

DAO AND TOKENIZED GOVERNANCE: THE PROBLEM OF DECENTRALIZED DECISION-MAKING

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This chapter analyses how the tokenization of decisional power – enabled by blockchain-based governance tokens – offers new governance models while simultaneously revealing structural, technological, and legal limits. After illustrating how electronic voting and token-based identification address challenges such as deepfakes, the chapter examines the functioning of DAOs, their governance procedures, and the informal community dynamics that shape decision-making. It then discusses the conceptual difficulties surrounding ‘decentralization,’ reviews existing metrics, and proposes alternative normative criteria, including minimum independent decision centres and the ‘mutualistic symbiosis’ between protocol, users, and developers. The final section evaluates legal obstacles under Italian law, showing the limited feasibility of tokenizing corporate participations and the centralizing effects introduced by the Fintech Decree. The chapter concludes that regulators must develop a coherent legal definition of decentralization and simplify regulatory frameworks for tokenized equity instruments.

Keywords: Decentralized Autonomous Organizations (DAOs), tokenized governance, decentralization metrics, Blockchain-based voting, CorpTech regulation, Fintech Decree (Italy).

1. The Importance of Tokenizing Decisional Power

Exercising voting rights through simple electronic means can significantly increase voter participation. Electronic voting reduces the costs that voters – whether investors, shareholders, or members of other types of organisations – must bear to exercise the rights they hold vis-à-vis the organisation.

Beyond increasing participation, the implementation of electronic voting also yields substantial organisational benefits. First, it improves the accuracy and reliability of vote recording. Second, it reduces logistical costs associated with physically convening voters at a single location, a particularly relevant consideration when many eligible voters are involved.

Today, especially in the aftermath of the COVID-19 pandemic, electronic voting has become increasingly common even among smaller enterprises. However, at the

heart of the exercise of administrative rights is the need to identify their owners correctly. When the meeting is held in person, *nulla questio*. But when the meeting is held using electronic voting tools, until some years ago, the possibility of seeing a person or of hearing their voice during a video conference guaranteed a certain level of certainty in relation to the fact that the person appearing on the screen or whose voice is heard was actually the one holding the power of decision in a given meeting. Unfortunately, recent technological developments have put the validity of this guarantee to the test. The reference is to the use of AI technologies to create so-called ‘deepfakes’.¹

Deepfake software enables replacing, even in real time, one person’s face or voice with another’s. That software uses artificial intelligence to faithfully reproduce the characters and voice of someone as if he were in front of the camera, even if he is not in reality. To do so, it is sufficient to provide the algorithm with images or videos of the person’s face to be replaced.² Images that are readily available on the internet or through social media. Uploaded those photos into the software; the system will be able to replace the face of the person actually present in front of the camera with that of the subject whose data has been collected. The possibility of creating not just a simple image but completely new video material in real time poses a danger, less dystopian than one might imagine. This fact leads to a rethink of the tools used for remote participation in meetings.

¹The era of early deepfakes – limited to simple manipulations that slowed down or distorted existing videos – is now far behind us. A well-known example is the case of Nancy Pelosi, the Democratic Speaker of the U.S. House of Representatives, who became the first prominent victim of a deepfake in May 2019, when a manipulated video circulated online portraying her as appearing severely intoxicated while speaking at a public event. Even at that time, the incident raised significant questions, including legal ones, concerning the creation, dissemination, and continued availability of such content on major social-media platforms. YouTube, owned by Google, removed the video on the grounds that it violated standards of accuracy and integrity; Facebook, by contrast, left the video online but restricted its sharing, reasoning that the relevant news value no longer lay in the alleged intoxication of the Speaker, but rather in the very fact that the video had been manipulated. For further information and to view the video, see ‘Distorted Videos of Nancy Pelosi Spread on Facebook and Twitter, Helped by Trump’ (24 May 2019) The New York Times, <<https://www.nytimes.com/2019/05/24/us/politics/pelosi-doctored-video.html>> accessed 24 November 2025.

²In early February 2024, a cyberattack based on Deepfake shook the financial sector, earning the label of the ‘scam of the year.’ The headline of a major national newspaper conveyed the gravity of the event unequivocally: ‘The scam of the year: they create a deepfake clone of his boss and convince him to transfer 25 million dollars.’ The events unfolded when an employee of a Hong Kong-based multinational received an invitation to an online conference call with the company’s Chief Financial Officer, several colleagues, and external guests. During the video call – where all participants appeared and sounded exactly like the real individuals – the CFO instructed the employee to transfer HK\$200 million (over USD 25 million) to five separate accounts. Trusting the authenticity of the meeting, the employee executed the transaction, falling victim to a highly sophisticated deception: the video call had been generated using artificial intelligence, and the individuals interacting with him were merely deepfake replicas. For further details, see ‘La truffa dell’anno: creano un clone deepfake del suo capo e lo convincono a versare 25 milioni di dollari’ (7 February 2024) Corriere della Sera, <https://www.corriere.it/tecnologia/24_febbraio_07/la-truffa-dell-anno-creano-un-clone-deepfake-del-suo-capo-e-lo-convincono-a-versare-25-milioni-di-dollari-fcb62466-31eb-421a-93be-79b935d2dxlk.shtml?refr_esh_ce> accessed 23 November 2025.

