Mapping out the DAO Ecosystem and Assessing DAO Autonomy

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Abstract: **With continuously changing operational and business needs of the organizations, Decentralized Autonomous Organizations (DAO) is the current need of the organizations. Centralized Autonomous Organization (CAO) lack transparency and are managed by few efficient managers whereas Decentralized autonomous Organization's (DAO) is novel scalable, self-organizing coordination on the blockchain, controlled by smart contracts and its essential operations are automated agreeing to rules and principles assigned in code without human involvement. Starting an organization with someone that involves funding and money requires a lot of trust in the people in working with. But it's hard to trust someone that have only ever interacted with on the internet. With DAOs there's no need to trust anyone else in the group, just the DAO's code, which is 100% transparent and verifiable by anyone. This opens up so many new opportunities for global collaboration and coordination. This article develops a proposed measure of autonomy for DAOs.**

Keywords: **decentralized autonomous organization, decision making, liability.**

1. INTRODUCTION

Decentralized autonomous organizations (DAOs) have emerged as an interesting new category of software application. Initial applications are disrupting the finance industry, but the technology is not restricted to fintech applications or assets. While other devices or software applications also claim to be autonomous, in many cases there have been levels proposed to scale or categorize the degree of autonomy afforded those applications. This notion of a level of autonomy is particularly important for consumer awareness as these autonomous devices and applications scale out to mass-market services. The societal impact from the operationalization of these technologies can be significant in terms of safety, security, privacy, and the consequences of failures. DAOs have been proposed in broader fields of human endeavor: reimagining work (Lustig, 2019) and the arts (Catlow, 2019); automating enforcement of ethical policies in business processes (Sulkowski, 2019); and restructuring the basis of governance and democracy in human societies (Merkle, 2016; Garrod, 2016). While these applications are claimed (from their name) to be autonomous; human action is still required to evolve these applications.

2. BRIEF REVIEW OF DAOS

Blockchain-based "Decentralized Autonomous Organizations" (DAOs) are the logical extension of the Cypherpunk ideal of cyber and physical autonomy. Scholars define a DAO as "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 decentralized (i.e., independent from central control)" (Hassan & De Filippi, 2021). In these software encoded institutions, "autonomous" refers to individual and collective selfgovernance as independence from external force and the control of others, human involvement, and self-direction through intelligent machines that can make decisions and participate in labour in the organization. The phrase "Decentralized Autonomous Organization" was first mentioned in the field of cybernetics, despite Vitalik Buterin, co-founder of the Ethereum smart contract enabled blockchain protocol, having claimed to invent it (Duran at al.,

2019; 1997; Buterin, 2016). In the field of cybernetics, the idea of autonomy and autonomous systems has been a longstanding theme to describe self-determination and the emergence of meaning in a system (Nabben, 2021). Here, autonomy is also political. Cybernetics developed in crisis as a reaction to the horrors World War II and a critique of liberalism and humanism as "a new fable" (Groos, 2020). It advocates to transcend the human to maintain societal order by treating society as an engineering problem that can be programmed and re-programmed through "the machine of governance". Tiqqun refers to this as "the ideal of a stable society, expressed by objectively controllable social mechanisms" to protect against accidents in the future (Groos, 2020). This idea of engineering society through cyber-physical system carries over into blockchain community manifestations of autonomous digital organizations. The concept of a "Decentralized Autonomous Corporation" was originally proposed in blockchain communities by Dan Larimer to describe cryptocurrency as profit-earning shares in a free market economy (Larimer, 2013). Buterin then adopted the phrase "Decentralized Autonomous Organization" or "DAO" (2013). Buterin described a Decentralized Organization as "a set of humans interacting with each other according to a protocol specified in code, and enforced on the blockchain" that control a treasury, and a Decentralized Autonomous Organization as "an entity that lives on the internet and exists autonomously, but also heavily relies on hiring individuals to perform certain tasks the automation itself cannot do" (Buterin, 2016). This interpretation of autonomous systems was partly inspired by futarchy (a mechanism for organizational governance via prediction markets by Robin Hanson), self-operating machines long referred to as "automatons", the novel series Daemon in which a distributed, persistent computer application begins to influence the physical world after the death of its creator, and Bitcoin (Buterin, 2016). This vision of autonomous organizations is hypothetically fulfilled by artificial general intelligence that runs on decentralized blockchains.

