



Department of
Business and Management

Chair of
Advanced Corporate Finance

**The ICO Phenomenon, an overview and a measurement of
their long- term price performance.**

Supervisor:
Prof.ssa: Rosella Santella

Candidate:
Ernesto Parra Puig
753251

Co-Supervisor:
Prof. Stefano Marzioni

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1.Introduction.

Blockchain technology and advancements in information technologies, that work as distributed ledger systems based on peer to peer web-based systems, have been revolutionizing the traditional financing industry in incredible ways. It is the technology that has made possible things like bitcoin, and that its applications cover a wide range of functions like value holding and transfer, micropayment systems, protection against socioeconomic conditions, entrepreneurship. The following research paper will focus on the entrepreneurial side of blockchain applications, with a specific instrument with which entrepreneurs can raise funds (as a new financing option) to finance innovative ventures, and investors can earn big returns, called “Initial Coin Offerings”.

In short words: Initial Coin Offerings (ICOs) are smart contracts based on blockchain technology that are designed to raise external capital by issuing tokens (Momtaz, 2018). In an initial coin offering (ICO), an entrepreneur raises capital by selling a newly minted cryptographic token to the public. The token is usually listed on a specialized exchange quickly after the ICO, creating a secondary market. ICOs have become the prevalent source of financing for start-up companies that use the blockchain technology; more than \$30bn have been raised so far through ICOs (Lyandres and Palazzo 2020). Most ICOs have the goal of developing an online platform on which the cryptocurrency can later be used to purchase products or services (Catalini & Gans, 2018). Using this model, entrepreneurs can bypass the highly prolonged and regulated processes involved in attracting funds from traditional sources such as venture capitalists and banks (Chen, 2019).

Talking about entrepreneurial finance, the key characteristic setting ICOs apart from crowdfunding projects for example is that cryptocurrencies can be traded on a secondary market and therefore allow for financial speculation. After an ICO, the price of the cryptocurrency fluctuates according to supply and demand in the market, and is not controlled by the entrepreneur (Cerezo Sánchez, 2017). In addition, an ICO enables entrepreneurs to raise the capital at a close-to-zero transaction cost by removing the intermediaries and facing few if any regulations (Amsden and Schweizer, 2018; Momtaz, 2020a). Giving several advantages to this funding mechanism. Despite all the advantages of ICOs as a funding mechanism, ICOs have not exploded more in popularity because of challenges and risks associated with blockchain projects, volatility of cryptocurrencies, governance, regulation, fraud, environmental costs, and security, as there is no guarantee that the information coded is true (Frizzo-Barker et al. 2019).

Research has explored the impact of various factors on the success of ICOs. Given the novelty of this financial approach and the current absence of regulations, there are diverse perspectives on what constitutes ICO success. Some scholars have gauged ICO success by examining the amount of capital a project raises (Ante et al., 2018), while others have emphasized the importance of the project's technological capabilities as a key determinant of ICO success (Fisch, 2019). Additionally, certain authors have found that the likelihood of ICO success is influenced by factors such as the availability of the source code, the presence of an ICO presale, and investors' ability to access specific services or share in profits (Adhami et al., 2018). (Chitsazan et al., 2022) systematically analyzed empirical studies on ICO success and conceptualized it, into a 6 determinant framework (founder, ICO, venture, market, investor, context). (Fahlenbrach & Frattaroli, 2020) Analyzed who were the ICO investors, meaning who is investing in the tokens, and came up with really interesting results. Authors often also measured the returns of ICOs focusing mostly in the short term due to the recent phenomenon. The most prominent theories for explaining the dynamics of ICOs which are used in entrepreneurial finance include signaling and systems theory, which talk about information asymmetry among other things.

The primary purpose of this dissertation is to provide a comprehensive overview of the ICO phenomenon talking about the literature review, characteristics, lifecycle, background, market, geography, comparison to other financing methods, regulation, etc. After giving a clear picture of what ICOs are and how they work, the focus will turn in particular, on the long-term price performance (returns) measurement of them. This is because most authors pointed out that such analysis was missing in the literature, due to the recent phenomenon.

This analysis tries to assess whether the success factors that make a project successful, previously found in the literature, still hold for longer time horizons, in particular for a: 6 month, 1 year, 2 year, 3 year time frame. Moreover the analysis will try to give a new insight to the studies, measuring a variable that was identified in the literature review (total amount raised). It would be interesting to see if projects that raised more money, ended up performing better for investors, in the short term and long term. The returns will be measured using the percentage price difference found in literature, as well as the difference between the logarithmic prices. Finally 4 ordinary least square (OLS) linear regression will be performed (one for every time frame) to assess the relationship between the returns and the variables studied.

In the following chapter there will be a review on the main academic studies related to ICOs and their findings. In particular, the section focuses on the main findings in academic literature related to ICOs in terms of success factors, returns measurements, characteristics. This includes previous studies both from the entrepreneur side as well as investor side. After this, there will be an overview of the ICO industry, characteristics, regulations, lifecycle, dynamics, etc. Following there will be a detailed section on the methodology and statistical techniques adopted in the study where the models will be explained. In the same section, there will also be a description of the composition of the data of the sample. After this, the results will contain the findings related to the long term return measurement, as well as the result of the statistical regression, and the relationship between the variables chosen. In the conclusion part, there will be the final remarks of the paper, and the main takeaways and learnings.

2. Literature Review.

In this chapter we will review the main studies that have been done on the relatively new Initial Coin Offering (ICO) topic, their understanding and results. First a general description of the phenomenon will be presented. Then, it will be discussed how entrepreneurship projects are using this tool to finance new ventures and success factors. Later, why investors would consider investing in these types of assets, the empirical studies on their returns, characteristics of the ICO investor, and post ICO success. Finally research on the theoretical foundation of ICOs.

2.1 Initial Coin Offerings Background

The advancements in information and communication technologies (ICTs) provide noble opportunities for starting up new ventures (Brown et al., 2017; Cappa, Pinelli, et al., 2020; Javalgi et al., 2012; Maiolini & Naggi, 2011; Stemler, 2013; Vismara, 2016). They represent more than a tool for improving the performance and reliability of existing organizational activities, as they have become an enabling factor for the emergence of new business models that have the potential to revolutionize entire industries, consumption patterns and the quality of life (Dé et al., 2018; Qureshi, 2017; Walsham, 2017; Yeh, 2017; Zheng et al., 2018).

One of the most recent ICT implementations is represented by blockchain technologies, i.e. distributed ledger technology (DLT) systems based on peer-to-peer systems that permit the emergence of new business opportunities (Chen, 2018; A. Tapscott & Tapscott, 2017). The blockchain records all transactions made in the cryptocurrency chronologically and publicly.

Blockchain has many applications, being popular in the financial field in the form of: micropayments, value storage, value transfer, investments, funding, etc. Interestingly, blockchain technologies are attractive to entrepreneurs not just because of the possibility to launch innovative business models, but also because their nature allows them to raise financial resources in an early stage of the venture and can access large crowds for funding all over the world (Cappa & Pinelli, 2020).

It is important in the topic of blockchain to give some definitions that will be of recurrence in this paper:

A coin is a unit of value native to the blockchain. A cryptocurrency's native currency is the coin. It serves as a medium of trade within the blockchain to encourage the

network of users to use the technology. Native coins include digital currencies like Bitcoin, Ether, Ripple, and Litecoin. The only purpose of the coin is value exchange and its functionality beyond that is limited (LeBeau, 2017).

A token can have functionality beyond value exchange, it can represent any asset or functionality desired by the developer. When a token is created in ethereum it is created as a smart contract, being governed by a unique contract (Castor, 2017).

Token types (determines its legal status): Utility tokens are the most popular type of token in an ICO, it carries the right to redeem a service or product, there is no ownership right attached to them, and its regulation is low, also it's a hybrid between an investment and payment method. Security tokens convey voting rights and are governed by securities laws, they are not common for an ICO (around 3%). Cryptocurrency tokens are general purpose stores of value or medium of exchange, for taxation most fall under asset laws jurisdictions.

ERC-20 is a token standard that allows interoperability and runs in the Ethereum blockchain network technology. Such a network allows for smart contract functionality and management of value and transfer of tokens. Also exchanges with Ether, ethereum's blockchain coin (Castor, 2017).

Smart contracts are computer protocols that automate value-exchange transactions between parties. Logic can be coded into the blockchain, creating the ability to replicate, for example, business processes that execute automatically (Momtaz, 2018).

Specifically Initial Coin Offerings (ICOs) or token sales are smart contracts based on distributed ledger technology (blockchain) designed to raise external finance by issuing coins or tokens (Momtaz, 2018). The owner of the token has a key that lets her create new entries on the blockchain, and re-assign the ownership of the token to someone else. These blockchain based digital assets (crypto-tokens) are issued by entrepreneurial ventures through ICOs, i.e open calls for funding promoted by organizations, companies, and entrepreneurs to raise money in exchange for crypto-tokens that can be sold on the internet (Adhami et al., 2018). Until the end of 2019, over 5,600 ICOs have raised more than USD 27 billion (retrieved from [https:// icobench.com/](https://icobench.com/) on January 16, 2020).

Therefore ICOs are attractive both to entrepreneurs and investors for different reasons. For entrepreneurs ICOs represent an alternative to raise funds for their

ventures, at all stages with global investor reach at close to zero-transaction costs. For investors on the other hand they represent an investment/speculative asset that offers a rapid exit option thanks to the liquidity of token exchanges (Momtaz, 2018).

From its emergence in the literature in 2008 (An et al., 2018; Catalini and Gans, 2019; Howell et al., 2018; Lipusch et al., 2019), ICO has grown consistently in practice. For instance, ICO had a drop for the following two years following a great debut in 2013. Then, in 2016, a few products were reintroduced. Over 90% of ICO projects successfully raised the capital they had set out to raise in the first half of 2017 (Lausen, 2019; Lee et al., 2018; Liebau and Scheuffel, 2019). This phenomenon's market grew quickly throughout this period.

