



From Token to DAO: A Regulatory Study on Decentralized Autonomous Organizations Based on Blockchain Technology

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Abstract. Based on defining the connotation and extension of blockchain-based DAOs, this paper elucidates their constituent elements and examines their relationship with the development path of management theories. Through the field investigation phase, data is collected and typical cases of DAO grassroots organizations are summarized, clarifying their development status and constraints. It also outlines the current issues faced by DAO grassroots organizations and potential future research directions to provide valuable references for future studies.

Keywords: DAO, Blockchain, Smart Contracts, Regulatory Study

1 Introduction

With the development of information technology and the increasing complexity of organizations, traditional employment relationships and management models are finding it difficult to adapt to the complex and changing environment as well as the demands of the new generation of individuals. Decentralized Autonomous Organizations (DAOs) integrate decentralization, autonomy, self-governance, and token-based economic incentives, treating various elements within the system as assets. [1] This fully integrates financial capital, human capital, and other forms of capital, thereby better stimulating the efficiency of the organization and enabling value transfer, providing a good solution to existing grassroots organizational management problems.

DAOs are a new type of organization based on blockchain technology, aiming to achieve decentralized management and autonomous decision-making through smart contracts. [2] Unlike traditional organizations, DAOs do not have a central authority. Instead, they encode rules on the blockchain via smart contracts, ensuring that all operations are transparent and immutable. Members gain voting rights and economic incentives through holding tokens, participating in organizational decision-making, with their token holdings typically determining their voting weight. [3] This model breaks the hierarchical structure of traditional organizations, achieving governance that is more equitable, transparent, and efficient. DAOs have a wide range of applications, covering areas such as finance, community governance, and project development. For

example, members vote to decide on the allocation of funds and the direction of projects, significantly improving decision-making efficiency and member engagement.

From the perspective of the development of artificial intelligence, distributed artificial intelligence not only represents the future development direction but also further provides the basis for the intelligent management of DAOs. Distributed artificial intelligence mainly studies how intelligent systems that are dispersed logically or physically can solve problems in parallel and collaborate with each other. In a distributed system, there is neither global control nor global data storage. The paths and nodes in the system can both process information concurrently and solve problems in parallel. Therefore, distributed artificial intelligence systems are more open and flexible than centralized systems.

2 Evolution of DAOs

Self-organization phenomena are extremely common in nature, resulting from the collaborative interactions among individual organisms. For example, the aggregation, migration, and cooperative foraging behaviors of ant colonies, bee colonies, flocks of birds, and bacterial colonies are all the results of local interactions without centralized control. The characteristics of self-organization, such as full openness, autonomous interaction, decentralized control, complexity, diversity, and emergence, not only laid the ideological foundation for the emergence of DAOs but also promoted the development of various disciplines. In 1959, Grasse studied the nest-building and foraging behavior of ants and named this phenomenon "stigmergy," which was later adopted by many other self-organizing systems. Starting from the 1970s, Professor Prigogine from the Free University of Brussels studied the relationship between the absorption and dissipation of energy in self-organizing systems and the organization's order from a thermodynamic perspective, establishing the theory of dissipative structures, which is of great significance for understanding the self-organizing evolution of complex organizational systems.

The true implementation of the DAO concept is thanks to the emergence of blockchain technology. Blockchain integrates technologies such as distributed data storage, peer-to-peer transmission, consensus mechanisms, and cryptographic algorithms, featuring decentralization, trustlessness, immutability, and collective maintenance. It can securely and efficiently achieve information transmission and value transfer. In 2016, the first DAO—The DAO—was developed and became the world's largest crowd-funding project at the time. Since then, a series of DAOs, such as Polkadot, Aragon DAO, and DashDAO, have been launched one after another. However, DAOs still face some problems in actual implementation, such as security issues, legal issues, immature technology, and intelligent governance challenges. [4]

Table 1. Representative Views of Scholars on DAOs

Scholar/Researcher	Country/Region	Key Perspectives	Theoretical Framework/Perspective	Research Focus
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Vitalik Buterin	Canada	DAOs enable decentralized governance via smart contracts, revolutionizing organizational structures, but face risks like code vulnerabilities and governance rigidity.	Technical Implementation & Decentralized Governance	Blockchain Technology, Smart Contract Security
Pri-mavera De Filippi	Italy	DAOs challenge traditional legal systems due to their autonomy; new legal-technological synergies must be explored.	Law & Technology Intersection	Blockchain Legality, Regulatory Compliance
Aaron Wright	American	DAOs act as "permissionless corporations" driven by token economics but require solutions for low participation and centralization risks.	Corporate Governance & Token Economics	DAO Governance Models, Incentive Mechanisms
Mei Xue-song	China	DAO practices in China must align with policy frameworks, prioritizing "regulatory-friendly" models over full decentralization.	Localized Application & Policy Adaptation	Blockchain Policy, DAO Use Cases in China
Xiao Feng	China	DAOs represent a new production relationship in the digital economy, blending "code-as-law" with community consensus to reshape future organizations.	Digital Economy & Organizational Transformation	Blockchain Economics, DAO-Industry Integration

*The table 1 is compiled by the author based on publicly available information.