As a novel digital environment connecting individuals worldwide – often without physical interaction – Web3 organisations have adopted innovative mechanisms to express decision-making power. Chief among these is the issuance of *governance tokens*, namely crypto-assets that incorporate voting rights. This new ‘ecosystem’ introduced a non-alterable system that guarantee the identity³ of a participant. The dangers of a technology that can reproduce and imitate virtual sounds or images can be contrasted only with the adoption of a technology that creates ‘objects’ that cannot be reproduced as governance tokens within a blockchain.

This innovation (i.e., the possibility of trusting people from around the world, without ever meeting in person) was so disruptive that the tokenization of voting rights raised the possibility of creating a new governance model incorporated into organisational structures called *Decentralized Autonomous Organizations* (DAOs).⁴

2. DAOs

The simplest definition of DAO is the following: a DAO is a ‘decentralized organization’ managed by an ‘autonomous agent’.⁵ In other words, it is an organization composed of people and assets, structured without a central authority (i.e. a decentralized organization) and managed by software that operates independently of both participants and programmers (i.e., an autonomous agent).⁶

A *decentralized organization* is a non-hierarchical organisation, characterised by the absence of a ‘central body’ that directs its operations.⁷ To compensate for the lack of hierarchical and central control, any actions within these organisations are

³ In this context, the term ‘identity’ is used in the sense of ‘the actual holder of a specific right’.

⁴ The corporate law profiles and issues characterising DAOs have already been extensively examined in Raffaele Lener and Salvatore Luciano Furnari, ‘Prime riflessioni su DAO e principi generali del diritto dell’impresa’ (2022) 3 *Rivista di diritto privato* 335. On this matter, see also Raffaele Lener and Salvatore Luciano Furnari, ‘DAO e impresa collettiva’, in Barbara De Donno and Federico Raffaele (eds), *Saggi di diritto societario e finanziario delle nuove tecnologie* (forthcoming 2026); Usman Chohan, *The Decentralized Autonomous Organization and Governance Issues* (SSRN, 2017); Samar Hassan and Primavera De Filippi, ‘Decentralized Autonomous Organization’ (2021) 10 *Internet Policy Review* 2.

⁵ This is from the words of Vitalik Buterin, according to whom a DAO is ‘an entity that lives on the internet and exists autonomously, but also heavily relies on hiring individuals to perform certain tasks that the automaton itself cannot do’. See Vitalik Buterin, ‘DAOs, DACs, DAs and More: An Incomplete Terminology Guide’ (2014) *Ethereum Blog*.

⁶ The concept of DAOs is not, as one would guess, exclusive to the business world. DAOs, while assuming (as an ‘organization’) the possibility of owning or managing assets, does not have among its ‘ideological’ assumptions the production or distribution of profits. For distinguishing DAOs with a properly entrepreneurial vocation from others, the different acronym DAC or ‘Decentralized Autonomous Corporation’ has also been coined. See Wulf A Kaal, *Decentralized Autonomous Organizations – Internal Governance and External Legal Design* (Now Publishers 2021) 6–7.

⁷ See Buterin (n 5).

governed by *ex-ante-established* rules shared by participants or incentivised through reward mechanisms. It is here that autonomous agents enter the scene. Autonomous agents are software whose existence depends on humans only in their creation: once created, their operation is indifferent to the will of their programmers.⁸ While the first example of an autonomous agent is a computer virus, modern technologies enable these systems to be realised using *smart contracts*. This makes autonomous agents even more independent from their developers. Although the DAO concept dates to 2013,⁹ efforts to classify this phenomenon have emerged only recently.

The most important classification is the one based on their function. DAOs can indeed be classified into at least three categories: (i) Grant or Social DAO; (ii) Protocol DAO; (iii) Investment DAO.¹⁰

Grant or Social DAOs focus primarily on philanthropic purposes and aim to distribute funds raised during the DAO's establishment to projects selected by DAO participants. Examples of grant or social DAOs include NounsDAO,¹¹ MolochDAO,¹² GitCoin DAO,¹³ and Big Green DAO;¹⁴ these projects collect and

⁸ In this regard, it is possible to use the (perhaps emphatic) expression used in Buterin (n 5) who, with reference to the description of these entities, stated '*there is no need for any humans to exist that are aware of the agent's existence*'.

⁹ See also Kaal (n 6) 6, fn 11, according to which the concept of DAO would be born as late as 2005.

¹⁰ This classification is a reworking of that proposed by Chisom Moduoran, 'The Complete Guide to Crypto DAO' (2023), <<https://milkroad.com/dao/>> accessed 25 November 2025, also referred to by Ellen Naudts, 'The future of DAOs in finance. In need of legal status' (2023) Occasional Paper no 331, European Central Bank.

¹¹ NounsDAO is built around the daily, on-chain auction of a single non-fungible token (NFT) known as a 'Noun.' Each Noun confers governance rights, allowing holders to submit and vote on proposals concerning the management and use of the DAO's treasury. The project is designed as an experiment in continuous, permissionless community building funded entirely through on-chain auction proceeds. For more information, see the official website: <<https://nouns.wtf/>> accessed 25 November 2025.

