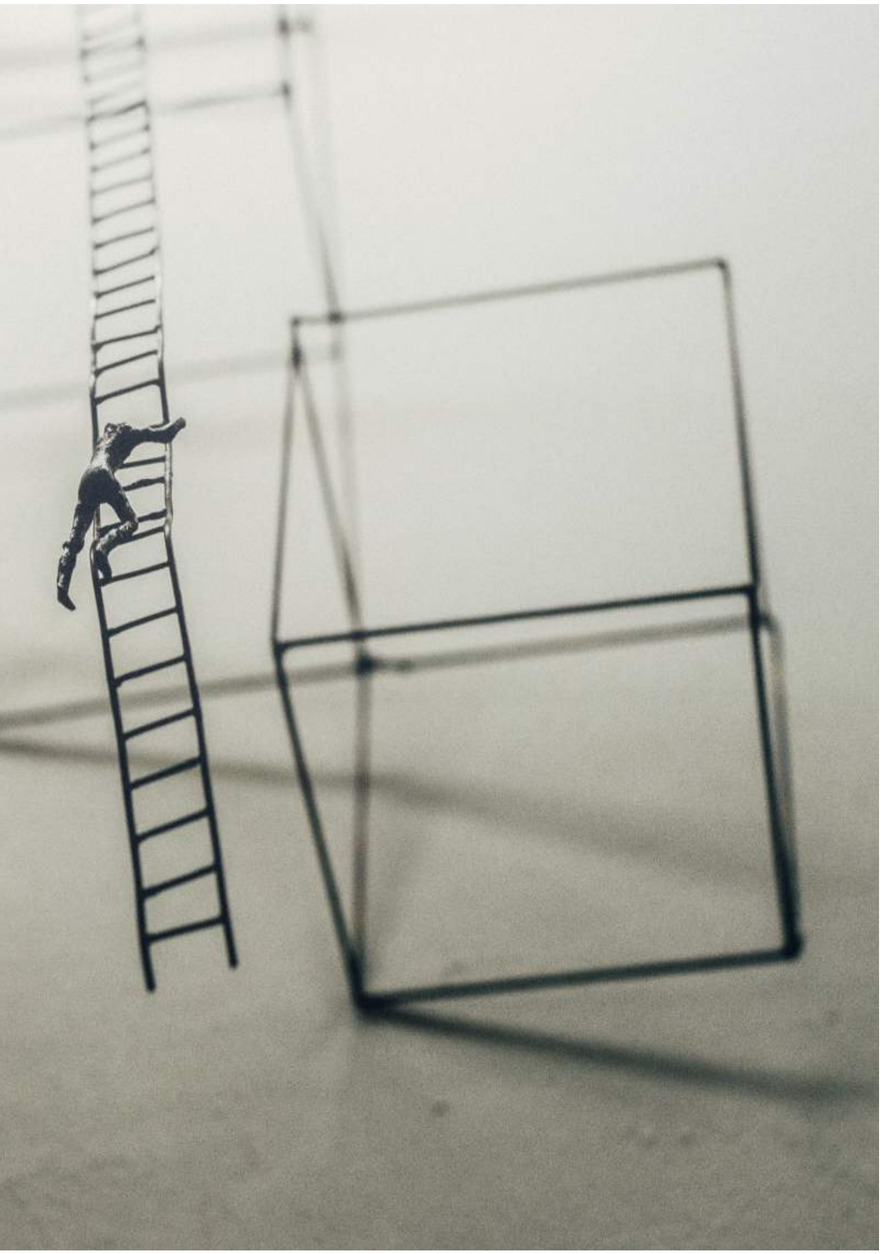
AN INTRODUCTION TO BLOCKCHAIN-BASED TOKENS

RESEARCH PAPER

Infloat



This document discusses academic studies on blockchain-based tokens. Academic and practical research are essential to strengthen our understanding around this fascinating topic, as we constantly work on new value propositions and business cases. Infloat's goal is to create sustainable token models with sound economic structures that create value for both the client as well as the ecosystem the token will be issued in.

