are lost.

While ICO projects were sometimes only an idea without a written business plan or roadmap, projects that want to undertake an IEO must be prepared to pass professional due diligence conducted by experts (Bahrynovska, 2019). The exchange handles all the KYC/AML procedure, compliances and regulations allowing teams' projects to concentrate on the project only, instead of spending time on learning about regulations and how to comply with them. This process enhances the credibility of projects and protects the reputation of the exchange that would risk losing its users and doing so it restores trust in token-based offerings.

Further, the exchange plays a crucial role also in managing smart contracts and tokens, then conducting the marketing campaign on behalf of the project, exploiting the crowd of investors already registered on the platform, thus the project's team needs to focus exclusively on sales and on the distribution process (Athanasiou, 2019). This is cost reducing for projects and enables them to reach a larger audience with lower efforts.

After the end of the marketing campaign, the exchange lists coins on behalf of the project and distributes digital assets among already existing and verified platform's clients (Myalo and Glukhov, 2019). Indeed, to participate in an IEO, investors must pass through KYC/AML verification procedures and then activate an account on the platform, while ICO teams have to do KYC/AML by their own, whether they do.

Only platform's users can participate in IEOs proposed by the platform (Sergeenkov, 2019). After a token is issued, it can be exchanged on the same platform (Comandini, 2020).

The exchanges' efforts have made listing a faster project, increased the effectiveness of token promotion on the market, and made safer and simpler the investment process for investors.

The first IEO took place in 2017, but the phenomenon did not reach a significant volume until the first semester 2019 when IEO had its strong momentum. The two most notable IEO were Bitfinex that raised up to $1 billion in a week on May 2019 and Fetch.ai that raised $6 million in 22 seconds on the 25th of February 2019.

According to ICObench.com, 295 IEOs have been launched in the last three years that raised $1.7 billion.

Most important exchanges are Binance Launchpad, that was the first to launch an IEO and it is the most known, LaToken, that performed more than 140 IEOs, Probit, p2pb2b, Exmarkets, Coineal Launchpad, Huobi Prime, BitForex IEO, Bittrex International, KuCoin Spotlight, OKEx. However, some countries restricted the access to national markets to some exchanges: for instance, OKEx is not available in the USA, Binance restricts the trading opportunities for Albania, Belarus, etc. (Myalo and Glukhov, 2019).

3.3.1 The IEO Ecosystem

The IEO ecosystem has three players: the exchange, the investors and the teams.

- The **exchange** plays a crucial role in the IEO ecosystem because it simplifies the investing process for both investors and projects. IEO exchanges move from a pure trading business into an advance and more complex business models (that is, issuing of securities).

  The exchange provides projects with a ready-made base of potential IEO participants and performs the whole marketing work.

  The main source of income of the exchange is from trade commissions of tokens listed. Hence, more users and coins during the listing produce more transactions and higher income from commissions. In addition, the exchange takes from projects a listing fees and a small portion of tokens sold through IEO (Myalo and Glukhov, 2019).

Exchanges' success depends on the reputation they built on their verification procedures and the work they do on behalf of projects. Indeed, the exchange performs due diligence, KYC/AML procedures, vetting activities, and lists projects on its platform. All these activities increase exchange's reputation and attract new users that means higher revenue from trade commissions.

Furthermore, the exchange simplified investors' usability, because they do not need to open a new wallet anymore, but only to register on the platform and the exchange provides wallets: the investor simply needs to deposit funds in the exchange account, and the tokens can be purchased (Bahrynovska, 2019).

- The **investors** significantly benefit from the introduction of IEO thanks to the increased trust and security compared to ICOs. (Athanasiou, 2019). Moreover, investors go through the KYC/AML procedures only once when they register on the exchange, instead of passing through multiple KYC processes every time they want to enter in an IEO, like it happens with ICOs.

  Investors trust more in the legitimacy of exchange and its vetting activities as an intermediary than single token issuing projects.

  Investors can trade tokens immediately after IEO is over and directly on the exchange platform.

- Unlike ICOs, IEO **teams** can focus on core capabilities such as technology development, product roll-out because most of the IEO process is done by the exchange. Teams leverage on the exchange's capabilities for marketing activities and to reach a broader target audience that reduces marketing costs. Further, teams delegate to the exchange cybersecurity, KYC/AML, and other non-core activities.

  Finally, teams exploit the exchange's brand to reach legitimacy and increase the probability of success.

3.3.2 The IEO process

The process described below does not consider the KYC/AML verification procedures because they are conducted only once when the user registers on the exchange platform – even before a project starts the IEO process – therefore without the need to pass through the KYC/AML procedures every time he/she wants to invest in an IEO.

IEO process can be divided into four major stages:

3.3.2.1 Preparation stage:

- **Planning and strategy.** A company that intends to launch an IEO has to show a solid preparation and an organized strategy in order to be accepted by the exchange. Further, planning gives the company higher chances to raise more funds.
- **Building the team.** Once the preparation is done, the company has to create a team of partners, advisors, lawyers, social media managers, etc. It is important to build a team made up of members experienced in token-based offerings (or more specifically in IEOs), because this aspect plays a key role in passing the vetting process and helps to gain more investors to the project.
- Furthermore, having the project at some point of development, and not only an idea, will help the company to pass the vetting process. For instance, if the company shows up it already has 10 million users before initiating the IEO process, it will be surely selected by the exchange (10 million can appear a high number but consider this number on a global scale; moreover, for example, BitTorrent had 100 million users before choosing an exchange).

3.3.2.2 Pre-IEO

- **Choice of the exchange platform.** In the choice of the exchange platform, the company should take care of two aspects: selection criteria and reputation of the exchange. It is crucial to know in advance the selection criteria because the team can set the project on them increasing the likelihood to pass the vetting process. The reputation of the exchange should be considered because it is a source of legitimacy for the project and because higher the reputation larger the crowd of potential investors.

- **Drafting the white paper.** The white paper should include an analysis of the market, the development strategy, tokenomics, roadmap, information about the team.
- **Building the marketing Website.** The project and the exchange have particular attention to the creation of the website because this is the spot where users can know about the brand and have more information about the project.
- **Creation of the token.** Once the website is done, the exchange concentrates on the development of tokens. Tokens value must be defined according to its correlation to the real-world assets and functionality.

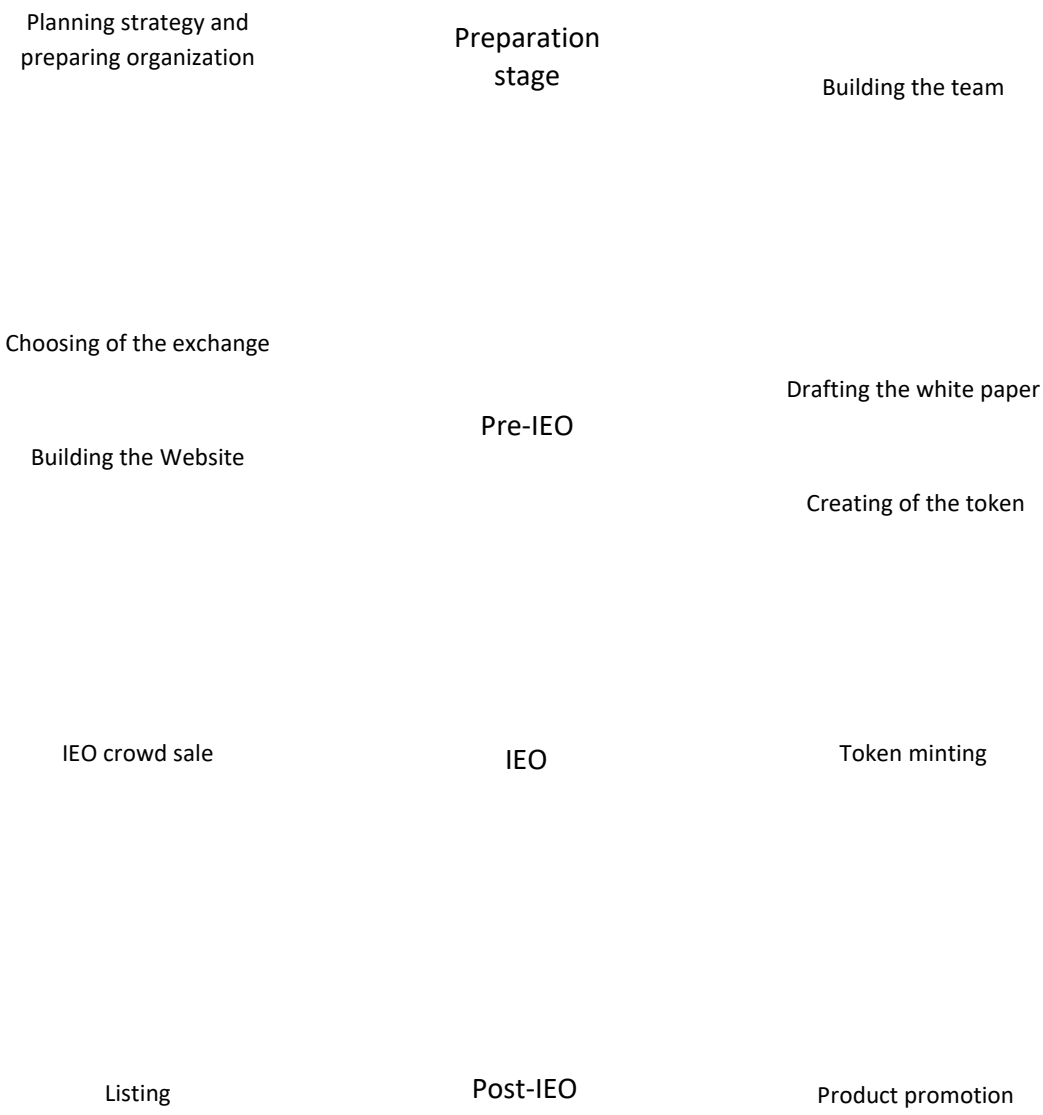
3.3.2.3 IEO

- An aspect to consider when the company is going to launch the IEO is to fix a maximum funding requirement to ensure that the goal looks practical and tangible.
- During the IEO, tokens are minted and sold to investors.

3.3.2.4 Post-IEO

- Once all tokens are sold, the exchange lists them to be traded.
- Now the company can promote the product with the funds raised.

Figure 14: The IEO process.



Source: Own elaboration.

3.3.3 Advantages

- **Fast launch process**. Since the exchange centralizes the process and leverages on an audience of potential investors already registered on the platform, IEOs have become faster than ICOs, where all stages of the process are made by the team itself.
- **Lower risk of scams and failed projects**. As long as projects are submitted to verifications procedures by the exchange, IEOs are more secure than ICOs. Further, the exchange reputation depends on the success and credibility of projects, thus doubtful projects are rejected to keep the standards high and to enlarge the number of well done, profitable projects (Bahrynovska, 2019). Moreover, because projects perform the IEO on the exchange, they gain an extent of legitimacy which would be very difficult and expensive to get through other means. (Athanasiou, 2019).
- **Lower waste of resources**. Projects ask for the advice of the exchange that is composed of professionals and disposes of crowd of potential investors. Consequently, this reduces the resources wasted by projects' teams because they do not need to do all stages of the process on their own, or to create a marketing campaign from zero, since the potential crowd of investors already exists. Furthermore, the synergy between the project and the investor increases the efficiency of tokens promotion to the market.
- **No need to open new wallet**. Exchanges provide investors with wallets wherein to transfer fiat or crypto currencies after their registration on the platform. This solution avoids the investors to create wallets by their own relying on their software development skills that sometimes can fail (Myalo and Glukhov, 2019).
- **Higher trust and security**. Investors can benefit from higher trust and security compared to ICOs (Athanasiou, 2019).

3.3.4 Disadvantages

- **Few exchanges**. The low number of exchanges platforms means that IEOs are limited to a certain number of exchanges and this can put in disadvantage investors who do not have an account in the same exchange of the project (Bahrynovska, 2019).
- **Low number of IEOs.** The number of IEOs is significantly lower than the number of ICOs. This is partly due to the fact that ICOs have an older history and because

exchanges admit only few verified projects. Nevertheless, it could be also affected by the unwillingness of exchanges to take additional work in an industry where IEO exchange are few.

- **Concentration of ownership**. Some investors may have no time to order and buy tokens of big projects because of the high distribution speed of IEO projects, since some other investors with larger funds can be faster to purchase tokens and run out all of them. Further, a high percentage of coins are held by a small number of people. As a result, it is easy to control or manipulate the price of the coin by the few large holders (Myalo and Glukhov, 2019).
- **Centralization**. Centralization brought some benefits because it made it easier for users to participate, hence demand and offer have more chances to meet each other compared to decentralized token-based offerings. Nonetheless, centralization created a huge problem with cybersecurity, because centralized systems can be more easily attacked than decentralized ones (as blockchain taught).

3.3.5 IEO Regulatory Framework

Like ICOs, IEOs can issue utility tokens or security tokens. If the company issues security tokens, the IEO can be treated as a STO. Hence, most national jurisdictions do not feel the need to regulate IEO and limit to apply the regulations already in place, especially those countries like Malta, Switzerland, Estonia, and Singapore that issued specific regulations to token-based offerings. Only US SEC and Italian Consob released noteworthy documents.

3.3.5.1 USA

The Securities and Exchange Commission's Office of Investor Education and Advocacy released an alert[12] wherein it warns investors of the potential risks from IEOs on January 14th, 2020.

The SEC considers IEOs similar to ICOs, because they both are offerings of digital assets to raise capital but recognizes the innovation of the introduction of an online trading

[12] U.S. Securities and Exchange Commission. Initial Exchange Offerings (IEOs) – Investor Alert. 14 January 2020.

platform (that is, the exchanges) which claims to perform due diligence or other quality assessments of IEOs.

Nevertheless, the SEC states that exchange platforms "*involved in an IEO may also be acting as a broker or dealer that is required to register with the SEC*" and become a member of the Financial Industry regulatory Authority (FINRA)[13]. "*SEC-registered broker-dealers are subject to legal and regulatory requirements that govern their conduct and provide important safeguards for investors, including acting in a manner consistent with the SEC's customer protection standards*", because exchange platforms may conduct due diligences improperly and in violation of federal securities laws.

Further, if the offerings involve securities, the IEO is subject to registration requirements according to federal securities laws. Registration requirements mean that the IEO has the obligation to provide proper disclosures about the company, its business, the digital assets offered, and the terms of the offering to investors.

Finally, the SEC alert warns investors to invest in offshore trading platforms because they may hide important information, since offshore platforms avoid regulatory scrutiny by US authorities.

3.3.5.2 Italy

Consob (the Italian financial supervisory authority) issued a document "Initial offers and exchanges of crypto assets" on January 2nd, 2020, after a year of public consultation.