¹² MolochDAO is a grant-making decentralized organization focused on supporting public-goods development in the Ethereum ecosystem. It pioneered the 'Moloch' governance framework – characterized by simple voting mechanisms, non-transferable membership shares, and a 'rage-quit' function enabling members to exit with their proportional share of assets – thereby emphasizing minimalism, security, and resistance to governance capture. For more information, see the official website <<https://molochdao.com/>> accessed 25 November 2025.

¹³ Gitcoin DAO is a decentralized governance structure overseeing the Gitcoin ecosystem, a platform dedicated to funding open-source software and digital public goods. Through quadratic funding rounds, community-curated grant programs, and token-based governance, Gitcoin DAO allocates resources to builders and projects based on broad community support rather than centralized grant-making. For more information, see the official website <<https://www.gitcoin.co/>> accessed 25 November 2025.

¹⁴ Big Green DAO is a decentralized grant making organization associated with the nonprofit Big Green, aimed at funding initiatives related to food justice and community-based agriculture. It represents an experiment in nonprofit decentralization, enabling donors and grantees to participate directly in funding decisions through governance tokens and on-chain voting procedures. For more information, see the official website <<https://dao.biggreen.org/home>> accessed 25 November 2025.

distribute resources to worthy projects, usually selected by the entire community of token holders.

Protocol DAOs¹⁵ are those which primarily aim to ‘manage’ a decentralized protocol. Examples include projects like Uniswap,¹⁶ MakerDAO,¹⁷ ICP¹⁸, and Yearn¹⁹ projects.

The Investment DAO category includes DAOs whose purpose is to raise funds

¹⁵ Protocol DAO are extensively discussed in Salvatore Luciano Furnari and Chiara Villani, ‘Regulation of Financial Protocol DAOs: Addressing the Problems of Decentralization and AI Governance’, in Michael Lustenberger and others (eds), *Decentralized Autonomous Organizations – Governance, Technology, and Legal Perspectives* (Springer 2025).

¹⁶ Uniswap, for instance, in its original version, is one the best example to understand protocol DAOs. Uniswap operates as a so-called ‘decentralized exchanges’ (DEX) using a so-called ‘automated market maker’ (AMM) model, where users deposit crypto-asset pairs of equal value into so-called ‘pools’ managed by smart contracts. These ‘liquidity pair’ enable exchanges between assets in each pair without needing to identify, directly, a specific counterparty. In fact, when an exchange order is sent, the smart contract holds the originator’s crypto-asset and returns an equivalent value of the crypto-asset requested and present in the liquidity pair. The exchange is based on a mathematical formula embedded in the algorithm implemented in the smart contract; the most popular AMMs employ a formula that ensures that the product of the values in each liquidity pair remains constant before and after each transaction. Users who deposit crypto assets into ‘liquidity pools’ participate in the distribution of ‘fees’ generated by each exchange in proportion to what they deposit. More information on this project at <<https://uniswap.org/>> accessed 25 November 2025. For this reason, they are also referred to as ‘Constant Product Market Maker’. Vijay Mohan, ‘Automated Market Makers and Decentralized Exchanges: a DeFi Primer’ (2022) 8, 20 Financial Innovation 7 and 8. Variations to this formula involve, for example, the sum of value being constant; others involve ‘hybrid’ or ‘dynamic’ formulas. The reference is to the systems known as Constant Mean Market Maker (CMMM), Constant Sum Market Maker (CSMM), Hybrid Function Market Maker (HFMM) and Dynamic Automate Market Maker (DAMM).

¹⁷ MakerDAO is a lending protocol that issues DAI, a widely used overcollateralized stablecoin pegged to the US dollar. The system relies on smart contracts allowing users to deposit crypto-assets as collateral in ‘vaults’ to generate DAI. Governance decisions regarding risk parameters, collateral types, and protocol upgrades are carried out by holders of the MKR token. More information on this project, see <<https://makerdao.com/>> accessed 25 November 2025. See also Raffaele Lener, ‘Decentralized Lending Protocols and Regulated Banking Services’, in Maria Teresa Paracampo (ed), *Beyond MiCA* (Giappichelli 2025); Salvatore Luciano Furnari, *La Finanza Decentralizzata. Cripto-attività, protocolli, questioni giuridiche aperte* (Editrice Minerva Bancaria 2023) 59ff, for more information on lending protocols.

¹⁸ The Internet Computer Protocol (ICP), developed by the DFINITY Foundation, is a decentralized computing platform that aims to extend public blockchain functionality to general-purpose internet applications. Its governance is administered through the Network Nervous System (NNS), a decentralized, algorithmic governance framework in which ICP holders can lock tokens into ‘neurons’ to vote on protocol changes and network configuration. More information on this project at <<https://internetcomputer.org/>> accessed 25 November 2025.

