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ABSTRACT

Decentralized Autonomous Organizations – DAOs constitute a new form of collective organization in the digital era. They usually relate to the use of blockchain technology, that ensures decentralization. DAOs rely on smart contracts to define their functioning rules and their operation. In general, DAOs are not related to traditional corporate forms and are not necessarily registered or recognized by law as corporates or associations. In any case, DAOs enable a new kind of governance, a governance based on technology and based on the use of smart contracts deployed on a blockchain network. In this sense, they could represent a revolution on collective governance. A revolution that could shape governance in the digital era. For this reason, DAOs could be the governance tool of Web3. The use of tokens as means of participation and voting by the members of a DAO provide a new technology tool that can combine law, governance, game theory, and behavioral economics. DAOs themselves could be viewed as technology tools that could transform governance in general and even democratic participation. The paper examines these issues and try to critically evaluate the potential and possible caveats of using DAOs as a governance tool. It demonstrates that the idea of decentralized governance in DAOs is similar to decentralization of governance of open-source software. The paper also highlights that the notion of modularity present in the open-source scene is also present in the blockchain technology realm and could be transposed to governance in DAOs. This modularity also contributes to the disruptive nature of governance in and by DAOs. As demonstrated in the paper, DAOs are true catalysts of law, governance and technology and represent the future of governance systems. The article refers that DAOs enable the coexistence of multiple democratic governance stacks. In any case, also mentions that some problems could arise from these multiple governance instances, as the fragmentation of the collectivity, the difficulties associated with the choice of the governance modules, the risk to the democratic principles in creating partial democratic instances, and the risks associated with a technocracy. At the end, considering all the benefits and risks related to the use of these new digital collective governance tools, the article concludes that DAOs can be considered the future of governance systems.

1. Introduction

Decentralized Autonomous Organizations (DAOs) constitute a new form of collective organization in the digital era. They usually relate to the use of blockchain technology, that ensures decentralization. DAOs rely on smart contracts to define their functioning rules and their operation. In general, DAOs are not related to traditional corporate forms and are not necessarily registered or recognized by law as corporates or associations.

In any case, DAOs enable a new kind of governance, a governance based on technology and based on the use of smart contracts deployed on a blockchain network. In this sense, they could represent a revolution on collective governance. A revolution that could shape governance in the digital era. For this reason, DAOs could be the governance tool of Web3.

2. Decentralized Autonomous Organizations - DAOs

2.1 Concept and notion

The use of smart contracts based on blockchain technology enabled the emergence of the decentralized autonomous organizations (DAO's). The concept of DAOs is not univocal, but it is possible to define some relevant traits for its definition.

2.1.1 Organizations

On the one hand, a DAO is a kind of *organization*, a way of organizing the actions of a collectivity, usually of people. This means that the DAO's function corresponds to promoting the organization of resources and efforts on the part of this collectivity, with one or several objectives.

Furthermore, DAOs can involve not only the organization of people, but also of machines and equipment. According to Primavera De Filippi and Aaron Wright, "*We could thus witness the emergence of decentralized autonomous organizations that enter into contractual relationships with individuals or other machines in order to create a complex ecosystem of autonomous agents interacting with one another according to a set of pre-determined, hard-wired, and self-enforcing rules*" (DE FILIPPI and WRIGHT, 2015, p. 17).

Therefore, DAOs constitute tools based on blockchain technology used to promote organization of efforts with a view to one or more goals. This is typically the organizational face of DAOs. This represents the use of blockchain technology for the purpose of organizing the joint action of people or machines and equipment.

2.1.2 Decentralization

Other relevant characteristic of DAOs that is essential is *decentralization*. DAOs are not just organizations. They are *decentralized* organizations.

Decentralization provided by DAOs largely derives from the decentralized characteristic of blockchain networks. Primavera de Filippi and Aaron Wright mention that "*By facilitating coordination and trust, a blockchain enables new forms of collective action that have the potential to bypass existing governance failures. It can thus potentially resolve many of the common problems related to the opacity and corruption inherent in the decision making of many organizations*" (DE FILIPPI and WRIGHT, 2015, p. 16).

The purpose of this text is not to specifically examine blockchain technology and its characteristics, but it must be assumed that blockchain technology presupposes the decentralized registry of information in several nodes in a network that can be public (accessible to anyone) or private (accessible only to those authorized to do so). This information is gathered and registered into blocks, which contain encrypted information (through the use of hashes) and are chained together. The inclusion of information in the network and in the blocks is replicated in all the nodes of the network and is made possible by the use of consensus mechanisms (such as proof of

work or participation and proof of stake) that ensure validity (provenance and veracity) of the information to be recorded in all blocks.

The decentralized characteristic of DAOs contrasts with the traditional notion of organization, based on fixed structures, organized hierarchically in a chain of command and control. Unlike traditional organizations, DAOs involve an open and decentralized structure, not subject to a certain hierarchy.

This is probably the central characteristic of DAOs. They involve a decentralized form of organization, which subverts traditional notions of hierarchical-based organization. And it is precisely this characteristic that makes them revolutionary.

The entire theory of organizations and the developments concerning the theory of the company are related to the examination of relationships based on an organization founded on hierarchy and chains of command and control. The examination of incentives within a business or other traditional organization considers this characteristic of supra-infra-ordination.

Most of these studies are also related to the examination of principal-agent (principal/agent) relationships and interactions, in which there is a relationship of dependence and command between the principal and the agent. Thus, for example, the managers (agents) of a particular company report to the company's board (principal). The executive board (agent), in turn, acts in a subordinate manner to the shareholders (principal), to whom it is accountable for its actions.

In the case of decentralized organizations, this traditional notion of organization is not present. This requires a new vision regarding the forms of organization, imposing a relevant change of the traditional organizational paradigms.

Hence the relevance of the notion of decentralization for DAOs.

2.1.3 Autonomy

Another aspect related to DAOs is related to their autonomy. Autonomy relates to the absence of specific command by the members of a DAO. A true DAO acts autonomously and separately from its members and their wills and determinations.

The DAO has autonomous action and behavior of its members. "*As long as they receive sufficient funds to operate on their own, they can thus subsist independently of any third party. If a decentralized organization is truly autonomous, no one (including its original creator) can control it after it has been deployed on the blockchain*" (DE FILIPPI and WRIGHT, 2015, p. 17).

The autonomous performance of DAOs is only possible due to the use of blockchain technology and the use of computer codes (smart contracts) by which is defined the way a DAO works and is automated.