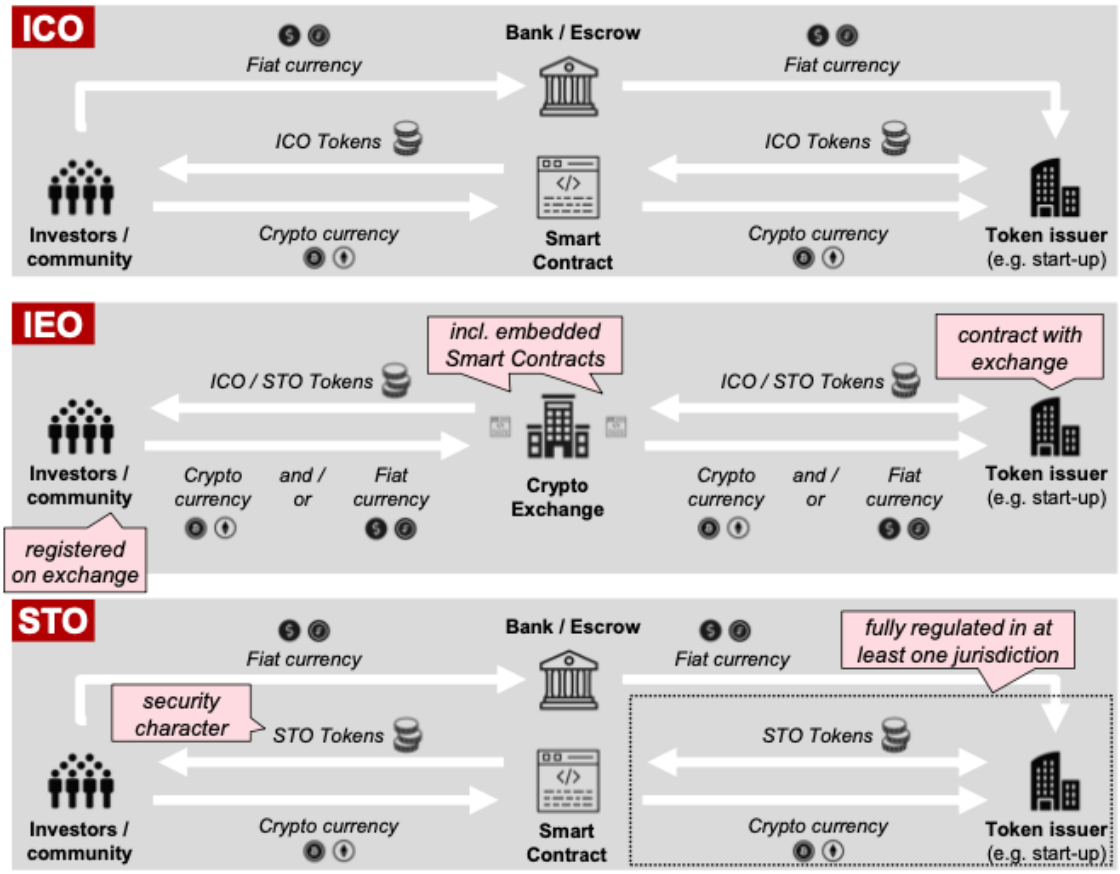
Consob recognizes the innovation of the IEO, the cost-cutting role, the greater protection of subscribers from the point of view of "liquidity". Nevertheless, the document states that a crypto-assets exchange platform should be registered with Consob in order to carry out an IEO and provide suitable investor information on the characteristics of the tokens and the offer.

[13] The FINRA is a non-governmental agency that regulates brokerage firms and exchange markets in the USA.

3.4 Comparison between ICOs, STOs, IEOs

In Chapter 2 and 3 I analysed the three token-based offerings, and now it is the moment to do a complete comparison between ICO, STO, and IEO to have a deeper understanding of the phenomenon using a framework of variables.

Figure 15: The three token-based offerings compared.



Source: PWC report 2019.

*Token seller***.** With the ICO, the development team plays a strong role as the token sale is launched from the project's website, while the STO, which is an evolution of ICO, is launched from a security token issuance platform. Finally, IEOs are launched from the crypto exchange platform where all the process has been conducted.

Type of tokens. The ICO has been the first token-based offering to appear, hence has a larger range of types of tokens compared to STOs and IEOs. ICOs' tokens are mainly utility tokens, a smaller portion are security tokens, and then there are cryptocurrency/payment tokens and all other hybrid tokens. STOs developed from

security tokens, which is the only type of token available, to comply with national regulations. IEOs use both utility and security tokens.

Payment method. All the three types of token offerings can accept both cryptocurrency and fiat currency, but it depends on the single project the choice to restrict the range to some currencies or to only specific cryptocurrencies. However, exchanges, and in particular IEO exchanges, offer the possibility to change fiat currencies with crypto.

Security. Since 2013, and especially with the 2017 uncontrolled boom, many ICO investors have been victim of scams and cyber-attacks because fundraising is performed from projects' websites or because there were scammers behind the fake ICO project. This obliged regulators to take countermeasures to the low level of security for investors. STOs are more secure than ICOs because they have been developed to comply with national regulations. IEOs are considered highly secure for many reasons: the exchange conducts due diligence and KYC/AML in the interest of the investors who choose platforms with high reputation, and further the exchange platform has more resources to invest in cyber-security than single teams, but on the other hand centralization open the doors to cyber-security risks that could be avoided with decentralization.

Fees. While ICOs have no fees because they are developed by the projects' teams, STOs companies have to pay a small percentage of the funds raised to the security tokens issuance platform and fees to the exchange that trade security tokens. IEO projects have to pay exchanges with fees and a small portion of shares.

Speed. ICOs can take several months to raise funds because the crypto investors may have limited funds to invest or because the project itself did not set a limit to the maximum amount to raise. STOs are slower and can take up to a year due to the compliance procedures with all regulations. Instead, IEOs are faster and can take several weeks or few days because investors are qualified investors in compliance with national regulations, hence they already have enough funds to invest, and because they are already registered on the exchange platform.

Regulations. ICOs opened the debate on what the most appropriate regulation to apply on tokens could be. What emerged is that security tokens are regulated as securities, while utility tokens, which are the vast majority, are not considered

investment means since they do not provide rights to investors. As a consequence, ICOs have a low level of regulation, while STOs have a high level of regulation since issuers and projects have to be registered at national regulatory authorities to legally operate. IEOs have a medium level of regulation because they still involve utility tokens and, for this reason, they are restricted in many countries, included the USA.

KYC/AML. ICOs has been the first to use KYC/AML procedures but these were performed by the project's team itself. STOs and IEOs provided an evolution because the KYC/AML procedures took on a standard that made projects more credible: for STOs, they are performed by security token issuance platforms, while for IEOs they are performed by the exchange, so existing platform users do not have to go through it again.

Project assessment. There is no evaluation for ICO projects, while for STOs it is only required to be compliant with the regulation of the countries wherein the project is launched. A real due diligence is conducted to IEO projects as the exchange can accept or reject potential IEOs.

Automatic token listing. ICOs and STOs do not have an automatic token listing procedure, but projects have to find out an exchange on their own to list their tokens. An automatic token listing is only performed by IEOs exchanges since they conduct almost all stages of the process, with the exemption of product development and distribution.

Smart contract. For what concerns ICOs, the smart contract is developed by the team itself with all the risks that a bug in the smart contract's code entails (The DAO is an example). The higher security of STOs and IEOs projects is also due to the fact that they leave the smart contract development to specialized experts of the security tokens issuance platform, for STOs, or of the exchange platform, for IEOs.

Fundraising. With ICOs the fundraising is conducted directly by the tokens issuer's website, while STOs funds are raised by the security token issuance platform, instead IEOs funds are raised by the exchange platform.

Decentralization. The level of centralization is directly affected by the concept of decentralized ledger technologies and the evolutions of token-based offerings occurred in the last three years. Since ICOs were the first token-based offering to appear, it is strongly decentralized: every company develops almost all stages of the process on its

own and conducts token issuance from its own website. Instead STO projects have a medium level of decentralization because they delegate some aspects of the process to third parties like security tokens issuance platform, exchanges, custodians. IEOs are the most centralized token-based offering because almost all stages of the process are conducted by or partnered with an exchange platform that allows the projects' teams only to focus on product development, post-IEO marketing and sales.

Liquidity. The level of liquidity is affected by the degree of centralization in the process, the speed in reaching out a large audience, the speed to move tokens from listing to a secondary trading market, and national regulations. Considering these factors, ICOs have a medium level of liquidity because they can raise funds from a large crowd of investors that are not necessarily qualified investors (in particular with utility tokens). For what concerns STOs, the level of liquidity is low due to the fact that security tokens can be only purchased by accredited investors and because projects' teams have to find an exchange after listing security tokens. IEOs has the highest level of liquidity because all the IEO process from development of the smart contract to the listing and trading on secondary markets are managed by the same exchange, which can guarantee a certain number of investors registered on its platform.

First starting date and evolution. The first ICO were launched in 2013 but only in 2017 the phenomenon boomed, while STOs evolved from ICOs from the end of 2017 and had the best period in terms of volume and launches between the end of 2018 and the beginning of 2019, whereas IEOs were first launched in 2017 but had the pick in the first semester of 2019.

Marketing. The marketing among the three token-based offerings differs according to the level of centralization. ICOs, which are the most decentralized, require a high amount of funds for marketing for the project to get the attention of investors. Instead, STOs invest lower resources because they do not have to promote the offering to a vast crowd of investors, but only to accredited investors, and because issuance platforms might provide extra marketing. IEOs spend the lowest in marketing because this activity is performed by the exchange which leverages on an existing crowd of interested investors.

Ecosystem actors. Ecosystem actors change among ICOs, STOs, IEOs. The ICO ecosystem consists of the team, which conducts all operations and launch the ICO from

its website, the blockchain platform (i.e., Ethereum), which provides the coding language to write smart contracts (i.e., Solidity), a cryptocurrency (i.e., Ether), and a standard token (i.e., ERC-20), investors and the exchange platform, which is involved only if the ICO raise the expected funds. Instead for STOs the ecosystem is more complex and centralized because there are the team, the legal advisor, the issuance platform, the exchange, the custodian, and accredited investors. Finally, the IEO ecosystem has less actors and is the more centralized because the exchange conducts almost all operations, then there are the team and the platform investors.

Investor's rights protection. The level of protection varies among the three types of offering, because we move from ICOs, which have been heavily criticized for the low level of investor's rights protection, to STOs, which emerged to protect investors' rights according to national securities laws, and to IEOs, which have a medium level of protection due to the adoption of both utility tokens (no rights protection) and security tokens (strong rights protection).

Investor accessibility. Even investors accessibility varies but inversely to investors' rights protection, because ICOs are characterised by global participation without restrictions from projects, while STOs still allow participants from all over the world but they must be accredited investors in their countries, and finally IEOs have a medium level of accessibility as long as investors can purchase both utility and security tokens.

Table 2: Comparisons between ICOs, STOs, and IEOs.

	ICO	STO	IEO
Token seller	Development team	Security tokens issuance platform	Cryptocurrency exchange
Type of tokens	Utility tokens, security tokens, cryptocurrency/payment token, and hybrids	Security tokens only	Only Utility tokens and security tokens, because cryptocurrency is provided by the exchange
Payment method	Crypto/Fiat	Crypto/Fiat	Crypto/Fiat
Security	Low security Fundraising is performed via startups'website	Highly secured due to regulatory compliance	Highly secured Crypto Exchange is a crowd sale platform
Fees	No fee	Small percentage of shares (STO platform), fees (Exchange)	Fees and a small portion of shares to the exchange
Speed	Several months	Up to a year	Several weeks or few days
Regulations	Low (but in improvement)	High	Medium (face some restricted areas)
KYC/AML	Performed by development teams and not standard procedures	Standard procedures performed by STO platforms	Standard procedures performed by exchanges
Project assessment	Not particular, audit performed by the team (conflict of interests)	The project must be compliant with regulations in the chosen jurisdiction	Mandatory – Exchange conducts due diligence
Automatic token listing	No, the company has to find an exchange to list its tokens	It depends, if the selected security issuance platform is also an exchange	Yes
Smart contract developer and manager	The start-up conducting the token sale	Security token issuance platform	The cryptocurrency exchange
Fundraising	Conducted by the project's Website	Conducted by the security tokens issuance platform	Conducted by the platform of the exchange
Decentralization level	High	Medium	Low
Liquidity	Medium	Low	High
First starting date and evolution	Early 2013, boom in 2018	End 2017, evolution 2018	Early 2017, peak in 2019
Marketing	High amount of funds for the marketing of the project to attract the attention of investors	Low marketing costs, because the target are only accredited investors	Low marketing cost. because performed by the exchange which leverages on an existing crowd of interested investors
Ecosystem actors	Team, blockchain platform, investors, exchange platform	Team, legal advisor, issuance platform, exchange, custodian, accredited investors	Exchange, team, investors registered on the platform
Investor's rights protection	Low. Weak rights protection	High. Strong rights protection	Medium, due to adoption of both utility and security tokens
Investor accessibility	High	Low	Medium

Source: PWC report, 2020; Myalo and Glukhov, 2019.

CHAPTER 4. The opaque relation between tokens offerings and money laundering

In this chapter I analyse the role of national regulations and their correlation with the spread of token offerings. In the first part of the chapter, I sum up factors that legislations need to consider when they are developing new laws to regulate token-based offerings, providing three categorizations of the existing worldwide regulations. In the second part of the chapter, I analyse a database and a dataset of variables in order to search possible explanations under the regulatory point of view.

In the third part of the chapter, I conduct a country-by-country analysis in order to understand which are the reasons why some countries registered higher levels of capitalization than others.

4.1 Factors to develop national regulations

4.1.1 Information asymmetries

ICOs were born with the aim of reducing information asymmetries and costs by eliminating third parties. With this purpose, ICOs, STOs, and IEOs may potentially enlarge the projects' audience on a global scale, and entrepreneurial ideas that previously were limited by national borders, now and in the future, should be allowed to raise funds even from the most remote and underdeveloped countries. Nevertheless, the work done by third parties is performed using computer codes, called smart contracts, and which should execute investor protection instead of using more traditional legal mechanisms adopted by IPOs (Amstad, 2019a). Therefore, smart contracts require investors to have technical skills to analyse whether the code is consistent with disclosures made by promoters. Indeed Cohney et al. (2018) found out that codes often do not match promoters' disclosures, that signals an increase of information asymmetries with token-based offerings.

Another crucial aspect is that ICOs, STOs, and IEOs projects do not have any underwriter bank which might smoothen asymmetries.

Further information asymmetries are given by white papers. According Zetzsche et al. (2018), ICO white papers issued in 2017 provided only technical information about the product in 20% of cases, and do not provide project's financial details in 31% of cases, while only a small portion appeared to be advised by lawyers specialized in securities

markets operations. The main reason that explains these facts is that there are no external auditors who certify what is written in the white paper (Zetzsche et al., 2018).
In the last three years, the introduction of STOs and IEOs has tried to minimize information asymmetries: the former introduced tokens assimilable to common securities, the latter centralized the projects' selection to exchanges that evaluate their reliability to reduce the risk of scams.
Finally, a crucial role is being, and will be, played by national legislators. As I will describe below, we registered different reactions to this phenomenon: some applied already existing securities laws, while few others promulgated new *ad-hoc* regulation, or even other countries did not anything. However, sooner or later, legislators will be obliged to cope with token-based offerings in order to lower information asymmetries to guarantee investors' protection rights.

4.1.2 Financial Stability

Financial stability risk usually emerges when financial market players have significant size (too big to fail), or when they are heavily connected (too interconnected to fail) (Amstad, 2019a). According to the Financial Stability Board (2017), token-based offerings and fintech are still a small phenomenon that would have a limited impact in terms of financial instability. However, they are expected to grow in the future years, hence enhancing the connectivity among financial institutions in these fields. I observed that 5770 between ICOs, STOs, and IEOs raised $24.7 billion since 2015, apparently a huge amount but which looks small if compared with much larger banking and financial sectors.
In any case financial investors and operators have to pay attention because a major risk that remarkably threatens digital finance is cybercrime. Blockchain-based projects are constantly under the risk of cyber-attacks, since large sums of money are involved (even billions in few cases). A famous example is The DAO, a project which was launched with an ICO in early 2016. After few months, security vulnerabilities emerged, and The DAO was attacked by hackers that stole 14% of the total capital raised.

4.1.3 Market Integrity

Blockchain technologies introduced unexpected innovations in finance, the token-based offerings (ICOs, STOs, IEOs), however they introduced new risks to market integrity in addition to cybersecurity: money laundering.

The Financial Action Task Force (FATF), an independent organization created by the G7 and which fights money laundering and financing terrorism, recommended in 2014 to focus on digital currencies due to the anonymity that characterized their users. Indeed, virtual assets may be misused for money laundering and terrorist financing (Amstad, 2019a).

In the last few years national legislators have started to put into practice these recommendations, and in the group of countries I considered in the analysis below 16 out of 19 applied AML procedures to security tokens, while only five applied AML to utility or payment tokens.

