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Blockchain and Initial Coin Offerings: Blockchain´s Implications for Crowdfunding

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December 2018

in: Business Transformation through Blockchain
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WI-843

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Abstract

Interest in Blockchain technology is growing rapidly and at a global scale. As scrutiny from practitioners and researchers intensifies, various industries and use cases are identified that may benefit from adopting Blockchain. In this context, peer-to-peer (P2P) funding through initial coin offerings (ICOs) is often singled out as one of the most visible and promising use cases. ICOs are novel forms of crowdfunding that collect funds in exchange for so-called Blockchain tokens. These tokens can represent any traditional form of underlying asset and have already been used, among others, to denote shares in a company, user reputations in online systems, deposits of fiat currencies, and balances in cryptocurrency systems. Importantly, ICOs allow for P2P investments without intermediaries. In this chapter, we explain the fundamentals of ICOs, highlight their differences to traditional financing, and analyze their potential impacts on crowdfunding.

Keywords

Blockchain, Initial Coin Offering, ICO, Distributed Ledger Technology, Crowdfunding, Cryptocurrency, Crypto-token, Use Case Analysis

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1. Crowdfunding and Blockchain

The concept of crowdfunding, a novel method for raising venture capital (Mollick 2014), has increasingly gained recognition from entrepreneurs and established companies, leading to an estimated $738 million in allocated funds in 2016. Crowdfunding can generally be described as a public invitation to invest in a project or startup, usually issued via the Internet, where campaigns may be supported by a large group of interested individuals (Danmayr 2014).

There are multiple examples of successful crowdfunding campaigns. Likely the most popular was that by the US technology startup Oculus VR. In April 2012, the company announced a virtual reality headset and subsequently started a campaign on Kickstarter, the most prominent crowdfunding platform. The campaign not only proved successful but also raised $2.4 million in funding—ten times more than its initial goal of $250,000 (Kickstarter 2012). Approximately six weeks after the campaign, Oculus started shipping the advertised product (Luckey 2013). The project was not only known to developers but also generated strong media attention (Griffiths 2013). Naturally, even established technology firms became interested in Oculus's virtual reality technology. Two years after this Kickstarter campaign, Facebook acquired Oculus for $2.3 billion.

Although there are many successful examples of crowdfunding campaigns, the concept still has significant downsides, especially for a funder. Use of a crowdfunding platform is seldom free. To use its service, one usually must pay a commission based on the total funds raised, as well as a payment processing fee (Taylor 2013). Also, trust is a key challenge when seeking venture capital via crowdfunding. As a company without any prior business, it may be hard to gain sufficient investor credibility. To ensure that investors feel safe enough, most companies use platforms such as Kickstarter for their crowdfunding activities. These platforms seek to implement far-reaching policies to reduce the risk of fraud for investors. Although these mechanisms may help to build some trust, they also strictly limit the way crowdfunding can be done according to the platform's rules.

In the same year as Oculus VR's Kickstarter campaign, the software developer J. R. Willett also sought to raise venture capital for a project called MasterCoin. He was fascinated by the opportunities offered by the cryptocurrency Bitcoin and wanted to further enhance them. At the time, Bitcoin was mainly used to do very simple transactions, namely, sending money from one account to another. Willett saw a strong potential to enable even very complex financial functions—for instance, the implementation of smart property and savings wallets—by adding a new communication layer on top of the existing Bitcoin network. To support this project, one could send Bitcoins to the team overseeing the software development. In exchange, contributors received digital tokens that represented the provided support. These tokens would later be used as the primary currency to conduct financial services in the MasterCoin environment. Even if someone was unwilling to use these financial services, they would still have incentives to purchase tokens. The ongoing development of the project may attract more people who would like to use the service. The higher demand would then result in a higher value of the usage token,

so that initial contributors could sell their tokens and make a profit (Willett 2012). Willett's idea succeeded. After his fundraising campaign in July 2013, he had a fund of 5000 Bitcoins, then worth approximately $500,000 (Jaffe 2018). This process of raising venture capital later became known as an initial coin offering (ICO), relating to the term initial public offering (IPO) (Schweizer et al. 2017).

Comparing the concepts of crowdfunding and ICO, we find several similarities. First, both approaches are primarily used to get venture capital to fund overall growth of a company or to finance new projects. Second, a public fundraising call makes it possible for almost anyone to invest. Third, since the Internet provides the fundamental basis for communication and payment, anyone can contribute from almost anywhere in the world. Fourth, in most cases, the contributors get something in exchange for their investment, for instance, hardware, a token that makes it possible to use a software package, or a share in the company's equity (Kravchenko 2017).

We also find differences between crowdfunding and ICO. Foremost, the underlying system employed in the fundraising process has far-reaching implications. While traditional crowdfunding uses central platforms hosted by a third-party provider, an ICO utilizes a decentralized peer-to-peer (P2P) network and Blockchain technology to conduct operations (Schweizer et al. 2017). Blockchain enables the completion of financial transactions in a trustless environment—there is no need for trust in any entity. In a crowdfunding campaign, crowdfunding platforms and banks serve as these trusted entities. In an ICO, transactions are verified by a network-wide consensus mechanism. Applying these attributes, we can see how Blockchain in the form of an ICO counteracts the aforementioned downsides of crowdfunding. Since one no longer needs platforms or financial institutions, funders can save money they would otherwise need to spend on related services. Further, there are almost no rules or platform policies to be considered when doing an ICO, which gives one great flexibility when raising funds (Enyi and Le 2017).

Since its first appearance, Blockchain technology has steadily evolved, and is now seen as a multipurpose technology, providing Turing-complete programming languages that allow for the implementation and execution of business logic. These Blockchain programs are called smart contracts and are based on computer protocols. Smart contracts enable complex transactions without being explicitly triggered by an external third party. The smart contract source code is stored on every node of the Blockchain and, when triggered, is executed on every node of the network (Christidis and Devetsikiotis 2016; Glaser 2017). These smart contracts make it now very easy to issue digital on-chain tokens and thus implement trust-free trade in an asset (Buterin 2014; Beck et al. 2016; Kõlvart et al. 2016). Thus, in 2016 alone, the estimated volume of raised funds via Blockchain tokens was $250 million. By November 2017, the cumulative funding exceeded $4500 million (CoinDesk 2018; Smith and Crown 2017). While technology startups are interested in raising funds via the sale of crypto-tokens, regulators are also addressing this topic. For instance, the Swiss Financial Market Supervisory Authority has released guidelines describing how to do ICOs and how to apply financial market legislation (Lux

and Mathys 2018). The potential of this unregulated sale in shares is substantial. Reducing costs for fund-seekers and increasing trust for potential investors are an exciting improvement over the previous crowdfunding system.

