SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2023
ORGANIZATION AND MANAGEMENT SERIES NO. 174

THE CONCEPT OF A DECENTRALIZED AUTONOMOUS ORGANIZATION AS AN INNOVATIVE ORGANIZATIONAL STRUCTURE

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Purpose: The aim of this article is to present the concept of Decentralized Autonomous Organizations in the context of the evolution of organizational structures. The article presents the current state of knowledge about DAOs, taking into account the principles of their functioning and the current state of development. The roles of individual actors involved in the DAO were also discussed and typical features of the DAO organization were indicated.
Design/methodology/approach: The main method used in this article is a literature review supplemented with an analysis of online industry sources and reports of consulting companies. The analysis included a review of the characteristics of the DAO organization against the background of traditional structures and the ways of functioning of the DAO.
Findings: The article describes the characteristics of organizations managed with smart contracts created thanks to the use of blockchain technology. The stages of the formation of DAOs and the main principles of their functioning based on the possession of digital tokens of a given organization, as well as the right to participate in voting on decisions made in the DAO, were indicated. The basic advantages and risks associated with the functioning of DAOs were also indicated.
Originality/value: The originality of this article lies in the confrontation of the theory and practice of DAOs with traditional, hierarchical organizations with specific features. The current literature in the field of DAOs is not very extensive, especially in relation to the issue of organizational structures, as demonstrated in the Materials and Methods section of this article.

Keywords: decentralized autonomous organization, organizational structure, blockchain technology, smart contracts.

Category of the paper: literature review.

1. Introduction

Among the many problems of the modern world, issues such as the war in Ukraine or the development of the economy in the post-pandemic world and in an environment full of high inflation are currently mentioned. An increasingly important issue is also the issue of coping with the global energy and food crisis, as well as the increasingly frequent problems of the labor market. Nevertheless, among the key challenges of the modern world, there are those related to the so-called "metaworld". The latter of the above-mentioned problems is related to the evolution of the Internet, perceived as a necessity to create a "new version of the Internet".

Among the companies with the largest market capitalization around the world, technological companies based on the use of the Internet, such as Apple, Microsoft, Alphabet (Google) and Amazon, are in the lead, as shown in Figure 1.

Rank	Name	Market Cap	Price
1	Apple AAPL	$2.141 T	$135.21
2	Saudi Aramco 2222.SR	$1.892 T	$8.60
3	Microsoft MSFT	$1.757 T	$235.81
4	Alphabet (Google) GOOG	$1.183 T	$91.78
5	Amazon AMZN	$973.85 B	$95.46

Figure 1. Market capitalization of largest world companies.

Source: https://companiesmarketcap.com/, 19.01.2023.

The fact that the Internet is used as the main channel for servicing the Internet flow by the world's top companies suggests the need to consider the evolution of the Internet itself. Over the years, three stages of its development can be observed:

- Web 1.0 - refers to the first generation of the World Wide Web that emerged in the 1990s. It was primarily a static, read-only network, where users were able to get access to information but could not interact with it. Web pages were simple and mostly text-based, and the main way of interacting with them was through hyperlinks (Getting, 2007).

- Web 2.0 - emerged in the early 2000s and brought a more interactive and dynamic experience to the web. It introduced the concept of user-generated content and social media, allowing users to actively participate and collaborate on the web. Popular examples of Web 2.0 platforms include social networking sites like Facebook and Twitter, as well as blogs and video sharing sites like YouTube (O'Reilly, 2005).
- Web 3.0 - also known as the "Semantic Web" is the next evolution of the web (Berners-Lee, 2001). It aims to create a more intelligent and interconnected web that can understand and interpret the meaning of the content it contains, rather than just the surface-level information. This is achieved by adding a layer of metadata to web pages, which allows machines to understand the context of the data (Harris, 2009). Web 3.0 technologies like the blockchain, artificial intelligence, and the Internet of Things (IoT) are expected to play a major role in this evolution. It also allows for the creation of decentralized applications and smart contracts, which can provide a new way of organizing online activities and transactions.

The previously mentioned companies with the world's largest market capitalization undoubtedly operate in a digital environment. However, they use traditional methods of management and organizational structures, which may raise the need for evolution of the current perception of organizational structures of enterprises.