¹⁹ Yearn Finance is a decentralized yield-optimization protocol that automatically allocates user deposits across various DeFi platforms to maximize returns. Governance is managed through the YFI token, which grants holders the ability to propose and vote on protocol upgrades, fee structures, and strategic integrations. Yearn is known for its highly community-driven development and minimal centralized management. More information on this project at <<https://yearn.fi/>> accessed 25 November 2025.

to invest in entrepreneurial projects, intending to divide profits among DAO participants.²⁰

2.1. *Decision-Making Procedures*

Decisions within a DAO are typically adopted through governance procedures that involve submitting a voting proposal (in industry parlance, simply called a ‘proposal’). A proposal may concern virtually any aspect of the DAO’s operations and often addresses highly technical matters aimed at modifying the underlying protocol on which the DAO is built. In most governance frameworks, the right to submit proposals – and subsequently to vote on them – is restricted to holders of governance tokens issued by the DAO itself.

Once the voting process is concluded, the technical implementation of the approved proposal may occur either automatically or manually. The manual implementation by developers appointed by the DAO is required in all cases where third-party services are used to conduct the vote (i.e., off-chain voting). Although third-party voting platforms (e.g., Snapshot) offer a more user-friendly experience, their use does not guarantee that the approved proposal will be technically executed. In such cases, what is recorded on chain is merely the voting outcome, not the operational effects that the vote is intended to produce.²¹

The foregoing analysis makes it evident that DAOs incorporate governance mechanisms that diverge significantly from those of traditional organisations, most notably through the degree of automatism with which decisions, once adopted, may be implemented.

However, a deeper understanding of a DAO’s organisational dynamics requires careful attention to the procedures – largely unconstrained in form – that precede the formal voting stage. Behind each DAO, there is typically a community that engages in continuous, often informal, discussion through social platforms such as Discord channels or Telegram groups, which constitute the principal *fora* for preliminary deliberation.

Within these communities, smaller sub-communities may occasionally emerge and function as *de facto* voting syndicates. These observations underscore the need to critically assess the meaning of the concept of decentralization, which may be substantially attenuated by the presence of informal coordination structures and socially influential actors.

²⁰ Within this last category falls the first project to have claimed to ‘take on’ the form of a DAO: it dates to 2016 and is known as TheDAO, one of the most cited projects by scholars, often regarded as a landmark crowdfunding experiment due to the significant funds raised in a short period. However, the project was abandoned, both because of a hacker attack, and in relation to a report by the Securities and Exchange Commission, which acknowledged the nature of ‘security’ to TheDAO tokens offered to the public.

²¹ Stefano Ballestti and others, ‘Slaying the Dragon: The Quest for Democracy in Decentralized Autonomous Organizations (DAOs)’ (SSRN 2025).

2.2. The Issue with DAO Decentralization

Tokenization of decision-making power enables decentralized organizations to operate. However, given the dynamics observed in practice within DAO communities, it is necessary to clarify the meaning of the term decentralization.

In particular, the term *decentralization* should not be understood to imply an absence of control. Because a DAO remains a sociotechnical structure involving human participation, the natural tendencies of individuals toward aggregation and cooperative behaviour inevitably manifest. It is therefore entirely possible – even predictable – that within a DAO, concentrations of influence may arise in the hands of groups of token holders who coordinate around a shared objective.

The circumstance just described has sparked a significant academic debate on the meaning of decentralization.

While the simplest definition is provided by the International Organization for Standardization (ISO),²² which – in the context of blockchains – describes decentralization as a ‘*distributed system wherein control is distributed among the persons or organizations participating in the operation of the system*’, early academic attempts to measure decentralization focused primarily on quantitative indicators, most notably the *Gini coefficient*²³ – the most widely used index for assessing inequality within a distribution – and the *Nakamoto coefficient*,²⁴ defined as the minimum number of independent entities required to compromise a network’s security.

A more structured and analytically refined approach is advanced in Gochhayat and others²⁵ who propose a multilayered framework distinguishing among three different layers: the governance layer, the network layer, and the storage layer. In their view, assessing the decentralization of a system requires evaluating the degree of decentralization at each constituent layer. Accordingly, the authors offer the following definition: ‘*Decentralized systems are a subset of distributed systems where multiple authorities control different components, and all fully trust no authority. Decentrality is a property related to the control over the system. Better decentralization means higher resistance against censorship and tampering.*’

The definitions and methodological approaches examined above exhibit a

²² ISO is an independent, non-governmental international body composed of national standards organizations from over 160 countries. It develops and publishes globally recognized technical and industrial standards, including those relating to information technology, cybersecurity, and distributed ledger technologies.

²³ The Gini coefficient is a statistical measure of inequality within a distribution, ranging from 0 (perfect equality) to 1 (maximum inequality). Originally developed for income distribution analysis, it is widely used in blockchain studies to assess the concentration of token ownership or control.

²⁴ The Nakamoto coefficient is a decentralization metric indicating the minimum number of independent entities that must collude to compromise the security or operational integrity of a distributed system. A higher coefficient corresponds to a more decentralized and resilient network.

²⁵ Sarada Prasad Gochhayat and others, ‘Measuring Decentrality in Blockchain Based Systems’ (2020) 8 IEEE Access 178372.

predominantly ‘static’ character. They provide conceptual tools for assigning a qualitative assessment to a phenomenon at the moment it is observed.