To be able to fully leverage the potential of this novel form of fund-seeking, we must thoroughly understand the theoretical background of ICOs, as well as its implications. We will now focus on the underlying Blockchain technology, the theoretical concept of crowdfunding, and ICOs' main characteristics. In section "Blockchain and ICOs Are Reshaping the Crowdfunding Sector", we take a close look at Blockchain technology's implications for traditional crowdfunding and ICOs' roles regarding financial regulations. In section "Benefits, Challenges, and Consequences of ICOs", we will further describe potentials, challenges, and future development of ICOs.

2. Background

2.1 Blockchain and Smart Contracts

The global interest in Blockchain has increased substantially in the past few years, since various practitioners and researchers are recognizing its potential to radically change a broad spectrum of business processes (Beck et al. 2016; Wright and Filippi 2015). While the technology is commonly known as the enabler of Bitcoin, numerous current applications already go beyond its initial cryptocurrency application (Crosby et al. 2016).

Blockchain can be described as a decentralized transaction and data management technology (Yli-Huumo et al. 2016) that enables data sharing across a network of multiple participants (Xu et al. 2017). Transactions between users are grouped into blocks that are cryptographically chained to one another in chronological order—hence the name Blockchain. A consensus algorithm running on all participating nodes guarantees the correctness and order of transactions. There are multiple such algorithms (proof-of-work, proof-of-stake, proof-of-elapsed-time, etc.) that provide varying levels of security, latency, and energy consumption (Christidis and Devetsikiotis 2016; Zhang et al. 2016).

In short, Blockchain systems have the following characteristics (Schlatt et al. 2016):

- Data redundancy, to ensure persistence among the transactions and data
- Use of cryptography, to ensure data security and integrity
- Use of a consensus algorithm, to coordinate transactions among the network peers
- Decentralization, which enables trusted direct interaction among the network peers
- Auditability, transparency, and verifiability of network activities

Blockchain can be used in various ways, from allowing new forms of distributed software architectures to a wide range of associated use cases and tokens (see section "Tokens and Cryptocurrencies"). The associated tokens range from distributed virtual currency (called cryptocurrencies) to asset representation or digital rights management on the Blockchain (Conley 2017; Nærland et al. 2017).

Since its introduction by Satoshi Nakamoto in 2008, there has been a three-step evolution: Blockchain 1.0, 2.0, and 3.0. These categories illustrate the way of blockchain technology from its original cryptocurrency use case of Bitcoin (1.0) to the ability to implement programs on the Blockchain (2.0) (so-called smart contracts), to justice, efficiency, or coordination applications (3.0) (Swan 2015).

Public interest in the first generation of Blockchain only sparked when its role as the basis for cryptocurrencies was discovered after the publication of Bitcoin: A Peer-to-Peer Electronic Cash System under the pseudonym Satoshi Nakamoto (Nakamoto 2008). The first generation of Blockchains was a breakthrough in computer science, because distributed networks, cryptographic technologies such as hash functions, and asymmetric encryption were first linked. The technology was the first to efficiently solve the double-spending problem (Kopfstein 2013), which allowed one to infinitely copy digital assets (Swan 2015).

The second generation of Blockchain evolved in 2013 with the introduction of Ethereum, which went beyond (cash) transactions. Ethereum has a built-in, Turing-complete programming language called Solidity, which provides a general-purpose programmable infrastructure. This infrastructure enables the use of smart contracts (Buterin 2014). The concept of smart contracts, which was first introduced in 1994 by Nick Szabo, describes a computerized transaction protocol that automatically executes terms of a programmed contract on a Blockchain. Although not all smart contracts are contracts in the official form of contract law, they can enable massive automatization of processes, since their tamperproof characteristics allow for the option to design generic interactions between mutually distrustful parties (Lauslahti et al. 2017). A trusted network is controlled by a network administrator, whereas an untrusted network cannot be controlled or managed. Smart contracts enable programmable transactions and can be used to control digital assets, implement a trust-free trade in assets, and facilitate the issuance of tokens (Buterin 2014; Teutsch et al. 2017; Nærland et al. 2017).

Currently, second-generation Blockchains are still in the prototype development phase. The next steps will be a rollout of the Blockchain 2.0 use cases in working environments. Thus, as yet, Blockchain 3.0 is mostly still a concept and an ideal.

The third generation of Blockchain is expected to move beyond transactions and second-generation smart contracts and is mainly about three topics: scalability, interoperability, and sustainability. In the context of cryptocurrencies, one can think of scalability from three perspectives: transactions per second, network, and data. These perspectives are directly interlinked; that is, the more people join the network, the more data will be produced and the more transactions per second will be needed to handle the increasing number of transactions and data in the Blockchain.

Interoperability means that not one Blockchain rules them all. We already have many Blockchain networks such as Bitcoin, Ethereum, Ripple, or Litecoin. All these systems have their own business logic and rules. As yet it is difficult for the different networks to understand one another. Blockchain

3.0 must offer a standard and must link these different networks without a trusted third party, such as an exchange.

Sustainability means that, once implemented, Blockchains should not be seen as a static technology but as a technology that can be modified when technology and use cases change. Changing something in a Blockchain means that a so-called forking (i.e. changing the underlying protocol) must be done. This is a problem faced by first-generation and second-generation Blockchains. Thus, Blockchains can break apart. Examples of forks are Bitcoin and Bitcoin Cash or Ethereum and Ethereum Classic.

In third-generation Blockchains, smart contracts are being developed into decentralized autonomous organizational units with their own laws and high autonomy and in almost all spheres of life, including government, health, and science (Swan 2015). Cardano and ICON are examples of projects that are building third-generation Blockchains.

Cardano as third-generation Blockchain addresses the scalability aspect by using a proof-of-stake consensus mechanism instead of proof-of-work. In terms of interoperability, Cardano has a sidechain concept which allows cross-chain transfers. For sustainability Cardano plans to implement improvement proposals via hard or soft forks (Cardano 2018). ICON is a decentralized network hyperconnecting the world, with the goal of developing global standards for inter-blockchain networks. With ICON, isolated communities like capital markets and insurance and healthcare companies can connect and share various services through the ICON network (ICON 2018).

New distributed ledger technologies besides Blockchain are also being developed; these can become part of and often referred to as Blockchain 3.0 although they are not strictly Blockchains. These new technologies no longer have blocks but are directed acyclic graphs. The tangle of IOTA and Swirlds hashgraph are well-known representatives of directed acyclic graphs. Especially Blockchain's limitations in terms of scalability and micro-transactions for Internet of Things (IoT) applications can be overcome with these technologies (Bashir 2017). A block in the Bitcoin Blockchain currently has a limited size of 1 megabyte and is mined about every ten minutes. Subsequently, only seven transactions per second can be executed (Zheng et al. 2017). Many micro-transactions must be executed in order for machine-to-machine communication in the IoT to occur. This demands a technology that can handle many more transactions per second than first-generation and second-generation Blockchains.