BLOCKCHAIN TECHNOLOGY

Blockchain technology is a form of distributed ledger technology (DLT). A distributed ledger is a digital and decentralized database that keeps, shares, and synchronizes records between all nodes in a peer-to-peer network (Rückeshäuser, 2017). A blockchain stores records in fixed structures called 'blocks', which are 'chained' together, forming a 'blockchain' (Catalini & Gans, 2017; Rückeshäuser, 2017). A blockchain relies on cryptography and a predefined consensus mechanism to ensure the validity of the records and the state of the ledger. Records that are added to the ledger are immutable, meaning that records cannot be unilaterally changed once recorded. This distributed and decentralized architecture lead to disintermediation, as well as increased transparency, security, and efficiency of storing and sharing data (Böhme et al., 2015; Rabah, 2017).

Blockchain technology, and DLT in general, evolved in 2008, as one of the underlying technologies behind the Bitcoin protocol. This innovation enabled, for the first time in history, that digital value could be reliably transferred between untrusting parties, without the need of an intermediary (Bigi et al., 2015). In the Bitcoin protocol, this digital value represents a financial transaction in the form of a bitcoin, but that is not the only type of data that a blockchain can handle. Blockchains can store digital data ranging from identity records, medical files, and voting rights, to ownership of currency, shares, intellectual property, information, contracts, and even physical objects (Catalini & Gans, 2017).

ETHEREUM AND SMART CONTRACTS

Since the implementation of the Bitcoin protocol, many new projects that propose the use of blockchain technology have emerged. Ethereum was one of the first major extensions beyond the Bitcoin protocol. It sought to bring more development flexibility by not only providing the infrastructure for transacting the blockchain's native currency (Ether in this case), but also by providing the capability for easily creating and autonomously managing other secondary digital tokens of value (Sehra et al., 2017). In essence, Ethereum is a permissionless, distributed computing-platform, that allows anyone to write smart contracts and build decentralized applications. Smart contracts are computer code that can facilitate the storage and exchange of digital value, in a decentralized and automated way, without the need of trusted third parties (Bigi et al., 2015; Sehra et al., 2017). When running a smart contract on a blockchain as Ethereum, it becomes a self-operating computer program that automatically executes when specific conditions are met (Brenig, Schwarz, & Rückeshäuser, 2016; Catalini & Gans, 2018).

CRYPTOCURRENCIES

Cryptocurrencies, also referred to as crypto tokens, are digital assets secured with cryptography. Some tokens are native to a blockchain, such as bitcoin is native to the Bitcoin blockchain; other tokens are secondary tokens that 'live' on top of an existing blockchain. These secondary tokens are a specific type of smart contract, that allow developers to use the existing infrastructures and protocols of the blockchain that the secondary token is built upon (Brenig et al., 2016). The majority of tokens in the market today live on top of an existing blockchain, most commonly on the Ethereum blockchain.

SECONDARY TOKENS

Secondary tokens are used as a medium of exchange (Catalini & Gans, 2017, 2018) and can represent anything of value, such as financial instruments, physical assets, collectibles, digital contracts, memberships, and access to products and services (Brenig et al., 2016; Conley, 2017; Davidson et al., 2016a). With a lack of formal definitions, one of the most prominent tokens that is being issued are so-called *utility tokens*. These tokens carry no rights other than the right to use them as a means to obtain services on a specific blockchain-based platform, and to enable interaction with the platform, that either already exists or will exist in the future (Catalini & Gans, 2018; Sehra et al., 2017).

These blockchain-based platforms provide an open, decentralized, and shared infrastructure for providing services, and enable agents in a network to interact and transact with the platform, without the need for hierarchical systems or intermediaries (Allen, 2017; Catalini & Gans, 2017). Value that is created can easily be distributed between agents, either via the digital platform in question, via over-the-counter (OTC) trading, or via a cryptocurrency exchange (Sehra et al., 2017). This structure allows rents to be more equally distributed as agents can benefit from the returns a platform generates (Catalini & Gans, 2017).

Hence, the combination of a peer-to-peer network, blockchain technology, and tokens, enable entrepreneurs to create new markets that are not defined by or restricted to any geographic location, political structure or legal system (Davidson et al., 2016). As Catalini and Gans (2017) say: "On these platforms, trust in a platform operator is replaced by trust in the underlying incentives, code and consensus rules. As a result, market power of the intermediary, privacy risk and censorship risk are drastically reduced" (p.13). The barriers to entry and innovate are drastically lowered, which allows startups to directly compete with incumbents, increasing the level of competition for a variety of services (Allen, 2017).