It is, in a way, a controversial aspect, insofar as it implies a separate and independent action from its members. Thus, the functioning and performance of a DAO may not have any relation to the will of its members, if this form of action was established in the smart contracts that govern this organization.

Considering the notion of autonomy, it is possible to identify a gradation in the degree of autonomy of DAOs. It is possible to conceive DAOs with a maximum degree of autonomy, in which the existence of specific funds allows the continuity of their activities regardless of the role or manifestation of the will of the members and DAOs with a lesser degree of autonomy, in which smart contracts (computer codes that establish the existence and functioning of a DAO) require periodic and specific manifestations from members regarding certain issues and matters relevant to the functioning and performance of the DAO.

> The former are called **algorithmic** DAOs and the latter, **participatory** DAOs.

Aaron Wright points out, in this sense that "*Algorithmic DAOs defer entirely to software to structure and coordinate social interactions, in the same vein as Bitcoin, Ethereum, and other decentralized blockchain-based protocols. Participatory DAOs are being used to engage in traditional commercial endeavors—like venture capital financing—and are being explored to manage open source technology involving a smart contract running on the Ethereum blockchain*" (WRIGHT, 2021, p. 157).

Therefore, DAOs can be more or less autonomous, as established by the computer code of the smart contracts that created them and regulate their performance.

2.2 Digital nature

A fundamental characteristic of DAOs is their digital nature. These are fundamentally digital organizations, created in computer code and existing within the framework of blockchain networks. This means that, unlike traditional organizations, DAOs do not necessarily have physical headquarters. They exist digitally and function within the framework of blockchain networks.

This does not mean that DAOs cannot have physical or real-world manifestations. At least in the current phase of technological development, the interrelation between the digital space and the physical world is necessary at various times.

In the case of DAOs, it is even feasible to design certain organizations as purely digital. However, if these organizations intend to carry out activities that go beyond the boundaries of the digital space to generate effects in the "physical" world, there will be a need for some interfaces that ensure that digital action translates into consequences in the physical world.

An example allows us to understand this circumstance: if a DAO has the objective of developing and encouraging education, at certain times it will be necessary for the human, intellectual and material resources raised by the DAO to be applied in the physical world, in schools and educational institutions benefited by the

DAO's performance. Another example is a DAO that aims to provide social assistance to certain groups. The existence and digital functioning of the DAO will be useless if the funds and assistance that are the basis of its existence do not reach the beneficiaries of its activities. For that reason, interfaces between the existence and performance in the digital realm with the performance in the physical world are necessary. Cryptographic assets must be translated into fiat currency or used to acquire goods and utilities for those benefited by the DAOs actions.

In any case, this circumstance does not rule out the fact that DAOs constitute native digital organizations. Thus, they arise and exist digitally. The gathering and organization of people is promoted digitally.

2.3 Smart Contracts and DAOs

From the above, it can already be seen that smart contracts play a fundamental role in the establishment and operation of DAOs. The existence of DAOs is closely linked to the use of computer code consistent of smart contracts.

The smart contracts allow the very existence of DAOs. There is no way to talk about DAOs without using technology that involves programming their existence and way of functioning in one or more smart contracts. These define how the DAO will be structured and how it will work.

Computer codes present in one or more smart contracts establish the form and structure of the DAO and how it will work. Such codes also define other aspects such as the way in which the members of a DAO act and whether certain tokens related to this participation will be issued and how these tokens relate to the operation of a particular DAO.

Codes automate the functioning of a DAO and regulate the way it operates. Shermin Voshmgir mentions that "*A DAO can be formalized by a smart contract. Use cases range from simple to complex. The complexity depends on the number of stakeholders, as well as the number and complexity of processes within that organization that will be governed by the smart contract*" (VOSHMGIR, 2019, p. 119).

Therefore, smart contracts are essential for any DAO. Generally, the smart contracts are registered and executed on a certain blockchain network. The association of the computational code to a blockchain network assigns certain characteristics to these smart contracts, which become immutable and self-executing.

As they are registered on a decentralized blockchain, these smart contracts also contribute to the decentralization of a DAO. It is not feasible that one or some of its members intend to promote changes in the functioning of a DAO by altering the respective smart contracts without this being agreed by the other members (or approved by the number of members established by the code that establishes the DAO) or without this being promptly verified by the other members.

Smart contracts are the source of existence of DAOS. It is by the way of these smart contracts that the objectives and way of functioning of a DAO are established, as well as relevant aspects of its governance.

2.4 Origins

The origin of DAOs is related to internet age organizations and the notion of open-source software. The development of experience related to open-source software is referred to by Aaron Wright, who mentions that "*Inspired by models of open source collaboration, DAOs connect people together through blockchain-based protocols and code-based systems, focusing on achieving a shared social or economic mission*" (WRIGHT, 2021, p. 155-156).

2.5 Evolution

Like the technology that allows their existence and operation, DAOs are also currently evolving. It is possible to identify some evolutionary traits in relation to DAOs.

Aaron Wright mentions that DAOs are an evolution of the forms of human organizations. According to the author, as our world becomes increasingly digital, technologists continue to pursue the evolution of social coordination using blockchain technology and smart contracts to structure and automate central aspects of a group's decision-making process, formation and use of capital (WRIGHT, 2021, p. 153). Still according to Wright, DAOs are digital native organizations that are expected – at least in the eyes of their creators – to serve as the primary organizational structure for the internet age (WRIGHT, 2021, p. 154).

2.6 Use Cases

Like traditional organizations, DAOs also serve a variety of purposes. They can perform different functions.

They can be used to establish organizations within the scope of what is called Decentralized Finance (DeFi). They can also be used in organizations focused on the pursuit of a greater social objective, as is the case with the social DAOs.

The fact is that the same existing flexibility regarding the use of smart contracts is also present regarding DAOs. The relative neutrality of the computational code underlying a DAO allows it to be employed for a variety of purposes.

Whenever there is a situation in which there is a need to establish a certain organization (people or machines/systems) with a certain objective, it is feasible to establish a certain DAO.

This does not mean that DAOs are all-purpose entities or that their use could be viewed as a true panacea. As in the case of traditional organizations, there will be situations in which the use of DAO allows overcoming a certain organizational problem that would not be possible with the use of another form of organization. But this

will not always be true. In some cases, decentralized and non-hierarchical structuring may not be the most recommendable solution to solve a given organizational problem.

2.7 Types of DAOs

Several species of DAOs can be identified, according to their way of functioning and according to their function. Depending on how they work, one can identify algorithmic DAOs and participatory DAOs, in the classification given by Aaron Wright (WRIGHT, 2021, p. 157).