4.1.4 Principle-Based Regulation

To cope with the previously listed factors, most legislators choose a principle-based approach when they have to regulate fintech innovations, because this approach does not require a constant updating for a continuously developing industry, hence it is more cost effective (Amstad, 2019a).

There are two principles often present in most regulations: legal certainty, and technology neutrality.

- Legal certainty is a crucial principle because a regulation should provide a definite perimeter and being transparent in the application of existing laws, which is fundamental to attract investors. When setting regulations, legislators have to consider the high speed of development of the industry – that's why some countries adopted a wait-and-see approach. Another challenge that legislators are facing is coordinating the number of government institutions involved in financial regulations (Amstad, 2019a). For instance, in Germany a conflict arose between the BaFin (the German Financial Supervisory Authority) and the Higher Regional Court of Berlin, because the former considers cryptocurrencies as financial instruments, while the latter expressed an opposite opinion.

- Technology neutrality is an additional principle to keep in the mind of the legislator, because technology is changing faster and faster. Here, it has been observed that the legislator focuses its attention on the functionalities offered (Amstad, 2019a). For instance, security tokens have been regulated as financial instruments in most cases, being considered as similar as conventional securities.

4.1.5 Three Types of Regulation

Amstad (2019b) classified existing regulatory approaches into three categories: ignore, duck type, and code.

- *Ignore*. Countries adopting this alternative choose to keep the financial application of blockchain unregulated. This is a typical approach of the very first period during which ICOs appeared. However, some countries that registered a considerable level of capitalization from token-based offerings still adopt a wait-and-see approach, like British Virgin Islands. Nevertheless, fintech companies are limited when they operate in a regime of legal uncertainty. Indeed, it has been observed that with this scenario there has been an increasing level of frauds and Ponzi schemes. Furthermore, according to Amstad (2019b), an appropriate regulation might foster growth of fintech industry and allow the companies to thrive in a regime of legal certainty.
- *Duck type*. This option groups all legislations that ruled tokens using existing regulations, following the principle of "same risk, same rules". The name "duck type" derives from the so-called *duck test* used in computer programming, which in turn derives from the phrase written by the American poet J.W. Riley: "when I see a bird that walks like a duck and swims like a duck and quacks like a duck, I call that bird a duck". Legislations adopting the "duck type" approach focus on the economic function or on the underlying risks of the token (Amstad, 2019b). Security tokens are the most frequent examples of tokens ruled according to this approach, when national financial supervisory authorities decide to apply already existing securities laws, evaluation processes, and anti-money-laundering procedures. This is the case of the Howey Test in the USA, and of the FINMA Guidelines in Switzerland.
- *Code*. This option concerns those legislators that proposed a regulation tailored towards the new functionalities introduced by an innovative technology. This is the

case when tokens do not work in the same way as traditional finance. Underlying risks might remain the same (market, credit, liquidity, and operational risks) but the new technology might introduce new variables, and new risks might emerge. Here, the legislators should take into consideration three aspects: specific features of the blockchain technology (i.e., decentralization), new combination of business models, new digital operational risks (Amstad, 2019b). This option is actually the least adopted among the three because it entails that national governments promulgate new laws for a still young and constant growing phenomenon. A noteworthy example that adopted this approach is Malta that issued three acts in 2018.

4.2 Market Overview

The following analysis wants to investigate the characteristics that makes a legislation more attractive to token-based offerings under a regulatory point of view, hence I did not directly consider other economic variables that can influence the attractiveness of a country, such as national GDP, GDP growth rate, GDP per capita, interest rates, nor other non-economic country-specific variables, such as technological advancement level, national level of bureaucracy, ease of doing business in a country, global competitiveness index, human development index, literacy index.

In this part of the chapter, I describe data obtained from a massive database in which I collected 5770 operations. Then, I explain data obtained by a dataset I built with 16 variables that aim to investigate the role of national regulation.

4.2.1 Analysis Of The Database

I created the database hand-collecting all successful ICOs/IEOs/STOs from four Websites: ICOs and IEOs were retrieved from Icobench.com, the most important ICO/IEO database, while STOs were gathered from BlockState, Coinspeaker, and STO Analytics, as suggested by Lambert et al. (2020).

The total number of token-based offerings as of 11th September 2020 were 5770 that is divided as follows: 5245 ICOs, 294 IEOs, and 231 STOs. The reason why initial coin offerings (ICOs) are far more numerous is that ICOs are the oldest form of token-based offering and the most unregulated, hence they faced less regulatory constraints, especially before 2018 when certain regulations started to be promulgated.

Unfortunately, I can't quantify the total number of token-based offerings because the Websites that collect them eliminates unsuccessful offerings.

I recorded the following types of information: country of incorporation, capitalization, start date, name of the exchange, name of the platform, category of token.

Below, there is a top 5 countries of incorporation ordered by the level of capitalization. It can be observed that these countries share a common feature, that is they all are finance and business friendly. This group alone corresponds to 58.5% of the total capitalization registered. In particular, the USA raised 31.5% of the total, whereas the other four countries raised much less with Singapore that raised 9.8%, then Switzerland and UK with 6%, and finally Cayman Islands with 5.1%.

Table 3: Top 5 countries of incorporation by total capitalization.

Country	Number of operations	Total capitalization
USA	731	$ 7.772.423.445
Singapore	574	$ 2.421.391.134
Switzerland	264	$ 1.514.473.621
UK	512	$ 1.469.547.409
Cayman Islands	129	$ 1.249.938.398

Source: Own elaboration.

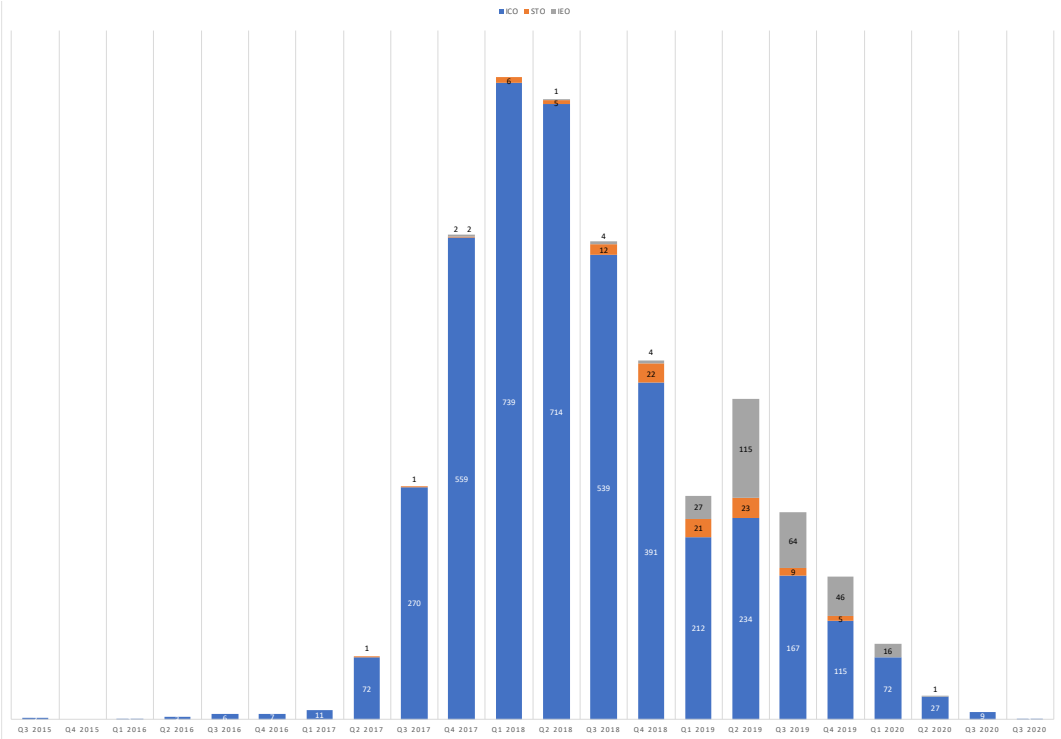
The level of capitalization I recorded could probably be not complete because there were 3905 cases (3573 ICOs, 170 IEOs, 160 STOs) in which capitalization were not given, but only classified as "Unknown"[14]. The total level of capitalization I found is $24.678.454.921, divided as follows: $21.999.399.950 raised through ICOs, $1.676.491.756 through IEOs, and $1.002.563.215 for STOs. ICOs raised 89% of the total, and this can be explained because initial coin offering was the first type of token-based offering to appear, and so they are more numerous, but also largely unregulated and a source of scams (Fisch, 2019; Zetzsche et al., 2018). As it can be observed in Graph 2, a significant reduction in the number of operations can be observed in conjunction with the introduction of new regulations or the application of already existing laws around 2018-2019. Even though it is still unregulated in some countries, national authorities

[14] Different works faced the problem of incompleteness of these databases such as in Momtaz (2018) and in Fisch (2019).

strongly warned investors to be careful about investing in ICOs due to the correlated riskiness.

In Graph 2, we can observe the trend of the three types of token-based offerings compared during the last 5 years. It should be pointed out that as ICOs began to reduce, STOs started to gain more success (Q3-Q4 2018), followed by the sudden and sharp rise of IEOs (Q1-Q2 2019). It is noteworthy that the number of ICOs cut of 70% from 2018 to 2019, in conjunction with the application of national securities laws in several jurisdictions interested by the phenomenon. Blue bars represent the ICOs, orange bars are the STOs, while grey bars are the IEOs.

Graph 2: Comparison between ICOs, IEOs, and STOs trends during the last 5 years.



Source: Own elaboration.

Another reason that justifies the decrease of ICOs is that the most offered category of tokens are utility tokens, that do not grant any investor's right, but only the possibility to benefit from a service or a product when the project is completed. Further, some countries discouraged the use of utility tokens, whereas others warned that they would have analysed case-by-case to make sure that certain utility tokens do not have the characteristics of securities. In this case, utility tokens with characteristics typical of

securities would have been treated under securities laws: hence, the obligation to cope with mandatory registration, preparation of the prospectus, investors' protection provisions, and anti-money laundering (AML) procedures. After that, we can better understand the increase of STOs, that issue security tokens offerings, from 2018 to 2019, keeping in mind that the trends in Graph 2 are significantly lower than what they really should be due to the incompleteness of the information provided by the sources.

Nevertheless, with data available it can be noticed that utility tokens are the vast majority of the total tokens issued, in line with the literature review, with 95.46%, while security tokens represent 4% of the total, and payment tokens are only 0.54%.

Table 4: Partitioning of the total number of tokens.

Category of token	Total number	%
Utility	5508	95.46%
Payment	31	0.54%
Security	231	4.00%
Total	5770	100%

Source: Own elaboration.

An interesting observation concerns the adoption of an exchange. Exchanges were first introduced with ICOs to trade tokens; however, they grew in importance with the birth of IEOs, because they moved from controlling only a phase of the process to driving the entire process, as I described in chapter 3.

According to Icobench.com, exchanges are involved in operations for $2.4 billion. In Table 5, I listed the top 10 of exchanges by capitalization, and we can observe that the first position is occupied by Bitfinex Lauchpad that raised 42% of the funds controlled by exchanges, while the second position is occupied by Binance Launchpad, the most important exchange that revolutionized the token-based offerings by introducing the initial exchange offerings (IEOs).

Table 5: Top 10 exchanges by total capitalization.

Exchange	Capitalization
Bitfinex Launchpad	$ 1.010.750.000
Binance Launchpad	$ 317.469.791
Coineal Launchpad	$ 199.306.281
Latoken Launchpad	$ 142.681.973
AmerX	$ 134.000.000
Bitforex Launchpad	$ 127.194.224
Exmarkets Launchpad	$ 104.228.585
Probit Launchpad	$ 101.631.648
LBank Launchpad	$ 65.650.000
Kucoin Spotlight	$ 34.200.000

Source: Own elaboration.

Another type of information I collected is the name of the platform used to prepare tokens and the offering. Platforms play a crucial role in developing a blockchain-based project because they provide the underlying infrastructure, and the catalogue of tokens from which developing one with the desired characteristics (the most famous is ERC-20, offered by Ethereum).

In table 6, I provided a top 10 of the platforms and we can see that Ethereum plays an almost monopolistic role in the market, because 88.3% of operations are Ethereum-based that corresponds to 88.8% of the capitalization.

Table 6: Top 10 platforms per total capitalization.

Platform	Capitalization	Number of operations
Ethereum	$21.924.633.508	5095
Filecoin Network	$ 257.000.000	1
Waves	$ 159.651.268	135
Electroneum	$ 40.000.000	1
Custom	$ 33.168.813	5
EOS	$ 32.971.789	34
BitForex	$ 24.000.000	1
ICON	$ 23.116.555	8
Hyperledger	$ 21.940.576	4
Bitshares	$ 19.635.489	9

Source: Own elaboration.

Now, I go on the analysis with a focusing more on the three forms of token-based offerings.

4.2.2 ICO

ICOs first appeared around 2015 and rapidly spread around the world, however some countries registered a higher concentration of this type of operations than others. We can observe in Table 8, which ordered countries by the number of operations, that USA, Singapore, and UK emerged as the three most attractive countries of incorporation for ICO companies. Indeed, Graph 3 tells us that they got respectively 12%, 10%, and 9% of the total. They all three are English-speaking countries or have English as an official language. Further, they have common law legislations, and they are globally recognized financial hubs with a significative level of technological advancement and striving for innovation.

From data available in Graph 4, ICOs were introduced around 2015 and spread out during 2017, reaching peaks of over 700 operations per quarter in the first six months of 2018. Then, they have quickly decreased in number when several national legislations started to regulate ICOs through their financial authorities and parliaments (i.e., Malta in November 2018). Indeed, a justification to the decrease of ICOs after the first semester 2018 may be surely the increased attention paid by financial authorities to these new operations that had had an unprecedented growth in few years.

Other reasons of the reduction of operations may be the dozens of warnings issued by national financial authorities concerning utility tokens, which were the most used category of tokens. Utility tokens do not provide rights like securities (i.e., dividends, voting rights, etc.), but only the possibility to use a service or a product once the project is finished. For example, it could happen that utility tokens were issued with securities' features, but which did not grant securities rights because they were formally named utility tokens. As a consequence, a large number of fraudulent projects used utility tokens as a mean to fraud investors with the hope of not being prosecuted under securities laws. Indeed, the period between 2017 and 2018 has been characterized by a huge number of scams. After this period of time, the need for regulatory certainty forced legislators to find regulations, investors to be more cautions, and honest projects to find

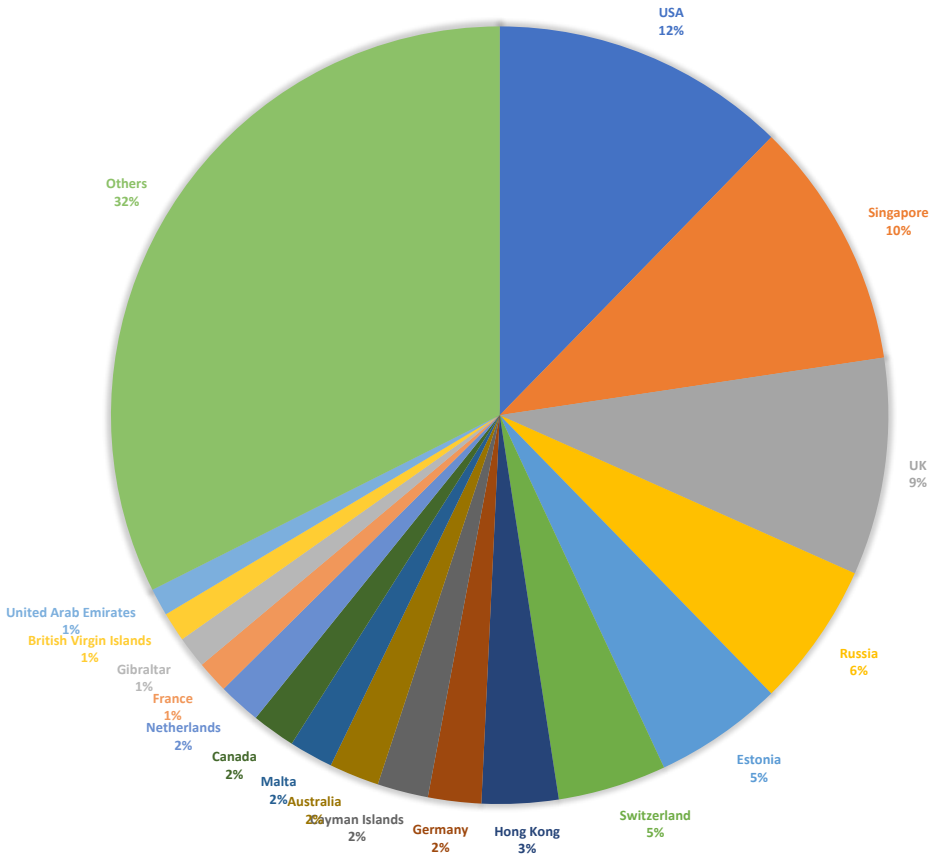
new forms of legitimation. Indeed, to satisfy the needs of all actors in the arena the year 2018 has seen the birth of new forms of token-based offerings: STOs and IEOs.