TABLE I: Comparison between DAO and traditional organization

DAO	Traditional organization
Usually flat, and fully democratized.	Usually hierarchical.
Voting required by members for any changes to be implemented.	Depending on structure, changes can be demanded from a sole party, or voting may be offered.
Votes tallied, and outcome implemented automatically without trusted intermediary.	If voting allowed, votes are tallied internally, and outcome of voting must be handled manually.
Services offered are handled automatically in a decentralized manner (for example distribution of philanthropic funds).	Requires human handling, or centrally controlled automation, prone to manipulation.
All activity is transparent and fully public.	Activity is typically private, and limited to the public.

3. ANALYSIS

The real forefront of how decentralized governance is evolving through DAOs is in the detail of autonomy. A clear picture of an autonomy that benefits the people participating in Decentralized Autonomous Organizations is yet to be articulated in blockchain communities. Who or what is being made "autonomous" in "Decentralized Autonomous Organizations", and whether this is sentient algorithms, or individuals and communities is yet to be clarified in the participatory visioning of DAO builders. When our imaginaries mature to allow the perceived participants in these systems to consider "autonomy", perhaps we will be ready to meet our self-made systems of superintelligence. The narrative of what DAOs are, and what they will be is in flight. At present, DAOs are neither optimistic and emancipatory, or deeply repressive. In some ways, they might be both. The idea of "autonomy" is an imaginary perpetuated in DAOs, which both helps bind a community in participating towards the objective of effective self-governance and creates risks of abuse of power and exploitation. This piece has explored the concept of autonomy and autopoiesis in decentralized organizations as a means to inform the subjective design and governance of these systems. Many DAOs in the Ethereum community are not geographically concentrated around the Venture Capital funding and socio-economic disparities of Silicon Valley but are geographically diffuse, diverse communities bound by memes that may actually represent a kind of "world computer". Digital artisans are being celebrated and finding their place in generating all kinds of hypermedia, including memes and "NFTs", applying capitalist "DeFi degeneracy" to spawn new ecosystems, and bridging the "Metaverse" between physical and digital space in creative ways that enable individual ownership of digital assets and data for individual and collective autonomy. The permissionless nature of the decentralized digital economy does not just create pathways for digital artist engineers but also new categories of roles, such as "dank meme lords", and

self-employment opportunities, such as "play-to-earn" cryptocurrency games (Cryptojobs, 2021; Axie Infinity, n.d.). Whilst this still is a niche field in many ways, a culture that welcomes curiosity and an ideology of permissionlessness mean that participation is open to anyone that wants to engage in playing serious games. In fact, blockchain-based systems may provide an approach to more distributed governance of AGI, with public blockchains offering a more distributed, open, and secure infrastructure for governing Machine Learning and AGI algorithms (Harris & Waggoner, 2019; Montes & Goertzel, 2019).

4. DISCUSSION

A. DAO Autonomy Measurement Proposal

Building on the notion from, it is proposed that a DAO be considered autonomous to the extent that it has capacity to legally accept liability. The level of DAO autonomy can thus be measured financially as the aggregate liability that can be the DAO has the capacity to absorb. The legal system already has mechanisms to identify and allocate liabilities arising from various causes. Accounting processes for identifying reporting on the financial impact of direct and contingent liabilities are already well established.

▪ DAO Developer Impact of DAO Liability Capacity: Developers of these DAOs can also more explicitly consider the potential liabilities associated with the DAOs they are developing. This enables them to more efficiently design mechanisms to explicitly identify and address those contingent liabilities; and enable the appropriate recovery by their users. As a design option, the capacity to support liabilities could be dynamically computed

▪ Regulatory Impact of DAO Liability Capacity: Where the capacity to absorb liabilities is explicitly quantified, regulators can more easily assess the suitability of particular DAO offerings for particular market segments (e.g., mass market versus qualified investors) and manage potential risks to overall market stability. The end–end or total market view of regulators enables them to identify contingent liabilities that could propagate through markets. Regulators could also impose requirements for particular capitalization levels, insurance requirements, etc.

▪ User Notice of DAO Liability Capacity: The capacity of a DAO to accept liability should be disclosed to humans transacting with the DAO. The quantification and disclosure of potential liability limits enables users engaging in transactions with these DAOs to understand the scale of risk that they are undertaking when transacting with a DAO. First, there is a need for notice to mass-market consumers that they are entering into a transaction with a DAO. Second, the disclosure of the DAO's capacity to absorb any (e.g., contingent) liability enables users to evaluate whether this is adequate for the envisaged transaction. Third, disclosure of the considerations and calculations by the developer of the DAO as to the probabilities and potential magnitudes of potential liabilities enables the user to consider the thoroughness and reasonableness of the DAO developers' preparations as well as whether there are substantial unforeseen potential liabilities.