The difference between them resides in the form of action and functioning - and in the greater or lesser importance given to the manifestation of its members in the definition of fundamental questions related to its functioning and performance.

This is one of the criteria used to classify DAOs. There are other criteria, as their main function or purpose (there can be social DAOs, governance DAOs, grant DAOs, and investment DAOs), that due to the limits and purpose of this text are not going to be fully explained here.

3. Governance, Law and Behavioral Economics

To a large extent, DAOs allow us to deal with governance issues, but also pose a series of questions related to their framing in different law systems. Besides this, DAOs computer code structure is capable of embed mechanisms that can be used to promote technics of behavioral economics and game theory.

3.1 DAOs and the revolution in governance

Given this, it is possible to say that DAOs have the potential to revolutionize governance systems. The first characteristic of DAOs is their flat structure, without hierarchy. This alone constitutes a major revolution in traditional forms of governance.

But the revolution in governance provided by DAOs is not limited to that. The combination of the use of computational code, behavioral economics and game theory has great potential for innovation in governance systems.

3.2 The Tech Substrate

The first aspect is related to the tech substrate. In DAOs, technology – and largely, computed code – plays an essential role. Blockchain networks are also central to the existence and functioning of DAOs. DAOs as new governance tools are possible thanks to the use of blockchain technology and smart contracts, as mentioned above.

In this sense, Shermin Voshmgir mentions that "*Tokenized networks based on blockchains and smart contracts can disrupt traditional governance structures and challenge the current forms of how society organizes itself.*

They are a game changer in many aspects of governance by (I) reducing the principal-agent dilemma of organizations through transparency; (II) incentivizing network actors with a native token, thereby disintermediating and reducing management costs by orders of magnitude, and (III) replacing the reactive procedural security of the current legal system, with proactive and automated mechanisms that make a potential breach of contract expensive, and therefore infeasible" (VOSHMGIR, 2019, p. 104)

Unlike traditional computerized management tools (v.g. traditional ERP software), DAOs promote a substantial change in the relationships and organization of human groups. And this is feasible only if we consider the existence of DLT/blockchain technologies.

3.3 The Role of Tokens

Tokens are essential elements of blockhain networks. Tokens are digital representations, issued within a blockchain network and which can be programmed.

According to Michèle Finck, "*A token or coin is, essentially, a digital good that is artificially rendered scarce and tracked through a blockchain or blockchain-based application. These cryptoassets are artificially scarce, as the prohibition of double spending prevents an owner from spending a coin more than once. (…) tokens can have different purposes and represent anything from goods or services to rights, including voting rights*" (FINCK, 2019, p. 16).

Shermin Voshmgir also mentions that "*Cryptographic tokens represent programmable assets or access rights, managed by a smart contract and an underlying distributed ledger. They are accessible only by the person who has the private key for that address and can only be signed using this private key*". (VOSHMGIR, 2019, p. 139)

3.3.1 Tokens as elements of participation

In the case of DAOs, tokens are essential tools. As in traditional companies, tokens represent the participation of an individual in a DAO. Individuals are qualified as members of a DAO since they have in possession tokens emitted by the DAO.

Tokens, in this case, are similar to a company's stocks. They represent the participation of an individual in a decentralized organization. Holders of tokens are members of a DAO because they hold a token emitted by the DAO. They ensure the right of the holder to vote inside a DAO.

3.3.2 Tokens as elements and tools essential for governance

Tokens are not only a representation and a "key" to participate in a DAO, but they are essential tools for governance. They can be considered fundamental elements for a DAO governance framework, as they can ensure and implement governance rules and encourage certain behaviors.

3.3.3 “Tokenomics” and Governance

One aspect of the tokens as governance tools is related to what is called “tokenomics”. The elements of economic theory, when applied to token emissions in a DAO could produce (or induce) certain behaviours. The idea of tokenomics is related the role of tokens as (digital) tools that can be used to coordinate and influence behaviors of the participants in a system.

According to Lisa Jy Tan “*Token economics is a new field in economics that looks into the incentive design and mechanisms of token-based ecosystems. It is defined by the general framework used to design the incentives of the system*” (TAN, 2021, p. 15).

Accordingly, tokens can be used in DAOs as a tool to coordinate and influence behavior through positive and negative incentives.

3.3.4 Game Theory and Tokens in DAOs

In some sense, tokens can also be used to implement game theory principles.

It should be noted that all blockchain networks are structured around game theory principles and mechanisms. This implies that the blockchain networks are also bound to traditional economic principles based on the rationality of the agents. The idea of scarcity that influences and drives rational conducts of rational agents is behind the organizational principles of the DLT and blockchain networks.

In the words of Shermin Voshmgir, “*In blockchains, game theory is used to model human reasoning to build networks that need no oversight but have positive outcomes for the greater good. There is, furthermore, an entire class of games in the network science literature, called “network formation games" that cover everything from how academic citation and collaboration networks emerge, to Twitter graphs, etc. However, planning for unpredictable human decisions first requires that we understand what motivates people. Traditional game theory seeks to pinpoint the decisions rational players should choose. Rationality is a primary assumption of game theory, so there are not explanations for different forms of rational decisions or irrational decisions*”. (VOSHMGIR, 2019, p. 241).

The author also mentions that “*Tokens can also incentivize an autonomous group of people to individually contribute to a collective goal. These tokens are created upon proof of a certain behavior*” (VOSHMGIR, 2019, p. 139).

3.4 Behavioral Economics in DAOs

As economic studies are not limited to the traditional economic principles that are in the base of game theory, blockchain (and DAOs) also go further and profit from the development of the economic understanding.

In this sense, ideas and theories that study irrational behaviors – besides rational behaviors -, present in the field of behavioral economics and cognitive psychology are also used to structure blockchain networks and DAOs.

This is highlighted by Shermin Voshmgir: *It is therefore necessary to enlarge the assumptions of current cryptoeconomic primitives by taking concepts from behavioral economics, and behavioral finance, and behavioral game theory, and cognitive psychology, which could help develop more sophisticated cryptoeconomic primitives*". (VOSHMGIR, 2019, p. 241)[1].

The consideration of economic principles related to behavioral economics directly impacts the structuring of blockchain networks, the issuance of tokens and the structuring of DAOs. The use of specific tokens, which are not related to an economic value *per se*, become relevant to direct and influence the behavior of participants in a DAO.