As a result, the method gained enormous popularity all over the world (Adhami et al., 2018; Amsden and Schweizer, 2018; Boreiko et al., 2019; Momtaz, 2019, 2020; Ofir and Sadeh, 2019). Despite the steep rise, ICO decreased sharply in the last months of 2017. Regulators highlighted the risks associated (upregulation, expected returns, fraud), resulting in uncertainty for founders and investors.

In a short period of time, ICO raised more money than the combined amount of the European venture capital market and all campaigns on Kickstarter, the world's top crowdfunding site (Adhami et al., 2018; Momtaz, 2020a).

2.2 Initial Coin Offerings (ICOs) to finance new ventures

An ICO is a mechanism through which new ventures can raise capital for the development of blockchain-based businesses, by selling capital to a crowd of investors, often these tokens are cryptocurrencies running on top of an existing blockchain.

ICOs represent an innovation in entrepreneurial finance. In an ICO, investors buy tokens directly from a new venture; these tokens are intended to become functional future units of the venture's project (e.g., utility function, right to ownership, royalties) (Fisch, 2019).

This new mechanism has some interesting differences from traditional entrepreneurial capital raising methodologies. Traditionally early stage startups have secured funding to initiate operations from angel investors or venture capital firms. Usually startups take on different rounds of financing (series) until the company has enough "success" that it can raise an Initial Public Offering (IPO). When a company is getting capital from this traditional equity mechanisms, its gaining capital to continue with its operations and growth, giving up in return a

portion of the ownership (equity) to the investors, that gain in the form of dividends (if the company is profitable) or cash value as the company grows and stock appreciates in the market.

Instead with a token sale, the venture has technology and a business model value proposition that rely on the token as a core feature of the operating model (Massey et al., 2017). “They’re like if the Wright brothers sold air miles to finance inventing the airplane” (Levine, 2022). The key difference is that the token is sold not as ownership in the enterprise (equity) but as a utility for the ecosystem's technology. The company sells tokens to attract new users that will engage with the product and become stakeholders, the more users in the platform the more valuable the tokens become.

The company like any startup finances its growth, operations and product with the proceeds from the tokens, the purchaser on the other hand gains product value, being able to spend those tokens in the platform, and token value appreciation with the possibility to trade it for other cryptocurrency or fiat, in a liquid crypto market (exit opportunity) leaving those who invested early with a profit.

ICOs enable startups to raise large amounts of funding (globally) with minimal effort while avoiding compliance and intermediary costs (Kaal and Dell'Erba, 2018; Sameeh, 2018).

(Fisch, 2019) in his paper examines the determinants of ICO success and tries to answer the question of what factors determine the success and funds raised in ICOs. Him and most of the other researchers that examine this exact question use signaling theory (Spence, 1973) as a framework to try to answer the question. Signaling theory is applicable because there is a high amount of information asymmetry between the key players (founders and investors). Founders need to send the right signals for business success (Spence, 2002). Ventures that are perceived as high quality from investors, will be the ones attracting more funds.

In their work (Chitsazan et al., 2022) systematically review 78 empirical studies from 2017 to 2022, incorporating signaling theory and synthesizing fragmented literature on the conceptualization and success of ICOs. They concluded that researchers have focused on 5 main themes: founders, ICO, venture, market, and investors.

This study found that the team (human capital) generates positive signals for investors, also social media sentiment was another positive signal for the ventures, and the founders educational and work background was underscored as a positive effect. Financial details affect the ventures success positively, providing an initial

price for the token, number of tokens to sell, and operating in an existing platform like Ethereum with exchange possibilities with other cryptocurrencies.

The venture's whitepaper (Before launching an ICO, the promoting startup needs to draft a document containing all the relevant information and characteristics on the venture's plans" (Cappa & Pinelli, 2020)), highly affects the ICO success.

In addition, the ventures sector, technical capabilities (GitHub), characteristics and behavior of investors were also found as success factors.

The authors developed the following framework that helps to study future ICOs projects and advanced the yet underdeveloped knowledge of ICOs:

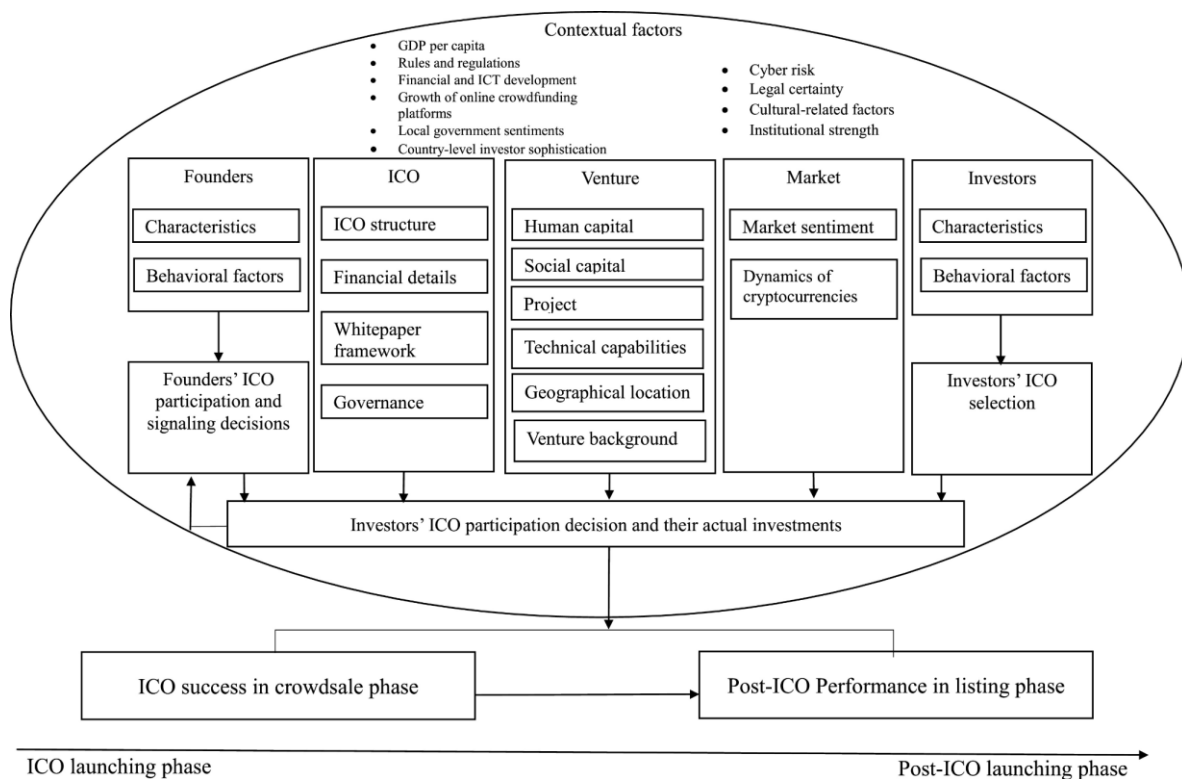


Figure 1 ICOs success framework¹

2.3 ICO investing

¹ "Chitsazan, H., Bagheri, A., & Tajeddin, M. (2022). "Initial coin offerings (ICOs) success: Conceptualization, theories and systematic analysis of empirical studies." Technological Forecasting and Social Change, 180, 121729.

As new entrepreneurial opportunities build on and around blockchains, the number of startups that offer new crypto-tokens in exchange of funds has been rapidly growing over the last few years (Extance, 2015; Eyal, 2017). Although Bitcoin and Ether clearly dominate the market with around 70% of the market capitalization (Global Chart Market Capitalization, 2020), several new cryptocurrencies are continuously being released into the market by new ventures that, instead of accessing capital through traditional forms of financing, they opt for raising money through ICOs (A. Tapscott & Tapscott, 2017). These crypto tokens will be listed and traded on a secondary market (crypto exchange), ensuring liquidity and thus monetization on the investment. Considering the global, unregulated, information asymmetrical crypto market. There are different advantages for an investor that will be discussed further, also there is a huge volatility in the success of these ventures, giving the possibility to earn very high returns at a very high risk (volatility), thus attracting different kinds of investors. In short there are two primary motivations to participate in an ICO. The first is to make a financial profit (speculators), the second to pre-purchase the product or service the venture is developing (stakeholders).

Some studies have examined the measurement of ICO performance in the short-term and long-term, to shed light on the empirical returns as well as success determinants.

(Cappa & Pinelli, 2020) Examined the returns of ICOs that took place between April 2017 and January 2018, as well as detailed information about the ventures like: beginning price, which blockchain they ran on, funds raised, funding objectives, sector of the company, Know your customer (KYC) procedures. They analyzed the returns (price changes) for the first day trading (i.e the day in which a crypto-token is listed), and also price changes over the 30 days following the listing. The average percentage price change between the crypto-token the day of the listing was 121.02% (median 29.34%) in comparison the average return over the same time period was 26.6% and 21.62% for Ether and Bitcoin. The insights of this analyzes were that: a) on average tokens increase significantly in value between end of ICO and listing date b) there is a big volatility of ICOs returns on prices c) Tokens on average outperform bitcoin and ether, lastly they noticed tokens prices peaked after one month of the ICO.

(Momtaz, 2018) Also measured short term returns (first-day returns) as raw and as equally- and value- weighted abnormal returns for ICOs between 2015 and 2018. Ranging from 6.8%-8.2% (mean), to 2.6%-3.4% (median), indicating that in the short term, on average it creates investor value. The author draws on interesting

results, pointing out that around 40% of ICOs result in negative first-day returns destroying investor value, also stating that the ICO market is positively skewed both for proceeds and first day returns (all dimensions of the ICO market). Possible explanations suggest a “hot” market (overbids), also the quality of the project are predictors of success suggesting that the wisdom of the crowd works in the ICO market.