The dynamic dimension of the phenomenon is more effectively captured in the study by Papangelou and others,²⁶ the proponents of the *Apokedro Decentralization Index* – a metric designed to evaluate decentralization by considering the probabilities of all possible subsets of nodes that could collectively centralize control. The underlying intuition is particularly effective: decentralization can be meaningfully assessed by quantifying the system’s exposure to centralization risk.

This latter approach offers a valuable point of departure for our discussion. Because a DAO is, at its core, a human system, it is doubtful that its governance structure will remain static over time. It is inherently impossible to predict how such a system may evolve: a single participant may one day acquire all governance tokens from the other holders, or multiple participants may decide to bind themselves through a legal agreement – functionally akin to a shareholders’ agreement – in order to manage the DAO’s governance in a coordinated and effectively ‘centralized’ manner.

Drawing this conclusion has significant implications for the DAO paradigm. Recognising the impossibility of ensuring, except through probabilistic methods, the sustained decentralization of a DAO’s governance framework leads to a paradox akin to Schrödinger’s cat. Focusing solely on the probabilistic dimension means accepting that a DAO may be simultaneously centralized and decentralized at any given moment, given the inherent impossibility of ascertaining the true identities and relationships of all token holders.

There are a few avenues to avoid this paradox. The first is to accept and value the *potential* dimension of decentralization within a DAO. One might argue, in other words, that the mere tokenization of decision-making power – and the corollary that each token is, by definition, tradable and easily transferable – makes it possible for governance power to be widely redistributed. Decision-making authority may therefore be characterised as (*potentially*) *decentralized*, irrespective of its contingent concentration at a specific point in time.

Unfortunately, this ‘probabilistic’ approach offers limited utility for legal analysis, as legal definitions necessarily rely on a binary classification: a system must be either centralized or decentralized. It is self-evident that legal norms cannot be applied based on probabilities, nor can they be applied *probabilistically*. From the standpoint of legal qualification, it is of little practical value to know that a system composed, for example, of three layers with ten participants per layer has only a 2% probability of being centralized. Legal application would instead require a concrete assessment of who the participants are and whether any relationships among them may give rise to conflicts of interest or situations of joint control.

If one seeks, therefore, to assign a numerical threshold suitable for normative purposes – while abandoning probabilistic reasoning – it becomes apparent that a

²⁶Stamatis Papangelou, Klitos Christodoulou and Antonios Inglezakis, ‘Apokedro: A Decentralization Index for DAOs and Beyond’ (2025) 3 Blockchains 4.

system is decentralized whenever it is *not* centralized. If centralization occurs when decision-making power over the entire system can be traced back to a single locus of control, then a system must be deemed decentralized when multiple centres of power exist, provided that these centres do not collude. The minimum ‘normative’ number for defining a system as decentralized is therefore two, assuming that the relevant actors are independent and possess equal decision-making authority.

Indeed, just as a system composed of one million independent actors can be described as decentralized, the same conclusion may be reached for systems comprising ten thousand, one thousand, or even smaller numbers, such as one hundred, fifty, or twenty-five. Repeating this reductive exercise reveals that the minimum number of actors required for a system not to be centralized is at least three – that is, the smallest number that allows a collective to form a majority whenever a decision must be taken.²⁷

A system may therefore be regarded as decentralized when, at least from a logical and governance-theoretical standpoint, it is composed of *no fewer than three independent actors*.

Thus, the presence of at least three independent decision-making centres should be the focus of analysis for legal scholars and regulatory authorities seeking to determine whether a DAO system satisfies the decentralization requirement.

2.3. *The Symbiotic Relationship: An Alternative Criterion to Assess Decentralization*

It becomes necessary to articulate a single normative criterion for the concept of decentralization. What is needed, in particular, is the identification of the minimum set of characteristics a system must possess to be classified as decentralized. All definitions surveyed thus far focus on the degree to which a system may be controlled. They presuppose the existence of a centralized structure whose control is subsequently dispersed and then measure – or essentially calculate – the probability that such a system may revert to the control of a single individual.

A closer examination of commonly observed decentralized systems reveals an additional feature that may be described as a form of ‘mutualistic symbiosis.’ To appreciate this, the protocol offering a given service must be considered *holistically*, rather than solely from the perspective of the party providing it. For instance, in assessing a decentralized exchange, one must not limit the inquiry to the exchange’s developers or to those capable of exercising control over it. Instead, it is necessary to account for the system’s users and how they interact with one another and with the protocol itself.

Focusing on user interaction shows that the decentralization of a protocol cannot be reduced to control alone. Even where control over the protocol is, *de facto*,

²⁷ A system composed of only two decision-makers cannot be considered centralized, yet the mutual veto power inherent in a structure with just two parties forces to reach identical decisions, failing which the system becomes paralyzed.

attributable to a single entity, the protocol cannot operate without the participation of a plurality of actors (i.e., at least more than one). This observation diminishes the normative relevance of probabilistic assessments of control.

If a protocol requires, for meaningful functionality, the participation of at least three actors performing distinct roles, then one may already observe a minimal degree of decentralization within that system.

To this, it could be objected that many services require multiple actors to operate (i.e., one that sells a service and one that buys it). Nevertheless, here, what distinguishes decentralized finance is the protocol itself – an immutable set of rules to which all participants must conform and within which they move and act.