3 The Operation Mechanism of DAOs from the Perspective of New Institutional Economics

3.1 MakerDAO’s Governance Mechanism and Game Theory.

MakerDAO is a decentralized finance (DeFi) platform that allows MKR token holders to participate in decision-making through voting on issues such as risk management, types of collateral, and interest rate adjustments. This mechanism reflects the “voting game” in game theory: token holders express their preferences through voting, and the outcomes directly affect the stability and returns of the DAO. Research indicates that the passage of proposals significantly increases the return rate of DAO tokens, with an average increase of 4.7%. Moreover, the higher the voting participation rate, the more pronounced this effect becomes. [5]

3.2 Decred’s Governance Mechanism and New Institutional Economics.

Decred employs an on-chain governance model through its governance platform, Politeia, where stakeholders can vote on fund allocation, development proposals, and network consensus changes. This governance approach aligns with the theoretical framework of “institutional choice and incentive mechanisms” in new institutional economics. By decentralizing decision-making power to community members,

Decred's governance mechanism not only enhances transparency and trust but also ensures active participation through token incentives. This decentralized governance structure reduces reliance on centralized institutions, embodying the principles of new institutional economics that advocate for reducing transaction costs and improving governance efficiency.

3.3 Tezos's Governance Mechanism and Game Theory.

Tezos's on-chain governance mechanism allows token holders to propose and vote on protocol upgrades. This mechanism resembles a "prediction market" in game theory, where the voting outcomes of token holders predict and determine the future direction of the protocol. By optimizing the protocol and introducing new features, Tezos's governance mechanism ensures the long-term stability and adaptability of the block-chain.

3.4 Community Governance and New Institutional Economics.

In some DAOs, community governance emphasizes broad community participation and consensus decision-making. This governance model aligns with the theory of "institutional diversity and adaptability" in new institutional economics, which suggests that different governance structures can be adjusted according to community needs and environments. For example, community voting on fund allocation and project direction not only improves decision-making efficiency but also enhances members' sense of participation and belonging.

Through these empirical cases, it is evident that the theoretical frameworks of game theory and new institutional economics provide powerful tools for understanding the governance mechanisms of DAOs. These theories not only help explain the motivations of members within DAOs but also offer theoretical support for designing more efficient governance mechanisms.

4 Value Implications of DAOs for Grassroots Autonomous Organizations

As an innovative form of organization, DAOs have thoroughly changed the traditional organizational management model. However, there is currently a lack of research on Decentralized Autonomous Organizations, and the theoretical framework is not well-developed. The focus of further research should be on explaining the constituent elements and essence of Decentralized Autonomous Organizations, sorting out their evolutionary paths based on the theoretical frameworks of management science and economics, and analyzing their developmental logic.

4.1 The Core Attributes and Operational Elements of Decentralized Autonomous Organizations.

The core attributes and operational elements of decentralized autonomous organizations mainly consist of three aspects: smart contracts, token incentives, and distributed governance. DAO organizations help clarify the core attributes and operational elements of decentralized autonomous organizations. The core attributes of decentralized autonomous organizations include decentralization, self-governance, and flat openness, while the core operational elements include smart contracts, token incentives, and distributed governance. Decentralized autonomous organizations, based on blockchain technology as the underlying technology, represent a completely new organizational form that has completely changed the traditional organizational management model.

4.2 The Impact of Blockchain on Organizational Trust.

Currently, there is a mix of optimism and pessimism about the future of blockchain. Behind the contradictory emotions, the conceptual misunderstanding hinders the development of new technologies. Viewing it as a "trust technology" is a misleading concept. What blockchain is good at solving is not the problem of "belief" but the problem of "distrust." "Belief" and "distrust" are two related but significantly different social psychological activities and cognitive decision-making activities. DAO organizations can use blockchain to enhance organizational credibility. The following discussion focuses on analyzing the transformation and governance mechanisms of grassroots organizations based on blockchain technology and exploring the impact of blockchain technology on grassroots organizations.

4.3 The Feasibility of Grassroots Organizations Using DAO Organizational Management.

DAO organizations are autonomous organizations, but they are not unorganized. They are a new type of organization generated by the application of blockchain technology. Through consensus mechanisms and smart contract technologies, organizational management can be more efficient, management costs can be lower, and management outcomes can be better. It can be said that the application forms and scope of DAOs are very extensive. The characteristics of grassroots autonomous organizations are generally flat and dumbbell-shaped, and DAO organizations are very suitable organizational forms for them. Regardless of size, the personnel of autonomous organizations do not necessarily have to be internal company staff; they can also hire external professionals to provide services, that is, the current "gig economy" and "shared talent market" employment models, reducing fixed labor costs and maximizing the achievement of "low cost, high efficiency, and high benefits".