2.2 Tokens and Cryptocurrencies

Token can have a multitude of meanings and can be defined as "a piece resembling a coin issued as money by some person or body other than a de jure government" (Merriam Webster 2018). We use token to refer to the usage of digital tokens in the context of Blockchain. From a technical perspective, tokens can be used for various purposes, such as the facilitation of transactions, as an internal unit of account, or to grant token-holders privileged access (Conley 2017; Glaser and Bezzenberger 2015; Schweizer et al. 2017). As illustrated in Fig. 1, tokens can be separated into the tokens inherent to a

Blockchain (protocol tokens) and tokens issued on top of a Blockchain using smart contracts (application tokens or on-chain tokens). On-chain tokens are created by smart contracts whose most prominent enabler is the Ethereum Blockchain (Schweizer et al. 2017).

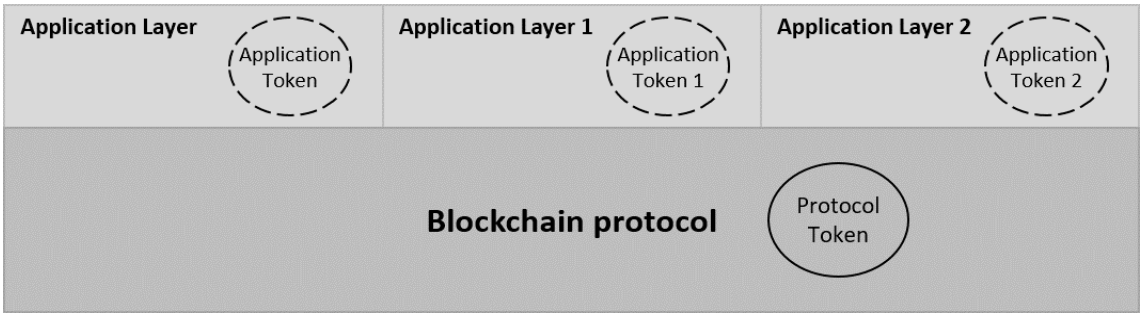

Figure 1 Differentiation between application tokens and protocol tokens

It is also important to distinguish tokens according to their types and purposes (see Table 1). Tokens can be categorized into usage tokens, which give the holder access to a digital service, work tokens, which enable holders to contribute work to a network (Tomaino 2017), funding tokens, which have the use to raise funds, and staking tokens, which refers to the potential use of tokens as the right to be a stakeholder, participate in a network's decisions, and—in some cases—earn a reward (Buterin 2014; Nærland et al. 2017).

Token type	**Example**	**Description / Function**
Usage token	Ethereum (ETH), Bitcoin (BTC), Litecoin (LTC)	A usage token is required to access the digital service, which no central party controls. The most common example is Bitcoin. To use the Bitcoin Blockchain, one needs BTC. The resources this digital service provides are its hashing power, which secures the Blockchain, the users, and developers. Bitcoin gets its value from providing these resources and people benefitting from the secure, publicly distributed ledger.
Work token	Reputation (REP), Maker DAO (MKR), Ethereum (ETH)	With a work token, one has the right to contribute work to a decentralized network to help that organization to function. When Ethereum is going to switch from proof-of-work to proof-of-stake, ETH will also be a work token, since it gives users the right to validate transactions and earn a fee in exchange.
Funding token	Ethereum Funding Token (EFT)	This token is used to raise funds. A good example is the Ethereum Funding Token, which is provided in exchange for donating to someone in need. It can be

		held or traded for profit like any other token, but mainly represents pride of ownership.
Staking token	tZero	These tokens (also called tokenized securities) represent shares in a business and can allow users to have active roles in corporate governance. Since they have been deemed securities, the tokens now fall under the regulatory scope of governmental regulators. An example is the tZero token, which entitles token-holders to quarterly dividends derived from the tZero platform's profits.

Table 1 Classification of Tokens by type and purpose

Tokens can be facilitated in various ways, the most common being a token sale, while airdrops or rewards are also possible forms. When participating in an airdrop, one can be credited airdrop tokens for free when holding a specific other token. The airdrop tokens will be sent proportionally to the current balance of the referenced token (for instance, for holding one Ether, one will receive ten airdrop tokens). Airdrops are especially used as a marketing instrument for investors. One can reach millions of users within a short time, creating much awareness for the token. Further, governments are interested in any project in which capital is being generated or a product is sold. With an airdrop, these risks can almost be eliminated (Malwa 2018). Tokens facilitated as rewards are especially created for the mining process of the proof-of-work algorithm in the Blockchain, where the community is motivated to contribute computational resources to solve cryptographic puzzles (Tomaino 2017). Tokens can also be emitted and used for payment in the form of legal tender or cryptocurrency.

Cryptocurrencies as an Example of Digital Tokens

All digital currencies have in common that some digital token type is used as a medium of exchange, a unit of account, or a store of value (Monetary Authority of Singapore 2017). Frequent flyer miles or computer game and online casino currencies are examples of digital currencies (Lee 2015). One can generally buy a digital currency with physical goods or services, identical to physical currencies, or the currency is only valid online, for instance, for a specific game or airline. Digital currencies that are restricted to a certain ecosystem, such as the airline ecosystem, are also known as virtual currencies (Akkizidis and Stagars 2015).

With the advent of Bitcoin, a new digital currency type emerged: cryptocurrency. The notion of cryptocurrency dates back to the financial crisis in late 2007, in which people experienced dramatic declines in the value of physical currencies such as US dollar and the euro. Central banks around the world began to flood the markets with liquidity in order to maintain confidence in their economy. Thus, banks changed the key characteristics of the currencies' values. Satoshi Nakamoto is said to have

developed the cryptocurrency Bitcoin, issuing it in 2009 to create a new monetary system that belongs to no one and can therefore not be steered (Istomin 2017): Bitcoin—a P2P version of electronic cash—which is the first use case that made use of Blockchain technology as a distributed ledger.

Cryptocurrencies differ from other digital currencies mainly in that transactions do not rely on trustworthy intermediaries but are shared in a decentralized network. Here, cryptographic hash functions and a network protocol secure and verify the transfers' values. Generally speaking, cryptocurrencies share attributes with other digital currencies. Further, cryptocurrencies are based on cryptography, facilitating security via encryption. One cryptography type used in cryptocurrencies is a digital signature, which proves to the network that one is the owner of a specific account and that a transaction is authorized by this account's legitimate owner. The concept is comparable to a digitally signed e-mail, where the signature proves that the sender is who they claim to be and that the message was not modified during its transit (Grant 1998).

Since the phenomenon of cryptocurrencies is very young—compared to traditional fiat money—they lack transparency and experience high volatility as well as high credit, liquidity, legal, and operational risks (European Central Bank 2015).

2.3 Crowdfunding

Crowdfunding is a revolutionary concept initiated as early as 2006 during the Web 2.0 era that has since gained popularity. It may be described as a public call for financial investment that is distributed among a large group of users who can evaluate the project owner's concept and can support them (Danmayr 2014). While any single investor would be unable to sponsor the endeavor as a whole, the group or crowd may be able to provide the necessary capital. Thus, crowdfunding is based on the "ability to pool money from individuals who have a common interest and are willing to provide small contributions towards the [project]" (Lynn and Sabbagh 2012). While venture capitalists only provide money toward selected projects that seem to have the potential to exceed expectations, crowdfunding became popular to fund smaller projects.