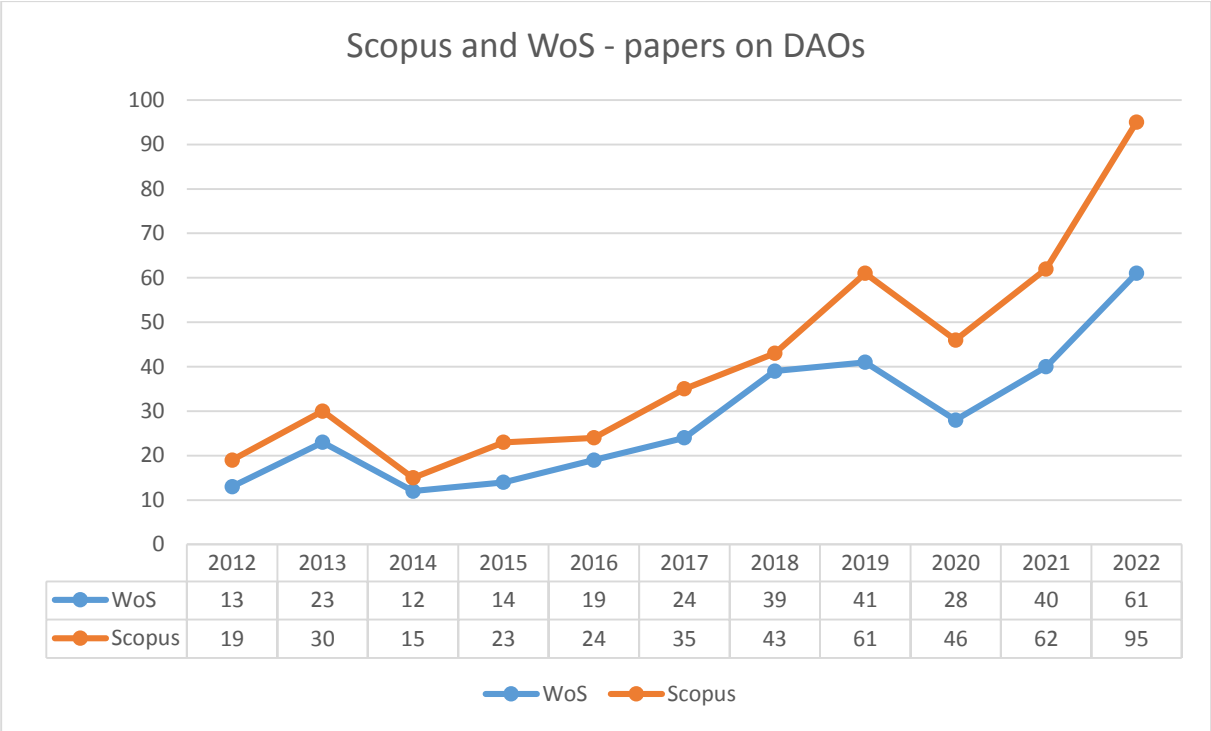
2. Materials and methods

A literature review - in particular bibliometrics - was carried out for research without the publishing time limitation on the topic of Decentralized Autonomous Organization. The first step was to analyse publications included in the Scopus database. However, for a comprehensive study, the analysis was deepened to include the Web of Science database.

The following queries were run on January 10th 2023:

- Scopus: TITLE-ABS-KEY ("decentralized AND autonomous AND organization"),
- WoS: TOPIC: ("decentralized autonomous organization"); Indexes: SCIEXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCREXPANDED, IC.

The search results showed a relatively small number of publications (WoS - 478, Scopus - 711) in the subject area. Figure 2 shows the number of publications on DAO over the last 10 years in both analyzed databases.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
WoS	13	23	12	14	19	24	39	41	28	40	61
Scopus	19	30	15	23	24	35	43	61	46	62	95

Figure 2. Publication of articles in each year for Scopus and WoS databases.
Source: own study.

