

# Quantifying Autonomy in Decentralized Autonomous Organizations: A Framework for Defining and Measuring DAO Autonomy

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The concept of "autonomy" occupies a central position in contemporary discussions across computer science, particularly in the realms influenced by artificial intelligence and blockchain technologies. Its significance is further accentuated within Decentralized Autonomous Organizations (DAOs), where autonomy is not only a foundational principle but also a defining characteristic. However, the ambiguity surrounding the term "autonomy" poses considerable challenges, owing to its varied interpretations across different scientific disciplines and among practitioners. This lack of consensus complicates communication within the DAO community, potentially leading to misunderstandings and inefficiencies in DAO research and development.

This paper addresses the critical need for a standardized definition of autonomy within the context of DAOs. It proposes a comprehensive framework, developed through a systematic literature review, aimed at unifying the concept of autonomy. This framework serves as the basis for establishing a set of key performance indicators (KPIs) designed to measure autonomy within DAOs. These KPIs are derived from an analysis of existing autonomy indicators across multiple disciplines, including social science and organizational research, and are tailored to fit the proposed definition of autonomy in DAOs.

A novel aspect of our research is the introduction of the Autonomy Level Indicator (ALI), an aggregated measure that encapsulates the autonomy of a DAO into a single quantifiable metric. The development of ALI is informed by recent research on measuring decentralization within DAOs and utilizes confirmatory factor analysis (CFA) to validate the selected KPIs and their contribution to the overall autonomy measure. This methodological approach not only ensures the robustness of the ALI but also facilitates the application of statistical frameworks for future analysis and refinement.

The practical implications of the ALI are significant for both researchers and practitioners. By providing a quantitative method to assess and compare autonomy across different DAO designs, the ALI aids in informed decision-making regarding autonomy-related aspects of DAO development. Furthermore, it complements existing research on DAO decentralization, offering a holistic view of the structural properties critical to DAO functionality and governance.

In conclusion, this paper makes a pivotal contribution to the field of DAO research by clarifying the concept of autonomy and introducing a measurable framework for its assessment. The ALI represents a valuable tool for advancing the understanding and implementation of autonomous principles in DAOs, with the potential to influence future research directions and practical applications in decentralized governance systems.