GLOSSARY ENTRY

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Decentralized Autonomous Organization

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Abstract: A DAO is a blockchain-based system that enables people to coordinate and govern themselves mediated by a set of self-executing rules deployed on a public blockchain, and whose governance is decentralised (i.e., independent from central control).

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Definition

A DAO is a blockchain-based system that enables people to coordinate and govern themselves mediated by a set of self-executing rules deployed on a public blockchain, and whose governance is decentralised (i.e., independent from central control).

Origin and evolution of the term

Organisation theory has abundant literature on decentralised organisations of several kinds (Shubik, 1962; Beckhard, 1966; Freeland & Baker, 1975). Yet, the first references to actual *Decentralized Autonomous Organization* (DAO) only emerged in the 1990s to describe multi-agent systems in an internet-of-things (IoT) environment (Dilger, 1997) or nonviolent decentralised action in the counter-globalisation social movement (Schneider, 2014).

However, the modern meaning of DAOs can be traced back to the earlier concept of a *Decentralized Autonomous Corporation* (DAC), coined a few years after the appearance of Bitcoin (Nakamoto, 2008). The DAC concept was used mostly informally in online forums and chats by early cryptocurrency enthusiasts, using both "decentralized" and "distributed" autonomous corporations interchangeably. It was only in 2013 that the term became more widely adopted, and publicly discussed in a variety of websites (S. Larimer, 2013; D. Larimer, 2013), in particular by the co-founder of Bitcoin Magazine Vitalik Buterin [1] (Buterin, 2013).

DACs were described as a new corporate governance form, using tokenised tradable shares as a means of providing dividends to shareholders. Such corporations were described as "incorruptible", running "without any human involvement" and with "publicly auditable" bylaws as "open source software distributed across the computers of their stakeholders" (S. Larimer, 2013). According to this definition, anyone could become a stakeholder in a DAC by simply "buying stock in the company or being paid in that stock to provide services for the company". As a result, the owners of a DAC stock would be entitled to "a share of its profits, participation in its growth, and/or a say in how it is run". (ibid). Such a definition reflects the

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1. Vitalik Buterin would later co-found the Ethereum platform in 2014.

maximalist view of many blockchain advocates considering that "DACs don't need regulation" because "you don't want to regulate them, and happily you can't" (ibid).

The term was inherently linked to corporate governance and therefore was too restrictive for many blockchain-based applications with a more general purpose. Thus, several alternatives to the term appeared, leading to the emergence of *decentralized applications* (dapps) (Johnston, 2013), and later to the generalisation of DAOs as a replacement for DACs (Buterin, 2014).

While some argue that Bitcoin is effectively the first DAO (Buterin, 2014; Hsieh et al., 2018), the term is today understood as referring not to a blockchain network in and of itself, but rather to organisations deployed as smart contracts on top of an existing blockchain network. Although there have been several attempts at instantiating a DAO on the Ethereum blockchain (Tufnell, 2014), the first DAO that attracted widespread attention is a 2016 venture capital fund confusingly called "TheDAO" (DuPont, 2017). Despite the short-life of the experiment [2], TheDAO has inspired a variety of new DAOs (e.g., MolochDAO, MetaCartel), including several platforms aimed at facilitating DAO deployment with a DAO-as-a-service model, such as Aragon, DAOstack, Colony or DAOhaus.

The DAO concept has enabled other derived terms: the term *Decentralized Collaborative Organization* (DCO) is typically referred as a DAO with strengthened collaborative aspects (Hall, 2015; Schiener, 2015; Davidson, De Filippi, & Potts, 2018); a more elaborate concept derived from those attempts is *Distributed Cooperative Organization* (DisCO), which highlights its co-op and democratic nature (Troncoso & Ultratel, 2019).