It is true that, also in traditional sectors, services also require multiple actors (traditional securities markets depend on a variety of intermediaries – such as clearing houses and brokers – to function). However, the most decisive role is played by a central authority. In decentralized systems, this role is covered by the protocol (merely software) whose immutability favours the creation of symbiotic relations among the parties involved and should not be subject to the *stable* control of any particular entity.

To summarise, for this alternative approach, the essential criteria for determining the degree of decentralization in a system are therefore: (i) the multiplicity of interactions, which necessarily implies the presence of multiple participants; and (ii) the presence of a protocol within rules that actors coordinate their activity.

3. *Legal Obstacles in the Tokenization of Voting Power*

The second ‘enemy’ of the adoption of a decentralized governance model is... the law. This does not mean that having a decentralized structure is illegal. However, DAOs’ governance structures are so innovative that the law is simply not ‘ready’ to regulate decentralized structures. This is true from both macro and micro perspectives.

From a macro perspective, decentralization (especially when accompanied by pseudo-anonymity) is an obstacle to ensuring strong controls on DAOs offering services without the required authorisation. For instance, given that DAOs offer gambling services, the decentralized, cross-jurisdictional nature of their operational model renders them largely exempt from licensing requirements in each jurisdiction in which they operate.

Nevertheless, when discussing tokenization of decision-making power, it is more important to analyse the ‘micro’ perspective (i.e., the one focused on company law issues), which raises more legal issues.

Taking, for instance, into consideration the laws applicable in Italy, before the entering into force of Decree-Law n. 25 of 17 March 2023²⁸ (so-called ‘Decreto

²⁸ Decree-Law no 25 of 17 March 2023, coordinated with Conversion Law no 52 of 10 May 2023

Fintech'), it was not possible to issue financial instruments (and, more in general, every form of *titoli di credito*, such as shares of *Società per Azioni*) in a tokenized form. Moreover, even with the innovation brought by Decreto Fintech, some issues remain.

To understand this issue, it is helpful to explore the possibility of tokenizing companies' participations, with or without the Decreto Fintech.

3.1. Tokenizing Companies' Shares and Quotas

To explore the possibility of tokenizing companies' participation, it is necessary to consider first Italian companies limited by shares (*Società per Azioni*) and then Italian limited liability companies (*Società a Responsabilità Limitata*).

Starting with the shares of *Società per Azioni*, when the circulation regime is the one in which shares are issued (*cartolarizzazione*), shares must be incorporated into a physical 'object' to circulate. This fact represents (involuntarily) a formality that can impede the 'direct' tokenization of shares. Indeed, the difficulty in considering a token as something 'physical' seems incompatible with the rules of circulation of nominative shares.²⁹ Circulation of shares under this regime requires the exchange of a physical item. There is substantial doubt about the possibility of including in the definition of 'physical' a computer program, such as a smart contract, or, even less, a mere registration such as a token. Indeed, even admitting that the material support on which shares need to be represented can be different from paper, the possibility of considering a token or a smart contract as a 'material' support in which shares can be incorporated has been excluded by their 'virtual' nature.³⁰

However, since this regime is not mandatory, pursuant to Article 2346, paragraph 1, of the Italian Civil Code, a company can decide not to incorporate shares in physical documents (*azioni non cartolarizzate*). So, share certificates are not issued (*azioni non cartolarizzate*), and their circulation is controlled only by registrations made by the company in the shareholder book.

This second regime appears to be more in favour of tokenizing shares. The transfer of non-securitised shares becomes effective when the parties agree to it³¹, and their consensus does not even need to be formalised in writing.³² The transfer needs to be registered in the shareholder book, and this registration seems to

'Urgent provisions on the issuance and circulation of certain digital financial instruments and the simplification of the FinTech experimentation'. See Davide Schettini, 'Il regime di responsabilità del tenentario del registro nella circolazione degli strumenti finanziari digitali' (2024) 2 Diritto commerciale digitale 189.

²⁹ cf Nicola de Luca, 'Documentazione crittografica e circolazione della ricchezza assente' (2020) Rivista di Diritto Civile 101, 124.

³⁰ *ibid* 110.

³¹ Ilaria Kutufà, *Azioni non emesse e autonomia nella circolazione* (Giappichelli 2015) 13.

³² Nicola de Luca, *Circolazione delle azioni e legittimazione dei soci* (Giappichelli 2007) 283ff.

require just specific formalities that are considered unnecessary for the transfer to be effective.³³

Therefore, in this circulatory regime, the Shareholder Book kept by the company plays a central role. This book is very similar to a DLT register and can be kept through informatics tools, according to Article 2215-bis of the Italian Civil Code. Among these tools, smart contracts can be included.

In light of the above, we can conclude that, by adopting the circulatory regime of *azioni non cartolarizzate*, it may be possible to tokenize a company's shares to adopt a governance model very similar to that of DAOs.³⁴

The solution illustrated appears to be the only legal option for an SPA to distribute to the public crypto-assets *representing* its shares as an equity token. However, it is true that, by adopting this solution, the tokens will not *actually* represent the shares of a company. Legally speaking, this system will only allow tokens to serve as a means of communicating that a shareholder has decided to transfer his shares, thereby triggering the mechanism to update the shareholder's book.