(Hsieh & Oppermann, 2020) Also examine first day returns of ICOs from 2014 to 2018, they find an extraordinary initial return of 110%, in comparison IPOs in the same period was 15.67%, but the median return was slightly negative in their study.

They give insight into how ICOs are very risky compared to IPOs, more ICOs fail on the first day, but their profit potential is higher. Furthermore their analysis showed a significant ICO underpricing phenomenon, presale and lengthy whitepaper negatively affect the initial return, ICOs are strongly correlated to bitcoin and ether, so the cryptocurrency market has a strong influence on ICO returns.

(Fisch & Momtaz, 2020) Examine the role of institutional investors in ICOs, assessing the empirical analysis of buy-and-hold abnormal returns (BHAR) for different holding periods 1 to 12 months. They argue on the paper that institutional investors (e.g. Venture capitalists, hedge funds) are rising interest in innovative ICOs, increasing their funding from \$1 billion (2017) to \$3.9 billion (2018), these types of investors are crucial to developing the market and overcoming uncertainty. They find institutional investor backing is linked to better post ICO performance (26.5% 6 month BHAR with 3.8 SD), attributing these results to better screening (selection effect) and coaching abilities, thus minimizing information asymmetries.

(Fahlenbrach & Frattaroli, 2020) Search to characterize the typical ICO investor, and understand their motives to participate in this market. They interestingly find that the majority of investors are retail investors, finding that the average ICO has close to 4700 investors, meaning the ICO market has given access to finance innovation to a new class of investor. The motivations appear to be speculative rather than the prepurchase of the product, and investors appear to be selling in the secondary market quickly after the ICO, buying at a discount first. ICOs have features similar to lottery stocks, and most projects show a new technology with great potential (could be a reason for buying also). Finally they point out that ICO returns are on average positive 9 months after the ICO.

(Lyandres et al., 2022) Explore the Post ICO-operating performance and the financial implications it has. They measure platform adoption by a change in the number of wallets containing the ventures token as a proxy, and find two very

interesting results: first is that the relationship between platform adoption and token returns is found to be positive, second is that the relationship between platform adoption and token return volatility is found to be negative. Another result they found was that ICOs in which founders retained a larger portion of tokens are more likely to produce a working product.

2.4 Theoretical background

Most authors have used signaling theory and systems theory which form part of the crowdfunding theoretical framework and entrepreneurial finance in order to explain the dynamics of the ICOs ventures.

General systems theory:

The general systems theory, developed by Ludwig von Bertalanffy in the 1940s, offers a holistic approach to understanding complex interactions in various fields (Skyttner, 2005). A system can be understood as a combination of objects that have regular interactions and are interdependent (Mele et al. 2010). The theory emphasizes the interdependence of objects and individuals within a system, the importance of information and feedback, and the adaptation of systems based on external stimuli. Open systems theory (OTS) builds on these concepts to look at organizations and their relationships with the environment in which they operate. Organizations must be able to process information about the environment and adapt in order to survive (Katz and Kahn, 1979). In the context of initial coin offerings (ICOs), which operate as open systems, interactions with external stakeholders and feedback play a crucial role. ICO projects involve information exchange, enduring relationships, incorporating feedback, and the need for adaptation. Organizations that are able to survive in a certain context characterized by change by adapting to the feedback received are considered viable systems (Mele et al, 2020). Understanding ICOs through systems theory sheds light on their dynamics and the significance of information and feedback in their success.

Signaling theory:

Signaling theory states that several markets are characterized by an information gap between sellers and buyers, notably financial markets, in which investors don't possess the same information as entrepreneurs.

Signaling theory is crucial for understanding initial coin offerings (ICOs) within the broader context of multiple interacting systems. In the ICO market, there exists an information gap between project promoters and investors, leading to information asymmetry (Momtaz, 2019). This information asymmetry problem, as per signaling theory, arises when one party possesses more information than the other during

supra-system interactions, in this case promoters of the project hold crucial information, which investors lack. The concept of adverse selection is introduced, highlighting the risk of dishonesty when there are significant differences in information between parties. In a market characterized by adverse selection, it becomes difficult to distinguish between high-quality and poor-quality projects, which necessitates the provision of quality signals to mitigate this information imbalance. Third-party institutions play a role in collecting unbiased information and acting as channels between market participants to enhance transparency.

Signaling theory revolves around signalers, receivers, and signals. Signalers, who possess privileged information, aim to transmit that information to receivers to project high-quality projects. Effective signals should be observable to receivers and involve costs to ensure their value and prevent easy replication. The signaling theory assumes that equivalent signals have different costs depending on the quality of the projects. In venture capital (VC) projects, aspects such as problem size, solution elegance, entrepreneurial team, financial statements, and legal aspects are typically verified during due diligence (Yadav, 2017). Without proper information transfer between participants the market will perform poorly, hence the importance of institutions in signaling information. However, ICO projects, being highly technological and associated with substantial financial risk, face increased information asymmetries and a lack of information disclosure, emphasizing the need for signaling.

In ICOs, signals affirming high-quality projects may include patents, technical whitepapers containing costly and detailed technological information, and high-quality source code. These signals aim to reduce information asymmetries and may be presented in whitepapers, dedicated ICO websites, or social networks such as Twitter or GitHub.

Success factors:

Signals play a crucial role in the success of ICO projects by reducing information asymmetries and enhancing their perception as high-quality ventures. However, there are additional factors that contribute to project success, even if they do not fulfill the criteria of being signals. Previous research has primarily focused on adapting crowdfunding success factors to ICO projects due to their similarities. Identified success factors include industry, location, team size, number of advisors, social network presence, share of retained equity/tokens, and early investment possibilities (Campino et al., 2022). These factors can be categorized as project-related or campaign-related, with significant emphasis placed on the importance of

social networks as a determinant of success. Team characteristics have also received attention in the literature.

2.5 Geography

As highlighted in King and Levine (1993), innovative activities co-evolve with capital markets, financial systems, and the legal environment.

In this part of the chapter we will examine where ICOs are most present, this means which countries have more ICOs than others, and what could be the possible explanatory reasons for that.

In their research (Huang et al., 2019), they tried to answer this exact question studying 915 ICOs between 2017-2018 in 185 countries, which resulted in the following figure.

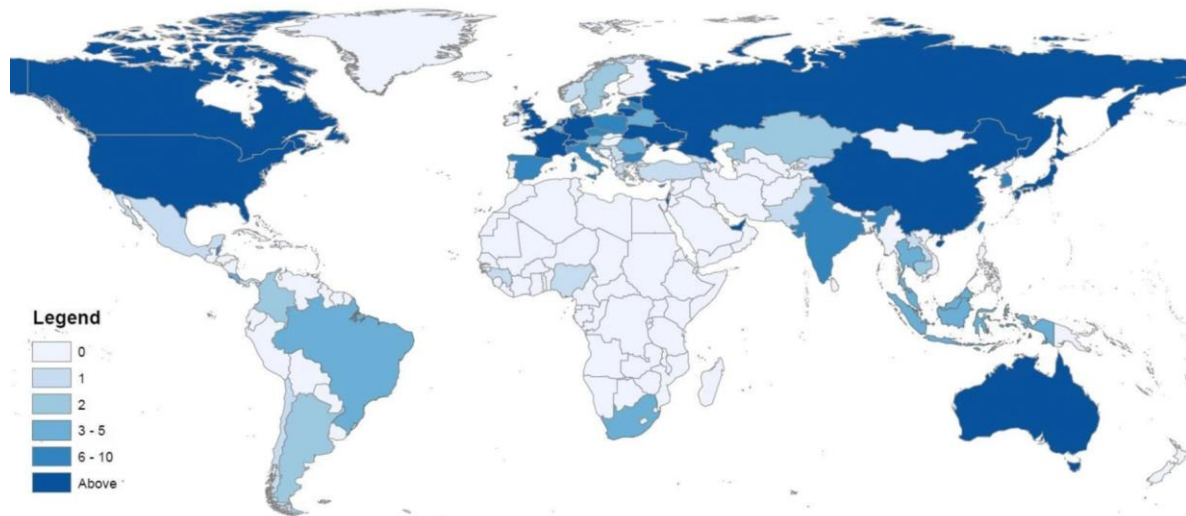


Figure 2 Map of the world with the number of ICOs by country²

They considered In line with entrepreneurship studies, 4 country-level perspectives that have a potential influence in the evolution of digital entrepreneurial activities. Particularly: development of financial systems, information and technology (ICT) development, ICO regulation status, and the growth of online crowdfunding

² Huang, W., Meoli, M., & Vismara, S. (2019). The geography of initial coin offerings. *Small Business Economics*. <https://doi.org/10.1007/s11187-019-00135-y>

platforms. Finally taxation is also examined in the study, to see whether tax friendly countries attracted more ICO projects.

Relationship between ICOs and variables of the study.

A well-functioning capital market can stimulate demand for entrepreneurship, as a larger financial market provides greater potential for transforming existing business models through innovative services and digitalization. This concept aligns with the ideas of Schumpeter (1934), who posited that effective banks play a role in driving technological innovation by identifying and funding entrepreneurs with the greatest potential for implementing innovative products and processes successfully. The success of these innovative investments then encourages imitators to emerge, fostering innovation in various sectors. Essentially, advanced financial markets naturally foster tech-enhanced entrepreneurship. Numerous studies have confirmed the positive relationship between financial systems and economic growth, both theoretically and empirically (Bencivenga et al., 1995; Demirgüç-Kunt and Maksimovic, 1998). According to King and Levine's (1993) model, robust financial systems support economic development by assisting potential entrepreneurs and financing promising innovative projects. A well-developed financial system is thus correlated with the growth of high-quality entrepreneurs and projects, leading to increased rates of productivity improvements (King and Levine, 1993), thus it should be expected that a well developed financial system positively influences ICO creation.