ISSUING A TOKEN

Issuing a token is a completely bottom-up process (Allen, 2017) that require identification and understanding of the ecosystem the token will be issued in. Brenig et al. (2016) describe an economic ecosystem as "a business environment consisting of several entities and their corresponding relationship. It is characterized by competition and collaboration to pursue the overarching objective of generating added value" (p.4). The authors mention that tokenized ecosystems consist of end-users directly or indirectly using a token, and of organizations offering complementary applications and services. Catalini and Gans (2017) and Bolt and Van Oordt (2016) also include investors and other agents that do not directly interact with a platform, such as regulators and media. An agent could, obviously, fulfil multiple roles.

Despite the increasing interconnectedness that enable global access to digital ecosystems, the unknowns of blockchain-based ecosystems makes entrepreneurs question on how agents behave (Brenig et al., 2016). Researchers did find that agents collaborate and coordinate information about discovering and developing token markets (Allen, 2017), but mainly collaborate to increase their own gains (Böhme et al., 2015; Davidson et al., 2016b; Nair & Cachanosky, 2017).

Agents can increase their gain in two ways. First, the bigger an ecosystem is, the greater return an agent can have (Nair & Cachanosky, 2017). Second, the more functionalities a token has that matches an agent's preference, the more possibilities an agent has to maximize his utility (Brenig et al., 2016).

However, increasing the number of functionalities increases the potential need for an intermediary (Böhme et al., 2015), which is associated with higher costs and greater risk. Conley (2017) says: "Startups should be careful to think about how the functions and attributes they give their tokens could be used for unintended purposes that might harm their platform or benefit their competitors" (p.6). Sehra et al. (2017) confirm this by saying that a token structure needs to be viable in order to realize the sustainability of a project.

We did not encounter any article that stated how to create a viable token, but rather several articles discussing token-related concepts. Tokens have been discussed in relation to monetary theory, economics, and game theory (e.g. Catalini & Gans, 2017; Conley, 2017; Nair & Cachanosky, 2017; Sehra et al., 2017), but few actually go deeper than that.

MONETARY POLICY AND INITIAL COIN OFFERINGS

Monetary policy is part of a token issuance strategy, and relates to the amount of tokens to be issued, as well as the token's inflation and deflation rate. The most common way to introduce a token to a market is via an initial coin offering (ICO). During an ICO, projects raise capital by exchanging new tokens for existing cryptocurrencies, such as bitcoin. Agents that buy these new tokens can sell them on the secondary market or use them in the future to gain access to products or services (Adhami, Giudici, & Martinazzi, 2017).

For many projects, the ICO process has shortened the time to raise capital to fund innovation and reach a critical mass of early adopters (Böhme et al., 2015; Catalini & Gans, 2017). In an early stage, the primary functionalities of a platform and token are limited. This means a token issuer relies both on early adopters that want to support the project to "create a viable alternative and dervive utility from developing the technology further" (Catalini & Gans, 2017, p.12), and on investors that expect an appreciation of the token's value (Conley, 2017; Sehra et al., 2017).