For an Italian limited liability company (*società a responsabilità limitata*), tokenization is even less practical. Quotas represent SRL participations. Unlike shares, quotas cannot be incorporated in physical instruments to facilitate their circulation. They can be transferred because of the parties reaching a consensus. To be effective vis-à-vis third parties, the transfer must be notified to the Companies Register. The notification must comply with precise, mandatory formalities that require the intervention of a specific 'intermediary,' such as a notary or a chartered accountant. This system appears to be too centralized to be tokenized. On the one hand, the role of the Register of Companies creates a strong element of centralization. Without the transcription of the transfer within the Register, the circulation of quotas has no external effect. It means that a single quota could be sold to more than one person, to the detriment of the first acquirer. So, the Register of Companies has the important task of preventing double-spending. A second element of centralization is that transfer communications must be sent only by qualified individuals, such as a public notary or a chartered accountant.

A different solution for *società a responsabilità limitata* could be reached by using the so-called *alternative regime*³⁵ introduced by Article 100-ter, paragraph 2-bis of

³³ On this opinion, see de Luca (n 29) 127.

³⁴ This is true both from a technical and a legal point of view. To do that, after having decided to not issue share (i.e. to not incorporate them in physical documents), the shareholder book should be created using a smart contract. Then tokens representing company's share can be issued. A shareholder will have to connect with a specific section of the company website to transfer his tokens. There he could interact with a smart contract programmed with the task of intermediating the circulation of the tokens issued. In doing so, this smart contract (being itself the shareholder book) could be updated with the information of the new shareholder to whom shares are transferred.

³⁵ For further details on the alternative regime, please see Nicola de Luca, 'Crowdfunding e quote "dematerializzate" di s.r.l.? Prime considerazioni (art. 100 ter, 2° co. bis e 2° co. quinquies, t.u.f. introdotti dall'art. 4, 10° co., d. l. 24 gennaio 2015 no 3, conv. dalla l. 24 marzo 2015 no 33)' (2016) NLCC 1.

the Legislative Decree n. 58/1998 (*Testo Unico della Finanza* or TUF)³⁶ with the explicit intention of favouring the development of a secondary market of a specific 'kind' of quotas. These are the ones distributed following the conclusion of an equity crowdfunding³⁷ campaign, an alternative financing instrument characterised by very low liquidity.³⁸ Article 100-ter, paragraph 2-bis, of the TUF provides a solution to the need to communicate each transfer to the Register of Companies through a notary or a chartered accountant. The solution consists of the participation in the system of an intermediary authorised to provide investment services. Its role is to acquire the shares offered during the equity crowdfunding campaign in the investors' interests, but not in their names. That implies that, upon the conclusion of the funding campaign on the equity crowdfunding platform, the intermediary will submit a request for registration to the Register of Companies for all the quotas subscribed by investors who have opted for this circulatory regime. This intermediary will become the only quota-holder resulting from the Register of Companies. However, the quotas are held by him, but in the interest of each participant in the equity crowdfunding campaign.

For the alternative regime to function, the intermediary must keep a register containing the information of the quota-holder they are *working* for. This mechanism allows quota-holders to transfer their participation by simply communicating with the intermediary. When the communication is received, he will only change the name of the investors contained in his register.³⁹ In this way, there will be no need to notify each transfer to the Register of Companies, since the intermediary is the only quota-holder registered therein in place of the investors.

The alternative regime is less *formal* than the traditional one applicable to SRL participations. This *informality* makes it adaptable for re-creation using DLT to issue equity tokens. The issuance of equity tokens in this circulatory regime, however, does not depend solely on the company's will. It is, indeed, necessary for the participation of the mentioned intermediary. It is he who should adopt a DLT solution

³⁶ Despite the apparent limitation of applicability of this circulatory regime, it seems still useful to analyse its functioning and its possible application to DLT, considering how similar is equity crowdfunding to an ICO. For the possibility to launch an ICO using the legal regime of equity crowdfunding, see Salvatore Luciano Furnari, 'ICO in Italia: applicabilità della disciplina sull'equity crowdfunding e suoi potenziali benefici', in Raffaele Lener (ed), *Fintech: Diritto, Tecnologia e Finanza* (Minerva Bancaria 2018) 145.

³⁷ Equity crowdfunding is an innovative financing instrument that let an entrepreneur to offer shares of its company of the on the market in exchange for money to develop its entrepreneurial project. For further details, see Nicola de Luca, Salvatore Luciano Furnari and Andrea Gentile, 'Equity Crowdfunding' (2017) 1 *Digesto delle Discipline Civilistiche: Sezione Commerciale* 59.

³⁸ Illiquidity is one of the most relevant risks associated with an equity crowdfunding investment. This is caused by the lack of an appropriate secondary market. For a precise list of pros and cons of equity crowdfunding, see Salvatore Luciano Furnari, 'Market analysis, economics and success drivers of equity crowdfunding' in Massimo G Colombo and Giancarlo Giudici (eds), *Proceedings of the 3rd Entrepreneurial Finance Conference* (Politecnico di Milano 2018) 8–9.