Previous research has demonstrated the positive impact of information and communication technology (ICT) development on economic growth by reducing transaction costs (Lichtenberg, 1995; Colecchia and Schreyer, 2002; Roller and Waverman, 2001). Greenstein and Spiller (1996) formulated a model illustrating the importance of investments in digital infrastructure, particularly local telephone networks. Investments in digital technology not only influence consumer demand for telecommunications but also foster the establishment of businesses within communities. As technology improves the business environment, it paves the way for the emergence of diverse business models and services, creating entrepreneurial opportunities in the market. Undoubtedly, a more advanced digital economy has a higher propensity to generate demand for entrepreneurship. As countries increase their investments in ICT to enhance economic growth and social interactions, they create opportunities for entrepreneurs and tech-skilled human capital to venture into new business ventures.

Crowdfunding and ICOs share similarities and differences, firstly both ICOs and crowdfunding essentially occur on internet-based platforms. In practice, ICOs are primarily used to fund early-stage ventures (theoretically they can fund any stage), similar to crowdfunding. Both ICOs and equity crowdfunding (different from donation, debt and reward based crowdfunding) involve return-based investment instruments and offer tokens or shares as value representations. In terms of risk perception, equity crowdfunding provides investors with equity shares, allowing them to realize returns only when they sell their shares, ICOs share this characteristic with equity crowdfunding, as ICO investors bear uncertainties until they sell their tokens on secondary markets. The absence of rigorous regulation on ICO portals makes the fundraising process easier compared to crowdfunding platforms. Furthermore, the ICO market is more liquid than the crowdfunding market, as ICO investors have the ability to sell their tokens on the secondary market. ICOs and equity crowdfunding might, therefore, play competing roles in the financing of innovative ventures and could be supplements or even complements.

Results.

In choosing their location, digital ventures may not be driven by the same factors as more traditional entrepreneurship (Lehmann et al. 2018). The research findings yield valuable insights. ICOs are more prevalent in countries with well-established financial systems and equity markets, advanced investments in ICT infrastructure and human capital skills, and a regulatory framework for ICOs. Furthermore, the number of ICOs in a country correlates positively with the development of crowdfunding markets. However, the analysis does not reveal similar relationships between ICOs and other traditional alternative finance methods like debt, venture capital, and private equity funds. The complementary connection between ICOs and crowdfunding platforms demonstrates that digital fundraising technologies are preferred by innovative ventures and cater to the investment needs of small investors. The prevalence of ICOs is higher when fundraising methods are more direct and disintermediated. Moreover, the initial findings indicate that tax considerations do not play a crucial role in determining the choice of launching an ICO.

3. Characteristics and Market overview

3.1 History and Characteristics

To trace back the history of ICOs, following up the developments in information and communication technologies (ICTs) that first made blockchain possible. In July 2013, the first ICO took place. More than \$5 million worth of Bitcoins were able to be raised for the Mastercoin project (now Omni). Since then, more than 165,000 tokens have been generated on the Ethereum blockchain, and as of January 2019, about 5,000 businesses had launched an ICO. However, only 20 ICOs generated around 37% of all ICO revenue in 2017 (Momtaz, 2018).

As for any financial deal (ICO included) it's the outcome of the matching between supply and demand for capital. In the past, there were different ways these projects were conducted and structured, however as the market matures, there is a clear way to structure an ICO and a movement to standardization, with careful planning and a good execution that is centered around key characteristics (Massey et al., 2017), which should be included and explained in the projects technical white paper, the most basic characteristics are:

Cap on the amount of money to raise. It has become acceptable to cap the amount of money a venture can raise, this is due to the fact that in the past some uncapped ventures have caused high price volatility of the token and also ether, affecting the projects reputation and fund usage credibility.

Time limit on the token sale. This characteristic is important and can complement the first point, because it allows investors to decide when is the best time to invest based on their valuations of the project or motives. However the time limit doesn't always work, because investors rush to buy immediately after the offering. In this case the token sale ends when one of two things happens first, the cap is reached or the time limit is. There is no rule of thumb for how much an offering can last (can be hours, days or even a year), but tokens that are created on the ethereum

blockchain (most of them) have to follow the Ethereum Request for Comment 20 (ERC20) standard. The standard provides a list of rules for the token to be listed.

Transparency of the token volume in circulation and in the sale. Possibly the most important characteristic of a token sale. It helps the buyers to determine the value of the token during the sale, in a more accurate way. It should be made transparent the amount of tokens held by developers, owners, and held for future growth. The smart contract should be programmed to limit the creation of new tokens after a certain level or arbitrary.

Clear token value, typically quoted in relation to fiat money or popular cryptocurrencies like bitcoin and ether.

3.2 Comparison to other financing methods and valuation

A comparison between ICOs and other conventional financing methods will be presented, such as crowdfunding, venture capital, and initial public offerings (IPOs). An overview developed by (Momtaz, 2018), synthesized some key differences between the methods. It compares the characteristics of the firm, investors, and deal characteristics.

	Initial Coin Offerings	Reward Crowdfunding	Equity Crowdfunding	Venture Capital	Initial Public Offerings
Panel A: Start-up or Firm Characteristics					
Funding stage	Theoretically all stages	Before seed stage (prototype)	Early stage	Balanced-stage	After later stage
Issuance	Utility tokens, cryptocurrencies, or security tokens	Product (vouchers)	Equity-like instruments	Equity shares	Equity shares
Panel B: Investor Characteristics					
Investors	All types	Early adopters	Angel investors	Limited partners	Public
Motivation	Financial and non-financial	Financial and non-financial	Financial and non-financial	Financial	Financial
Panel C: Deal Characteristics					
Investment amounts	>\$100k	\$1k—\$150k	\$100k—\$2m	\$500k—\$10m	>\$10m
Transaction costs	Low	Low	Low	Medium	High
Information basis	Whitepaper	Project description	Business plan and pitch deck	Business plan and pitch deck	IPO prospectus
Degree of regulation	Low	Low	Low	Medium	High
Panel D: Post-Deal Characteristics					
Liquidity	High (if listed)	Low	Low	Low	High
Voting rights	Security tokens: yes; utility tokens and cryptocurrencies: no	No	No	Yes	Yes
Exit options	ICO, open market	IPO, acquisition	IPO, acquisition	IPO, acquisition	Open market

<https://doi.org/10.1371/journal.pone.0233018.t001>

Figure 3 Funding methods comparison³

³ Momtaz, P. P. (2020). "Initial coin offerings." Plos One, 15(5), e0233018.

Startup/Firm characteristics.

There is usually a funding method that corresponds to the stage and needs of the venture. Crowdfunding is used in early stages, Venture Capital covers all stages (balanced-stage), and IPOs are used at a later stage for high growth of established firms and the possibility to raise large amounts in regulated capital markets. Contrasted with ICOs can theoretically be employed during all funding stages, even though the majority of ventures are early stage entrepreneurial projects. Examples of ICOs that have successfully raised funds cover a range of hundreds of thousand up to 4.2 billion dollars. Another difference between the fundraising methods besides the risk, is what investors obtain as a return of their money. With crowdfunding investors receive products or equity-like instruments, whereas in venture capital or IPOs, investors receive stocks. ICOs on the other hand, can give investors utility tokens (products or services), cryptocurrencies (mediums of exchange), or security tokens (equity shares). In this sense it's notable that tokens have more flexibility in terms of structure and uses.

Investor characteristics.

Traditional financing methods usually attract similar types of investors. Early adopters and angel investors are drawn to reward and equity crowdsourcing, respectively. Traditionally, sophisticated investors are more drawn to venture capital and IPOs. Additionally, these funding techniques have different investor motivations. While investors in ICOs and crowdfunding are frequently motivated by both financial and non-financial reasons (such as altruism, product interests, providing feedback, etc.), venture capitalists and IPO investors are more likely to be motivated by financial reasons. It's interesting to see that ICOs in this sense are also different and attract all kinds of investors (early adopters, altruistic, small retail, institutional), and also its interesting the findings of (Fahlenbrach & Frattaroli, 2020) were they observed the average ICO has 4,700 investors.

Deal and Post-deal characteristics.

The fact that ICOs have almost no transaction costs and require documentation and regulations similar to those of crowdfunding campaigns (minimum) but may allow start-ups to raise significant funding on par with expensive and strictly regulated venture capital transactions or IPOs is a major factor for their rising attractiveness. The after-market liquidity is one of the main factors that attracts investors to ICOs. Even while this isn't the case for all tokens, within three months

of the ICO's finalization, many tokens are listed on a token exchange platform that allows online trading around-the-clock. Neither Venture capitalists nor Crowdsourcing are able to offer the same levels of liquidity as ICOs initiatives. Depending on the type of token issued, ICOs can also flexibly carry voting rights, which is a noteworthy design feature.

The exit method is possibly the biggest striking ICO benefit. Exits in venture capital or crowdfunding campaigns are frequently unrealized before a particular maturity stage and impractical immediately since a possible purchaser must be found or an IPO must be planned. ICOs, on the other hand, offer the earliest exit option out of all forms of fundraising. Although the majority of ICO projects keep a portion of the tokens, the liquidity of the tokens ensures rapid exits at any moment, given that the token is listed (Momtaz, 2018).

Valuation.

Many of the blockchain-based initiatives being developed are "protocols" which govern how users interact in a decentralized autonomous network. According to this framing, users conduct transactions among a decentralized network of participants using the native tokens produced during the ICO without the aid of a centralized body or platform. The value of the decentralized network depends on the number of users that decide to conduct transactions using the specified protocol, just like it does with other platforms or marketplaces that link people.

A study by consulting firm EY (EY Research: Initial Coin Offerings (ICOs), 2017) analyzed 317 ICO projects trying to understand among other things how investors are valuing these financial instruments. They found some interesting points that are then synthesized in the following figure.

The most common type of token sold during an ICO is for a means of payment for services on a future blockchain platform. Valuation depends on many parameters that are difficult to determine at the development stage. In most cases, valuation is determined by hype, white paper quality and token sales technique.