Table 7: Top 15 Countries by number of ICOs launched.

Country	N° of operations	Capitalization
USA	646	$ 7.231.280.868
Singapore	541	$ 2.279.270.710
UK	474	$ 1.334.867.179
Russia	316	$ 573.734.025
Estonia	281	$ 874.192.948
Switzerland	237	$ 1.376.314.618
Hong Kong	167	$ 537.391.452
Germany	116	$ 330.572.090
Cayman Islands	111	$ 1.237.954.558
Australia	109	$ 248.107.813
Malta	96	$ 199.727.829
Canada	95	$ 480.908.924
Netherlands	93	$ 117.787.872
France	70	$ 143.956.814
Gibraltar	69	$ 324.971.997

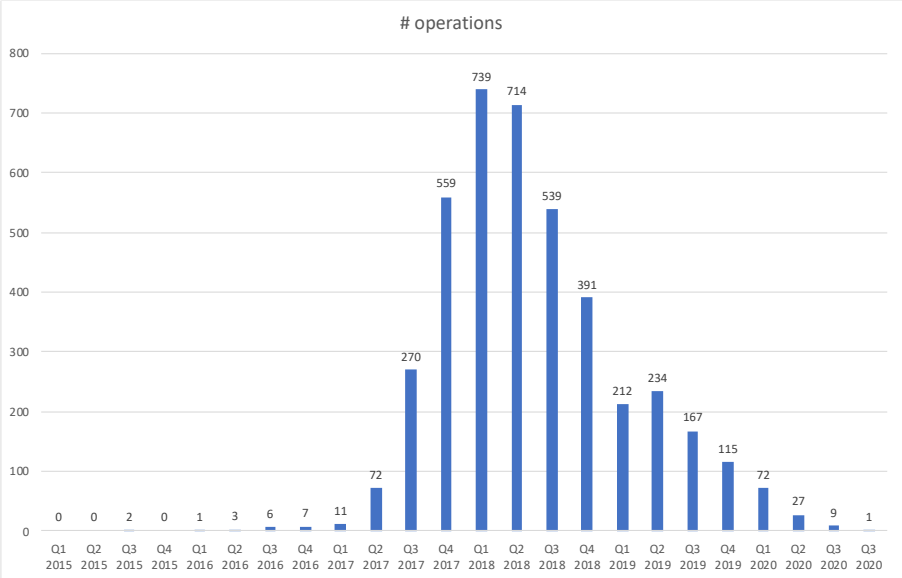
Source: Own elaboration.

Graph 3: Distribution of ICOs by country.



Source: Own elaboration.

Graph 4: Number of ICO operations per quarter (Unknown start date=1094).



Source: Own elaboration.

4.2.3 STO

As ICOs started to be seen as a synonymous of scams, several projects shifted to STOs in order to give major legal certainty to investors.

It is noteworthy that most STOs (about 25% of the total) chose to be incorporated in the USA. The reason may be due to the fact that the US Securities and Exchange Commission (SEC) was the most authoritative and among the first financial authorities to take a clear stand against ICOs. Indeed, the American financial authority clearly stated that utility tokens should be considered by their substance over their form. This happened because many tokens' issuers started to issue tokens classified as "utility tokens" because they were called that, but which were securities in reality. As a consequence, the SEC decided to pass all types of tokens through the so-called Howey test (seen in chapter 2 and 3) to assess whether they are securities or not, and to be included under the federal securities laws, whether they are classified as securities. Thus, numerous projects chose to directly issue security tokens, avoiding the risk to be fined after the Howey test; hence we can observe the rise of STOs right in the Q3 and Q4 2018.

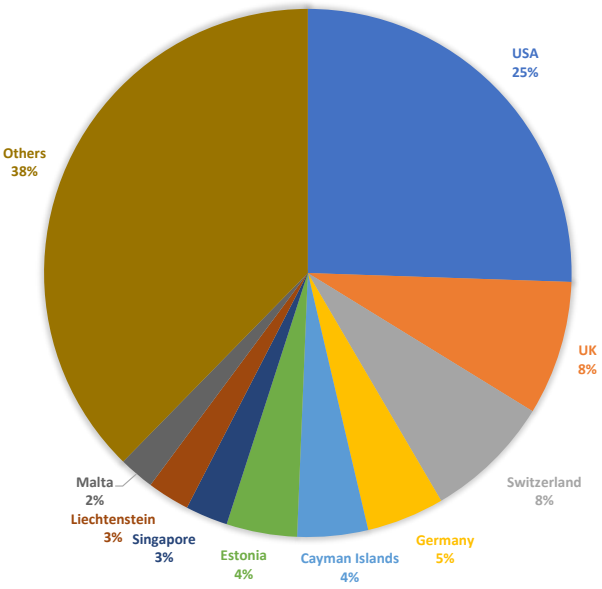
Other major countries interested by STOs were UK and Switzerland, that clearly marked the difference between securities and non-securities tokens. In particular, the Swiss FINMA was the first financial authority together with the SEC, to define the three categories of tokens: for example, the FINMA speaks about asset tokens, while the SEC called them security tokens.

Table 8: Top 10 Countries by number of STOs launched.

Country	N° of operations	Capitalization
USA	59	$ 489.101.355
UK	19	$ 39.805.805
Switzerland	18	$ 98.930.822
Germany	11	$ 8.105.775
Cayman Islands	10	$ 4.000.000
Estonia	10	$ 7.348.840
Singapore	6	$ 15.000.000
Liechtenstein	6	$ 1.000.000
Malta	5	$ -
Netherlands	4	$ 858.796

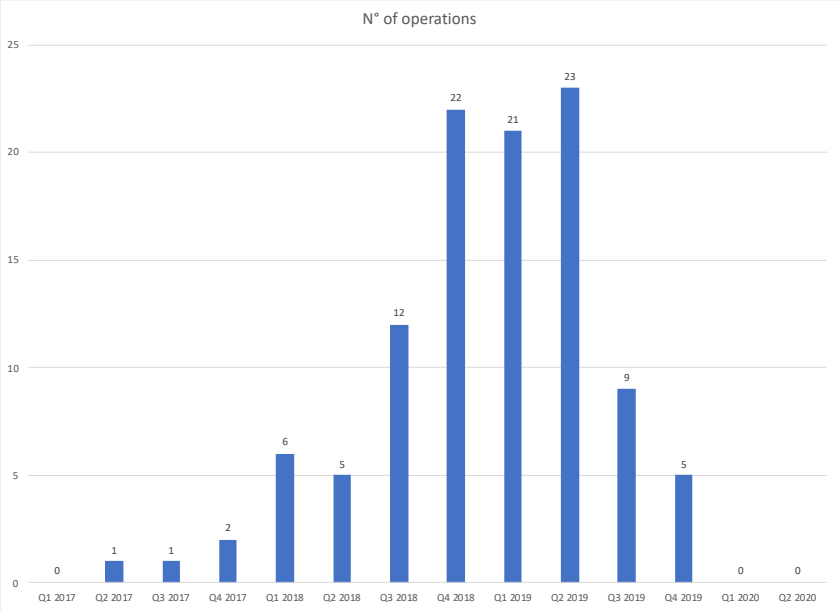
Source: Own elaboration.

Graph 5: Distribution of STOs by country.



Source: Own elaboration.

Graph 6: Number of operations per quarter (Unknown start date = 124).



Source: Own elaboration.

4.2.4 IEO

For what concerns IEOs, the most attractive country is surprisingly Estonia. The rise of IEOs coincides with the introduction of a specific regulation by the EFSA (Estonian Financial Securities Commission). Behind Estonia in Table 9, we find Singapore, USA, UK and Hong Kong: countries that have a consolidated financial history.

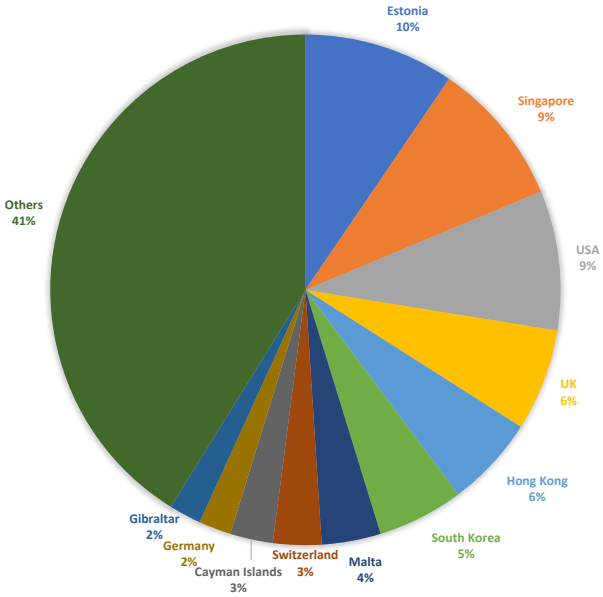
It is interesting to note from Graph 8 that IEOs registered a steeper and faster growth, if compared with STOs, and further they were awarded with a greater quantity of all operations recorded before June 2019: 153 IEOs against 93 STOs. This result may be explained by the fact that IEOs introduced a more significative innovation than what STOs has done. In fact, IEOs were developed as a form of token-based offering in which a trusted third party (the exchange) skims potential projects to assure a high level of quality and performs a vast range of operations which previously projects had to do on their own. In this way, projects benefit from higher performances, because the team can focus on the core aspects of the project itself, while the standard aspects of the launching process (i.e., marketing, tokens, etc.) are performed by a group of professionals.

Table 9: Top 10 Countries by number of IEOs launched.

Country	N° of operations	Capitalization
Estonia	28	$ 46.013.218
Singapore	27	$ 127.120.424
USA	26	$ 52.041.222
UK	19	$ 94.874.425
Hong Kong	17	$ 69.374.622
South Korea	16	$ 6.510.000
Malta	11	$ 6.798.863
Switzerland	9	$ 39.228.181
Cayman Islands	8	$ 7.983.840
Germany	6	$ 6.453.547

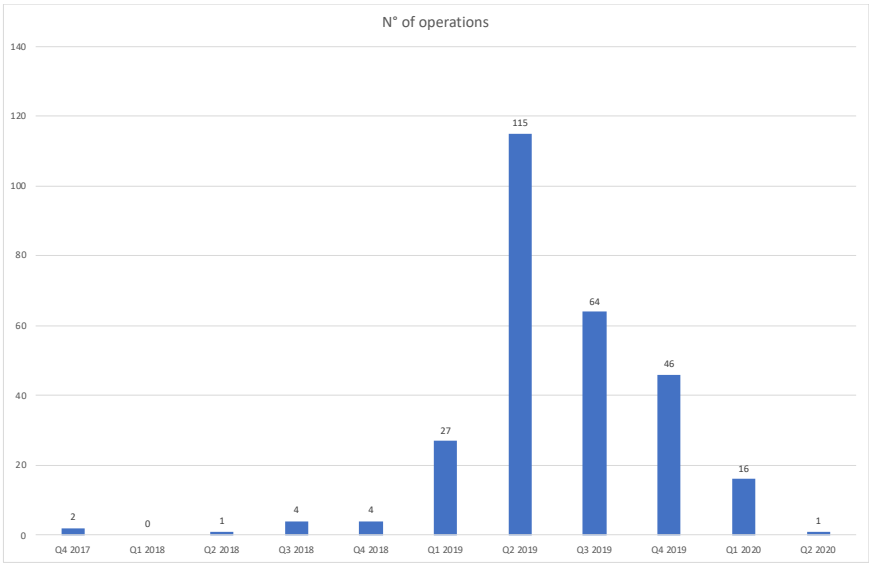
Source: Own elaboration.

Graph 7: Distribution of IEOs by country.



Source: Own elaboration.

Graph 8: Number of IEO operations per quarter (Unknown start date = 14).



Source: Own elaboration.

4.2.5 Analysis of The Dataset

To analyse the data collected in the database, I created a dataset of 16 variables with the information I retrieved from the Website of the Library of the Congress[15] of the Unites States, the Global Legal Insights – Blockchain & Cryptocurrency Regulation (2019), and the *Initial Coin Offerings (ICOs) for SME Financing* (OECD, 2019).

In Table 9, I briefly explain each variable, what I searched and how the score works for each one. The variables "*Registration*", "*Prospectus*", "*Investors' protection provisions*", and "*Anti-Money Laundering*" are repeated twice because the first group of four variables belongs to "*Security tokens*", that analyses only security tokens' features, while the second group of variables belongs to "*Utility/payment tokens*", that analyses both utility and payment tokens together. This is due to the fact that security tokens are more broadly regulated with already existing laws or with the introduction of new specific laws. Instead, utility/payment tokens' regulation are rarer, and, when they exist, they regulate both utility and payment tokens.

Further, I gave a score to each variable as follows: 1 point if the variable exists in the national regulation, and 0 points if it doesn't. Then, two exceptions are:

- the variables "*Utility tokens regulated*" and "*Payment tokens regulated*" where I used three types of scores: 0 points if not given regulation, 0.5 points if it is given a sort of regulation but without mandatory registration or prospectus, and 1 point if the countries provided a complete regulation.
- the variables "*Token offering specific regulation*" and "*Speed in providing regulatory certainty*" to which I gave a scoring scale from 0 to 2.

[15] Library of the Congress' website: https://www.loc.gov

Table 10: Description of variables used in the dataset.

Variable		Description	Score
Security tokens	Registration	If registration is required by law	No = 0 pts; Yes = 1 pt.
	Prospectus	If prospectus is required by law	No = 0 pts; Yes = 1 pt.
	Investors' protection provisions	If projects must follow investors' protection statutory provisions to operate	No = 0 pts; Yes = 1 pt.
	Anti-Money Laundering	If projects and investors must be passed through statutory AML procedures to operate	No = 0 pts; Yes = 1 pt.
Utility/payment tokens	Registration	If registration is required by law	No = 0 pts; Yes = 1 pt.
	Prospectus	If prospectus is required by law	No = 0 pts; Yes = 1 pt.
	Investors' protection provisions	If projects must follow investors' protection statutory provisions to operate	No = 0 pts; Yes = 1 pt.
	Anti-Money Laundering	If projects and investors must be passed through statutory AML procedures to operate	No = 0 pts; Yes = 1 pt.
Intermediaries' regulation		If intermediaries trading/dealing tokens are regulated	No = 0 pts; Yes = 1pt.
Token offering specific regulation		If authorities issued token offering specific regulations	No = 0 pts. if issued by Financial Securities Commission = 1pt. if promulgated by the parliament = 2 pts.
Security tokens regulated		If security tokens are regulated	No = 0 pts; Yes = 1 pt.
Utility tokens regulated		If utility tokens are regulated	No = 0 pts. If no mandatory registration or prospectus = 0.5. Yes = 1 pt.
Payment tokens regulated		If payment tokens are regulated	No = 0 pts. If no mandatory registration or prospectus = 0.5. Yes = 1 pt.
Country specific variables		If there are country-specific variables (i.e., tax heaven)	No = 0 pts; Yes = 1 pt.
Already existing laws adoption		If authorities apply already existing laws (i.e., securities laws)	No = 0 pts; Yes = 1 pt.
Speed in providing regulatory certainty		It measures if national authorities have been fast in providing regulatory certainty	No = 0 pts. first statement in 2018 = 1 pt. first statement in 2017 = 2 pts.