Crowdfunding campaigns are executed through so-called crowdfunding platforms. These platforms are usually hosted on a website, and traditional financing schemes efficiently facilitate the interaction between project owners and individuals willing to fund their project. This inevitably leads to a significant reliance on the trust of at least one third-party actor. Beyond their website, crowdfunding platforms must cooperate with banks and payment service providers to facilitate the necessary financial transactions. There are three actors in any crowdfunding venture: the investors (who give money), the intermediary (who transfers the money), and the project owners (who seek money). They all take various risks and opportunities, which are necessary to a successful crowdfunding.

Figure 2 demonstrates a common crowdfunding service ecosystem, comprising a bank, capital-seekers, investors, payment providers, crowdfunding partners, and their various connections. While both the

payment providers and the bank offer fairly traditional services, crowdfunding partners are increasingly making use of disruptive services. While capital-seekers are increasingly seeking to use these disruptive and innovative services and infrastructure, many conventional intermediaries are bound to traditional services.

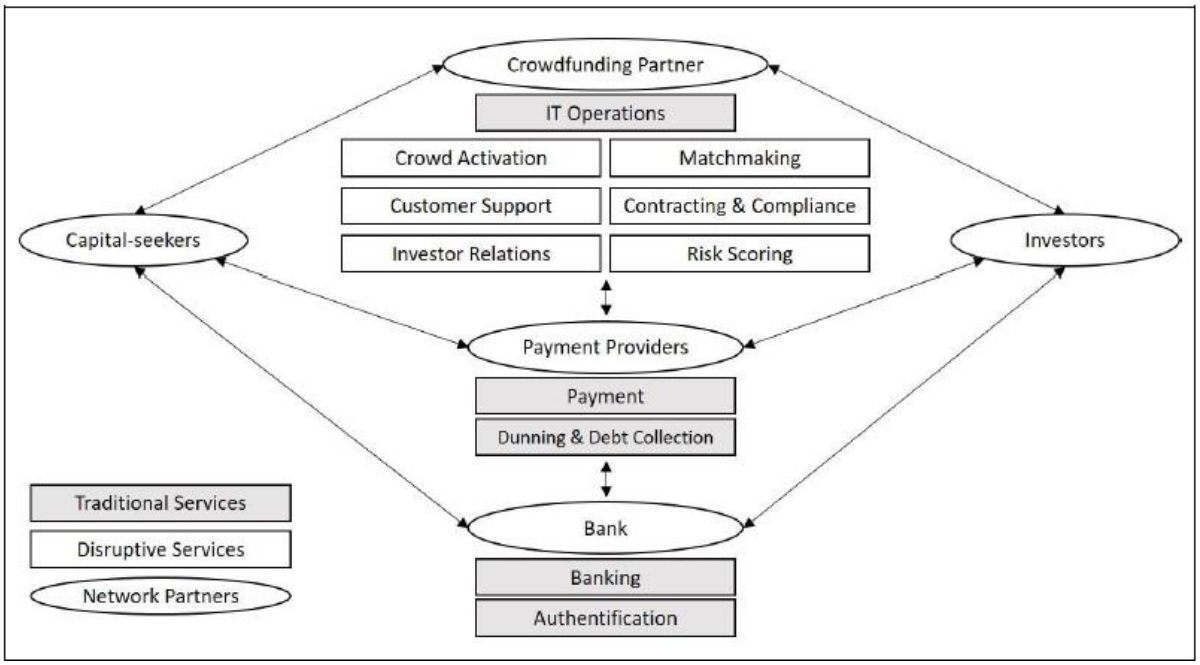

Figure 2 Crowdfunding service ecosystem (Haas et al. 2015)

Academia and business usually differentiate between four different forms of crowdfunding: donation-based crowdfunding (crowd-donation), reward-based crowdfunding (crowdsupporting/crowdfunding and pre-selling), lending-based crowdfunding (crowdlending), and equity-based crowdfunding. Table 2 sums up their respective key characteristics.

Donation-based crowdfunding	Capital-seekers receive their funding without any requirements to return their investment.
Reward-based crowdfunding	Capital-seekers receive their funding in exchange for – usually non-monetary – rewards.
Lending-based crowdfunding	Capital-seekers must fully refund the monetary resources they have raised through their campaign. They may have to cover interest or fees for receiving such funds.
Equity-based crowdfunding	Capital-seekers must provide their investors with a share of equity and part of their profits.

Table 2 Characteristics of the four most prominent forms of crowdfunding

Crowd-donation is one of the earliest forms of crowdfunding and involves a capital-seeker demonstrating their project online and several individuals or groups making small donations without the expectation of any return on investment. This form of crowdfunding has become increasingly popular among philanthropic organizations (Yen et al. 2018). The second form of crowdfunding is reward-based crowdfunding, where capital-seekers receive their funding in exchange for—usually non-monetary—rewards. While, as explained in Table 8.2, there is a close relationship between crowdlending and equity-based funding models (Mollick 2012), since they closely resemble standard investment schemes, other crowdfunding forms are based on alternative schemes. Crowd-donations, for instance, may be most appropriate for social entrepreneurship projects (Frydrych et al. 2014): individuals may donate to a cause without expecting any direct monetary or reward-based returns on their investment, since they are convinced that this project will create positive and worthwhile impacts for others.

Crowdfunding is primarily used to fund small, early-stage, emerging firms or projects (Schwienbacher and Larralde 2010). While traditionally a small number of venture capitalists and business angels provide most of the capital for startups and small businesses, crowdfunding capital is raised through large groups of individuals that each decide to invest a small amount of money in a potentially successful, relevant, or interesting idea. Further, crowdfunding platforms strongly rely on intermediaries such as banks and payment service providers (Haas et al. 2015). While crowdfunding platforms mostly focus on connecting a group of individuals (the crowd) to capital-seekers, the banks and payment services facilitate capital flow between these two actor types. These actors are motivated by both intrinsic and extrinsic factors (Koch 2012), including economization, cooperation, and community (Massolution 2012). Ultimately, there are entrepreneurs who seek to finance their innovative ideas through crowdfunding. For many years, they were the individuals who failed to raise capital through other means, since they were unable to generate any interest from venture capitalists. This has changed somewhat in modern crowdfunding.

Crowdfunding's strengths include the potential for entrepreneurs, depending on the previously agreed-upon terms, to retain their right to make business decisions, the accessibility of low-risk capital for individual contributors, and an opportunity to test the business model's marketability (Valančienė and Jegelevičiūte 2013). Despite the many potential benefits that crowdfunding may provide in a Web 2.0 environment, it also has several weaknesses that have not yet been resolved. These potential weaknesses include administrative and accounting challenges, a strong reliance on intermediaries, and weak investor protections (Valančienė and Jegelevičiūte 2013). A novel form of Blockchain-based crowdfunding is emerging that seeks to overcome these issues in order to bring equal benefits to investment-seekers and investors (Yadav 2017).