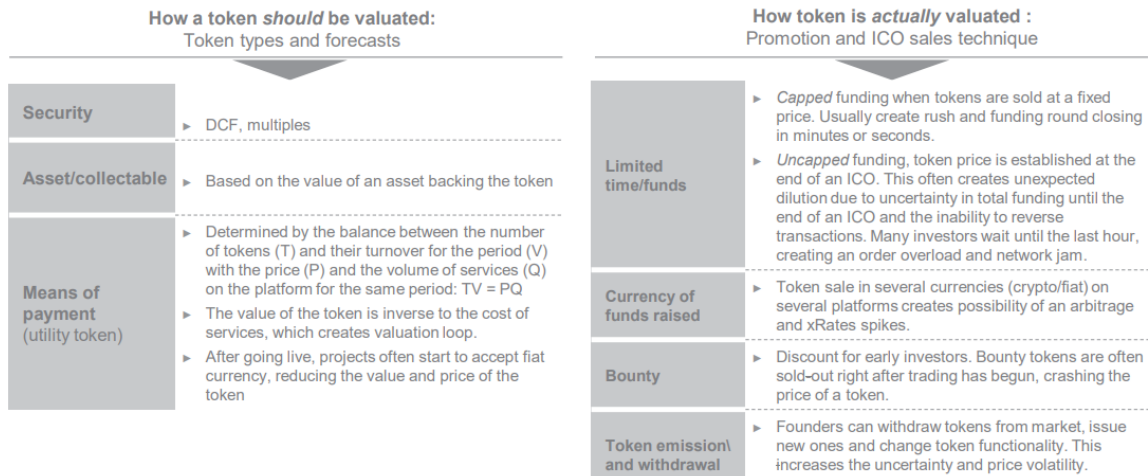


Figure 4 Token valuation⁴

The research mentions the following points:

If there was a balanced supply and demand, the valuation would be more closely related to a stock, based on the project forecasts and token nature. Instead it is based more on a “fear of missing out” sentiment. The most frequent type of token sold during an ICO is a utility token (means of payment for products and services developed by the venture), security and cryptocurrency tokens are less frequent. Therefore the token valuation is based on parameters difficult to assess at the start or development of the project - balance between the number of tokens (T) and their turnover for the period (V) with the price (P) and the volume of services (Q) on the platform for the same period: $TV=PQ$.

Tokens have a dual nature, that further complicates valuation, Investors hope that their platform results successful, incrementing users (customers) and as a result token price. If the price of the token increases, the service cost in the platform would decrease (expressed in tokens). So the value of a utility token is inverse to the cost of a service unit. ICOs sales techniques and preparation drive capitalization, capped funding (sold at a fixed price) usually creates a rush and

⁴ EY research: initial coin offerings (ICOs). (2017). https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/banking-and-capital-markets/ey-research-initial-coin-offerings-icos.pdf

funding closes quickly. Uncapped funding (price established at the end) makes investors wait until the end because of the uncertainty, and often creates unexpected dilution.

3.3 Process and life cycle

Let's remember these projects are platforms that work on the blockchain, and the value of the new cryptocurrency depends on the size of the network, also how much funds are raised depends on the awareness and value creation signals they send to investors. Therefore the process of an ICO starts and finishes before and after the coin offering. In this part of the chapter we will explore what an ICO process usually looks like, (de Andrés et al., 2022) developed a diagram that represents this process:

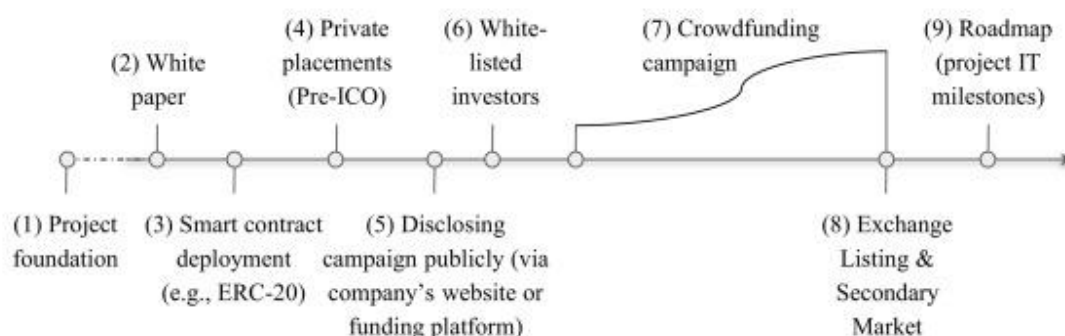


Figure 5 ICO Process⁵

An ICO starts when an entrepreneur feels they have reached a point in the development of a product or service that allows potential investors to recognize its merits and potential (Ibba, Pinna, Baralla, & Marchesi, 2018). Consequently, what the entrepreneurs think is a value-creating project, excluding opportunistic ventures or scams (that nonetheless happen), have to announce their idea through marketing campaigns. Marketing the project starts as soon as the project itself,

⁵ de Andrés, P., Arroyo, D., Correia, R., & Rezola, A. (2022). Challenges of the market for initial coin offerings. *International Review of Financial Analysis*, 79, 101966. <https://doi.org/10.1016/j.irfa.2021.101966>

announcing: project characteristics, future offering, objectives, business plan, blockchain, etc. A web page development usually accompanies early marketing activities and a white paper publication, explaining all the technicals, developments, and roadmap. Social Media plays an important role for marketing campaigns, the most commonly used are Telegram, Twitter, Facebook, Reddit, Slack, bitcoin talks, and also crowdfunding websites like Gitcoin. Marketing efforts aimed at community leaders or influential players try to increase the effectiveness of the campaign.

Following the first disclosure of information and marketing efforts, a smart contract is deployed in a Blockchain (overwhelmingly Ethereum, Haffke & Fromberger, 2020). As stated before, the majority of projects go on existing blockchains like Ethereum that provide interoperability with other tokens in the network, the token standard ERC-20 (runs on Ethereum) creates a template and besides governing a set of functions it makes it relatively straightforward to create a token, hence the popularity rise in ICOs.

A Pre ICO which is a private placement (at discount prices) before the public offering can be present. A Pre-ICO has the goal of raising funds (lower desired amount), offering incentives to early adopters, cover costs of actual ICO, and send information to investors about pricing and volume for example.

Before the ICO an important step is to ensure the token does not fall under securities regulation, this can be done by the Howey test which will be explained later in the chapter. The pricing of an ICO is usually quoted on a single cryptocurrency (de Andrés et al., 2022), and usually follows one of two ways: is set by the issuer or determined through a Dutch auction system. For quality projects niche advisors have appeared, offering services that are close to what a traditional investment bank would do. At this point marketing intensifies, and another way to attract interest is to offer early participants a place in the white-list. The list is especially helpful (giving priority) when there are “hot” projects listing and the blockchains can become congested making order execution troublesome.

During the designated campaign period, potential investors participate by placing orders and receiving corresponding tokens, similar to a subscription period in a public offer. Typically, successful campaigns last for a few days, while unsuccessful ones may extend significantly (with an average duration of 40 days according to Howell et al., 2020). The conclusion of a prosperous campaign is marked by the listing of tokens (tokenization) after the ICO. This way tokens can be traded, providing liquidity, new investors, and is the start of the token to be used as a

currency. Token listings can occur on either Centralized Crypto Exchanges (CEX) or Decentralized Crypto Exchanges (DEX). While the importance of DEX is currently limited and lacks conclusive data on initial token listings compared to CEX, DEX is gradually gaining significance, accounting for approximately 10% of CEX trading volumes (Aspris, Foley, Svec, & Wang, 2021). CEX platforms offer user-friendly interfaces, high liquidity, easy conversion of cryptocurrencies to fiat currencies, and are generally more reputable than DEX. However, CEX platforms involve complex listing procedures (e.g., KYC and AML), control over user assets (custodial services), and a higher vulnerability to hacking attacks due to their size. However, according to Aspris et al. (2021), when ICOs have simultaneous access to both DEX and CEX for trading, the trading volumes in CEX tend to multiply by a factor of 70.

The completion of a successful ICO does not mark the end of the issuance process, even when tokens begin trading in a secondary market. The issuer may still lack full access to the funds raised, and it becomes crucial to ensure investor satisfaction in order to generate demand for future offerings. In terms of accessing the funds, the smart contract may have linked their release to the achievement of specific business milestones outlined in the Roadmap, which the issuer must now strive to fulfill. Additionally, providing liquidity may necessitate engaging the services of market makers, a requirement that applies to tokens listed on both centralized and decentralized exchanges (Angeris, Evans, & Chitra, 2020).

It's important to point out that even though the process uses blockchain, it also relies on traditional internet protocols (webpage, social networks) it is prone to attacks, they are easy to generate, and the lack of regulation and standardization creates information asymmetries. Finally funds access and management (custody) from part of the team, can be problematic for investors.

3.4 Regulations and Presence

Regulations.

ICOs offer entrepreneurs a more cost-effective means of accessing external finance compared to other financing methods due to minimal regulatory barriers and limited accreditation standards. Kaal and Dell'Erba's (2018) comparative analysis of regulatory responses of 25 ICO jurisdictions reveals ICOs are permitted or not explicitly prohibited by most of the countries.

But regulators are getting more active if there are signs of lawbreaking, several warnings have been issued concerning risky ICOs, and in fact, some regulators moved from ignoring ICOs to banning them or regulating them in accordance with

the token type. Although the interpretation for token type varies greatly between countries (EY Research: Initial Coin Offerings (ICOs), 2017).

As an example, while the UK displays an open and positive attitude towards the emerging fundraising method of ICOs, the Financial Conduct Authority (FCA) has cautioned investors regarding the potential high risks associated with ICOs. The FCA highlights that many proposed business models are in early stages or experimental phases. In a similar vein, the European Securities and Markets Authority (ESMA) has issued warnings to investors about the high-risk nature of ICOs and has established regulations requiring ICO firms to meet relevant regulatory standards (see ESMA press release on 13 November 2017).