For what concerns the variable "*Token offering specific regulation*", I did not assign 2 points, if some national specific regulations were promulgated in 2019, or are going to be promulgated but not yet existing, or specific working groups are in place. This because these regulations did not affect at all or affected only partially the vast majority of operations, I reported in the first database, since most of ICOs/STOs/IEOs had been launched before 2019 or, if during 2019, before these new laws could have effects on the operations. For example, this is the case of Gibraltar.

The dataset explores 16 variables that analyse the top 20 countries ordered by total registered capitalization from token-based offerings.

I began the analysis with the first group of variables which focus on security tokens, which are those that scored best results among all others. The first variable is "*Registration*", which recorded the highest score together with the variable "*Anti-Money Laundering (AML) – Security tokens*", and "*Security tokens regulated*": they three scored 17 countries out of 20. These three variables are probably strongly correlated because most countries applied regulations already in place for conventional financial instruments to cope with the new phenomenon and to protect investors, while waiting for a more stable situation that will help to better understand how to regulate token-based offerings. The only three countries that do not require the registration of companies issuing security tokens at national financial authorities are Russia, Belize, and Cyprus. In these three countries there is no apparent regulation towards token-based offerings.

The variable "*Prospectus*" has the second highest result with 16. The number of countries requiring the prospectus is lower than those which want the registration because the Cayman Islands does not require the prospectus. However, this variable is almost in line with "*Registration"*, since national financial authorities are very sensitive to tokens with characteristics similar to financial instruments.

Even the variable "*Investors' protection provisions*" registered a score of 16, because only four countries (British Virgin Islands, Russia, Belize, and Cyprus) do not hold in place any measure to protect investors; however, this variable figures between those with the highest score, like all other variables concerning security tokens.

As I said above, the variable "*Anti-Money Laundering (AML) – Security tokens*" is among those that score 17 out of 20. This is due to the fact that cryptocurrencies and tokens has been used for illegal activities, like criminal money laundering and terrorist financing, thanks to the anonymity that every blockchain aims to guarantee to its users. With a view to strongly combating criminal activities, national financial authorities have applied the same measures required for conventional financial instruments.

Now, I move on with the second set of four variables concerning "*Utility/payment tokens*". This set of four variables registered poor scores that highlight that only a group of few countries deeply involved in the blockchain industry proposed real measures to regulate non-security tokens, while the vast majority remained silent on what to do with them or use a case-by-case approach and simply regulate utility/payment tokens with securities features as they regulated security tokens. Only six countries got at least 1 point, and three among these got at least 3 points. These three distinguished to be the most token-based offerings friendly: Singapore, Estonia, and Malta. A common feature between these three countries is that they proposed regulations that match with the following variables: *"Registration*", "*Investors' protection provisions*", and "*Anti-Money Laundering (AML)*".

The best scored variable in the set of four is "*Anti-Money Laundering (AML)*", that signals the interest of some national regulators in combating criminal activities also when tokens do not represent securities. The other three countries, besides the three abovementioned, that implemented AML procedures to utility and payment tokens are: Hong Kong, UK, and Canada.

Table 11: Focus on Utility/payment tokens variables.

Country	Utility/payments tokens				
	Registration	Prospectus	Investors protection provisions	Anti-Money Laundering (AML)	Total
USA	0	0	0	0	0
Singapore	1	0	1	1	3
Switzerland	0	0	0	0	0
UK	0	0	0	1	1
Cayman Islands	0	0	0	0	0
Taiwan	0	0	0	0	0
Estonia	1	1	1	1	4
Hong Kong	1	0	0	1	2
British Virgin Islands	0	0	0	0	0
Russia	0	0	0	0	0
Canada	0	0	1	1	2
United Arab Emirates	0	0	0	0	0
Gibraltar	0	0	0	0	0
Germany	0	0	0	0	0
Japan	0	0	0	0	0
Australia	0	0	0	0	0
Israel	0	0	0	0	0
Malta	1	0	1	1	3
Belize	0	0	0	0	0
Cyprus	0	0	0	0	0
	4	1	4	6	15

Source: Own elaboration.

Continuing with the analysis, we find the variable "*Intermediaries regulations*". This just evaluates whether national financial authorities responded or not to the existence of intermediaries trading and dealing tokens. About 70% of the countries in the sample regulated intermediaries that in some cases must be registered at the financial authority or in others must be incorporated in the country in order to trade with its investors (i.e., Hong Kong). Only six countries do not apply any kind of regulation towards intermediaries probably because of the anarchist regulatory regime (Belize, Cyprus), or because they are tax heavens (British Virgin Islands, Cayman Islands), or because they are still working on a serious regulatory response (Germany, Taiwan).

Another important variable is the "*Tokens offering specific regulation*", that measures the temperature of the so-called "*blockchain fever*". Here, the score is a little bit different to better discriminate countries on the basis of their commitment to regulating token-based offerings. Indeed, countries that before 2019 promulgated parliamentarians' laws received 2 points, countries whose financial authorities just issued guidelines received 1 point, while countries that did not issued anything received 0 points. To notice that the final score of this variable is 18, because I adopted a score scaling from 0 to 2 points, instead of from 0 to 1. Therefore, this variable did not reach the best result.

The countries that issued parliamentarians' laws are Singapore and Malta: in particular, the latter issued a set of three acts and created an institution oriented to developing blockchain business opportunities in the country. Then, fourteen countries decided to issue warnings or guidelines through their financial authorities, while four do not provide any kind of regulation, neither laws nor guidelines. In particular, among those which do not provide any kind of regulation, in Germany and Gibraltar there is the tacit application of already existing securities laws, but no official statement or guideline have been presented, except for warnings.

To sum up synthetically all features captured by the previously explained variables, I used three other variables: "*Security tokens regulated*", "*Utility tokens regulated*", "*Payment tokens regulated*".

As I already said, "*Security tokens regulated*" is one of the best scored variables (17 countries out of 20) because tokens looking like financial instruments can be more easily regulated applying existing securities laws. Instead, in the case of the variables "*Utility*

tokens regulated" and "*Payment tokens regulated*" the scores are significantly lower, respectively got 4.5 and 5, because only about 25% of the countries in the sample issued specific regulations towards utility and payment tokens. These countries are Singapore, Estonia, Hong Kong, Malta, UK, and Canada. In particular, I gave 0.5 points to UK and Canada, because they do not require any mandatory registration or prospectus for utility and payment tokens to be fairer with countries that spent their energies to introduce a legislation: UK simply applies AML procedures, whilst Canada enforces both investors' protection provisions and AML procedures.

Even if so far I only consider regulations, I put the variable "*Country specific variables"* that considers specificities of a country. Here, I included tax heavens like Singapore, Cayman Islands, Hong Kong, British Virgin Islands, Gibraltar, Malta, Cyprus, and Belize; I also considered as tax heavens countries which were removed by the EU blacklist: Switzerland and United Arab Emirates. I inserted in this group even countries which are not tax heavens, but which share the common features of being leaders in the blockchain industry like: UK and USA, which both also have highly developed financial markets, and Estonia, which is considered the most digital society in the world and which recently decreased its corporate tax rate from 20% to 14%.

The last variable is the "*Speed in providing regulatory certainty*" for which I considered the first statement issued to warn or initially regulate token-based offerings, as reported in the *Initial Coin Offerings (ICOs) for SME Financing* (OECD, 2019). Further, I used a different scoring scale, because I assigned 2 points to countries that issued the first statement in 2017, 1 point to those that issued the first statement in 2018, and 0 points to countries that did not issued any statement or issued it in 2019. In this last case I considered that the influence on the number of operations and capitalization of token-based offerings launched before and during 2019 was almost inexistent. Countries which did not issue any statement are British Virgin Islands and Belize, whereas those which issued a statement during 2018 are Cayman Islands, Russia, United Arab Emirates, Gibraltar, and Israel. The remaining thirteen issued the first statement during 2017.

In table 12, I ordered country on the basis of the final score they got from the 16 variables framework. In the table we can isolate four groups of countries.

A first group is composed by the first four countries that scored from 15 to 17 points: Singapore, Estonia, Malta, and Hong Kong. Under a regulatory point of view, these countries share the common feature that they were the only jurisdictions that proposed regulations to impose mandatory registration and prospectus to utility and payment tokens' issuers. Then, Singapore, Malta, and Hong Kong are considered tax heavens, while Estonia recently cut its corporate tax rate from 20% to 14%. Further, these countries are of small size and have a small population: Hong Kong has 7.451 million inhabitants, Singapore has 5.6 million, Estonia has 1.3 million, and Malta has half a million. This may justify the greater efficiency in regulating and adapting rapidly to this new phenomenon. Furthermore, they have a high level of digitalization and technological innovation.

According to the three categories proposed by Amstad (2019b), this group of countries may be included in the category "*code*".

Then, there is a group composed by Canada and UK, which respectively scored 13 and 12.5. These countries showed timid attempts to regulate token-based offerings, however they haven't yet developed a proper legislation. Therefore, they would be included in the category "*duck type"*, according Amstad (2019b).

The third group of countries is the largest because it is composed by 11 countries which scored from 7 to 11: USA, Switzerland, United Arab Emirates, Japan, Australia, Taiwan, Gibraltar, Israel Cayman Islands, Germany, British Virgin Islands. To notice that in this group USA and Switzerland were the first that provide legal certainty on how to deal with the new phenomenon. These countries share the same regulatory approach to token-based offerings, because they all applied securities laws to security tokens and did not regulate utility and payment tokens. For these reasons they would be included in the category "*duck type"*, according Amstad (2019b).

Finally, there is a group of three countries which scored from 0 to 3: Russia, Cyprus, and Belize. These countries did not propose any sort of regulation or guidelines neither to security tokens nor to utility/payment tokens, hence they would be included in the category "*ignore"*.

To notice that here is no positive correlation neither between capitalization per country and final score, nor between number of operations per country and final score.

Table 12: Ranking of countries ordered by final score.

#	Country	Final score
1	Singapore	17
2	Estonia	17
3	Malta	16
4	Hong Kong	15
5	Canada	13
6	UK	12,5
7	USA	11
8	Switzerland	11
9	United Arab Emirates	10
10	Japan	10
11	Australia	10
12	Taiwan	9
13	Gibraltar	9
14	Israel	9
15	Cayman Islands	8
16	Germany	8
17	British Virgin Islands	7
18	Russia	3
19	Cyprus	3
20	Belize	0

Source: Own elaboration.

Table 13: Dataset of the variables of Top 20 countries by capitalization.

	Y variables		**X variables**															
			Security tokens				Utility/payments tokens											
Country	**Number of operations**	**Total Capitalization**	Registration	Prospectus	Investors protection provisions	Anti-Money Laundering (AML)	Registration	Prospectus	Investors protection provisions	Anti-Money Laundering (AML)	Intermediaries regulations	Token offering specific regulation	Security tokens regulated	Utility tokens regulated	Payment tokens regulated	Country specific variables (e.g. no taxation)	Already existing laws adoption	Speed in providing regulatory certainty	Total score
USA	731	$ 7.772.423.445	1	1	1	1	0	0	0	0	1	1	1	0	0	1	1	2	11
Singapore	574	$ 2.421.391.134	1	1	1	1	1	0	1	1	1	2	1	1	1	1	1	2	17
Switzerland	264	$ 1.514.473.621	1	1	1	1	0	0	0	0	1	1	1	0	0	1	1	2	11
UK	512	$ 1.469.547.409	1	1	1	1	0	0	0	1	1	1	1	0	0,5	1	1	2	12,5
Cayman Islands	129	$ 1.249.938.398	1	0	1	1	0	0	0	0	0	1	1	0	0	1	1	1	8
Taiwan	26	$ 1.077.578.000	1	1	1	1	0	0	0	0	0	1	1	0	0	0	1	2	9
Estonia	319	$ 927.555.006	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	17
Hong Kong	187	$ 659.217.352	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	2	15
British Virgin Islands	67	$ 604.491.918	1	1	0	1	0	0	0	0	0	1	1	0	0	1	1	0	7
Russia	323	$ 577.741.326	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	3
Canada	99	$ 481.288.924	1	1	1	1	0	0	1	1	1	1	1	0,5	0,5	0	1	2	13
United Arab Emirates	69	$ 372.641.307	1	1	1	1	0	0	0	0	1	1	1	0	0	1	1	1	10
Gibraltar	76	$ 352.571.997	1	1	1	1	0	0	0	0	1	0	1	0	0	1	1	1	9
Germany	133	$ 345.131.412	1	1	1	1	0	0	0	0	0	0	1	0	0	0	1	2	8
Japan	49	$ 290.820.496	1	1	1	1	0	0	0	0	1	1	1	0	0	0	1	2	10
Australia	112	$ 248.207.813	1	1	1	1	0	0	0	0	1	1	1	0	0	0	1	2	10
Israel	36	$ 215.641.313	1	1	1	1	0	0	0	0	1	1	1	0	0	0	1	1	9
Malta	112	$ 206.526.692	1	1	1	1	1	0	1	1	1	2	1	1	1	1	0	2	16
Belize	40	$ 194.874.732	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyprus	46	$ 176.803.594	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	3
			17	16	16	17	4	1	4	6	14	18	17	4,5	5	12	16	31	

Source: Own elaboration.

4.3 Analysis of The Reasons of The Capitalization's Level By Country

From this point, I move on to an analysis country-by-country that wants to bring to the surface the existing correlation between countries with opaque financial ecosystem and level of capitalization of ICOs/STOs/IEOs. Further, as we can see in the table below there is not even a correlation between total capitalization from token offerings and the national GDPs: How could a small country, e.g., Cayman Islands, have results almost equal to UK in terms of total capitalization? And how can two tiny Caribbean countries like the Cayman Islands and the British Virgin Islands be more technologically ready than Germany, Japan, and Australia together?

Table 14: Countries ordered by level of tokens offering capitalization and compared to national GDPs 2019.

Country	Capitalization (in $)	National GDP in Millions $
USA	7.772.423.445	21.374.418,88
Singapore	2.421.391.134	372.062,53
Switzerland	1.514.473.621	703.082,44
UK	1.469.547.409	2.829.108,22
Cayman Islands	1.249.938.398	5.517,36
Taiwan	1.077.578.000	611.391,00
Estonia	927.555.006	31.471,00
Hong Kong	659.217.352	365.711,53
British Virgin Islands	604.491.918	1.028,00[16]
Russia	577.741.326	1.699.876,58
Canada	481.288.924	1.736.425,63
United Arab Emirates	372.641.307	421.142,27
Gibraltar	352.571.997	3.268,20
Germany	345.131.412	3.861.123,56
Japan	290.820.496	5.081.769,54
Australia	248.207.813	1.396.567,01
Israel	215.641.313	394.652,21
Malta	206.526.692	14.989,42
Belize	194.874.732	1.879,61
Cyprus	176.803.594	24.948,94

Source: ICObench.com, Worldbank.org, CIA World Factbook, Gibraltar Government.

[16] The British Virgin Islands GDP is referred to the year 2017 because it was not possible to find more recent data.