2.4 From Crowdfunding to Initial Coin Offerings

While crowdfunding and crypto-tokens have worked in isolation from one another for some time, combining them turned out to be a very successful way for startups to raise early-stage financing. Instead of spending weeks convincing a venture capitalist or bearing the cost of an IPO of stock to get money for growth, Blockchain startups began to sell their tokens—a process called initial coin offering (Conley 2017).

While ICOs bear some resemblance to IPOs, their structures and processes differ in many aspects, such as underwriting, distribution, and regulations (Kuo Chuen et al. 2017). A token sale refers to a method of selling participation or royalties in an economy or a project that starts at a later date, whereas an IPO sells a share of ownership in the company. An ICO presents a new form of crowdfunding, in which participants exchange existing forms of cryptocurrencies (mostly Bitcoin or Ether) for entity-specific crypto-tokens (Robinson 2017). The phenomenon was first called the Bitcoin model for crowdfunding in 2014 and was described as a new business model for open-source software, in which any participant in a Blockchain protocol can participate anonymously in the funding, development, and revenue collection using tokens (Ravikant 2014; Kuo Chuen et al. 2017). However, the ways in which campaign creators and potential investors are brought together differ significantly between crowdfunding and token sales. As crowdfunding platforms need intermediaries such as payment services to collect money, ICOs are completely decentralized and rely solely on P2P mechanisms provided by Blockchains (Danmayr 2014; Ehrsam 2016; Schweizer et al. 2017). Thus, ICOs enable investors from across the globe to participate, which can lead to more money being collected. In 2017, $3.7 billion was collected in 235 ICOs (Coinschedule 2018). While traditional financing is tilted toward an intermediary and is designed to lower their risks, ICOs exploit these fundamental flaws of middlemen and bring equality to a project. According to the venture capitalist Fred Ehrsam, the ICO model of funding projects in advance can also help to overcome networks' classic "chicken and egg" problem. By buying tokens early on, becoming a partial owner of the network, and profiting from potential token price appreciation in later stages, users are incentivized to join a network (Ehrsam 2016).

As the crypto-token market matures, potential risks and challenges can be observed. The most severe is that token-issuing startups often provide an intangible product or no product at all. Since ICOs are used to generate early financing during the lifetime of a crypto-platform, token purchasers typically invest in a basic crypto-idea and the promise of the idea associated with the platform. While this may work well with core infrastructure systems such as Ethereum, many other token platforms struggle to keep their promises (Kaal and Dell'Erba 2017).

With little information given about a crypto-platform's business plan and purchasers' expectations of a token price's potential appreciation comes high volatility. Tokens issued to have functional and consumptive value are increasingly becoming objects of speculation, since the prospect of buying the token early on at a low price, holding it, and reselling it later at a higher price is increasingly attracting

investor attention (Rohr and Wright 2017). There is also a lack of constant cash flow to offset any upcoming costs, since the ICO tends to be a single event with a set market cap. After this initial funding phase, it may be hard for investors to collect further financial resources, especially when further funding is needed for another research, development, or production project. In the case of an ICO, more cash can only be generated by issuing additional tokens, which would devalue the tokens already held by other investors. However, similar effects may be observed in the case of IPOs. As soon as a company decides to issue new stock, existing investors are compensated, much like an airdrop usually leads to compensation.

2.5 The ICO Process: How to Do an ICO

While there is a wide range of flexibility regarding how to conduct an ICO, some fundamental steps are recommended to fully leverage the aforementioned benefits. The full process is shown in Fig. 3.

Figure 3 The Initial Coin Offering Process

In step 1, one must choose an appropriate infrastructure. From a technical perspective, there are two ways to carry out an ICO. First, a firm can decide to create a custom Blockchain platform, where the native coin represents the issued token. When, for instance, IOTA was doing its ICO, it developed its Blockchain protocol and set up the network. The main advantage of this method is that it facilitates maximum flexibility concerning the ICO's fundamental infrastructure. For small and medium-sized companies, on the other hand, implementing the network and attracting miners represent massive barriers. Thus, most ICOs are based on existing infrastructures—most dominantly, the Ethereum network. Using, for instance, Ethereum's inherent capabilities to create smart contracts and tokens makes it much easier to conduct an ICO, yet the process is strictly limited by the underlying infrastructure. In the end, the decision whether to create an infrastructure or issue a token based on an existing Blockchain is based on the specific business case and its requirements (EYGM Limited 2018).

After one has made decisions regarding the business model and the underlying technology, one must communicate the intention to do an ICO to the community and potential investors. A typical pattern to do so for a startup is to publish a white paper. In this document, a range of information is revealed to the public. It can comprise an extensive business plan including revenue streams and partners, but also a history of previous business experience in an industry. Thus, all information communicated via a crowdfunding platform during a standard crowdfunding campaign will be published in an ICO's white paper. Most importantly, the white paper also points out key token parameters, namely, the function of the issued token, the token creation process, and how tokens can be purchased (Conley 2017). After

publishing the white paper, the campaign creators do a virtual roadshow, to generate interest and present their project to potential investors. Since this is a critical period for a successful ICO, credible community management and rapid response rates in various channels are key. This marketing process may take up to several months.

Before offering the token to the public, a firm has the option to run an ICO pre-sale, also known as a pre-ICO. In this round, the acquisition is reserved to a small group of investors, and tokens are usually sold cheaper than in the later main ICO to compensate for the higher risk in this early funding stage. A primary reason for an ICO pre-sale is to raise funds used for future expenses that occur along the way to the main ICO; these likely include the costs for promotion, recruitment, and software development. Besides monetary functions, a pre-ICO can also help to create positive buzz around a project. The information that a startup has already raised a certain sum through investors can send optimistic signals to other potential investors, fostering credibility and trust in the project. Thus, a successful pre-ICO may boost fundraising in the main ICO. Some firms even use these positive aspects and conduct more than one pre-sale round (Jeffries 2018). Although dedicated pre-sales for selected investors are common practice, this approach also has downsides. The risk in this early stage of a company in which the pre-sale occurs is fairly high. Thus, the likelihood of the funded project failing, and the buyers of pre-sale tokens finding themselves holding worthless tokens, is also higher. Further, as tokens are usually cheaper in a pre-sale than in the main ICO, investors may use this property to leverage arbitrary profits. Divestment of discounted pre-sale tokens in the following main ICO phase can dilute the token and may drive down its price (Coinist 2018).

In the last step, the ICO takes place at a pre-announced date, and members of the public can purchase tokens to participate in the project; in some cases, they also have a stake in the project (Kuo Chuen 2017; Johnston et al. 2018). Many token sales are capped; that is, only a fixed number of tokens are distributed. For the most popular projects, these tokens sell within minutes, if not seconds (Rohr and Wright 2017).