These **purpose-driven tokens**, as referred to by Shermin Voshmgir are the way by which blockchain networks and DAOs embody the thoughts, ideas and techniques developed within the scope of behavioral economics. According to the author, "*cryptographic tokens might be a catalyst for such behavioral concepts in applied economics in the future*". (VOSHMGIR, 2019, p. 245). She also mentions that "*As the field of cryptoeconomics and purpose-driven tokens matures, it is likely that behavioral finance and behavioral game theory will find its way into the crypto economic modeling of such purpose-driven tokens.* (VOSHMGIR, 2019, p. 241).

The concept of specific purpose tokens is also highlighted by WEYL, OHLHAVER, and BUTERIN (WEYL et al, 2022). The authors coined the term "*soulbound token*", to refer to non-transferable tokens "*representing commitments, credentials, and affiliations*" (WEYL et al, 2022, p. 1). According to them, DAOs could use soulbound tokens "*to make leadership and governance programmatically responsive to their communities. Leadership roles could dynamically shift as the composition of the community shifts—as reflected in the changing distribution of SBTs across member Souls* (WEYL et al, 2022, p. 8).

Evidently, building governance rules in DAOs that take these principles into account and are effective in coordinating the actions of their participants is not a simple task. There are many ways to structure tokens and governance rules in DAOs to achieve the desired purposes and this will involve a lot of trial and error.

For the purposes of this text, it is sufficient to consider that DAOs (and tokens) are capable of these tasks and that the definitions over token and DAOs structures to convey certain structures and goals for governance will always be complex. In this sense, Shermin Voshmgir affirms that "*While blockchain has made it easy to incentivize any kind of behavior with a token, the question of how to design the governance rules of such purpose-driven tokens is subject to questions of public good theory, "free-rider" problems and externalities, behavioral economics, nudge theory, behavioral game theory, and behavioral finance*". (VOSHMGIR, 2019, p. 245).

3.5 Combining Tech, Economy, and Legal principles to Achieve Governance Structures

Thus, DAOs can combine technology, economy, and legal principles to define and build governance structures. In other words, governance in a DAO refers to a combination of legal norms, economic principles, and limitations and incentives derived from the use of technology.

Each of these aspects could be embedded in the smart contracts that define how a DAO works and functions. As referred to by Davidson, De Filippi and Potts, "*When coupled with token systems (as we will see in the Backfeed case study below), blockchains make possible new institutional orders that operate at a micro scale, yet with the full coordination properties of what we would otherwise attribute to a self-organizing macroeconomy*". (DAVIDSON, DE FILIPPI, et al, 2016, p. 15).

3.6 Law, Governance, and Technology – DAOs as Catalysts

In light of the above, it can be said that DAOs have a relevant role as catalysts for Law, governance principles and technology. They are capable of combine legal, governance and technology elements to influence and to coordinate human behavior.

And why DAOs and not other previous technologies? DAOs have a unique characteristic that is peculiar to them: they are based on DLT and blockchain networks and are structured around smart contracts. Self-enforceability inherent to smart contracts ensures that legal and governance rules are incorporated into DAOs, automating their enforcement.

4. Take a Ride on the Tech Side

All this is made possible by the use of blockchain technology. We are currently at a point in which is possible to refer to blockchain technologies as relatively settled concepts and tools. Although blockchain technology is constantly evolving, the basis of its implementation and the functions for which it can be employed are relatively developed and are the subject of real use cases.

4.1 Tech and Law

The relationship between technology and law is not simple or straightforward. There is a relationship of interdependence and complementarity between the two. Technology is influenced and regulated by law, but also influences and can be a regulatory instance (similar to legal norms).

That is why Michèle Finck mention that blockchains could be a *regulatory technology* (FINCK, 2019, p. 67-68).

According to her, "*Computer code has thus started to inaugurate a new era of legal codification. Blockchain technology could come to constitute an important building block of that evolution. Two main elements ground*

blockchains' potential as a regulatory technology. First, distributed ledgers' protocols enforce their creators' normative choices. Depending on their respective set-up, this could be leveraged by public and private actors alike to create an environment for transactions that adheres to specific rules, which may reflect applicable law, or not. Second, applications running on blockchains, most notably smart contracts, can be designed to be self-enforcing, automating compliance with a predetermined ruleset. As observed in the introductory chapter, smart contracts' execution cannot be stopped (unless this is explicitly indented from the beginning), leading to the automated enforcement of the encoded rule set" (FINCK, 2019, p. 67-68).

Kevin Werbach also indicates that "*In most cases, blockchain-based technical enforcement mechanisms and traditional legal structures will have no direct contact. Law shapes behavior for only in limited circumstances. There is a vast domain of activity that Blockchain-based ledgers can structure, where law is indifferent. Even when there is some potential for overlap, the two systems often serve different objectives*" (WERBACH, 2018, p. 165).

But the author mentions situations in which blockchain touches the legal system and vice versa. According to WERBACH, there are three possible forms of interaction: blockchain technology can supplement, complement, or substitute legal norms (WERBACH, 2018, p. 165).

The author explains that "*The blockchain acts as a supplement when it takes law as the basic means of enforcement. In these situations, the primary value proposition of the distributed ledger is the efficiency gain of a shared data record. Even though the blockchain creates its own enforcement mechanisms for transactions and smart contracts, they are structured in such cases to reinforce the established legal rules. Supplemental scenarios illustrate that blockchain-based systems do not necessarily replace legal arrangements, even when they operate as an alternative compliance mechanism. The blockchain acts as a complement when the legal regime is flawed. Law can fail for many reasons, even in jurisdictions with sophisticated and well-established legal systems. Sometimes the volume of activity scales beyond the capacity of legal mechanisms to regulate it. Sometimes the legal system needs a better way to keep track of the things it regulates. Sometimes it needs a better way to keep track of the people it regulates. And sometimes enforcement lags because incentives are improperly aligned. A blockchain consensus can step in to fill gaps in enforcement through traditional means. The blockchain acts as a substitute when it replaces law entirely as the enforcement mechanism. This is perhaps the most widely described scenario in popular discussions on law and the blockchain, but it will likely be the least common in practice*" (WERBACH, 2018, p. 165-166).

