Enhancing Decentralized Autonomous Organizations (DAOs) with complexity science mechanisms

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Decentralized autonomous organizations (DAOs) are a thought-provoking mechanism that emerged in blockchain and cryptoeconomics over the last decade, causing a shift in thinking from top-down hierarchical organization of society to bottom-up decentralized control. Although DAOs have gained momentum, leading to organizations of the size of mid-sized companies managing funds in the \$6.87b and building global infrastructure networks in the physical world, they are increasingly being challenged: Declining participation rates, increasing centralization of decision-making and a consolidation of the mechanisms used that limit their potential for innovation are just some of the factors. In particular, many DAOs today focus on token voting and improvement proposals, which are perceived as slow and with high barriers to entry for meaningful participation.

Cryptoeconomic systems such as DAOs are inherently complex systems. Therefore, complexity science is a useful starting point to analyze and improve potential shortcomings of DAOs. Especially since this discipline has found decentralized and bottom-up mechanisms that lead to emergent properties of a system that outperform those achieved by hierarchically top-down controlled systems - something that DAOs are all about. Nevertheless, we note that many of these insights, amongst others related to the effects of different voting mechanisms or participatory budgeting, are currently not used in DAOs, while at the same time novel mechanisms such as futarchies, idea markets or retroactive financing of public goods have not been rigorously analyzed in complexity science.

Therefore, in this paper, we bridge the gap between complexity science and the design and construction of DAOs to give DAO research another pillar to stand on, to inform improved DAO design, and to provide complexity science with an interesting research application.

In particular, we i) highlight current challenges in the design and construction of DAOs, ii) illustrate the nature of DAOs as complex systems and how principles of controllability and governance in complex systems are failing in DAOs, iii) introduce the concepts of collective intelligence, self-organization and digital democracy in the context of DAOs, and iv) map success mechanisms from these three concepts to the design and construction of DAOs. The result is both a conceptual toolbox for practitioners to construct DAOs and, for researchers, a rooting of DAO research in complexity science from which promising new research endeavors can be conducted.