B. Necessary Constraints

The boundaries of the DAO need to be well defined in order to develop a risk assessment to quantify any potential liabilities. The definitional challenges for both DAOs and other types of autonomous entities illustrate the general level of confusion. The computational scope of DAOs with both cross-chain and off-chain interactions, oracles, etc., can obfuscate the scale of potential liabilities. Note that such a constraint would be required regardless of the level of autonomy metric selected. The identification of responsible parties is a prerequisite to the assignment of liabilities. The identification of responsible parties for liabilities would be impacted by the legal structure associated with the DAO. The nature or purpose of the DAO may also be a source of limitations. The autonomous systems reviewed above were lawful civilian systems not intended to cause harm. Though liability notions may apply, intentionally harmful DAOs (e.g., autonomous criminal or lethal autonomous weapon systems are beyond the scope of this proposal.

C. Example Applications of the DAO Autonomy Measurement in Decentralized Finance

DAOs have been proposed for various purposes in the context of decentralizing finance. In this context, the DAO typically takes on a role disintermediating a number of other commercial entities (typically financial institutions) to complete a financial transaction. Transactions in financial institutions are typically well understood in terms of potential liability risks. Replacing some intermediate entities may reduce some risks, but cannot eliminate all risks, e.g., the DAO can automate a series of payments over time; but cannot eliminate the risk that the payer has sufficient funds available in

an account when the payment is due; nor can a DAO inherently guarantee transactions are conformant with future changes in the regulatory environment (e.g., new taxes). DAOs also introduce some new risks, e.g., failures of the DAO itself. The evaluation of contingent liability considerations for DAOs should also include stress cases (e.g., dissolution of the DAO), not just normal operation use cases. The point is that the scale and probability of these potential liabilities can be quantified. In many cases, quantification methods for such transaction risks have already been developed for calculating the regulatory capital requirements of financial institutions.

D. Mechanisms to Utilize Liability Autonomy Measurement

Liability as a metric has an advantage in that the legal and financial systems already manage liabilities. In particular, contracting, insurance, and limited liability entities have been developed across a number of legal systems. These mechanisms are not mutually exclusive, and in many cases, all three could be required for commercially operating DAOs.

Contracting:	*2) Insurance:*	*3) Limited Liability Entities:*
DAOs, particularly in the context of fintech applications, have been developed around smart contracts and the automated execution of contractual terms. Contracts typically have many terms, some of which identify expected normal transaction behavior, and others identify abnormal behavior that could result in some liability. When various types of anomalous behavior can be identified by the parties, then the parties to the contract can assign liabilities and specify values for liquidated damages to resolve those liabilities. Contracts might also specify that the DAO maintains a minimum capacity level of supportable liability.	Insurance is commonly used to contractually offset risks of various types onto an insurer. While insurance contract terms are beyond the scope of this article, many insurance contracts have an aggregate liability limit that could be used to provide an aggregate level of autonomy figure for a DAO. Note that insurance contracts have a cost. The DAO would need to pay that cost to the insurer. The cost of insurance is generally adjusted over time due to a number of factors (e.g., claims experience and interest rates). A DAO funding aggregate liability insurance would need a mechanism to incorporate such variable costs into its operations.	The notion of an autonomous system as a legal entity has already been discussed elsewhere in terms of robotics and artificial intelligence systems; here the legal notions are being applied to less "intelligent" autonomous systems. Legal recognition as an entity accepting accountability would imply legal recognition of the autonomous system as some sort of legal person. The law has long recognized that the category of legal persons is broader than humans. Corporations are examples of nonhuman legal persons, created to limit liability. There has been consideration of other examples of legal personhood with differing rationales (see animals and robots. State recognition of blockchain-based LLCs enables a DAO to be autonomous with limited liability.

5. CONCLUSION

Recent legal innovations have enabled DAO autonomy in the liability sense to be supported by limited liability entity structures as well as more traditional contract terms and insurance. As commercial DAO activities scale toward socially impactful mass-market interactions, well-understood liability regimes become important for the humans contracting with or through DAOs. Liability, as a scale for the level of autonomy of such DAOs, has both familiarities, and considerable utility for the humans interacting with DAOs.

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