The relationship between blockchain technology and legal norms is object of many studies. Wright and De Filippi also coined the term "*lex cryptographia*" to refer to the possibility that distributed ledgers and the technology behind them could be used to conform and rule behaviors. According to them, "*Today, we might be facing a similar inflection point in the history of the Internet. Just as the growth of decentralized communications layers, such as TCP/IP and HTTP, lead to the recognition of Lex Informatica, the progressive deployment of blockchain technology may give rise to yet another body of law—Lex Cryptographia—*

characterized by a set of rules administered through self-executing smart contracts and decentralized (and potentially autonomous) organizations" (DE FILIPPI and WRIGHT, 2015, p. 48). They affirm that "*The rise of Lex Cryptographia may reopen earlier debates about how to regulate the Internet and will raise new challenges concerning the regulation of decentralized (autonomous) organizations* (DE FILIPPI and WRIGHT, 2015, p. 48).

Thus, there is no doubt that blockchain technology, smart contracts, and therefore, DAOs could play an important role related to the relationship between law and code. Automation of legal norms could be possible using blockchain technology present in DAOs foundations.

4.2 Tech and Governance

The same can be said about the relationship between blockchain technology and governance systems. The use of blockchain technology allows the design of new, and more or less automated, modes of governance. These new governance modes could incorporate traditional modes of governance and build completely new ones.

Besides this, some authors claim that blockchain technology itself constitutes a mode of governance in digital form (DE FILIPPI and WRIGHT, 2015, p. 3).

And it is not only related to blockchain technologies. Before the advent of blockchain, other technologies -as the internet and its protocols - already posed governance questions.

Kevin Werbach indicates that different types of governance (cryptography, law, self-interest, and trust) are incorporated into blockchain systems. According to him, "*Cryptography and law govern by constraint: they limit what people can do. Self-interest and trust shape people's choices so that they choose voluntarily to act in a certain way. Cryptography and economics are forms of applied mathematics whose effects, over a sufficiently large data set, can be modeled objectively. law and trust are human-erected systems that always involve some measure of judgment and values.*" (WERBACH, 2018, p. 218-219).

Combine these (an eventually other types of governance systems) is not a simple task. This is the reason Werbach highlights that "*The governance challenge for blockchain-based systems is to merge these modalities. Each form of governance is imperfect by itself. Computer code neither knows nor cares whether it enables illegal behavior. Cryptographic constraints alone cannot ensure effective governance of distributed ledgers because they cannot comprehend human motivation*" (WERBACH, 2018, p. 219).

4.3 DAOs as a Technology Tool for Collective Governance

For their part, DAOs also constitute a technology tool for collective governance. First, they are, as mentioned above, organizations. Second, they rely on blockchain technology and smart contracts. For this reason, they could make use of smart contracts to implement and enforce governance rules for their functioning.

This is confirmed by De Filippi and Wright who indicate that "*The blockchain has the possibility to fundamentally change the way people organize their affairs. The technology can be used to create new software-based organizations referred to as decentralized organizations (DOs) and decentralized autonomous organizations (DAOs). These organizations can re-implement certain aspects of traditional corporate governance using software, enabling parties to obtain the benefits of formal corporate structures, while at the same time maintaining the flexibility and scale of informal online groups. These organizations also can be operated autonomously, without any human involvement.* (DE FILIPPI and WRIGHT, 2015, p. 3).

4.4 The Open-Source Software Model and Tech Governance

The open-source software model is referred to as a model of governance based on openness and also on composable participation. Community-lead development of open-source software is not based on hierarchy nor in command-and-control mechanisms.

For this reason, as mentioned above (v. item 2.4), the open-source software movement is seen as the precursor to DAOs.

In the case of open-source software development, there is an open governance structure that ensures that any interested party could bring contributions to the software code or review the contributions of others. There is an organization of an indeterminate number of participants with a common objective: to develop and update a certain software.

In a certain way, the ideals enshrined in the open-source software movement apply to DAOs as well. De Filippi and Wright mention that "*In that sense, decentralized organizations can be thought of as open-sourced organizations.* (DE FILIPPI and WRIGHT, 2015, p. 16).

The reference to an already known - and established - model of governance in the field of technology development is relevant because it provides a secure parameter for the construction of the model and the development of governance structures of these new organizations.

As Magnuson highlights, "*If anything, the suggestion that the blockchain is not radically novel, but rather follows in a long tradition of technologies aimed at spreading out knowledge and power, is a more helpful one than the claim that blockchain is so revolutionary that it has no precedents. If blockchain is sui generis, and thus without precedent, we are forced to examine it in a vacuum. Analysis in a vacuum is hard. But once we view blockchain and cryptocurrencies as part of a trend, not the exception to one, we can assess them in historical context. We can look back at other efforts and examine how they turned out. We can draw comparisons. We can take accounts*" (MAGNUSON, 2020, p. 211).

4.5 Modularity in the open-source scene

One of the key concepts of open-source software is modularity. Modularity implies that many pieces of a software code could be put together to compose a common (and functional) software. "*A modular system is thus represented as a complex of components or sub-systems, where designers try to minimize and standardize the interdependencies among modules*" (NARDUZZO and ROSSI, 2005, p. 86).The authors mention that "*The free availability of the source and the absence of code ownership make programming a truly public process, since good coding solutions are shared and adapted to solve similar problems (Pavlicek, 2000), and ex post interdependency conflicts are handled by employing a wider set of fine-tuning strategies*" (NARDUZZO and ROSSI, 2005, p. 96).

4.6 Blockchain Technology and Modularity

The reference to the open-source software development model is not casual. Blockchain networks and smart contracts are also based on open software, whose development follows the free software model. In this way, they also involve and benefit from the inherent modularity of the free/open software model.

This aspect contributes to the modularity of blockchain-based systems. DAO's benefit from the modularity and governance systems and rules implemented by DAOs tend also to be open and modular.

4.7 Blockchain Governance and Modularity

This allows governance systems established for a given decentralized organization to be easily leveraged in other organizations. More than that, in view of the modular nature of these systems, it is possible to use only part of the governance system and combine it with other systems. The combination of open and free software and the radical transparency ensured by the use of blockchain technology expands the possibility and potential of the modularity.

Modularity could present this first and specific sense.

But modularity could also have another sense. In this view, modularity is also present in the sense that there will be simultaneously several DAOs using different governance systems. A given individual may be part of more than one DAO and be subject to various governance systems. Depending on the objectives and purposes of each organization, a particular governance system will apply.

Also in this sense, there is modularity. The coexistence of several governance systems simultaneously produces modularization - and, in a way, some kind of "competition" between the existing models.

Modularity could also correspond to a third sense, related to different means of governance within the same decentralized organization (DAO). In an extreme simplification, one can consider on-chain governance systems and off-chain systems. Both are relevant and necessary to ensure the governance of a decentralized organization.