2.6 Practical Views

Ethereum's Crowdsale

The invention of ICOs goes back to J. R. Willet and his The Second Bitcoin Whitepaper, which was published in early 2012. Here, he hypothesized that someone could raise much money for a computer science project if a coin were created that is used by that project. In 2013, Willet started the first ICO for his project, Omni (formerly known as MasterCoin), publishing a white paper and a Bitcoin address. The idea was "that the existing Bitcoin network can be used as a protocol layer, on top of which new currency layers with new rules can be built without changing the foundation" (Willett 2012). A year later, Ethereum, the most important platform for ICOs today, was founded. Ethereum was financed by a crowdsale, a crowdfunding type in which cryptocurrency tokens can be sent in exchange for ICO tokens. During Ethereum's crowdsale, it was possible to send 1 Bitcoin and receive 2000 Ether in

exchange. As at March 2018, this investment would mean that someone who sent 1 Bitcoin in 2014 (worth $600 at the time) would have 2000 Ether to the value of $1.4 million.

The Ethereum Network

Today, Ethereum is the primary platform for conducting ICOs. Approximately 57% of 2017's ICOs were so-called Ethereum-based ERC-20 tokens, and only 30% built their custom Blockchain (Darko 2017). ERC-20 is a standard offered by Ethereum and can be seen as a guideline that provides rules and defines how an Ethereum-based token must be implemented. This standard enables various applications to interact with the ICO token. Interacting applications include wallets or crypto-exchanges. One significant advantage of the ERC-20 standard is that ICOs are easy and quick to set up; also, investors who participate in the ICOs can use Ethereum's infrastructure. This means that received ICO coins can be saved in—safe—Ethereum wallets; further, most crypto-exchanges now support the Ethereum token and the ERC-20 standard. This progress lowers the risk for investors that the purchased ICO coin can only be traded on some but not all token exchange platforms.

Owing to its ability to include smart contracts and decentralized applications, Ethereum has a special significance for ICOs. For instance, a smart contract can automatically receive tokens from other wallets or can decide how many tokens will be transferred to whom. The rules on which smart contracts are based on are set arbitrarily by the programmer, who then stores the contract on the Blockchain. Thus, the contract is stored immutably and will be executed in the same way for all network participants.

The smart contract is unlocked if certain conditions in the network are met, for instance, when it receives tokens (Buterin 2014). One example of the use of a smart contract is an auction. During an auction, the smart contract registers all the participants' addresses and bids. At the end of the auction, the smart contract chooses the highest bid and publishes the winner, refunding all other bids. One key advantage of smart contracts is that everyone can participate without credit cards, verifications, or e-mail addresses. Further, the Blockchain guarantees transparency and security.

The Filecoin and ICOBOX Use Cases

The number of ICOs increased from 1 in 2014 (value: $450.000) to 883 in 2017, to the value of $6 billion (ICO Data 2017). On the supply side, the significant increase in ICOs in recent years can be attributed to the simplicity of setting up an ICO and swiftly raising large sums of money. Filecoin's ICO in 2017 raised $252 million in 30 minutes (including pre-sale figures). On the demand side especially, an ICO's potentially high return on investment (ROI) makes ICOs attractive to investors. For instance, the ROIs of Ethereum and NEO, since their ICOs in 2014 and 2016, were 280,000% and 379,000%, respectively (ICO Stats 2017). Such potential ROIs and cryptocurrencies' liquidity are two key reasons why people are investing in ICOs (Metke 2017).

Increasing attention in and values of such ICOs have led to new business models around the execution of an ICO. ICOBOX's business idea is to support startups to sell their products via an ICO. To execute

an ICO, they set up your Ethereum-based smart contract, support marketing actions, and/or help to draft a white paper in various languages. Almost anyone can now do an ICO to realize their software project, owing to the professional and specialized competences of companies offering facilitating services. On the other hand, scams and unsuccessful ICOs are on the increase. Almost half of 2017's ICOs have failed, which illustrates the high risk of investing in them.

3. Blockchain and ICOs Are Reshaping the Crowdfunding Sector

3.1 Why ICOs Matter

In 2017, both Blockchain technology and ICOs had a substantial effect on early-phase funding and have reshaped the entire crowdfunding sector in ways that experts could scarcely have imagined. The ICOs of Bancor, a decentralized liquidity platform (Bancor 2018), and Gnosis, a decentralized platform for prediction markets (Aitken 2017), started a wave of campaigns, interest in this "new form of crowdfunding" has grown steadily (Mougayar 2017), and the results of this development are fairly clear: ICOs first topped the monthly average of angel and seed-stage investments in June 2017 (Verhage 2017), and the amount invested in ICOs has more than doubled by December 2017 (ICO Data 2017). During this time, the industry has seen fundamental transformation, which will continue to affect the technology-centered startup scene and will continue to disrupt the IT industry; it should therefore be taken seriously by both market leaders and established companies that seek to build on their success, as well as startup founders who seek to increase their liquidity in the early stages of their company.

ICOs have been extremely popular, since they deliver advantages to both investors and technology startups that could not be realized in a traditional crowdfunding or IPO environment. On the one hand, technology startups may benefit from the anonymous, decentralized, and participatory nature of ICOs, allowing them to receive their funding anonymously from across the world while enabling shareholders to participate in any decision contained in their investment's contractual basis. Further, companies that self-fund through ICOs don't have to work with international investment banks, financial service providers, or crowdfunding platforms, which allows them to not only set the rules of their ICO but also the save the fees levied by the aforementioned intermediaries.

On the other hand, investors may profit from ICOs, since they can speculate not only on a company's success but also on the underlying cryptocurrency; that is, individuals may invest in companies while the BTC/USD exchange rate is tilted in their favor. Further, the fact that ICOs allow anyone to invest any amount in a company enables individuals who don't want to interact with a company through intermediaries to become involved and invest in projects they consider worthy.

The North American and European capital markets were robust throughout 2017, and one could get the impression that technology-related IPOs are no exception to this overall trend. However, experts have concluded that "despite strong capital markets, tech companies were largely absent from the US IPO market" (Chitkara 2017). Founders and investors argue that ICOs may have played a key role in this

development. For European tech startups, a fairly similar pattern may be observed, as European tech startups represented 56% of tech IPOs' proceeds in the third quarter of 2017, a stable development based on traditional indicators (Chitkara 2017). However, beyond these indicators, the appearance of European tech IPOs declines, since their proceeds and profits are based solely on two companies' offerings: Landis+Gyr and Rovio Entertainment (known mostly for its mobile game Angry Birds). There were no European tech IPOs in the first quarter of 2017, with the second quarter showing little improvement.

Considering the constant decline of Western tech companies' interest in IPOs, despite welcoming capital market conditions, Northern American and European companies and investors are turning to ICOs as an alternative form of funding. Further, regulators are well advised to follow suit if they wish to sustain their—arguably—successful research and innovation scene.

3.2 Blockchain Technology's Implications for Crowdfunding

Looking closely at ICOs' implications on all four forms of traditional crowdfunding, one can see that ICOs have the ability to transform them to become more transparent, more effective, and cheaper. In Fig. 4, one can see that a Blockchain-based crowdfunding ecosystem relies on P2P transactions. This makes the concept of crowdfunding more interesting for both capital-seekers and investors. Thus, ICOs may become increasingly popular, potentially replacing traditional crowdfunding efforts in the foreseeable future.