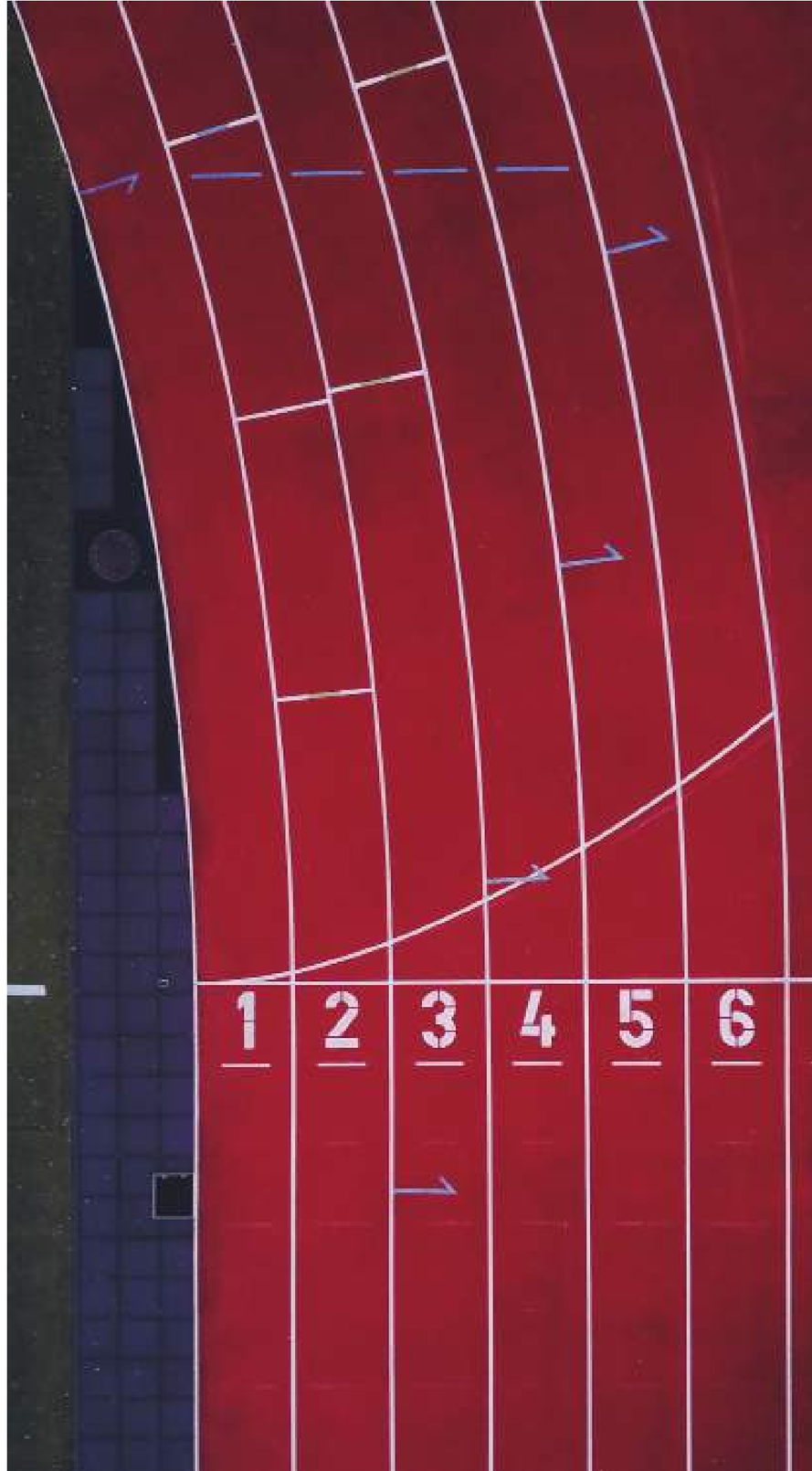
When issuing tokens, Conley (2017) encourages to not hold back tokens, while Sehra et al. (2017) indicate it is important for a project to keep some tokens behind in order to control the price. In addition, Catalini and Gans (2017, 2018) and Böhme et al. (2015) question what would happen if the size of an ecosystem grows at a different rate than the quantity of tokens in that ecosystem. These authors recommend a tightly controlled supply. This is to control the price, as a project sky rocking in value may be damaging to a project (Sehra et al., 2017), as well as to generate revenue in the future by selling tokens in the market.

PRICING A TOKEN

Pricing a token and valuing a blockchain-related project is considered hard, and few articles are devoted to outlining a structure on how to do this. A common referred measure for pricing a token is the number of transactions (Bolt & van Oordt, 2016), but this measure offers no information about what value was actually provided in exchange (Böhme et al., 2015). In addition, there are many unknowns that may influence the price of a token and the excitement around this new technology might increase an agent's willingness to pay to acquire the asset (Brenig et al., 2016; Conley, 2017; Rückeshäuser, 2017).

Most important, the value of a token and ecosystem is not only determined by the services offered via a platform of the token, but also by the underlying blockchain in use (Brenig, et al. 2016). Whereas today most of the value is captured in the applications built on top of standard protocols, the value of blockchain projects is mainly captured in the protocol of the underlying blockchain. These 'Fat Protocols' (Monegro, 2016) have profound consequences for market structures (Catalini and Gans, 2017; Rabah, 2017), and likely do not match with common accounting principles or business standards.

Conley (2017), however, does make a try in applying such standards to a tokenized ecosystem, stating that the value of tokens that are used as a currency, such as bitcoin, can be calculated by using the classic quantity of money theory. For tokens representing a financial security, he believes that the value must be equal to the present value of their associated flow of dividends. Conley does not discuss valuation measures for utility tokens.