In the United States, ICOs that issue equity and securities, are mandated to register and obtain licenses from the US Securities and Exchange Commission (SEC). Consequently, trade transactions related to such ICOs are subject to regulation under the SEC's authority. That's why previously mentioned "Howey test" is a crucial step preceding the ICO, to ensure the project's token does not fall under the legal definition of security and hence regulation. The Howey Test was developed in a U.S. Supreme Court case in 1946 and lays down criteria according to which a token might be considered a security from a regulatory standpoint. The four main criteria are (i) there is investment of money, (ii) profits are expected, (iii) money investment is a common enterprise, and (iv) any profits come from the efforts of a promoted or third party. The feature that most projects exploit to pass the Howey Test is that they make a decentralized cryptocurrency that is equivalent to a currency (or simply cash) with no central owner (Momtaz, 2018). Another regulation trend is that industry players are developing their own principles (rules) to fill the regulatory gap. One of the most recognized is the simple agreement for future tokens (SAFT), according to which investors receive an option until the token can be actually used as a means of payment (see figure 6).



Figure 6 Market players regulation⁶

Legal system development is essential for shaping regulations of the ICO market and helps stabilize the formation of this relatively new financing tool, reducing uncertainty (Huang et al., 2019). A well-developed digital regulation environment is more likely to accommodate the special needs from the ICO market.

Presence.

From (figure 2) (Huang et al., 2019) map countries by their number of ICOs, it's important to mention that ICOs are not restricted by physical boundaries or borders. We can see from the figure the top 5 countries (USA, Russia, UK, Singapore, and Switzerland). It is also worth noting that the British territories occupy only 2% of the ICO market around the world, instead when it comes to non domestic IPOs, they make around 27%. This is explained as mentioned by their studies because of developments in these countries in the areas of: financial systems, information technologies (infrastructure), regulations, crowdfunding platform adoption.

⁶ *EY research: initial coin offerings (ICOs)*. (2017). https://assets.ey.com/content/dam/ey-sites/ey-com/en_gl/topics/banking-and-capital-markets/ey-research-initial-coin-offerings-icos.pdf

An outlier of the study would be Russia (second biggest ICO market), because it scored low in these categories and the explanatory/control variables, except for population and tertiary education. They argue that Russia has a strong human capital specifically in mathematical knowledge and this could be part of the explanation.

Another interesting picture can be seen when we look at the 15 biggest ICOs since 2016 (in terms of amount raised \$) developed by PWC (2020)
















#	Name	Total raised amount (USD mn) ¹⁾	End of offering (month)	Focus	Industry	Country
1	EOS ²⁾	4'100	06/2018	Blockchain infrastructure for decentralized apps	BC infrastructure	 Cayman Islands
2	TELEGRAM	1'700	03/2018	Tokens to enhance messenger ecosystem	Social media	 British Virgin Islands
3	BITFINEX	1'000	05/2019	Tokens for fee discounts in the iFinex ecosystem	FinTech	 Hong Kong
4	TATATU	575	06/2018	Social entertainment on the Blockchain	Entertainment	 Cayman Islands
5	DRAGON	320	03/2018	Decentralized currency for casinos	Gambling	 British Virgin Islands
6	HUOBI TOKEN	300	02/2018	Token/ Coin for South Korean crypto exchange	FinTech	 Singapore
7	HDAC	258	12/2017	IOT platform backed by Hyundai BS&C	Internet of things	 Switzerland
8	FILECOIN	257	09/2017	Decentralized market for data storage	Data storage	 USA
9	TEZOS	232	07/2017	Blockchain infrastructure for decentralized apps	BC infrastructure	 Switzerland
10	KINESIS NEW	194	09/2019	Yield-bearing digital currency based on gold & silver	FinTech	 Cayman Islands
11	SIRIN LABS	158	12/2017	Secure open source consumer electronics	Consumer electronics	 Switzerland
12	BANCOR	153	06/2017	Enabling direct conversion between tokens	FinTech	 Switzerland
13	BANKERA	151	03/2018	Banking for the Blockchain era	FinTech	 Lithuania
14	POLKADOT	145	10/2017	Interoperability protocol across multiple Blockchains	BC infrastructure	 Switzerland
15	GCBIB	143	01/2019	Multi-asset digital wallet	FinTech	 United Arab Emirates

Figure 7 15 biggest token offerings overall since 2016⁷

We can see from this picture a huge difference in terms of funding, how it goes from over 100 million dollars up to 4.1 billion. Talking about the previous literature mentioned in this study, it seems like there are a few big winners in the market, and although ICOs are primarily used for early-stage funding, as the pictures suggest, there are still projects that raised big amounts of money, that would correspond to more mature ventures, in the more traditional funding mechanisms. Then, we can see that the geography of these ventures corresponds more or less to

⁷ [Presentation title] 6 th ICO / STO Report A STRATEGIC PERSPECTIVE SPRING 2020 EDITION In collaboration with. (2020).

https://www.pwc.ch/en/publications/2020/Strategy&_ICO_STO_Study_Version_Spring_2020.pdf

where the biggest markets are, and that many of these ventures come from the same countries. Finally we can see that the industries in which the ventures operate are varied (fintech, BC infrastructure, entertainment, etc) with fintech being the most repeated on the list.

3.5 Advantages and disadvantages.

This part of the chapter will briefly synthesize the advantages and disadvantages of ICOs that have been mentioned so far:

Advantages:

There are several notable advantages associated with Initial Coin Offerings (ICOs) that make them an appealing financing method, particularly in the context of blockchain technology and decentralized networks.

First and foremost, ICOs offer the significant advantage of reduced transaction costs. This is arguably one of the most crucial benefits. Smart contracts, known for their flexibility, have the capability to replace traditional financing methods with minimal transaction costs. By doing so, they effectively lower the expenses associated with raising capital. This reduction is achieved by circumventing the need for intermediaries and payment agents, streamlining the fundraising process. Furthermore, ICOs promote innovation by breaking down certain barriers that often hinder the development of innovative projects. They can serve as catalysts for open-source project development within decentralized networks. This openness to innovation contributes to the growth of blockchain technology and its associated applications.

Another compelling advantage of ICOs is their ability to gauge consumer demand and marketability at an early stage. This early feedback mechanism is invaluable for developers as it provides insights to enhance the platform and encourages healthy competition among potential buyers. Additionally, ICOs align the incentives of various stakeholders, including developers, users, and miners, all of whom share an interest in the platform's success.

The liquidity of tokens issued through ICOs is yet another advantage. When these tokens are listed on cryptocurrency exchanges, it opens up the possibility for innovators to quickly exit their positions, providing them with flexibility and potential for rapid returns on their investments.

Lastly, ICOs are financially sound choices for projects characterized by uncertain payoffs, a high proportion of idiosyncratic risk, and a significant risk of failure, as noted by Domingo et al. in 2020. This makes ICOs a suitable funding avenue for

ventures that may be considered too risky or unconventional by traditional investors.

In summary, ICOs offer reduced transaction costs, foster innovation, reveal consumer demand, provide liquidity for tokens, and make financial sense for projects with high uncertainty and risk profiles. These advantages collectively contribute to the appeal of ICOs as a means of financing in the blockchain and decentralized network space.

Disadvantages:

However, it's important to acknowledge that Initial Coin Offerings (ICOs) also come with their fair share of disadvantages, which warrant consideration in the context of blockchain-based fundraising.

Firstly, there is the risk of token depreciation, which is not fundamentally different from what can occur with regulated investments. The value of tokens in an ICO can fluctuate, subjecting investors to potential losses.

Furthermore, the ICO market has faced criticism due to its susceptibility to scams and security breaches. Unfortunately, there have been instances where fraudulent activities and hacks have taken place, highlighting the need for enhanced security measures and due diligence.

Asymmetric information and the absence of traditional institutions to signal the quality of a project can also pose challenges within the ICO space. Investors may struggle to gauge the legitimacy and potential of a project, leading to uncertain investment decisions.

Governance is another area of concern. Since tokens typically do not grant voting power to investors, their ability to influence the project's future direction and success is limited. While centralization can offer guidance to a venture in its early stages, the blockchain operates differently, with decisions being made collectively by the community.

The architecture of blockchain technology, which is resistant to unilateral changes by centralized parties, presents both an advantage and a challenge. During an ICO, the software protocol must embed as many rules as possible to govern the protocol permanently. Predicting all necessary rules for long-term success can be a complex and uncertain task.

Lastly, ICOs have the potential to expose a project's strategic details. Many early-stage ventures prefer to keep sensitive information private to prevent competitors from gaining insight into their ideas. However, participating in an ICO often necessitates revealing a startup's strategic roadmap and code, which can be copied by competitors for their own protocols.

In summary, while ICOs offer unique advantages, they are also associated with drawbacks including token depreciation, susceptibility to scams, asymmetric information, governance challenges, architectural complexities, and the exposure of a project's strategy. These disadvantages underscore the importance of careful consideration and due diligence when engaging in ICOs within the blockchain ecosystem.

4. Methods

4.1 Research Gap and Hypothesis

Previous research on ICO returns has predominantly concentrated on short-term assessments, primarily examining first-day returns, and occasionally extending the analysis to cover a span of six months to a year. This limited temporal scope was largely due to the novelty of ICO projects, which lacked sufficient historical price data for more extended analyses. To address this research gap, this study proposes a comprehensive examination of returns over varying time horizons: 6 months, 1 year, 2 years, and 3 years, contingent upon the availability of data. Moreover, this investigation will incorporate established success factors from the existing literature to evaluate their persistence over more extended periods.

Additionally, a distinct research gap identified during the literature review refers to the relationship between the initial fundraising success of ICOs, measured by the amount of funds raised, and their long-term performance. Consequently, this paper will delve into these critical inquiries, constituting the central focus of the research. In light of these considerations, the primary hypothesis guiding this study is formulated as follows:

Hypothesis (H): ICO projects that secure the highest levels of fundraising will exhibit superior performance for investors across the four distinct time intervals: six months, one year, two years, and three years.