In that regard, Kevin Werbach affirms that "*There are a variety of alternative methods to govern behavior without formal enforcement. Incentive structures may make the desired behavior the rational choice, even though people retain the option in theory to do otherwise. Behavioral "nudges" may produce similar results, even when not based on rational self-interest, by shaping the "choice architecture" of decisions. And community norms backed with community-based sanctions may be strong enough to promote compliance. Each of these mechanisms involves trade-offs. Choices made in the rule-making process are necessarily about compliance structures. Blockchain networks do more than just enforce consensus over distributed ledgers. They incorporate a variety of formal and formal governance mechanisms. The results will be different when the same dispute occurs on Bitcoin, Ethereum, Ripple, or R3 Corda. One benefit of the proliferation of blockchain networks is experimentation with governance models*" (WERBACH, 2018, p. 138).

On chain governance systems are based on smart contracts and thus, are automated and self-enforcing. Nevertheless, human-based governance (represented by off-chain governance mechanisms) remain essential to ensure a coordinated governance system and to avoid some problems and limitations inherent to systems based solely on smart contracts and code.

Werbach confirms this by indicating that "*Without such human-based governance and dispute resolution mechanisms, smart contracts on the blockchain will sometimes execute in ways that are inconsistent with the desire of the parties. Given the extraordinary scope of activity that could be tied into distributed ledgers, this is potentially a very worrisome proposition. The issue is not just financial loss, as with The DAO. (…) Blockchain networks cannot rely solely on their consensus rules to resolve conflicts that operate above the level of basic transaction validation*". (WERBACH, 2018, p. 141).

Therefore, even considering the innovative potential use of smart contracts by DAOs to implement algorithmic governance systems, it is not possible to ignore governance systems that are based on human action and deliberation. Successful DAOs combine both governance systems to ensure the achievement of the goals of the organization.

5. Composable governance: a primer

These premises allow us to present a preliminary notion of composable governance.

Composable governance is a notion that could be related to governance systems adopted by decentralized organizations (DAOs) and based on blockchain technology and smart contracts. These systems are modular and allow the combination - in a single organization or in several organizations - of different governance tools and governance mechanisms, which will necessarily combine algorithmic and traditional means of governance.

5.1 Governance and Web3

In view of the digital organizations currently existing on the web3, the issue related to governance systems is clearly relevant.

Web3 concepts are based on decentralized networks, decentralized applications (*DApps*) and decentralized organizations[2]. According to Kevin Roose, "*The term has been around for years, but it has come into vogue in the past year or so. Packy McCormick, an investor who helped popularize web3, has defined it as 'the internet owned by the builders and users, orchestrated with tokens'*" (ROOSE, 2022).

In this context, the role of DAOs as tools for collective organization in the context of Web3 will be essential. Traditional institutions are not be suitable to face the demands related to a decentralized reality. "*Tokenized networks of the Web3 introduce a new governance layer and introduce DAOs as a new social organism for the Internet. Decentralized autonomous networks represent dynamic living organisms governed by machine-enforceable protocols*". (VOSHMGIR, 2019, p. 112).

A decentralized web will also demand organizations that could provide governance tools able to tackle decentralization-related demands. In this sense, DAOs could be the ideal entities to the task.

As Shermin Voshmgir mentions, "*Blockchains and smart contracts offer the possibility to establish more fluid decentralized organizations around a specific economic, political, or social purpose. We can already see that some limited forms of Liquid Democracy are being applied in (a) consensus mechanisms like derivations of "delegated Proof-of-Stake," and "Proof-of-Work" when a miner joins a mining pool, and (b) smart contract-based DAO use cases*" (VOSHMGIR, 2019, p. 111).

5.2 Governance in the Digital Realm

The need for new tools and entities to build and provide governance is not only a need arising from Web3, but also a but also a concrete requirement derived from the expansion of the digitization of activities.

Digitization is a reality in every domain. Digital transformation currently plays a relevant role both in the private and public sector. The adoption of new technologies and digitization of many aspects of the life is a common trend all over the world. The Covid-19 pandemic was also a catalyst for digitization, as restrictions arising from protective health measures required that governments and firms developed alternative means to function digitally and online and to provide public services. The evolution of the digital realm during covid-19 pandemic was evident and contributed to the digital transformation of old practices.

In any case, digital transformation is an important factor to be considered when examining governance issues. The increasing use of digital resources introduces new tools and practices to old activities.

In this (digital) context, it is essential to rethink the idea of governance. "*Governance refers to the rules, norms and actions of how people interact within a community or organization through laws, norms, force, or language. The governance rules of an organization or group of people hereby regulate the process of decision making among all stakeholders involved*" (VOSHMGIR, 2019, p. 119).

For this purpose, governance tools and entities that ensure that these tools are applied must consider the new requirements of the digital reality. Many aspects of traditional governance processes are outdated when we face this new reality. Instant communication applications, decentralized organizations, and worldwide communities demand new and effective governance tools, that are more suited to the current (and future) reality.

According to VOSHMGIR, "*Since the emergence of the Internet, a vast array of distributed Internet tribes has emerged, which culminates in the social media platforms of today. Tokenized networks of the Web3 introduce a new governance layer, with DAOs as a new social organism for the Internet. Decentralized autonomous networks represent dynamic living organisms governed by machine-enforceable protocols*" (VOSHMGIR, 2019, p. 119).

5.3 Why Compound?

In this digital and decentralized scenario, it is not possible to have a unique or centralized form of governance. Whether in the private or in the public sector, decentralization makes it impossible to have a unified and/or perennial governance system.

Even if there were previously several modes of governance, according to the affiliation of a given individual to private organizations and submission to public entities, now we face a scenario that expands this reality.

According to Marcela Atzori "*(...) literature has conceptualized a rich variety of new organizational models, with the discussion of* ***multi-stakeholder*** *(Freeman, 1984; Almeida, Getschko & Afonso, 2015); decentralized (Shabbir, Cheema & Rondinelli, 2007);* ***distributed*** *(Abbott, 2000; Paquet, 2000); and* ***collaborative*** *governance (Ansell & Gash, 2008; Donahue, 2004). Although their meanings and definitions may change depending on context, these models share some basic features, such as: a trend towards deconcentration of hierarchical structures; a more responsive, transparent and accountable approach to decision-making; and the inclusion of multiple interest bearers in a platform of dialogue, in order to find consensus-based solutions to common problems*" (ATZORI, 2015, p. 14).

Different modes of governance will emerge and coexist. In this sense, the realization that decentralization produces the multiplication of governance means and tools requires a different posture on the part of individuals and companies.