³⁹ Article 100-ter, paragraph 2-quater, TUF.

to allow companies that have concluded an equity crowdfunding campaign to have their shares represented by an equity token.

In this regard, the intermediary is free (as a private entity) to choose the technological systems it prefers to manage both the receipt of transfer communications and the register in which the transfer must be recorded. It is possible to imagine a solution in which the intermediary and the company agree to assign each new investor a token representing what is recorded in their own registers. For instance, as already suggested, it could be imposed on quota-holders that transfers of equity tokens occur exclusively through interaction with a smart contract (accessible via a simple website), with the task of maintaining the register and automatically updating each quota-holder's record. The result would be a mechanism that allows 'tokenization' of quotas.⁴⁰

3.2. Tokening Using the Fintech Decree

As anticipated, the so-called Fintech Decree now allows the issuance of tokenized financial instruments. However, this new law does not permit carrying out this activity in a (really) decentralized way. Indeed, according to the Decree, tokenized financial instruments must be issued on a 'ledger for digital circulation' (*registro per la circolazione digitale*) kept by an authorised entity.

Pursuant to Article 3 of the Fintech Decree, the authorisation may be obtained not only by DLT infrastructure – within the meaning assigned by the EU DLT Pilot Regime Regulation⁴¹ – but also by the Bank of Italy, the Ministry of Economy and Finance, or by a so-called 'register operator' (*responsabile del registro*). The Decree thereby introduces a new type of quasi-financial intermediary, insofar as the functions entrusted to this entity occupy an intermediate position between a regulated financial activity and the provision of technologically based services. The role of register operator may be performed either by the issuer itself or by a third party designated by the issuer, provided that such entity is enrolled in a dedicated register maintained by CONSOB.⁴²

⁴⁰ To be more precise, the token released will not represent a participation of the company. This because, according to Article 100-ter, paragraph 2-bis, lett. b), n. 2, TUF, the intermediary can release to participants a mere certificate whose transfer has no effect on the transfer of the property of the quota. For this reason, the token released should be considered just as a part of the communication mechanism that let the intermediary (and only him) to transfer the property of the quotas with the recording on the register he keeps.

⁴¹ Regulation (EU) 2022/858 of the European Parliament and of the Council of 30 May 2022 on a pilot regime for market infrastructures based on distributed ledger technology and amending Regulations (EU) 600/2014 and (EU) 909/2014 and Directive 2014/65/EU.

⁴² Article 19 of the Decree further specifies the categories of entities eligible for registration – and thus capable of acting as register operators. These include: (i) banks, investment firms, and market operators, with respect to digital financial instruments issued either by themselves or by third parties; (ii) other financial intermediaries, though solely with respect to instruments issued by the intermediary itself or by entities belonging to the same corporate group; (iii) issuers, limited to the digital

The appointment of a register operator is subject to prior regulatory authorisation, thereby introducing a structural element of centralization into an otherwise decentralized system. The possibility for the issuer itself to act as register operator is, in principle, a positive development; however, its benefits materialise only under two conditions: (i) that the issuance may occur on a blockchain freely selected by the issuer – an interpretation that current regulatory practice appears to tolerate; and (ii) that the authorisation procedure be significantly expedited.

The innovations introduced by the Fintech Decree do not enable genuine tokenization of decision-making power, for the simple reason that the system – much like that established under the DLT Pilot Regime – introduces structural elements of centralization. This conclusion is even more compelling when one considers that, at present, this framework is not available to limited liability companies (*società a responsabilità limitata*).⁴³

This system nevertheless retains considerable room for improvement. A first enhancement could consist of shifting from an authorisation-based framework to a simple notification regime, particularly in cases where the issuer itself intends to act as register operator. A second, more straightforward improvement would be to extend eligibility to limited liability companies (*società a responsabilità limitata*), thereby allowing their equity interests to be tokenized as well.

4. Conclusion

The analysis demonstrates that the decentralization of decision-making power – enabled by the tokenization of governance rights – faces two significant challenges: one phenomenological and the other normative. On the one hand, lacking an established conceptual tradition regarding decentralization, we are unable to formulate a single, coherent phenomenological definition of it. On the other hand, and closely connected to this first difficulty, the European regulator still struggles to envisage legal frameworks capable of accommodating genuinely decentralized systems.

The regulator is therefore entrusted with a task that is both challenging and ambitious. On the one hand, it must develop – ideally in close cooperation with industry stakeholders – a normative definition of decentralization that is technically sound and broadly accepted. On the other hand, this aspect is comparatively less complex: the regulator should open the market for tokenizing equity interests by introducing simpler, more accessible regulatory frameworks.

financial instruments they have issued; and (iv) any other entities established in Italy, subject to their inclusion in the register. Central securities depositories that intend to perform the register-operator function on an ancillary basis are entered *ipso iure*.

⁴³ Davide Schettini, 'Dematerializzazione delle quote di piccole e medie imprese (art. 3)', in Giuseppe Cavallaro (ed), *Il mercato dei capitali e le agevolazioni per gli investimenti in Italia* (Maggioli Editore 2024).