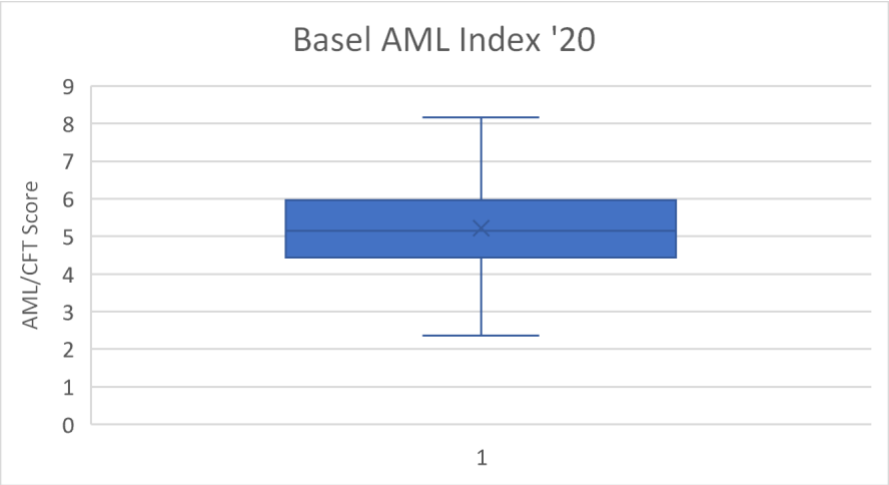
It is quite hard to create a statistic analysis that makes sense with token offerings as it could be with conventional finance. To show this difficulty, I tried to understand this phenomenon analysing the distribution of the scores that countries obtained from two different indexes: the Basel AML index 2020 and the Financial Secrecy Index 2020.

The Basel AML index measures the risk of money laundering and terrorist financing. Data are retrieved from: the Financial Action Task Force (FATF), Transparency International, the World Bank and the World Economic Forum. The Basel Institute of Governance website states that the risk scores cover five domains: Quality of AML/CFT Framework, Bribery and Corruption, Financial Transparency and Standards, Public Transparency and Accountability, Legal and Political Risks. Nevertheless, this index does not consider events like financial scandals (Boguslavska, 2019), a fact that affects the financial credibility of a country as we will see in the next pages. The scoring scale ranges from 0 to 10, where countries closer to 10 are the riskiest, while countries closer to 0 are theoretically the least risky.

From the graphic analysis of the distribution of the scores in the Basel AML index 2020 ranking, which groups 141 countries, I obtained the box plot below.

To notice that Gibraltar and British Virgin Islands were not included in the open access file.

Graph 9: Distribution of the Basel AML index '20 scores[17].



[17] The minimum value is 2.36 of Estonia, the maximum value is 8.16 of Afghanistan, the median value is 5.22.

We can observe that the box plot shows a symmetric data set. There is a strong concentration of countries in the interquartile range (second and third quartile), which groups countries that scored between 4.44 and 5.96, while the median is 5.14.
Among the 20 countries I analysed until now:

- in the fourth quartile I just found Cayman Islands (7.64);
- in the third quartile there are United Arab Emirates (5.89), Belize (5.64), Russia (5.51), Malta (5.48), and Japan (5.16);
- in the second quartile there are Hong Kong (4.99), Cyprus (4.81), Switzerland (4.74), Canada (4.68), United States (4.57) and Singapore (4.56);
- in the first quartile there are those countries that should be the least risky in term of money laundering: Germany (4.42), Taiwan (4.31), United Kingdom (4.02), Australia (3.84), Israel (3.62) and Estonia (2.36).

The Basel AML index 2020 is anything but a perfect measure of judgment. Indeed, on the one hand, the index is helpful because it reports Cayman Islands to be among the top 10 riskiest jurisdictions in terms of money laundering, and probably the level of token offerings' capitalization in this country ($1.25 billion) is not a case. On the other hand, in some cases the index looks unreliable. The most striking case is Estonia. This Baltic country, with a population of only 1.3 million, is an outlier in the box plot. Indeed, Estonia registered an exceptionally low money laundering risk score despite being in the centre of a major scandal in 2015 – the Danske scandal –, involving 200 billion dollars money laundered. This fact has as double explanation. First, the Basel AML index does not give much importance to scandals, but focuses on policies launched, that is they put emphasis on the good intentions rather than on events. Second, Financial Action Task Force (FATF) last evaluated the Estonia's money laundering risk in 2014. Since FATF reports are ones of the sources used to develop the Basel AML index, Estonia will be able to keep a good index until the next FATF report, when the country score will surely get worse (Boguslavska, 2019).
Another ranking is the Financial Secrecy Index (FSI) published by the Tax and Justice Network. The FSI evaluates the degree of the impact of financial secrecy of each country

on the global offshore economy. It ranks jurisdictions according to two major indicators: their secrecy and the scale of their offshore financial activities.

The FSI merges a qualitative measure, the secrecy score, with a quantitative one, weighting of the jurisdiction's size to the global market for offshore financial services.

For what concerns the secrecy score, the higher the score the more secretive the jurisdiction: in particular, countries ranged from 70 to 80 are the most secretive. If we consider only the secrecy score, we obtain similar results as of the Basel AML index; however, the combination with the weight of a jurisdiction gives us a more accurate representation. Indeed, the secrecy score might be deceptive, due to the criteria adopted to calculate it. The FSI admits it, as in the case of UK score of 46, that is why it uses the weight of a jurisdiction.

Table 15: FSI RANKING with our top 20 highlighted.

Rank	Jurisdiction1	ISO-3	ISO-2	FSI Value2	FSI Share3	Secrecy Score4	Global Scale Weight5
1	Cayman Islands	CYM	KY	1575,19	4,63%	76,08	4,58%
2	United States	USA	US	1486,96	4,37%	62,89	21,37%
3	Switzerland	CHE	CH	1402,10	4,12%	74,05	4,12%
4	Hong Kong	HKG	HK	1035,29	3,04%	66,38	4,44%
5	Singapore	SGP	SG	1022,12	3,00%	64,98	5,17%
6	Luxembourg	LUX	LU	849,36	2,49%	55,45	12,36%
7	Japan	JPN	JP	695,59	2,04%	62,85	2,20%
8	Netherlands	NLD	NL	682,20	2,00%	67,40	1,11%
9	British Virgin Islands	VGB	VG	619,14	1,82%	71,30	0,50%
10	United Arab Emirates	ARE	AE	605,20	1,78%	77,93	0,21%
11	Guernsey	GGY	GG	564,56	1,66%	70,65	0,41%
12	United Kingdom	GBR	GB	534,65	1,57%	46,20	15,94%
13	Taiwan	TWN	TW	507,57	1,49%	65,50	0,59%
14	Germany	DEU	DE	499,72	1,47%	51,73	4,71%
15	Panama	PAN	PA	479,51	1,41%	71,88	0,22%
16	Jersey	JEY	JE	466,81	1,37%	65,53	0,46%
17	Thailand	THA	TH	448,86	1,32%	73,25	0,15%
18	Malta	MLT	MT	442,20	1,30%	61,75	0,66%
19	Canada	CAN	CA	438,38	1,29%	55,84	1,60%
20	Qatar	QAT	QA	433,05	1,27%	77,00	0,09%

Source: Tax and Justice Network – Financial Secrecy Index 2020.

It is quite impressive to see that in the top 20 ranked countries, 13 are among the top 20 countries for level of token offerings capitalization (see Table 14). Some countries considered in Table 14 are not included in FSI ranking Top 20 because of their lower weight on global market of offshore financial services, but it does not mean they have a good secrecy score: this is the case of Belize, Cyprus and Gibraltar. Then, there is the case of Estonia that I briefly disclosed before, and I will deepen on the following pages.

The FSI ranking is helpful to explain qualitatively a fact that it is quite clear now: there is a direct correlation between token offerings capitalization and money laundering in countries with opaque jurisdictions.

4.3.1 Introduction to Suspicious Activities with Cryptocurrencies and Tokens Offerings

In the last years, the unusual growth of cryptocurrencies volume and popularity has been partially associated to criminal activities. Foley et al. (2018) stated that one quarter of bitcoin users were likely to be involved in illegal activities, estimating around $76 billions of bitcoins came from criminal activities. Further, Barone and Masciandaro (2018) affirm that cryptocurrency money laundering is associated with ICOs, as it may be an ideal mean for usury.

Notwithstanding, it is extremely hard to demonstrate it. There are several reasons why tokens offerings and cryptocurrencies are difficult to clearly link to money laundering and illegal activities in general.

First, the main feature of cryptocurrencies is the anonymity, or pseudo-anonymity in some cases. Indeed, it is impossible to monitor where cryptocurrencies come from, where they are going, who the investors are, where they are settled, and so on. Consequently, this facilitates tax evasion because national authorities are unable to know who enters into the taxable transaction (Houben and Snyers, 2018). These factors make tokens offerings and cryptocurrencies a perfect solution to those who were searching the financial anonymity in the last decade, since financial secrecy is diminishing worldwide under the pressure of global AML initiatives.

Second, there is no central authority because cryptocurrency transactions and tokens capital raisings are peer-to-peer transactions. No central intermediary can check and report suspicious activities or block tax evasion attempts. Hence, criminals and terrorists can act undisturbed.

Third, the cross-border nature is another helpful element to bypass every AML/CFT law. Indeed, cryptocurrencies can be moved from one country to another one where AML controls are either not effective, or they do not even exist (Houben and Snyers, 2018).

Fourth, the lack of proper regulation has helped crypto money laundering to thrive. Indeed, Houben and Snyers (2018) point out that the actual European AML framework misses tax avoidance measures against cryptocurrencies/tokens offerings because of

their anonymity and their "*easy-to-hide nature*" that make extremely hard to find a taxable base.

4.3.2 Preliminary Definitions

Before moving to the analysis of the countries which obtained the best capitalization from tokens offerings, it is necessary to give some short definitions.

I report here the definitions of Beneficial Ownership (BO) and of Legal Ownership (LO) given by the Tax and Justice Network survey "The state of play of beneficial ownership registration: A visual overview" (Knobel et al., 2018):

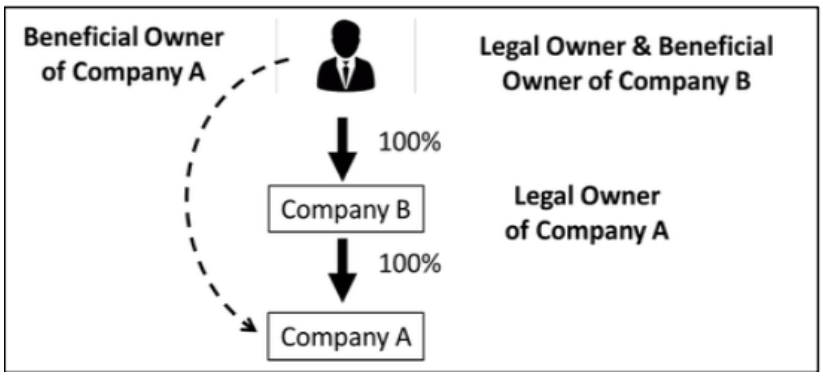
- "***Beneficial ownership*** *(BO) refers to the natural persons who effectively and ultimately control or benefit from legal vehicles such as companies, partnerships, trusts or foundations (the last tier of control).*

  […] BO registration involves requiring legal vehicles (e.g., companies, trusts, etc.) to register their beneficial owners with government authorities, e.g., a commercial register, the tax authorities or the Central Bank".

  […] The BO definition will determine how many individuals will be subject to BO registration. In the case of legal persons, […] most countries' definitions include thresholds. For example, anyone holding "more than 25%" of the capital of an entity will be considered a BO. The higher the threshold, the less people will be required to be identified as a BO. High thresholds also make it easier not to be considered a BO. For example, if the threshold is "more than 25%", as long as a company has 4 shareholders with equal shareholdings of 25%".

- "*the* ***Legal Owner*** *(LO) refers to the direct or immediate holder or owner of a legal vehicle (the first tier). An LO may be a natural person (e.g., a nominee shareholder) or another legal vehicle. If a person directly owns and controls a legal vehicle, s/he would be the LO and BO at the same time*".

Figure 16: Description of BO and LO.



Source: Knobel et al., 2018.

Another definition is that of **shell company**, given by the Transparency International (TI), The TI defines a shell company as "*a limited liability entity having no physical presence in their jurisdiction, no employees and no commercial activity […] formed in a tax haven or secrecy jurisdiction and its main or sole purpose is to insulate the real beneficial owner from taxes, disclosure or both*."

4.3.3 Country-By-Country Analysis

4.3.3.1 USA

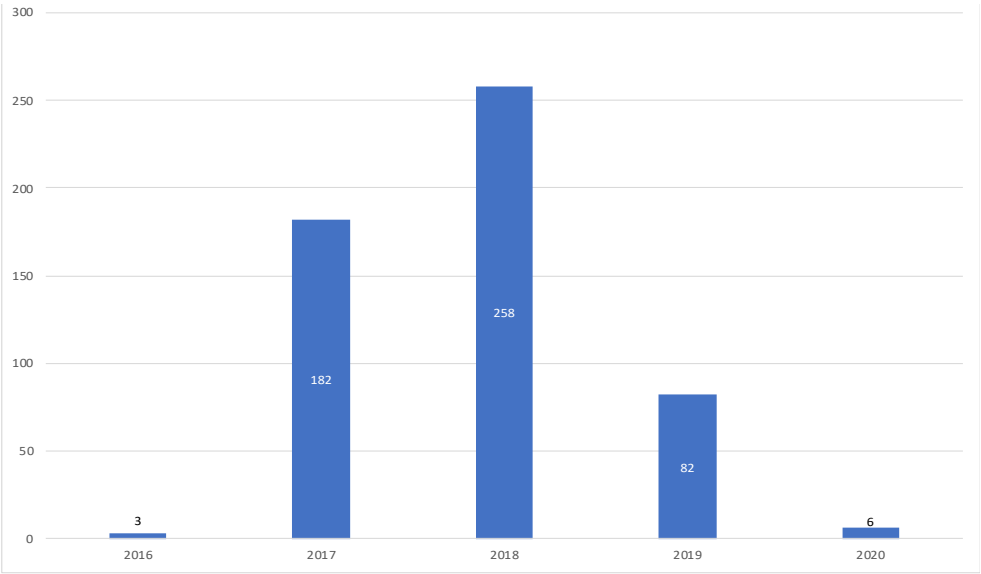
USA is the first country for tokens offerings capitalization with $7.77 billion, and the second most impactful according to the FSI ranking 2020. The largest economy in the world has been criticized several times due to the ease to open a company. Probably most people do not know it, but USA is one of the friendliest countries to shell companies. The reason is that there are no beneficial ownership or legal ownership laws (Knobel et al., 2018). As a consequence, every person can open a limited liability company and hide fraudulent money and keep their personal identity anonymous, without the need to go out from the US to much more renowned offshore financial centres, such as Panama or Belize.

Indeed, some argue that in the USA much more information is asked to require a library card or to get a driver's license than to open a shell company (Kasperkevic, 2016).

An interesting aspect that emerged is that the USA pressed other jurisdictions (usually in the Caribbean) to force foreign banks to disclose American taxpayers holding offshore

accounts and entities, while US banks are not required to disclose the same level of information for their foreign clients (Cotorceanu, 2016). This made USA an offshore financial centre for international money laundering from illicit activities and drug traffic, but also it helps some jurisdictions charged with US embargos to circumvent sanctions.
According to Kasperkevic (2016) and Chavkin (2019), three US states can be defined as "most prolific destinations for secretive companies": Delaware, Nevada, Wyoming. These US states offer offshore vehicles to investors such as Limited Liability Companies (LLC) or Trusts. In particular, more than 1 million enterprises and 66% of Fortune 500 companies are legally registered in Delaware, as affirmed on the Website of the State of Delaware's Division of Corporations. This data looks very strange if compared to the 217,000 enterprises registered in Massachusetts, a state with seven times the population of Delaware and a renowned entrepreneurial fabric. Further, Delaware is an onshore financial centre thanks to its low state income tax burdens, which make the state a tax haven within the US.
This combination of anonymous registrations for companies' owners, low state income tax burdens in several states, lack of financial transparency in disclosing foreign clients' information, made USA an ideal destination wherein hiding fraudulent money. It also makes it clearer why it figures as the first country for level of tokens offerings capitalization so far.