Dealing with multiple levels and means of governance will require a way of managing and composing these governance tools.

Hence also the mention to **composable governance**. Therefore, the need to compose and combine governance means does not derive only from a voluntary intent but will end up being a real necessity. And, to the extent that social relations and relationships between individuals and public and private entities depend on the ability to compose these multiple instances of governance, composition will be inevitable.

5.4 Algorithmic Democratic Instances/Stacks

The future will demonstrate that a given individual will always (although sometimes only temporarily) be tied to certain forms of governance. The correct functioning of these forms of governance involves the guarantee of the democratic principle in public and private institutions.

Being able to ensure that citizens are capable of participating and understanding multiple instances of governance will be essential to ensure democracy. This requirement becomes more complex as there will also be instances of algorithmic governance.

For all these reasons, a way of composing different instances and means of governance, whether purely algorithmic or participatory, will be essential.

Some authors, as De Filippi and HASAN mention that "*Various authors have pointed out that DAOs could be used to further economic and political decentralisation in ways that may enable a more democratic and participatory form of governance (Swan, 2015; Atzori, 2015; Allen et al, 2017; Tapscott & Tapscott, 2017). However, as the limitations of blockchain-based governance came into light, especially in the aftermath of the aforementioned TheDAO hack (DuPont, 2017; Reijers et al., 2018; Menar et al., 2019), the public discourse around DAOs has shifted from describing DAOs as a technical solution to a governance problem (Jentzsch, 2016; Voshmgir, 2017) to a discussion on how DAOs could change the nature of economic and political governance in general (Davidson et al., 2016; Beck et al., 2018; Zwitter & Hazenberg, 2020; De Filippi et al., 2020)*" (HASSAN and DE FILIPPI, 2021, p. 6)

5.5 Freedom and Governance

On the other hand, it is essential to understand that the means and instances of governance are also linked to individual freedom.

Are individuals free to adhere to or adopt a particular instance and form of governance? Can they exercise their freedom not to adhere to a particular mode of governance without having their rights impaired or restricted? These are essential questions to be asked when it comes to examining the multiple spheres and tools of governance, as well as the form to be adopted for their composition. It is certainly a complex task.

The tools to obtain the composition of governance instances, whether DAOs or other means, must necessarily consider this circumstance and ensure the protection of the principle of individual freedom and freedom of choice.

As De Filippi and Wright highlight, *(...) despite the potential benefits of software-based governance, increased automation could result in decreased freedom and autonomy*" (DE FILIPPI and WRIGHT, 2015, p. 43). The authors issue the following caveat in this regard: "*When pushed to its logical extreme, algorithmic governance, might eventually result in a system that is highly prescriptive and deterministic; a system where people are, indeed, free to decide the particular set of rules to which they want to abide, but—after the choice has been made—can no longer deviate from these rules, to the extent that smart contracts are automatically enforced by the underlying code of the technology, regardless of the will of the parties. This could potentially lead to the emergence of the modernized version of a totalitarian regime*" (DE FILIPPI and WRIGHT, 2015, p. 43).

5.6 Democracy and Governance

A system that contains multiple (and composable) governance instances will certainly affect (positively or negatively) democracy. Depending on its concrete functioning, it could enhance democratic participation or also jeopardize democratic principles.

De Filippi and Wright assert, in that sense, that "*The transition towards more decentralization may not only impact the implementation or application of laws, but also how we govern business organizations and society at large. Blockchain-based applications present a genuine promise for new kinds of scalable innovations in governance and institutional design, where the ideals for a corruption free and effective social democracy may come true*" (DE FILIPPI and WRIGHT, 2015, p. 36).

Specifically referring to blockchain technology – which is a key element to decentralized governance and composable governance systems – Marcella Atzori mentions that "*The blockchain technology potentially allows individuals and communities to redesign their interactions in politics, business and society at large, with an unprecedented process of disintermediation on large scale, based on automated and trustless transactions. This process might rapidly change even the tenets that underpin existing political systems and governance models, calling into question the traditional role of State and centralized institutions*". (ATZORI, 2015, p. 4).

She highlights that "*Democracy can become more effective through the direct participation of citizens in the decision-making process. The blockchain technology can implement new models of participation, such as Liquid Democracy*" (ATZORI, 2015, p. 9).

However, democratic principles could not simply be reduced or translated to code and embedded in smart contracts and DAOs in a blockchain network.

A truly democratic environment depends on different and inter-related governance systems. The interaction between these systems enhances the ability of democratic principles to thrive.

Marcella Atzori warns that "*the role of governments, politics and representative democracy cannot be reduced to a web of instant atomic interactions, entirely executable by automated processes (If X, Then Y)*" (ATZORI, 2015, p. 22). She continues indicating that "*When citizens rights are concerned, however, it is worth recalling that human agents cannot be hi-tech elites who proclaim themselves benevolent dictators: they must rather be public officers legitimated through formal, accountable and transparent procedures*" (ATZORI, 2015, p. 20-21) and that "*an indiscriminate process of decentralization and "gamification" (DuPont & Maurer, 2015) of public administration through token-based incentives may turn out to be an irresponsible choice, with detrimental effects on citizens' fundamental rights*". (ATZORI, 2015, p. 19).

For various reasons, this does not mean that blockchain technology and autonomous decentralized organizations - DAOs are not relevant from the point of view of governance systems. First, even though they could be at first used and have greater relevance with regard to the private domain, this is enough to expand the forms of governance within the scope of private institutions. Second, the existence of several governance instances, with the coexistence of governance systems based on DAOs and established (at least in part) algorithmically, has the potential to influence public governance modes and, with this, expand democratic instances and mechanisms.

It is precisely a question of considering the existence of several governance instances, which will be composable. In other words, the confirmation of the idea of composable governance.

In this sense, De Filippi and Wright give some examples on this: "*Friction in government could be further reduced by implementing new governance models where politicians could become unelected during their term if they failed to maintain minimum public approval levels. Voters could lodge their vote for a specified politician. Once elected, if the electorate disapproved of the politician's actions, it could shift votes to another candidate at any point during the politician's term. If a politician's approval fell below a specified threshold, the politician would have to make the case for why he or she should remain in office*". (DE FILIPPI and WRIGHT, 2015, p. 39).

This is not a simple or clear-cut task. On the contrary, the "*major challenge for global civil society will soon be to explore new political and social dimensions, with the aim of integrating the applications of disruptive technologies such as the blockchain with citizens' rights, equality, social cohesion, inclusiveness, and protection of public sector*" (ATZORI, 2015, p. 32).