Definitions in the field

There are multiple coexisting definitions of DAOs in use within the industry. The most relevant are the following:

- Buterin, in the Ethereum white paper (Ethereum, 2013, p. 23), defines a DAO as a "virtual entity that has a certain set of members or shareholders which [...] have the right to spend the entity's funds and modify its code". That is, the aim is to replicate "the legal trappings of a traditional company or nonprofit but using only cryptographic blockchain technology for

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2. This open-source project attracted 11,000 investors and USD$ 150 million, where the funds were operated by the code implemented, theoretically safe from managerial corruption. However, a bug in its code enabled vulnerabilities exploited by an attacker who stole USD$ 50 million, requiring a fork in the Ethereum blockchain to restore the funds.

enforcement" (ibid).
- Some of the most popular DAO platforms, such as DAOstack and Aragon define a DAO similarly as "a network of stakeholders with no central governing body" (https://daostack.io), "which is regulated by a set of automatically enforceable rules on a public blockchain" (https://aragon.org/dao). Conversely, other DAO platforms have opted to use a different terminology as a proxy to a DAO, such as the "colonies" of Colony (https://colony.io) or DAOhaus' "magic internet communities"(http://daohaus.club).

In the academic literature on DAOs, although some works avoid picking a definition (Norta et al., 2015) or refer to industry definitions (DiRose & Mansouri, 2018), multiple attempts have been made at providing a specific definition of DAOs. Most of these definitions include the following distinctive characteristics:

- DAOs enable people **to coordinate and self-govern themselves online**. [3] Although no mention is made as to the minimum size of the group, the term "organization" is generally understood to refer to an entity comprising multiple people acting towards a common goal [4], rather than a legally registered organisation.
- A DAO source code is **deployed in a blockchain** with smart contract capabilities like Ethereum—arguably always a public [5] blockchain.
- A DAO's smart contract code specifies the **rulesfor interaction** among people [6]—although it is unclear to which extent there may be other governance mechanisms that can affect or overrule such code. [7]
- Since these rules are defined using **smart contracts**, they are **self-executed** independently of the will of the parties. [8]
- The DAO governance should remain **independent from central control**: [9]

3. See e.g. Singh and Kim (2019, p. 119) who describe a DAO as a "a novel scalable, self-organizing coordination on the blockchain, controlled by smart contracts".

4. See e.g. El Faqir, Arroyo, and Hassan (2020, p. 2) according to whom a DAO is made up of "people with common goals that join under a blockchain infrastructure that enforces a set of shared rules".

5. See e.g. Hsieh et al. (2018, p. 2) claiming that a DAO should be deployed on a "public network".

6. See e.g. De Filippi and Hassan (2018, p. 12), describing a DAO as a"self-governed organization controlled only and exclusively by an incorruptible set of rules, implemented under the form of a smart contract".

7. See e.g. Singh & Kim (2019, p. 119)'s definition of a DAO as "an organization whose essential operations are automated agreeing to rules and principles assigned in code without human involvement". However, this definition is put into question by Reijers, Wuisman, Mannan, De Filippi and colleagues (Reijers et al., 2018) distinguishing between "on-chain" and "off-chain" governance in the governance structure of DAOs.

8. See also De Filippi & Wright (2018, p. 146), according to whom a DAO "represents the most advanced state of automation, where a blockchain-based organization is run not by humans or group consensus, but rather entirely by smart contracts, algorithms, and deterministic code".

e.g. some definitions specifically refer to self-governed (De Filippi & Hassan, 2018), self-organising (Singh & Kim, 2019), peer-to-peer and democratic control (Hsieh et al., 2018).

- Since they rely on a blockchain, DAOs inherit some of its properties, such as **transparency**, **cryptographic security**, and **decentralisation** [10]

Current open discussions

While the academic literature on DAOs is still fairly limited, there is a significant number of papers from the field of computer sciences focusing on blockchain technology as a technical platform for building new blockchain-based business models, such as decentralised exchanges (Lin et al., 2019; Bansal et al., 2019) or market-based platforms such as prediction markets (Clark et al., 2014) that operate as decentralised organisations with automated governance (Jentzsch, 2016; Singh & Kim, 2019). Yet, a DAO can be deployed to fulfill many different types of functions. A DAO can, for example, be used to create a virtual entity that operates as a crowd-funding platform, a ride-sharing platform, a fully automated company, or a fully automated decision-making apparatus. It is therefore important to understand that a DAO is not a particular type of business model or a particular type of organisation, but a concept that can be used to refer to a wide variety of things.