Graph 10: Number of token offerings per year (if known) in USA.



Source: Own elaboration based on ICObench.com data.

4.3.3.2 Singapore

Singapore is a worldwide renowned financial centre which built its prosperity on policies that have facilitated foreign banks and corporations to open their Asian branches. These policies established favourable tax rates for foreign investors who incorporate their companies here, enlisting Singapore in the group of countries considered tax havens, according to the Transparency report 2020.

Singapore also figures as the second-best country for level of tokens offerings' capitalization with $2.42 billion. This unusual and huge amount of money raised by a novel method of capital raising in less than four years can be associated with fraudulent activities in Singapore for some reasons. First of all, as Knobel et al. (2018) reported that the Singaporean financial system has no beneficial ownership law in place, which facilitates the creation of shell companies in perfect anonymity. Further, this Asian city-state was included in the IMF Offshore Financial Centers list 2007, and the Tax and Justice Network classified Singapore at the fifth place in the FSI ranking 2020 due to the huge weight in global offshore transactions and the high level of financial secrecy (it marked a 64.98 in the FSI secrecy score).

The Singapore government affirmed several times that its will is to combat money laundering, nevertheless the country has been the theatre of some financial scandals in the last decade, in which the major ones have been the Panama Papers and the recent FinCEN Files.

Singapore was largely involved in the Panama Papers leak, because of the essential role it played in the Mossack Fonseca international scheme. Indeed, it was reported to be the most important intermediary hub in terms of total transactions (Zhuhadar and Ciampa, 2019), having 706 incorporated offshore entities enrolled in this international scheme (Dominguez et al., 2020).

For what concerns the Financial Crime Enforcement Network (the so-called FinCEN) Files, BuzzFeed News started publishing articles from September 2020. The files were documents leaked from the US Treasury's (FinCEN), which have been estimated to contain fraudulent activities for about $2 trillion, according to the International Consortium of Investigative Journalists (ICIJ) – the same consortium which coordinated Panama Papers worldwide investigative reports. In an article appeared on BuzzFeed News website about FinCEN Files, Templon et al. (2020) reported that they found out

that 30 foreign companies had the same address in a small office in Singapore. In particular, they were investigating a Russian trading company, called Ask Trading, which were stating on its website to have 200 employees. Nevertheless, Templon et al. (2020) discovered that in the small office there was only one man, an accountant, whose role was to help foreign companies file the registrations, annual reports, and other compliances required by Singaporean's financial authorities. Further, the same accountant was fined $60,000 by the Singaporean authorities in June 2019 due to its involvement in helping tax avoidance.

Another important finding was about the relationship between Ask Trading and three international banks: Deutsche Bank, JP Morgan, and Bank of New York Mellon. These three flagged at least a dozen of transactions with Ask Trading as Suspicious Activity Reports (SARs), one of which reported a transaction of $27.1 million for the shipment of fluorescent lamps. The discovery of only one SAR allows the bank to interrupt immediately the business relationship with a suspicious client, unfortunately the three international banks never did it, as many other banks reported in the FinCEN Files.

Singapore has demonstrated to be a strategic position both geographically and financially in Asia. Further, the financial incentives may have facilitated to grow the number of launches of foreign tokens offerings (as testified by the $2.42 billion raised), and the systematic financial opaqueness may have encouraged massive fraudulent tokens offerings.

4.3.3.3 Switzerland

Switzerland has been historically associated to the banking secrecy, which was first codified in 1713, which made it the most ancient and renowned tax heaven, as reported by the Financial Secrecy Narrative report 2020 on Switzerland.

Switzerland is considered the third worst country in terms on impact of financial secrecy on the global offshore economy, according to the FSI ranking 2020; furthermore, it ranks among the most secretive countries in the world with a financial score of 74.

The country has no beneficial ownership laws, and it has always been considered a safe offshore jurisdiction where foreign investors can avoid tax paying and hide dirty money. Despite the efforts in the last decade, the Swiss FINMA failed to fight money laundering, as it recorded 6,000 SARs only in 2019 (Miller, 2020), thanks to the predominant role

some Swiss banks have played in international corruption events. And these results have been confirmed by the Panama Papers leak. Indeed, Swiss banks was a crucial intermediary in the Mossack Fonseca scheme to set up 10% of the total offshore companies in Panama (Zhuhadar and Ciampa, 2019).

Finally, this country, strongly associated with financial corruption and money laundering, registered also more than $1.5 billion raised through tokens offerings, the third highest level of capitalization in the world.

4.3.3.4 United Kingdom

United Kingdom is one of the most important financial centres in the world, that finds its roots back in centuries. The country is ranked 12th in the FSI ranking 2020, a result that combines a relatively low secrecy score of 46 with an enormous weight on the global market in offshore financial services of 16%, second only to the US.

According to the FSI Narrative report 2020 on UK, the low secrecy score alone may be misleading, and it must be considered in pair with the weight on the global offshore market for two reasons:

- the relationship between the UK, the *British Overseas Territories* (BOTs) in particular Cayman Islands, British Virgin Islands, Gibraltar, the *Crown Dependencies* (CDs), that is, Jersey, Guernsey, Isle of Man, and *former territories of the British Empire* (Hong Kong); and
- the existence of the City of London.

These factors brought the Financial Secrecy report 2020 to define UK "*as one of the biggest, if not the biggest, single player in the global offshore system of tax havens (or secrecy jurisdictions) today*".

The BOTs and the CDs are well-known offshore jurisdictions, as well as the UK itself, and not by chance they were enlisted in the IMF Offshore Financial Centers list 2007.

The close relationship between BOTs, CDs, and the City of London allowed the UK to create a *spider's web* through which extending the financial secrecy and pursuing fraudulent activities, according to the Financial Secrecy report 2020. Facts that were demonstrated by scandals in which the UK played a critical role. As discovered in Panama Papers, the United Kingdom was included in the group of the Top 10 most associated jurisdictions to open a shell company in the Mossack Fonseca international

scheme (Zhuhadar and Ciampa, 2019). Further, the UK was the pivot in the scheme behind the Danske Estonia scandal, which invested the "morally virtuous" Estonia in 2015 (this $200 billion scandal will be analysed in the paragraph dedicated to Estonia).

The ease to open a shell company to fraud people or to launder dirty money has been brilliantly described by Oliver Bullough (2019) in a long article appeared on The Guardian, titled "*How Britain can help you get away with stealing millions: a five-step guide".*

First of all, you have to open a bank account, and attach it to your company name: in the United Kingdom, no type of due diligence is conducted when you open a bank account. Then, go to the Companies House website to start opening a company. It will cost you £12, while opening a shell company in an exotic tax haven, such as British Virgin Islands, will cost you £1,000, plus the costs for an intermediary agent and the flight tickets.

You will be asked personal information, such as name and address, while registering a company on the Companies House website. Nevertheless, as Bullough (2019) reported, some impressive examples of frequent names and addresses are "Xxxxxxxx", or "Mmmmmm", or even "Xxx Stalin", resident in London.

Bullough also reported a much more credible situation which occurred when, during an investigation, it was found that a Belgian-based dentist signature was stolen and used in the documents of hundreds of shell companies. The signature was always the same, but the name was spelt in eight different ways. Another much more infamous situation involved a defrauded man who was found to be the director of 80 UK-registered companies under his name. His signature was stolen by fraudsters from documents the man filled out to access to services offered by one of their fake companies and used to complete the documents of others for the Companies House.

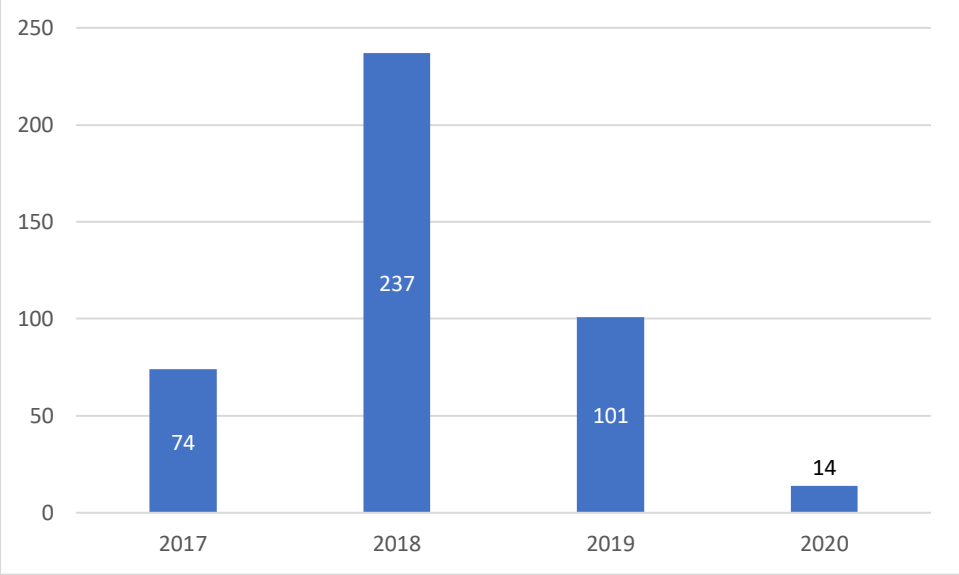
These stories are frequent as thousands of these kinds of companies can be found in the Companies House registers. Firstly, these companies used Limited Liability Partnership (LLP) denomination, because it allows investors to be liable for debts limited, namely they do not risk being personally bankrupted. Secondly, Companies House does not check if founders' identities are false, because it stated: "We do not have the statutory power or capability to verify the accuracy of the information that companies provide".

This is astonishing, but what is much more surprising is that every person with an internet connection can open a company on the Companies House website since 2011, as fast as to set up a Facebook account. Before 2011, only registered company-formation businesses could access to the Companies House. Consequently, the chances to open a shell company have risen exponentially, as reported by Bullough (2019). In order to bring this threat to the attention of the House of Commons, Kevin Brewer, a businessman involved in the company forming business for decades, tried twice to open companies using the names of Members of the Parliament: once with the Liberal Democrat Vincent Cable in 2011, and the second time with the Tory James Cleverly in 2015. He was responded that checking whether companies' information was true, it would be expensive, because it would have required hundreds of millions of pounds per year (for your interest, VAT fraud alone costs the UK economy £190 billion).

The government was not interested in coping with the rising number of shell companies and frauds in the UK. As a consequence, Kevin Brewer was prosecuted and convicted to pay a fine of £23,324, because it is "illegal to deliberately file false information in registering a company", due to his two attempts abovementioned.

After all, it does not look bizarre that $1.47 billion were raised by token offerings in the UK only.

Graph 11: Number of token offerings per year (if known) in UK.



Source: Own elaboration based on ICObench.com data.

4.3.3.5 Cayman Islands

The Cayman Islands is a British Overseas Territory (BOT) in the Caribbean which has been able to raise up to $1.25 billion in terms of tokens offerings capitalization.

Cayman also got a FSI secrecy score of 76. The high level of financial secrecy and the low company tax rate made the country "*the most intensive offshore financial centre in the world, with foreign assets at 1,500 times the size of the domestic economy*", according to the FSI Narrative report 2020. Thanks to these combined results, the Cayman Islands figures as the first ranked country in the FSI ranking 2020.

Furthermore, the country was included in the IMF Offshore Financial Centers list 2007, and also in the EU non-cooperative jurisdictions blacklist 2019 but removed in October 2020.

The country strived to gain a better opinion in front of international authorities. The FSI Narrative report 2020 describes that for this reason some measures were adopted, of which the most important are: the US Foreign Account Tax Compliance Act – to allow the US to seek more easily information about US taxpayers – and the decision to comply with the European Union Savings Tax Directive – to have a more "automatic information exchange". Nevertheless, these measures were obviously balanced by the efforts of the Cayman authorities to introduce a new kind of entity in its commercial code, designed on the Delaware's Limited Liability Company in order to help American investors to have a more familiar vehicle to use to hide their money.

As reported by Transparency International in 2017, the majority of banks operating in the country does not have physical presence, and 85% of the hedge funds in the world have a presence in Cayman. And we can find an evidence from the involvement of the Cayman Islands in the Panama Papers scandal, because it was found that 4368 companies registered in the Caribbean country were owned by Taiwanese people (Zhuhadar and Ciampa, 2019).

Additionally, Cayman is benefitting from the so-called British "domicile rule". The FSI Narrative report 2020 on the UK states that this rule set up during the years of Empire, and still existing nowadays, allows individuals (in our case Greek ship-owners, American bankers and Russian oligarchs, wealthy Britons) who reside in the UK, but who affirm to be *domiciled* in one of the British Overseas Territories, to enjoy the preferential tax rate of one of the BOTs.

The label of offshore jurisdiction may have attracted fraudulent tokens offerings and driven the growth of capitalization.

4.3.3.6 Taiwan

Taiwan, whose official name is Republic of China, is an island country with a particular international status. Indeed, the country is internationally recognized by only 15 countries – *de facto* insignificant small countries distributed between Oceania, Latin America, and Africa. Consequently, Taiwan is isolated and not admitted to international organizations like the UN, the OECD, the World Health Organization. Or, if admitted, it is called Chinese Taipei, despite its official name. This is due to its difficult relationship with the People's Republic of China (Communist China), which arose after the end of the Chinese Civil War in 1949, when the Republic of China relocated to the island of Taiwan (also known as Formosa), while the People's Republic of China took control of the China mainland and continues to claim the control of the Taiwanese territory since then.

Under this geopolitical framework, and after the Sino-American diplomatic recognition and the UN resolution which recognized the People's Republic of China as "the only legitimate representative of China to the United Nations" in 1970s, Taiwan faced some difficulties to attract foreign investments. To cope with this problem and to compete with unregulated foreign currency markets in London and Singapore, the government created an offshore vehicle in 1983 called Offshore Banking Unit (OBU). The FSI Narrative report 2020 on Taiwan states that the OBU allowed foreign companies and individuals "*to trade in foreign currency units via Taiwanese banks with minimal supervision, little regulation, secrecy and no taxes*".

The OBU is also used by Taiwanese companies to avoid taxes, faking that investments come from foreign companies. And this could be the reason why 4368 companies registered in the Cayman Islands were owned by Taiwanese people.

Despite Taiwan never appeared in neither in the EU non-cooperative jurisdiction blacklist, nor in the IMF Offshore Financial Centers list, the government reacted weakly to the problem of money laundering. Indeed, although a legislation to fight money laundering was passed in 2018, the Taiwan Financial Supervisory Commission did nothing to disclose the beneficial owners of each OBU, but only a company's direct and major shareholders. As a result, this has generated much more opportunities for money

laundering and tax avoidance in a country in which wealth hidden offshore is equal to one fifth of the Taiwan GDP, according to IMF Data.

Furthermore, Taiwan has been ranked 13th in the FSI ranking 2020, with a secrecy score of 66. After all, it is not surprising that the country has been able to raise more than $1 billion from tokens offerings.

4.3.3.7 Estonia

Estonia is a Baltic country, member of the European Union, and shares its eastern border with Russia. According to many reports, such as the Basel AML index (in which scored 2.86 out of 10) or the FSI ranking 2020, Estonia is among the best jurisdictions in terms of Anti Money-Laundering policies. However, some doubts arise if we look at the $900 million raised from tokens offerings in few years, or if we check that the last AML control by the FATF was taken in 2014.

The efforts of Estonian governments in favour of AML and financial transparency policies are undeniable, and indeed they have been helpful to bring to the surface some important money laundering scandals. Nonetheless, the geographic position of Estonia cannot remain unconsidered. Indeed, Estonia is a strategic gateway to the European financial market for former Soviet Union countries (Boguslavska, 2019).