GOVERNANCE AND INCENTIVES

Blockchain technology and tokens allow for the emergence of new forms of governance (Davidson et al., 2016a), based on invention and coordination among agents in an ecosystem (Brenig et al., 2016; Rückeshäuser, 2017). This leads to a shift from centralized monitoring, where the value of an agent's actions is assessed by a central authority, to a decentralized and collective responsibility of valuing actions (Davidson et al., 2016a). This shift contrasts with common management practices, and requires entrepreneurs to discover new roles and responsibilities that connect businesses and agents together (Allen, 2017; Rückeshäuser, 2017), without negatively impacting confidence in the ecosystem (Catalini & Gans, 2017).

Hence, the main purpose of a utility token, besides its role as a medium of exchange, is to incentivize and coordinate economic actions of agents in an ecosystem, both for the self-interest of an agent as well as for the greater good of an ecosystem (Allen, 2017; Davidson et al., 2016a; Sehra et al., 2017). Strong incentive models, combined with cryptographic techniques, are considered essential for decentralized ecosystems to operate securely and effectively (Conley, 2017; Davidson et al., 2016a, Rabah, 2017). Different incentive models are possible. For example, agents can be incentivized to contribute to an ecosystem by receiving an economic benefit when using a token (Sehra et al., 2017), such as a discount or receiving an additional digital asset (Böhme et al., 2015; Davidson et al., 2016a).

Another model to incentivize agents is via non-economic benefits, most commonly via a system of gaining and losing reputation and decision-making power (Allen, 2017; Catalin & Gans, 2017). These benefits are non-transferable between agents, nor can these benefits be transferred from one ecosystem to another. In addition, these benefits will be reduced or removed if an agent does not provide value to

an ecosystem, for example during a period of inactivity or by demonstrating poor behavior (Allen, 2017; Rabah, 2017). With agents coming and leaving an ecosystem, the influence of agents changes constantly, as well as the total value of an ecosystem (Davidson et al., 2016a).

Either way, separating rewards from economic gains is not sufficiently incentivizing and may lead to outcomes not benefiting an ecosystem as a whole (Conley, 2017; Sehra et al., 2017). Tokenized ecosystems are different than traditional open-source models, like Wikipedia, where agents contribute from an ideological reason or for the purpose of increasing their social capital (Davidson et al., 2016a). Agents in tokenized ecosystems would likely choose to, for example, use decision-making power to maximize their own rewards rather than the ecosystem's (Brenig et al., 2016; Gandal & Halaburda, 2014). This makes it essential to develop incentive structures that prevent or avoid agents from exhibiting behavior that is harmful to an ecosystem (Conley, 2017).

Nevertheless, an incentive does not provide the same value for every agent (Brenig et al., 2016). Whereas economic incentives may trigger some agents to provide more value to the ecosystem, it may trigger other agents to hold a token and speculate on its value (Bolt & van Oordt, 2016). Sehra et al. (2017) emphasize that "information needs to be focused on the benefits for holders in relation to the utility offered through increased access to a product or service, rather than speculatory financial benefits from holding a scarce token that can be sold for a profit when the price rises!" (p.27).

Conversely, allowing speculation incentivizes speculating agents to join an ecosystem in an early stage, which may create a positive feedback loop. A growing ecosystem benefits a

young project, while the risk-taking early contributors are rewarded by an increase in a token's price (Bolt & van Oordt, 2016; Catalini & Gans, 2017). Whereas bitcoin benefited from early excitement, new tokens first need to create interest and achieve confidence to realize a widespread use (Böhme et al., 2015). Once more agents have joined the ecosystem, it is considered crucial that the token restores it's role as a medium of exchange in order to realize sustainable growth (Bolt & van Oordt, 2016; Catalini & Gans, 2018; Cong, Li, & Wang, 2018).

REGULATORY UNCERTAINTY AND CHALLENGES

Conley (2017) indicates that the design and structure of a token determines whether there is a need to comply with financial regulations. However, regulatory uncertainty leaves a blockchain-entrepreneur in the middle, ensuring that many entrepreneurs try to structure their tokens in a way that these do not fall under financial regulations (Catalini & Gans, 2017; Sehra et al., 2017). Compliance with regulations may lead to significant increased costs (Conley, 2017; Moyano & Ross, 2017), a decrease in a token's usability and pseudonymity (Catalini & Gans, 2017), and a lower adoption rate.

In addition to regulatory uncertainty, the lack of structured and reliable data, both for a blockchain-entrepreneur and an agent, may result in lemon markets and information asymmetries. This may lead to an inaccurate assessment of a token's value, misjudgment of project risks, and instable ecosystems and markets (Adhami et al., 2017; Allen, 2017; Sehra et al., 2017).