The idea of composable governance can stimulate debates and questioning about new forms of governance provided by technology, blockchain technology and the use of DAOs. There is still a lot to be dealt with in terms of structuring governance systems, solve problems related to their compatibility and interoperability and, of course, defining the ideal means to compound all these complex governance systems.

William Magnuson emphasizes this aspect indicating that "*The pathologies and shortcomings of democracy have been studied and refined for millennia. The pathologies of the blockchain have only just begun to be studied. But it does suggest that the technology is based on much more than just algorithms. If blockchain were simply computer code and math problems, with nothing more, it could never have achieved the level of attention and passion that it has. The blockchain's great promise is that it is inspired by the same principles that inspire democracy itself. This also happens to be its greatest flaw*" (MAGNUSON, 2020, p. 203-204)

5.7 Problems Associated

The complexity inherent in composable governance systems necessarily involves dealing with some issues related to governance systems and technology-based governance systems such as DAOs. Some of these issues are mentioned below.

5.7.1 Fragmentation

The first issue to be considered when considering a composable governance system consists of the tendency towards fragmentation of governance instances. Fragmentation means that each governance system is considered separately, without considering the other existing and interrelated governance systems.

This situation could lead to the lack of effective governance related to certain relevant issues.

5.7.2 How to Choose? The Paradox of Choice

One issue related to the idea of fragmentation consists in the difficulties arising from a plex of multiple governance instances. Digitization and automating governance systems via DAOs, for example, could be a way to counterbalance this issue.

In any case, for individuals, a reality in which there are multiple governance systems could lead to confusion and difficulties to select and to enroll in one or more governance systems. How to choose one governance system? How to select a DAO to be member of? How to define for which organizations relevant to governance systems a certain individual should apply?

In a certain way, we face a situation that can lead to the paradox of choice. The variety of governance systems can lead the individual to paralysis - instead of promoting the expansion and decentralization of democratic governance instances.

5.7.3 Anonymity and its Caveats

Other aspect, that is more related to DAOs and blockchain-based governance is the anonymity (or pseudoanonymity) that is the rule in this kind of system. This could provide worldwide governance communities and enhance privacy but as a consequence, individuals do not know each other member of the same community.

Anonymity could lead to the weakening of the feeling of belonging to a community with a common objective.

In this sense, the ideas related to create tokens that are tied to a notion of reputation of the individual, as in the case of the proposed idea of a "soulbound token" try to tackle this problem (WEYL et al, 2022). Anyway, it is a relevant issue that must be dealt with to ensure the feasibility of a composable governance system.

5.7.4 Partial instances and democratic principles

Creating various partial instances of governance could also jeopardize democratic principles. It is hard to define and see a large community when we face many governance systems working simultaneously.

The difficulties related to this were identified also by Marcella Atzori, that asserts that "*The major problem of an hypothetical global society only run through organizational patterns based on individualism – namely Decentralized Autonomous Organizations, free market rules, and "authority floating freely" (Section II, point l) – is that it would essentially lack legitimate mechanisms to regulate the convergence of the particular into the general, which is the traditional role of centralized political institutions*". (ATZORI, 2015, p. 25).

5.7.5 Technocratic risks

The use of computer code and automated systems also could produce a technocratic society. Relying only in automated organizations based on smart contracts could result in a society that is controlled by those who create (and understand) the computer code and the systems created upon it.

Primavera De Filippi highlights that "*Accordingly, despite its potential for disintermediation and decentralized cooperation, the social and political implications of blockchain technology are difficult to predict. In particular, it remains unclear whether technological decentralization will lead to a more decentralized and democratic society - one where people can freely organize themselves in an open and decentralized manner, freed from the control of governments and corporations-or whether it will instead lead to a more authoritarian society-one where most of our social interactions and economic transactions are mediated by trustless technological systems controlled by a few dominant players*" (DE FILIPPI, 2019, p. 7).

5.8 The future of governance systems

As Kevin Werbach indicates, "*Governance is a fundamentally hard problem. Blockchain technology addresses a particular governance challenge - consensus about the status of the ledger - in a new way. That does not by itself resolve the higher-level coordination challenges that blockchain networks face. Effective solutions will need to draw upon the best aspects of legal and technical trust*. (WERBACH, 2018, p. 223).

The author's warning confirms that the future of governance systems does not lie solely in digital and automated governance systems, such as DAOs. Other governance systems should be in place to ensure individual rights and the democratic principles.

The challenge will reside in integrate all these governance systems in a way that could enhance democratic participation and also ensure universal human right. The notion of composable governance must consider this requirement. Governance systems as Law, political institutions and the new governance instances provided by DAOs should coexist and be interrelated in a composable governance system[3].

6. Concluding remarks

Considering the above, DAOs are true catalysts of law, governance and technology and could represent the future of governance systems. DAOs enable the coexistence of multiple democratic governance stacks and are essential to a scenario in which we face different and composable governance instances.

As examined, some problems could arise from these multiple governance instances, as the fragmentation of the collectivity, the difficulties associated with the choice of the governance modules, the risk to the democratic principles in creating partial democratic instances, and the risks associated with a technocracy.

In any case, considering all the benefits and risks related to the use of these new digital collective governance tools, DAOs can be considered an essential tool for the future of governance systems. It is necessary to take some careful steps to ensure that democratic principles and individual freedom are guaranteed.

Biography

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Footnotes

1. According to Shermin Voshmgir, "*Behavioral economics is a field of economics that studies how economic decisions of individuals and institutions are impacted by psychological, cognitive, emotional, cultural, and social factors. It opposes classic economic theory of the "homo economicus," which reduces economic decision making to simple profit maximization based on an individual utility function of "perfect selfishness."* (VOSHMGIR, 2019, p. 245). ↩
2. According to Wikipedia, "*The term "Web3" was coined by Polkadot founder and Ethereum co-founder Gavin Wood in 2014, referring to a "decentralized online ecosystem based on blockchain." In 2021, the idea*

of Web3 gained popularity. Particular interest spiked toward the end of 2021, largely due to interest from cryptocurrency enthusiasts and investments from high-profile technologists and companies". Available at https://en.wikipedia.org/wiki/Web3, retrieved on September, 13, 2022. ↩

3. In some sense, Kevin Werbach concludes the same: "*Another necessary dimension of blockchain governance, therefore, is the fusion—imperfect though it may be- of cryptography and law. (…) That leaves trust crossed with economics. Such a fusion must explore behavioral motivations that go beyond economic incentives*" (WERBACH, 2018, p. 222). ↩