4.2 Methodology and data collection

There will now be an explanation of the methodology used to conduct the analysis. The procedure to determine the initial returns of the ICOs, was to follow the basic approach for IPO initial returns (Ritter & Welch, 2002) which is basically the difference between the closing price between the date and the closing price on the first day of trading.

$$\text{Initial Return} = \frac{P_{\text{first}} - P_{\text{ICO}}}{P_{\text{ICO}}}$$

Also due to the volatility of ICOs and because of mathematical properties, it was considered appropriate to measure the returns as the logarithmic difference between the closing dates, as (Dombrowski, Drobotz, & Momtaz, 2023) performed in their analysis :

$$R_{i_t} = \ln(P_{i_t}) - \ln(P_{i_{t-1}}),$$

where P_{i_t} is the closing price of the ICO i at time t .

The dataset utilized in this study encompasses Initial Coin Offerings (ICOs) conducted in the year 2017, ensuring that these projects remained active for a minimum of three years following their launch, with corresponding price data available for these specified durations.

The selection process for these ICO projects drew inspiration from the work of Fahlenbrach and Frattaroli (2020). Specifically, their research focused on ICOs that garnered funding exceeding \$1 million, as smaller-scale projects often lack comprehensive or accessible data. To ensure the sample's representativeness, a diverse range of industries, legal structures, and a portion involving Know Your Customer (KYC) procedures were included.

Data pertaining to these ICOs was primarily sourced from the research paper by Fahlenbrach and Frattaroli, further supplemented by the Token Offerings Research

Database (TORD), created by Momtaz, P.P. (2021). As of January 2021, TORD stands as the largest publicly accessible repository of token offerings, encompassing more than 6,400 ICOs, Initial Exchange Offerings (IEOs), and Security Token Offerings (STOs).

Subsequently, price data for these ICOs was manually gathered from the Cryptocurrency Market Capitalizations website (<https://coinmarketcap.com>), recognized as one of the most widely accessed databases for cryptocurrency market information. This comprehensive platform provides details on various crypto-tokens available for trading.

It's important to note that out of the initial 180 ICOs assembled, only 42 possessed complete information across all variables and maintained price records spanning the entire three-year period. Consequently, the dataset encompasses a total of 168 return observations, derived from the 42 projects evaluated over four distinct time intervals.

Following the work of (Chitsazan et al., 2022) and the framework they developed, it was decided to include at least one variable from the 5 main categories of an ICO project: Founders, ICO, Venture, Market, Investors.

4.3 Proposed model

To compute the ICO returns with the OLS model, the following regression model was proposed:

$$R_{it} = \beta_0 + \beta_1 TSi + \beta_2 ETi + \beta_3 WPi + \beta_4 MBi + \beta_5 KYCi + \beta_6 CEi + \beta_7 CSi + \beta_8 TARi + \epsilon$$

Where R_{it} is the dependent variable and denotes ICO returns in four time horizons: 6 months, 1 year, 2 years, 3 years.

The independent variables are divided as follows:

TSi is the team size of the project in number of people, ETi is a dummy variable that takes the value of 1 if the team had ICO experience, and 0 in all other cases, WPi is the number of pages present on the projects white paper, MBi is a dummy variable that takes the value of 1 if the project reported a business model, and 0 in all other cases, $KYCi$ is a dummy variable that takes the value of 1 if the project reported a “know your customer” control, and 0 in all other cases, CEi is a dummy variable that takes the value of 1 if the project reported some sort of “celebrity endorsement campaign”, and 0 in all other cases, CSi is the number of days the

crowdsale lasted (actual), TARI is the total amount raised in millions of dollars for each project.

R studio software was used to perform the analysis.

4.4 Results

Descriptive statistics.

The presented descriptive statistics in **Table 1** reveals insights into the initial returns of the examined ICOs over various timeframes. Notably, there are positive average initial returns observed at the 6-month mark (+70%) and over a more extended 3-year duration (+200%), representing striking numbers. However, it's worth highlighting that the average initial returns are less favorable for the 1-year period (-22%) and the 2-year span (-28%), where negative average returns are present.

The considerable standard deviations across all timeframes signal significant fluctuations and pronounced volatility within the measured returns. Furthermore, a distinctive characteristic is observed as the median consistently falls below the mean, indicative of a right-skewed distribution. Across all timeframes, returns exhibit a negative skewness, with negative values at the 25th percentile. It is only at the 75th percentile that returns turn positive, a trend that holds true for both the 6-month and 1-year periods.

In the case of logarithmic returns, an interesting pattern emerges. Average returns prove negative across all four timeframes, accompanied by a decrease in the standard deviation, indicating a reduction in return volatility. Similar to the initial returns, logarithmic returns register negative values at the 25th percentile across all periods and transition to positive territory at the 75th percentile for the 6-month and 1-year intervals. Notably, the density function of logarithmic returns, as shown in **Figure 8**, exhibits a positive skewness. The majority of projects within all timeframes portray negative returns, while a select few projects showcase remarkable returns, exerting an upward pull on the overall return averages. However, this skewness is less pronounced when considering logarithmic returns, thereby motivating the continuation of the analysis using this variable (log returns).

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
1 icori_6m	0	1	0.769	2.71	-0.981	-0.763	-0.555	1.07	10.9	
2 icori_1y	0	1	-0.220	0.994	-0.998	-0.933	-0.838	0.507	2.20	
3 icori_2y	0	1	-0.281	1.85	-1.00	-0.979	-0.912	-0.535	8.66	
4 icori_3y	0	1	2.05	10.4	-1.00	-0.942	-0.895	-0.235	50.6	
5 team_size	0	1	9.82	6.57	2	6	8	12	33	
6 whitepaper	0	1	31.0	19.9	9	23	28	37	127	
7 crowdsale	0	1	21.7	21.7	1	1	15	34	68	
8 tot_amount	0	1	26.9	28.2	0	9.79	20	34.8	159.	
9 log_icori_6m	0	1	-0.442	1.51	-3.96	-1.44	-0.811	0.728	2.48	
10 log_icori_1y	0	1	-1.50	1.88	-6.50	-2.70	-1.82	0.410	1.16	
11 log_icori_2y	0	1	-2.48	2.40	-9.52	-3.84	-2.43	-0.766	2.27	
12 log_icori_3y	0	1	-1.93	2.56	-7.77	-2.85	-2.25	-0.268	3.94	

Table 1 Descriptive statistics

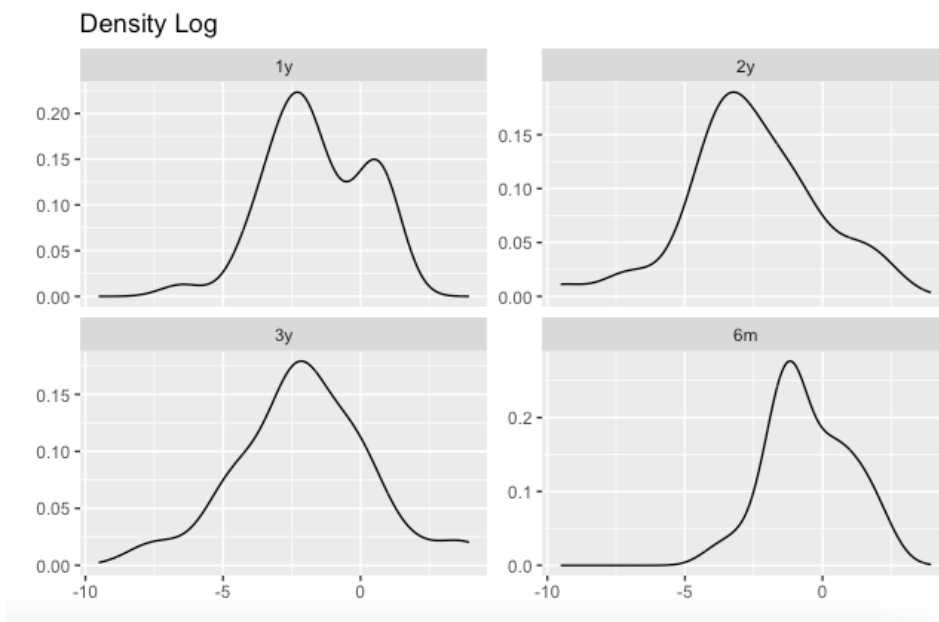


Figure 8 Log returns density function

These initial results imply the riskiness of investing in ICOs, but the profit potential is very big, compared to conventional assets. It also suggests information asymmetry in the crypto market and uncertainty about the valuation of ICOs, meaning Cryptocurrencies are market inefficient (Al-Yahyaee et al., 2018; Urquhart, 2016).

Correlation coefficients.

Table 2 provides the correlation coefficients of the variables used in the study.

	log_icori_6m	log_icori_1y	log_icori_2y	log_icori_3y	team_size	whitepaper	crowdsale	tot_amount
log_icori_6m	1	0.864 ***	0.7496 ***	0.6459 ***	-0.1475	-0.1725	-0.1768	0.0205
log_icori_1y	0.864 ***	1	0.8715 ***	0.7431 ***	-0.1824	-0.2166	-0.0768	0.1797
log_icori_2y	0.7496 ***	0.8715 ***	1	0.9145 ***	-0.2085	-0.1803	-0.1048	0.2207
log_icori_3y	0.6459 ***	0.7431 ***	0.9145 ***	1	-0.1959	-0.1537	-0.2326	0.1485
team_size	-0.1475	-0.1824	-0.2085	-0.1959	1	0.5489 ***	-0.0369	0.0697
whitepaper	-0.1725	-0.2166	-0.1803	-0.1537	0.5489 ***	1	0.0306	-0.0829
crowdsale	-0.1768	-0.0768	-0.1048	-0.2326	-0.0369	0.0306	1	-0.0289
tot_amount	0.0205	0.1797	0.2207	0.1485	0.0697	-0.0829	-0.0289	1

Table 2 Correlation coefficients. *, ** and * indicate statistical significance at the 10%, 5% and 1% level, respectively.**

All the correlations are lower than the suggested threshold of 0.7, meaning there are no multicollinearity issues.