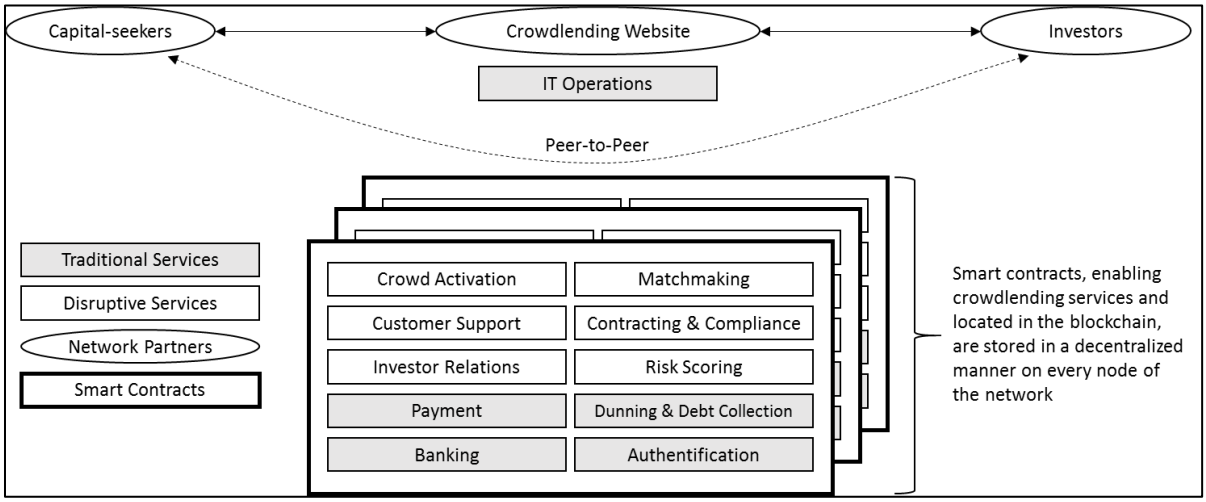

Figure 4 Blockchain-based Crowdfunding service ecosystem (Schweizer et al. 2017)

First, donation-based crowdfunding campaigns are crowdfunding campaigns in which the investor/donor usually acts based on an altruistic motivation or on peer recognition (Arvidsson 2009), which may be either intrinsic or extrinsic. Thus, the investor expects no monetary return on their investment and will receive no reward besides personal happiness or social recognition. On the one hand, while the ways in which charitable organizations are operated have changed significantly (Choy and Schlagwein 2016), they are usually the ones that profit directly from donation-based crowdfunding. On the other hand, researchers have argued that donation-based crowdfunding campaigns could even be economically useful, since they could contribute to the efficient allocation of a society's social capital

and production (Knudsen and Nielsen 2013). This may be one of the crowdfunding forms most easily represented in a Blockchain environment, since Blockchain technology allows any organization to receive funds from any individual across the world by providing them with their wallet's address. One could swiftly realize crowdfunding in a Blockchain 1.0 environment, since it only requires two individuals with a wallet in order to be executed. This facilitates a fairly simple representation in a smart contract-enabled Blockchain environment such as Ethereum (Ethereum Foundation 2018a) and has attracted several high-profile organizations that have successfully used the technology; these include the Bitcoin Foundation, WikiLeaks, and Internet Archive (TrueDonate 2018).

Second, in reward-based crowdfunding campaigns, the capital-seeker offers a - usually non-monetary - reward to attract potential investors. Reward-based crowdfunding may be one of the most visible forms of crowdfunding, since it is the model that most projects on popular platforms such as Kickstarter and Indiegogo have relied on. In the Blockchain world, reward-based crowdfunding may be most accurately represented in the form of an ICO token reward: individuals buying a certain cryptocurrency early on will receive a certain number of tokens as a form of reward. These tokens can usually be used later to access a certain service or even as a lead currency of a newly developed Blockchain environment. If the project is successful, and more people want to use it, the demand for these tokens rise, which makes them more valuable. Since tokens bought through an ICO are fairly cheap compared to later market prices, early investors can use this phenomenon to leverage high profits when they sell their tokens to potential platform users. If there is no demand for the service or the project fails prior to its completion, investors will be left with tokens with no use and therefore with no value.

Third, lending-based or debt-based crowdfunding campaigns are a crowdfunding form that most closely represents the process of traditional banks issuing loans to their customers. In this scenario, the customer would, for instance, present himself and his project to a bank's representative, who would then decide whether or not to approve the project for a loan. This form of financing used to have both upsides and downsides, since it provided stability for both a bank and an investor but also included several intermediary parties. There are now several Blockchain-based ICO platforms; these include the Tokenlend Platform and Crowd Genie. The Tokenlend Platform seeks to provide potential investors and loan-issuing entities with a Blockchain-based toolset via a web interface (Tokenlend 2017). To do so, the Tokenlend team is working on a smart contract-based business logic that automatically issues loan repayments according to a previously agreed-upon schedule and representatively distributes the overall payment amount between the loan-issuing entities (Tokenlend 2017). Crowd Genie is a P2P platform for small and medium-sized businesses (Jain 2017) in which loans are, similar to traditional loans, backed by personal securities. Owing to this, Crowd Genie has gained momentum as a Blockchain-based P2P lending platform that is officially recognized by its national monetary agency (Monetary Authority of Singapore 2018). Despite an increase in the number of lending-based crowdfunding campaigns that involve the Blockchain technology, many newly established platforms may effectively be classified as novel intermediaries, since they provide the marketplace for transactions to be executed.

Finally, equity-based crowdfunding most closely represents the traditional stock market, since it allows capital-seekers to offer some of their company shares in exchange for an investment. Such platforms usually require relatively high transaction costs, since they are often executed under significant financial regulations and high operational efforts. Owing to these aspects, one may argue that equity-based crowdfunding could be substantially improved by using Blockchain technology. In a Blockchain environment, equity tokens are used to facilitate such transactions. They represent an underlying asset, namely, a share in a company (Wilmoth 2017). Instead of a third-party intermediary, the trading of company shares is managed by a smart contract. This not only accounts for the balance of the tokens but also implements corresponding rights and duties. For instance, depending on the number of tokens held by a single entity, the smart contract provides individual investors with some say (a certain number of votes) in a decentralized autonomous organization (Ethereum Foundation 2018b).

3.3 Legal Analysis and Implications

Given the speculative success of ICOs, the lack of regulation and the risks attached to them for investors are becoming a focus of jurisdiction. Dealing with this is more complex than it seems, for two primary reasons: first, the characterization of ICOs has not yet been defined; second, ICOs' virtuality and pseudonymity make it difficult to enforce laws.