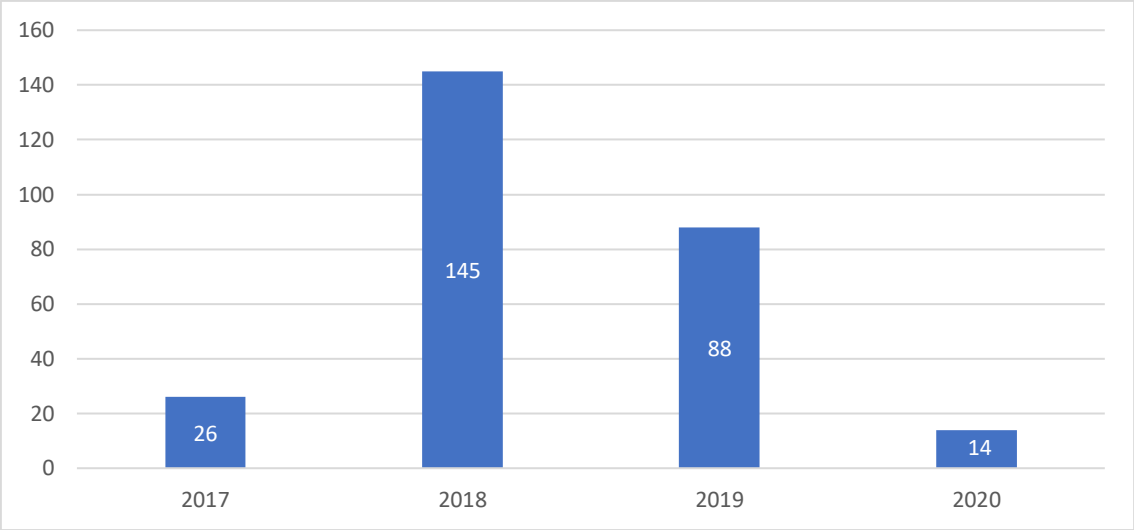
The most significant example is the Danske Estonia scandal, which blew up in 2015. From this scandal, it emerged that the Estonian branch of the biggest Danish financial institute, Danske Bank, had been the major vehicle for money laundering in the country in the years 2007-2015. Through the tiny Estonian Danske Bank branch, there were money laundered up to $200 billion. The dirty money came mostly from Russia and other former Soviet Union countries (in particular, Azerbaijan), passing through UK LLPs and LPs companies, which grant owners with personal identity secrecy (Bowers et al., 2020). Finally, the money was hidden in the Danske Estonia, which observed an unusual foreign investments growth in the period 2007-2015.

Another minor money laundering scandal involved Estonia. The Estonian branch of the Swedbank, the oldest Swedish bank, was found guilty of high-risk transactions – some of which directed to Danske Estonia – and of withholding AML information to the Swedish financial authorities in the period 2007-2015. Swedbank was charged with a fine of $4 billion in 2020 (Fulton et al. 2020).

After these scandals and simultaneously with the Danske Estonia trial, Estonian authorities revoked hundreds of licenses to companies involved in the crypto industry. Moreover, the Estonian police has found out a connection between most of frauds in the crypto industry and individuals with the E-residency[18]. Indeed, at least one third of crypto companies were pursued by a E-resident. The E-residency is a program launched by the Estonian government to push the country development and allow foreign investors to run businesses in Estonia from abroad. Since its launch in 2014, the program has issued 70,000 E-residencies to citizens from 174 countries, with a peak of requests from Finland, Russia and Ukraine. As a consequence, the Estonian authorities restricted the program and revoked more than 500 licenses to crypto companies. From 2019 to 2020 the number of crypto currency licensed companies dropped from 1234 to 353 (Ummelas, 2020).

Finally, the Estonian authorities are struggling to cope with the money laundering, but the geographic position and history of the country made it the gateway to Europe for illegal activities. As a consequence of the events occurred after 2014, Estonia will lose its position in AML rankings, as it happened to Malta from 2019 to 2020, when the FATF will evaluate the country in the future (Boguslavska, 2019).

Graph 12: Number of token offerings per year (if known) in Estonia.



Source: Own elaboration based on ICObench.com data.

[18] According to the program website "*E-Residency is the program that enables digital entrepreneurs to start and manage an EU-based company online through a digital identity issued by the Estonian government. E-Residency allows digital entrepreneurs to manage business from anywhere, entirely online*."

4.3.3.8 Hong Kong

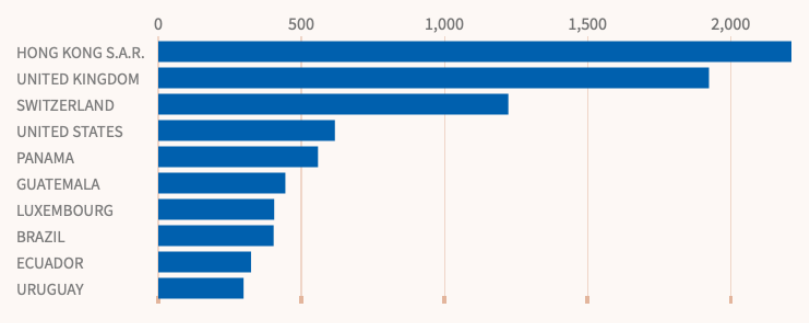
Hong Kong is a former British colony, and actually it is a Chinese Special Administrative Region (SAR) located on the southern border of China. The city is one of the most active global financial centres, and such a renowned offshore jurisdiction to be included in the IMF Offshore Financial Centers list 2007.

Hong Kong is a tax haven, since it does not charge taxes on capital gains, dividends or deposit interest, and inheritance. Only incomes produced in Hong Kong are taxed, but not those deriving from overseas trading operations, as reported by the FSI 2020 Narrative report on Hong Kong.

Hong Kong has no beneficial ownership laws in place, and that was clear when the Panama Papers scandal exploded in 2016. Indeed, Hong Kong was the most active centre for the creation of shell companies in the Mossack Fonseca international scheme, since 30% of the whole number of their offshore firms were settled in Hong Kong (Awai, 2016). The level of financial secrecy is so high in Hong Kong that the Tax and Justice Network calculated a secrecy score of 66. With such a high level of secrecy, many Chinese investors avoid taxes by using Hong Kongers shell companies, in order to be considered foreign investors when their funds come back to China (mainland). Indeed, Hong Kong figures to be the first foreign investor in China with US$1.2 trillion, according to the FSI 2020 Narrative report.

The offshore intrinsic nature of the city may have facilitated tokens offerings capital raisings the companies in Hong Kong were able to raise about $660 million from ICOs/STOs/IEOs. And suspicions that these millions come from money laundering are much more legitimate.

Graph 13: Top 10 countries where intermediaries operate in the Panama Papers.



Source: ICIJ.org.

4.3.3.9 British Virgin Islands

The British Virgin Islands (BVI) is an archipelago in the Caribbean with fewer than 36,000 inhabitants, but very attractive to foreign companies in the last 40 years. According to the FSI Narrative report on BVI 2020, there were 417,000 active companies in 2017.

The BVI is a perfect tax haven because no taxes are charged on effective income, capital gains, inheritance, gift, sales, or value added. Further, the country is a British Overseas Territory: the relationship with the UK – which gave legitimacy to the BVI financial activities – the zero-tax secrecy and lax corporate legislation and oversight have made it a prosperous offshore jurisdiction during years.

The most used vehicles offered to foreign investors are the International Business Company, which is designed on Delaware's LLCs, and Trusts, created to be a top tier vehicle for groups or for investors with diversified personal assets. And it is not a case that the British Virgin Islands were involved in the major financial scandals in the last decade. Indeed, it emerged from Panama Papers that half of companies in the Mossack Fonseca scheme were registered in this British Overseas Territory, and, in particular, there was a singular relationship with Hong Kong and China, making the BVI the second largest foreign investor in China (Pegg, 2020). Additionally, the country was significantly involved in the FinCEN Files scandal, as it resulted that 20% of SARs involved BVI companies (Pegg, 2020).

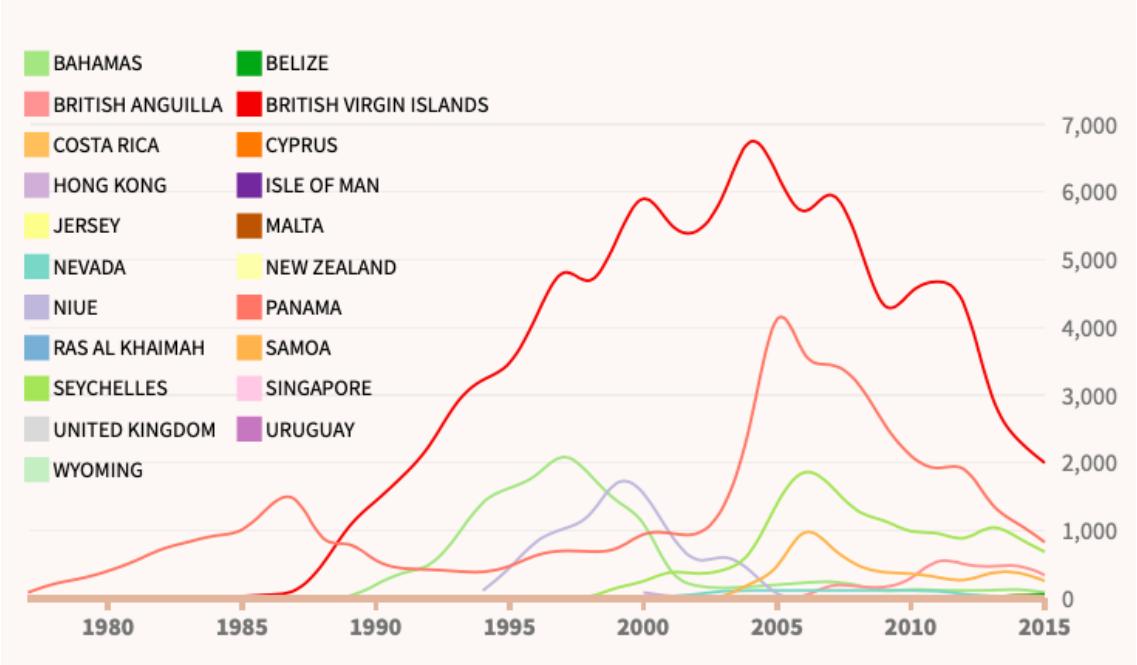
As a consequence, the British Virgin Islands have been under pressure from many foreign countries, in particular the USA, the UK, and the EU. The country responded positively becoming more transparent and providing information when the requests come from powerful countries and involved small clients, as reported in the FSI Narrative report on BVI 2020. In response to this change in transparency policies, the BVI oriented its new offshore services to investors from developing countries, which lack the power to fight money laundering and tax evasion.

The FSI ranking 2020 calculated a remarkably high secrecy score of 71, despite the country recently started discussing the introduction of a beneficial ownership law (Pegg, 2020).

Under this scenario, investments in crypto currencies and blockchain-based companies may have offered a new method of tax avoiding and money laundering, that may be

testified by the financial history of the BVI and by the fact that it has been able to raise more than $600 million from tokens offerings.

Graph 14: Tax havens used by Mossack Fonseca, where BVI is the most used.



Source: ICIJ.org.

4.3.3.10 Russia

Russia is the biggest country in the world and among the most powerful ones. Despite its bad reputation, Russia received relatively good scores in 2020 by both the Basel AML index (5.51 out of 10) and FSI (secrecy score of 57 out of 100). Nevertheless, these results need to be explained. Indeed, both these indexes place an emphasis not only on AML policies but also on Counter Terrorist Financing (CTF) efforts, for which Russia is seriously committed. According to the FATF, Russia registered 38 Terrorist Financing (TF) convictions per year, while UK had an average of 34 in the period 2014-2017, and USA has 26 convictions for TF per year (Boguslavska, 2020).

However, the true dimensions of money laundering are revealed when financials scandals erupt. As Pedro Felicio, responsible for AML at European police agency Europol, told Reuters that “huge inflows of criminal money are mainly coming into Europe from Russia and China”, and which is coupled with the “zero cooperation” from Russian authorities (O’Donnell, 2019).

As argued by Dr Andrew Foxall (2020), "Russian administration exercises political control over the domestic judiciary" since 2000s, and individuals and families close to the government have been involved in recent financial scandals, such as Danske Estonia, Swedbank, and Russian Laundromat[19]. In particular, the last one is a $20 billion scandal occurred in the period 2010-2014.

Russia has systematically tried to destabilize European financial structures (Foxall, 2020) and cryptocurrencies may have offered a perfect solution to illegal financial purposes in these years since Russian tokens offerings were able to raise more than $577 million.

[19] As explained by Harding (2017) on The Guardian, in the Laundromat scheme a company A "loaned" a significant sum of money to company B, while other Russian enterprises would guarantee these "loans". Company B would be unable to return the "money" and fail. Moldovan judges would fraudulently legitimize the "debt". At this point, Russian companies were able to move cleaned money to 19 banks in Russia, the to a bank in Moldova. Finally, the money was transferred to a bank in Latvia, entering in the EU.

CONCLUSIONS

In this thesis, I broadly analysed the blockchain technology and its financial applications with a particular focus on ICOs and relative evolutions to STOs and IEOs.

In the first chapter, I deeply analysed the blockchain technology, its functioning and applications. This technology introduced several novel concepts like decentralization and distribution, transparency and pseudo-anonymity, but the most innovative was immutability of data. In the last part of the chapter, I also studied the cases of Bitcoin and Ethereum.

In the second chapter, I focused on describing ICOs, the disrupting innovations introduced in the financial industry and the new instruments created (tokens, smart contracts, white paper). ICOs have enlarged potentially to everyone anywhere in the world the possibility to participate in fund raising a venture. Nevertheless, this unprecedented freedom from regulatory constraints has been undermined by a huge number of scams and projects' failures.

In the third chapter, I examined ICOs' evolutions to STOs and IEOs which tried to solve ICOs' issues by introducing respectively issuance platforms, which assist the venture in issuing security tokens and complying with national regulations and exchanges, which centralize the process and screen aspiring offerings to increase ventures' possibilities of success and to reduce investors' risks.

In the fourth chapter, I concentrated the analysis on national regulations in order to find a justification to the impressive volume raised by ICOs, STOs and IEOs. I noticed that there was a correlation between opaque financial systems and high levels of capital raised. Therefore, I conducted a country-by-country analysis to bring to the surface whether these countries could be fertile ground for money laundering and other illicit financial activities, and I found confirmation.

After studying this argument for more than one year, my opinion is that the blockchain technology is one of the crucial innovations of the last century, indeed it has been already adopted in different sectors with several purposes such as by notaries, accountants and lawyers for notarization, or in logistics to track items along the supply chain. However, I am sceptic regard to cryptocurrencies and ICOs.

The Initial Coin Offering is an exceptional invention, but it is completely out of control. The ease to raise funds from ICOs is mainly due to the lack of supervision to assess

whether investors are able to understand the riskiness of the investment, and so being eligible for them. Then, another reason to justify the amount of money raised is that a portion comes from illicit activities and ICOs may be a vehicle to launder dirty money. Indeed, countries which first introduced regulations to cryptocurrencies and ICOs are in reality those which I found most involved in financial scandals and frauds in the last decade. These countries allow investors who used limited liability companies to remain anonymous, or in the case someone can control companies registers it can be found that no authority really control them. Further, anonymity granted by the blockchain technology has contributed to hiding identities, and also with fraudulent purposes in some cases.

Moreover, many people and newspapers are enthusiastic in telling the benefits of bitcoin. Nevertheless, I would suggest a cautious approach because bitcoin value cannot be easily predicted. Indeed, this cryptocurrency has a high volatility and as it happened in the last year the value can fluctuate for tens thousands of dollars in a short time. In addition, cryptocurrencies are considered currencies, but they are not issued by any central bank, and no financial institution can oversee them. For this reason, I consider cryptocurrencies as means of speculation; hence the nature of cryptocurrency, and in particular of bitcoin, can be compared to gold and other precious metals, which cannot be analyzed through any balance sheet and income statement.

From the evidence I have doubts about the legitimacy of these means and I invite future research to understand if these volumes are justified by a functional economic underlying.

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