Hence, it is expected that tokens, which are considered a new digital asset class, will become subject to tighter regulations, that will demand issuers of tokens to disclose and inform according to predefined standards (Conley, 2017; Moyano & Ross, 2017; Rabah, 2017). This should result in reduced information asymmetry, potentially leading to a more rapid adoption of tokens and a more sustainable growth of ecosystems (Böhme et al., 2015; Sehra et al., 2017). Nonetheless, Catalini & Gans (2017) indicate that the gains coming from regulations take time. Even more, Allen (2017) indicates that new regulations might not be in favor of blockchain-entrepreneurs, as "incumbents [are] lobbying to defend their territory and draw blockchain technology within existing regulations" (p.7). Political influence is believed to impact a token's success (Davidson et al., 2016a), and sometimes forces projects to move to more favorable jurisdictions (Adhami et al., 2017; Sehra et al., 2017), which could result in a regulatory race-to-the-bottom.

INFLOAT'S IN-DEPTH RESEARCH PROJECTS

Helpful for businesses, but available to anyone.

You do not have to invest heavily to understand the opportunities blockchain technology and crypto tokens can offer you.

Whether you want to validate your current solution, broaden your understanding of the field, or find the best use case for your business, our research provides the information you need to guide your decision-making and discussions with stakeholders. Contact us and let us help you explore this exciting world.

SOURCES

Adhami, S., Giudici, G., & Martinazzi, S. (2017). Why do business go crypto? An empirical analysis of Initial Coin Offerings. Milan: Universita Bocconi.

Allen, D. W. (2017). Discovering and developing the blockchain cryptoeconomy. Australia.

Böhme, R., Christin, N., Edelman, B., & Moore, T. (2015). Bitcoin: Economics, technology, and governance. Journal of Economic Perspectives, 29(2), 213-238.

Bigi, G., Bracciali, A., Meacci, G., & Tuosto, E. (2015). Validation of Decentralised Smart Contracts through Game Theory and Formal Methods. Programming Languages with Applications to Biology and Security, 142-161.

Bolt, W., & van Oordt, M. R. (2016). On the value of virtual currencies (working paper). Ottawa, Canada.

Brenig, C., Schwarz, J., & Rückeshäuser, N. (2016). Value of decentralized consensus systems - evaluation framework. Retrieved from Association for Information Systems: http://aisel.aisnet.org/ecis2016_rp/75

Catalini, C., & Gans, J. S. (2017). Some Simple Economics of the Blockchain. Working Paper No. 2874598.

Catalini, C., & Gans, J. S. (2018). Initial Coin Offerings and the Value of Crypto Tokens. National Bureau of Economic Research.

Cong, L. W., Li, Y., & Wang, N. (2018). Tokenomics: Dynamic Adoption and Valuation. Colombia Business School.

Conley, J. P. (2017). Blockchain and the Economics of Crypto-tokens and Initial Coin Offerings. Nashville, Tennessee, United States of America.

Davidson, S., De Filippi, P., & Potts, J. (2016, July 16). Disrupting Governance: The New Institutional Economics of Distributed Ledger Technology . Retrieved from SSRN: https://ssrn.com/abstract=2811995

Davidson, S., De Filippi, P., & Potts, J. (2016). Economics of Blockchain. Fort Lauderdale: Public Choice Conference.

Monegro, J. (2016, August 6). Fat Protocols. Retrieved from Union Square Ventures: http://www.usv.com/blog/fat-protocols

Moyano, J. P., & Ross, O. (2017). KYC Optimization Using Distributed Ledger Technology. Business & Information Systems Engineering, 59(6), 411-423.

Nair, M., & Cachanosky, N. (2017). bitcoin and entrepreneurship: breaking the network effect. The Review of Austrian Economics, 30(3), 263-275.

Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System.

Rückeshäuser, N. (2017). Typology of Distributed Ledger Based Business Models. (pp. 2202-2217). Freiburg: University of Freiburg.

Rabah, K. (2017, September). Digital Cryptoeconomics Powered by Digital Cryptocurrency. Mara Research Journal of Computer Science and Information Security, 1(1), 107-131.

Sehra, A., Smith, P., & Gomes, P. (2017). Economics of Initial Coin Offerings.

Østbye, P. (2018, June 14). Model Risk in Cryptocurrency Governance Reliability

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