In terms of governance, diverse scholars recently started investigating the opportunities of blockchain technology and smart contracts to experiment with open and distributed governance structures (Leonhard, 2017; Rozas et al., 2018; Hsieh et al., 2018; Jones, 2019), along with the challenges and limitations of doing so (Garrod, 2016; DuPont, 2017; Scott et al., 2017; Chohan, 2017; Verstreate, 2018; Minn, 2019; Hutten, 2019). There is also an emerging body of literature from the field of economic and legal theory concerning DAOs. While most of these works focus on the new opportunities of decentralised blockchain-based organisations in the realm of economics and governance (Davidson et al., 2016, 2018; Sims, 2019; Rikken et al., 2019; Kaal, 2020), others focus on the legal issues of DAOs from either a theoretical (De Filippi & Wright, 2018; Reijers et al.. 2018) or practical perspective (Rodrigues, 2018; Werbach, 2018; Riva, 2019).

The political discourse around DAOs is more pronounced, at least in the context of

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9. See e.g. Hsieh et al. (2018, p. 2) describing DAOs as "non-hierarchical organizations that perform and record routine tasks on a peer-to-peer, cryptographically secure, public network, and rely on the voluntary contributions of their internal stakeholders to operate, manage, and evolve the organization through a democratic consultation process".

10. "A decentralized, transparent, and secure system for operation and governance among independent participants" which "can run autonomously" (Beck, 2018, p. 57).

many existing blockchain communities (Scott, 2015; Swartz, 2017; DuPont, 2019). 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; Mehar 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).

The use of the term "decentralized autonomous organization" or DAO is now fairly established in the blockchain space, yet there are still many misconceptions and unresolved issues in the discussion around the term.

(1) First of all, with regard to the "decentralization" aspect of a DAO, it is unclear whether decentralisation only needs to be established on the infrastructural layer (i.e. at the level of the underlying blockchain-based network) or whether it also needs to be implemented at the governance level (i.e. the DAO should not be controlled by any centralised actor or group of actors).

(2) Second, it is unclear whether a DAO must be fully autonomous and fully automated (i.e. the DAO should operate without any human intervention whatsoever), or whether the concept of "autonomy" should be interpreted in a weaker sense, (i.e. while the DAO, as an organisation, may require the participation of its members, its governance should not be dependent on the whims of a small group of actors).

(3) Third, there are some debates as to when the community of actors interacting with a smart contract can be regarded as an actual "organization" (independently of any legal recognition). For instance, it is unclear whether the mere act of transacting with a smart contract qualifies as an organisational activity, or whether a stronger degree of involvement is necessary, such as having a governance model or collective interactions amongst participants.

The latter has triggered important discussions in the blockchain and legal field, as regards whether a DAO could be considered as an entity separate from the human entities that operate it (i.e. as a legal person) or whether it can only be considered as an entity when it is identified as such by the law (i.e. the law should identify a DAO as a legal person for the DAO to be considered as such). Yet, the common un-

derstanding today is that the "autonomous" nature of a DAO is incompatible with the notion of legal personhood, as legal personhood can only be established if there is one or more identified actors responsible for the actions of a particular entity. The discussion on whether a DAO should be recognised as a legal person has important implications in the legal field, as it can determine the extent to which a DAO can be considered as a separate legal entity from its human actors, and therefore the extent to which these actors can be shielded from the liabilities of the DAO.

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Zwitter, A., & Hazenberg, J. (2020). Decentralized Network Governance: Blockchain Technology and the Future of Regulation. *Frontiers in Blockchain.* https:/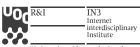/doi.org/10.3389/fbloc.2020.00012