5 Problems and Shortcomings Caused by DAOs

DAOs, as an innovative form of organization, hold great potential for development but also face numerous challenges and issues.

5.1 Legal and Regulatory Uncertainty.

The decentralized nature of DAOs makes it difficult to fit them into traditional legal frameworks, resulting in unclear legal status globally. For example, in some jurisdictions, DAOs may be considered illegal organizations or may not be able to obtain legal status. This uncertainty increases legal risks for investors and participants, limiting the large-scale application and development of DAOs.

5.2 Governance Mechanism Vulnerabilities.

Despite achieving autonomy through smart contracts, the code of these smart contracts may contain vulnerabilities that can be exploited maliciously. For example, there have been historical instances where DAOs were hacked, leading to the theft of funds. Incomplete governance mechanisms may exacerbate internal conflicts of interest and even cause organizational instability.

5.3 Technical Security Risks.

Blockchain technology itself carries security risks, such as 51% attacks and smart contract vulnerabilities. Additionally, the decentralized nature of DAOs increases the complexity of technical maintenance. Technical security issues can lead to asset loss, data leakage, and a decline in user trust.

5.4 Inefficiency of Community Governance.

DAO decision-making relies on community member voting, but participation is often low, leading to inefficient decision-making. Moreover, community members may struggle to reach consensus due to conflicting interests. Inefficient governance mechanisms may hinder DAOs' ability to respond quickly and adapt to market changes.

5.5 Lack of Transparency and Accountability.

Although blockchain technology is inherently transparent, information asymmetry may exist in the actual operation of DAOs. For example, the decision-making processes and fund flows of some DAOs are not transparent enough, and there is a lack of effective accountability mechanisms. The absence of transparency and accountability may lead to internal corruption and abuse of power, harming the interests of investors and users.

6 Policy Recommendations for Regulating DAOs

6.1 Clarifying Legal Status and Regulatory Framework.

Governments should develop specialized legal frameworks based on the characteristics of DAOs, clarifying their legal status and operational rules. For example, DAOs could be recognized as a special type of legal entity, with regulations governing their fund management and operational activities. International cooperation should be promoted to establish unified global regulatory standards for DAOs, reducing legal conflicts and regulatory arbitrage.

6.2 Improving Governance Mechanisms.

DAOs should introduce multi-level governance mechanisms, including technical audits, community oversight, and external regulation. For example, regular code audits of smart contracts should be conducted to ensure their security and reliability. Standardized governance processes, such as voting mechanisms, proposal procedures, and dispute resolution mechanisms, should be established to enhance governance efficiency and transparency.

6.3 Enhancing Technical Security and Risk Management.

DAOs should adopt advanced blockchain technologies, such as zero-knowledge proofs and multi-party computation, to enhance security. At the same time, emergency response mechanisms should be established to address potential technical risks. Collaboration with professional security firms for regular security testing and vulnerability patching is essential to ensure the stable operation of DAOs.

6.4 Improving Community Governance Efficiency.

Incentive mechanisms should be used to increase community member participation, such as introducing token reward mechanisms to encourage active voting and decision-making. Decision-making processes should be optimized to reduce lengthy voting procedures. Leveraging the transparency of blockchain technology to publish decision-making processes and outcomes in real-time can enhance community members' trust.

6.5 Enhancing Transparency and Accountability.

DAOs should establish transparent information disclosure mechanisms, regularly publishing fund usage, project progress, and major decisions. External audit mechanisms should be introduced to oversee DAO operations. By leveraging the immutable nature of blockchain technology, all decisions and fund flows should be recorded to ensure the effectiveness of accountability mechanisms.

7 Conclusion

DAO organizations are a new type of management organization generated by the application of blockchain technology combined with self-organization management theories in management science. They are voluntarily joined by a group of organizations and individuals with a common vision, who collaborate to complete organizational goals and tasks. Interest distribution is completed through token-based incentives based on job responsibilities, quantified work, and the achievement of work results. The management, operation, and decision-making of the organization are implemented through the consensus mechanisms and smart contracts of blockchain technology, thereby achieving an organizational form of intelligent management and token-based incentives. This paper incorporates the construction of DAO organizations into the academic system of holistic governance theory, enriching and developing the theories and practices of organizational management under the digital paradigm, elucidating and developing the intrinsic connection between new institutional economics and the development of decentralized grassroots autonomous organizations, and exploring the legal nature, underlying technological programs, and organizational functional goals of decentralized autonomous organizations.

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