Most ICOs are structured as virtual currencies, but some are also loans, vouchers, securities, or other financial service instruments. Given this variety and the lack of clarity of many tokens sold, ICOs have not been subject to governmental regulatory scrutiny for some time, although they have dealt with digital assets. This stands in stark contrast to proceedings of investment contracts, since in the US, for instance, they are strongly regulated under the Securities Act of 1933 and Securities Exchange Act of 1934 (Robinson 2017). These acts seek to ensure that security sellers provide truthful and accurate information to buyers, so that they can make informed investment decisions. In such a transaction or arrangement, all securities offered must either be registered with the US Securities and Exchange Commission (SEC) or must be eligible for one of several exemptions to such registration.

To address this, on July 25, 2017, the SEC released an investigative report on "The DAO"—the most prominent case of a Blockchain-based decentralized autonomous organization—and the offering and sale of digital assets (referred to as ICOs) by "virtual" organizations, pointing out that these transactions are subject to the federal securities laws' requirements. This was the first attempt to provide a broadly applicable analysis to classify ICOs. But since the DAO case differs significantly from most contemporary ICOs, to date, most have not complied with any of the registration or disclosure requirements; thus, the SEC cannot control the truthful and accurate distribution of information and tokens; it can only prohibit them in extreme cases (Robinson 2017). Similar processes can be observed in the case of the German Federal Financial Supervisory Authority, which wants to investigate case by case whether an ICO even categorizes as a security or investment and which laws apply (BaFin 2018). Taking a broader view, it is unsurprising that some ICOs even have been launched without ever having

a functioning prototype or viable product, expressing their idea on little more than a few lines of code in a white paper.

Second, ICOs' virtuality and pseudonymity make it hard for governments and regulators, which seek to enforce tax and banking laws. Given their virtuality, the main risks of ICOs are the issuance of scam coins (Matsakis 2018) and cybersecurity. Although the Blockchain has the reputation of being very safe and an unfalsifiable ledger, there have already been hacks and cyberattacks. While a ledger was never manipulated through a hack, systems surrounding it, like trading platforms, were. The most prominent case hereby is the DAO hack, which demonstrates the expansion of legality through Blockchains. The DAO was hacked only one month into action, and the hackers managed to divert $53 million in DAO tokens to their account, which was immediately frozen. Since the DAO functions on the Ethereum Blockchain and was "too big to fail", the Ethereum Foundation decided to create a hard fork, which led to a split in the Ethereum Blockchain but which allowed investors to recover their money in the new chain. This system comes close to rewriting history as if the hack had never existed, allowing the crowd to erase unwanted events, provided that all participants accept it (Biederbeck 2016).

Many other examples (pump-and-dump schemes, where capital is swiftly raised and immediately dumped in exchange for other instruments at a profit) illustrate the risks of cryptocurrencies and ICOs for investors (Crypto Calls 2018). To address the problems and risks, one must decide which regulations apply to ICOs. To do so, tokens must first be characterized, but this is challenging, given the variety of possible uses (see section "Tokens and Cryptocurrencies") and different proposed solutions based on case-by-case decisions, owing to the complexity surrounding the topic. However, it appears that most tokens can either be specified to have currency-like features, dealing with the question whether cryptocurrencies are money in the legal or economic sense1 or have security-like features, granting the tokens share-like features, sometimes even bond-like ones.

Once ICOs can be categorized and partially regulated, the question arises which party receives jurisdiction and which laws will apply to the case. Since ICOs are carried out on public Blockchains, which are virtual spaces without any territorial or geographical boundaries, it is unclear which laws apply in a given situation, to date leading to decisions being made case by case. Another conflict arises from the fact that subscribers from across the world can take part in an ICO, which leads to permanent conflicts of laws and jurisdictions (Robinson 2017).

4. Benefits, Challenges, and Consequences of ICOs

The benefits of ICOs are becoming increasingly apparent to investors and startups, as well as to the public and major players in the international markets. While many of them appreciate the decentralized, anonymous, and unregulated nature of ICOs, established companies have begun to recognize the ability to raise capital for projects they could not finance via their budgets or traditional forms of finance. Owing to the white paper process, entrepreneurs and capital-seekers are receiving early and direct feedback

from their potential customers. This helps them to create viable products that are approved by the public rather than the opinions of "enlightened VC managers". In fact, ICOs are increasingly positioning themselves as a serious alternative to existing financing options, since they create independence from existing financing instruments and shorten the current time to market. The latter is especially true when comparing an ICO and a stock market IPO. Stock market regulations are fairly strict and only offer limited flexibility.

While the Blockchain may offer the possibility to interact completely without any existing platforms or intermediaries, the latter will not vanish completely. At least as long as cryptocurrencies are not part of everyone's daily lives, people will still have to rely on banks, marketplaces, and ICO platforms to be able to spot new projects and buy their tokens. On the other hand, with the advancement and acceptance of cryptocurrencies, these dependencies are decreasing. Especially for technology startups, an ICO often matches the business plan very well. The issued tokens work as an asset and can also be used to gain access to a particular service offered by the company. Thus, an ICO can also enable new business cases, potentially bringing value to the public.

Regarding the potential challenges and disadvantages of ICOs, compared to traditional financing schemes, the legal implications for coin-offering startups and businesses, and the risks that investors take, must be at the forefront of any decision being made.

The legal analysis uncovered some major implications for ICOs which remain to be discussed, if they benefit or risk them. As at early 2018, there is still broad disagreement on how ICOs and the issued coins should be recognized under existing regulations in a proverbial patchwork of national jurisdictions. Thus, it remains to be seen whether supranational institutions will be able to establish common frameworks on how to interact with the revolutionary concept of cryptocurrencies. Regulators must still answer very basic questions. For instance, many countries have not yet decided how to characterize an ICO and its tokens; while most authorities categorize them as virtual currencies, some consider them to be loans, vouchers, or even securities.

Further risks of ICOs are mainly the issuance of scam coins (Ponzi scheme) and cybersecurity. Although Blockchain has the reputation of being a very safe technology, the de facto security depends on reasonable source code and the software's execution. The best example of this was the Ethereum DAO hack. In fact, the Blockchain was not hacked; one of the smart contracts the DAO was set up on was. This means that firms and individuals who are willing to do an ICO must acquire advanced knowledge and must audit the code. Although a set of standard token contracts is now available and can be adapted, one wrong line of code can render a whole ICO vulnerable. Thus, the potential risk that needs to be faced may lead to new platforms and intermediaries, which then seek to provide certain security levels. By doing so, some benefits (e.g. lower transaction costs) will no longer be able to play out to their full capacity.

We have sought to demonstrate that ICOs have fundamentally reshaped the crowdfunding sector and have become a leading investment source for startup companies with a focus on technology or banking. Thus, ICOs have become more popular than traditional IPOs for tech startups in the Western hemisphere (EYGM Limited 2018) and have managed to exceed venture capital investments for Blockchain and Blockchain-related startups in both Europe and North America. This fairly recent development signals the massive potential to disrupt the market that can be expected in the next few years.

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