From a correlation perspective, it is noteworthy that all non-categorical independent variables (namely team size, whitepaper page count, time of crowdsale, and the total amount raised in dollars) exhibit negative correlations with returns across all examined time frames, except for the total amount raised. Particularly there is a negative correlation associated with the team size variable, implying that, in terms of correlation, larger teams are associated with poorer returns. Conversely, the correlation analysis suggests that as the project secures more funds, returns tend to improve, although this trend does not hold for the 6-month time frame.

Regression results.

Table 3 reports the results of the 4 linear regressions (6 months, 1 year, 2 years, 3 years) analysis.

Variables	ICORi 6M	ICORi 1Y	ICORi 2Y	ICORi 3Y
(Intercept)	2.73 * (1.16)	0.644 . (0.343)	0.891 (0.994)	8.885 (6.08)
team_size	-0.041 (0.109)	0.003 (0.035)	-0.062 (0.089)	-0.38 (0.486)
exp_team1	-2.663 (1.567)	-0.861 (0.54)	-0.944 (1.149)	-7.849 (6.318)
whitepaper	0.005 (0.023)	0.001 (0.008)	0.027 (0.027)	0.127 (0.148)
bus_model1	0.166 (1.529)	-0.866 * (0.36)	-1.016 * (0.471)	-3.546 (2.623)
kyc_aml1	-0.472 (1.127)	-0.563 (0.485)	-0.775 . (0.419)	-1.627 (1.773)
celeb1	-1.109 (0.891)	-0.312 (0.368)	0.007 (0.529)	1.52 (2.615)
crowdsale	0.009 (0.018)	0.016 . (0.009)	0 (0.01)	0.005 (0.049)
tot_amount	0.004 (0.013)	0 (0.006)	0.004 (0.011)	0.028 (0.046)
Adj.R2	0	0.214	0.058	0
F.Stat	0.883	2.086	1.248	0.965
N.Obs	33	33	33	33

Table 3 Regression results

The regressions results can be interpreted in the following way:

For the 6 month period, there is a negative relationship between the returns and the coefficients of: Team size, Team experience, KYC procedure, Celebrity endorsement. As opposed to a positive relationship for the coefficients of: White paper page count, Business model, Crowdsale length, Total amount raised. There is no statistically significant variable for this regression, and the R square value is 0, meaning the model is not explaining the variability (Generally, the higher the R-squared, the better the model fits the data, on a scale from 0 to 1).

For the 1 year period, there is a negative relationship between the returns and the coefficients of: Team experience, Business model, KYC procedure, Celebrity endorsement. As opposed to a positive relationship for the coefficients of: Team size, White paper page count, Crowdsale length. The coefficient for the total amount raised is 0, meaning it doesn't affect the returns for the 1 year period. There is one statistical significant variable at the 10% level (low) which is the business model, meaning the projects that presented business had lower returns for the 1 year period. The R square value is .214 meaning the model is able to predict some of the variability, but it's still a low value.

For the 2 year period, there is a negative relationship between the returns and the coefficients of: Team size, Team experience, Business model, KYC. As opposed to a positive relationship for the coefficients of: White paper page count, Celebrity endorsement, Crowdsale length, total amount raised. There is one statistical significant variable at the 10% level (low) which is the business model, meaning the

projects that presented business had lower returns for the 1 year period. The R square value is .058 meaning the model is not predicting the variability.

For the 3 year period, there is a negative relationship between the returns and the coefficients of: Team size, Team experience, Business model, KYC. As opposed to a positive relationship for the coefficients of: White paper page count, Celebrity endorsement, Crowdsale length, total amount raised. There is no statistically significant variable for this regression, and the R square value is 0, meaning the model is not predicting the variability.

The regressions performed on the returns indicate that the explanatory power of the variables is quite low, and the only variable that showed some degree of significance was the business model variable (negative). Some mixed results were present in terms of the value of the coefficients across the time frames and success factors, and the relationship they had with the returns. But in general team experience and size, as well as KYC procedures negatively affected the returns. On the other hand in general the white paper page count, crowdsale length, and total amount raised, affected the returns positively.

The aim of the analysis, through the regression models, was to answer the research question and hypothesis of this paper:

Hypothesis (H): ICO projects that secure the highest levels of fundraising will exhibit superior performance for investors across the four distinct time intervals: six months, one year, two years, and three years.

The response to this question lies in the observation that, although the coefficient associated with the variable TARI (Total amount raised) consistently maintained a positive value in all regressions, it failed to attain statistical significance in any of the models. Consequently, this lack of statistical significance precludes its validation for the intended scope of this paper.

4.5 Discussion

Drawing upon signaling theory (Spence, 1973), which serves as the theoretical foundation for the examination of ICO projects and entrepreneurial finance, it becomes evident that the quality of a project is closely intertwined with the strength of the signals it conveys to its stakeholders. In essence, the more compelling and positive the signals emitted by a project, the higher the anticipated quality of the project, and by extension, its expected performance.

As a quick recap, most previous research has identified that ICO structure, financial details, whitepaper framework, and governance as the signals that founders generated to guide and attract investors in their decision to invest in their ICO projects (Chitsazan et al., 2022). Also the venture's technical capabilities (Fisch, 2019), including its patent, online code repository (GitHub), and the total number of committed codes, as well have a significant association with ICO success. Several papers showed that the return, volatility, and price of these cryptocurrencies have a significant relationship with ICO success, and ICOs are positively associated with the general trend of the whole cryptocurrency market (Cappa & Pinelli, 2020). (Momtaz, 2018) showed in his work that the quality of the management team is a first-order predictor for the success of ICO projects, whereas highly visionary projects trade at a discount due to an increased probability of failure.

The objective of this study was to examine whether the variables incorporated into the model would retain their significance in the context of a more extended analysis, spanning up to three years. This extended analysis sought to address a research gap resulting from the recent emergence of ICOs. Despite the absence of statistically significant variables in the model and the consequent inability to confirm the hypothesis, it is noteworthy that a positive relationship was observed for crowdsale and total amount raised. This suggests that these projects may have exhibited higher quality and were more effective in signaling this quality to potential investors.

Regarding returns over longer time horizons, the results are less clear. Initial returns over a two-year period were -15%, whereas returns over a three-year period surged to 179%. Notably, the descriptive statistics reveal a discernible trend: the maximum return value increases as the time horizon lengthens. This trend implies that holding a token with strong performance over an extended period can potentially yield remarkable returns.

5. Conclusion

Blockchain and crypto-tokens are recent phenomena that are increasingly attracting the interest of both academics and practitioners (Catalini & Gans, 2016; Chen, 2018; Extance, 2015; Fisch, 2019; Giudici & Adhami, 2019; Larios-Hernández, 2017; D. K. C. Lee et al., 2018; Marsal-Llacuna, 2018; Swann, 2017; D. Tapscott & Tapscott, 2017).

ICOs have the potential to change how new projects raise money, providing more control to entrepreneurs, greater liquidity to investors, and additional investment opportunities to early adopters. Regulatory uncertainty surrounding ICOs has slowed their explosive growth. It is unclear whether they will soon become a popular option for early-stage financing or whether this trend will subside (Domingo et al., 2020).

Previous studies have provided an overview of the differences among crypto-tokens (Arvind et al., 2016; Böhme et al., 2015; Dwyer, 2015; Halaburda & Sarvary, 2016), the implications brought about by ICOs for traditional fundraising (Böhme et al., 2015; Catalini & Gans, 2016; Gans & Halaburda, 2015; Walport, 2015; Yermack, 2015), and explored the dynamics of ICOs (Fisch, 2019; Giudici & Adhami, 2019), also the conceptualization of success factors that drive success for the ventures. The understanding of the returns on investments in ICOs is still limited, specially for longer time horizons.

After making a long term price performance measurement in four time periods (6 months, 1 year, 2 years, 4 years) the results were mixed but in some cases in line with previous studies, for example the distribution of returns is skewed to the right, meaning the majority of the projects present negative returns, but there are a few "winners" that deliver impressive returns and drive the average. In general the dynamics presented for 1 year studies dont change too much for 2 or even 3 years. The importance of correctly signaling investors couldnt be statistically proved, but we can see positive relationships between the white paper page count, total amount raised and returns.

ICO returns have characteristics analogous to lottery stocks, and most projects involve innovative technologies that could result in significant efficiency gains and new uses. Retail investors have been demonstrated to be interested in both of these features (see Kumar 2009 or Cooper et al. 2001, for examples). These traits may be the reason why retail investors bought ICOs even though there was little information available about the funded companies and why ICO returns are often positive on average in the short and long term.

This research faced several limitations, primarily stemming from challenges in data availability for the selected projects. The absence of a unified database posed a significant constraint. Additionally, the project selection process was influenced by

the project selection set forth in (Fahlenbrach & Frattaroli, 2020), which focused exclusively on projects that raised over \$1 million in funding. Consequently, the final dataset utilized for the model represented a subset of this larger dataset, encompassing only those projects that remained listed for a duration of three years post-ICO and possessed price data sourced from CoinMarketCap. This resulted in a smaller data set in the study, which is not great. These constraints introduce potential biases in the analysis.

Nonetheless, this study makes contributions to the understanding of ICOs and its awareness. It is advisable for future researchers to better understand what drives ICO returns, also utilizing more extensive datasets. ICOs are particularly intriguing due to their novel approach to entrepreneurial funding, offering numerous advantages and the potential to drive innovation and economic growth. Furthermore, they hold substantial appeal for investors, whether retail or institutional, given their capacity to generate significant returns. As institutional investors increasingly incorporate ICOs into their portfolios, market efficiency may improve, and information asymmetries could decrease.

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[Presentation title] 6 th ICO / STO Report A STRATEGIC PERSPECTIVE SPRING

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