In the next step, to examine the state of research on decentralized autonomous organization in the context of organizational structures, the following queries were run on January 10th 2023:

- Scopus: (TITLE-ABS-KEY (decentralized AND autonomous AND organization) AND TITLE-ABS-KEY (organizational AND structure)),
- WoS: TOPIC: ("decentralized autonomous organization" AND "organizational structure"); Indexes: SCIEXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCREXPANDED, IC.

The search results indicate a small number of publications (Scopus - 26, WoS - 20) embedding the topic of DAO in the context of organizational structures, which confirms the author's assumptions about the legitimacy of in-depth analyzes in this area. During the preparation of this article, the literature review resulting from the above bibliometric analyzes was supplemented with a review of industry reports and reports of analytical and consulting companies.

3. The potential for changes in the perception of organizational structures

The concept of contemporary organizational structures evolution outlined in the introduction requires defining the current state of their basic features. Among the features of traditional organizational structures, mostly vertical ones, the following can be noted:

- a hierarchical structure - there is a clear chain of command and levels of authority. This means that decisions are made by those at the top of the hierarchy and are then passed down through the organization (Crumpton, 2013),
- centralization - the power and decision-making authority is concentrated in a small group of people at the top of the hierarchy, while the rest of the organization is dependent on these decisions (Mintzberg, 1979; Fredrickson, 1986),
- a lack of transparency - information and decision-making processes are not shared with all members of the organization. This can make it difficult for employees to understand the reasoning behind decisions and to hold leadership accountable (Albu, 2014; Ashana, 2013),
- the dependence on the unit and its internal resources - low ability to adapt to changes in the environment and to take advantage of external opportunities,
- the need for trust in decision-makers, as they are not transparent, which can lead to a lack of trust from the employees and from the public. This can make it difficult to build relationships and partnerships,
- the arbitrariness of decision-making - decisions are often made based on personal opinions and biases rather than on data and evidence. This can lead to poor decisions and a lack of accountability.

Noting the above-mentioned features, it seems reasonable to ask if it is worthy to decentralize management structures. Table 1 shows the potential direction of change in traditional organizational structures.

Table 1.
The direction of changes in the characteristics of organizational structures - a proposal

Features of traditional structures	The direction of changes
Hierarchy	Democracy
Centralization of management	Decentralization
Unit dependency	Community dependency
Limited transparency	Full transparency
The need for trust	Trust with software

Source: own study.

The directions of changes in the characteristics of traditional organizational structures mentioned above can be achieved by undertaking a series of activities that can be arranged in the following sequence:

1) Decentralize decision-making process: Instead of having all decisions made by a small group of people at the top of the hierarchy, decision-making process can be distributed throughout the organization. This can be achieved by giving employees more autonomy and allowing them to make decisions that affect their work.

2) Increase transparency: Organizations can increase transparency by sharing information and decision-making processes with all members of the organization. This can be achieved by implementing communication channels such as open-door policies and employee surveys.
3) Implement democratic processes: Organizations can implement democratic processes such as voting and consensus-building to make decisions. This allows for multiple perspectives to be considered and for decisions to be made based on the majority opinion.
4) Use blockchain technology: Organizations can use blockchain technology to increase trust and transparency. Blockchain allows for transparent and tamper-proof record keeping, which can provide a way to track decisions.
5) Use data-driven decision-making: Organizations can use data-driven decision-making to ensure that decisions are based on evidence and not on personal opinions or biases. This can be done by collecting and analyzing data and using it to inform decision-making processes.
6) Use data-driven decision-making: Organizations can use data-driven decision-making to ensure that decisions are based on evidence and not on personal opinions or biases. This can be done by collecting and analyzing data and using it to inform decision-making processes.
7) Encourage employee participation and empowerment: Organizations can encourage employee participation and empowerment by creating an environment where employees feel valued and invested in the organization's success. This can be done by providing opportunities for professional development, recognition, and rewards for achieving goals.
8) Foster a culture of trust: Organizations can foster a culture of trust by being open, honest and transparent in their communication and by being responsive to the concerns of employees and other stakeholders.

By following those steps, organizations can create management structures that are more democratized, decentralized, transparent, and trustworthy as suggested in Table 1. This can lead to more efficient and effective decision-making, increased employee engagement, and improved organizational performance. The concept which can be appropriate to achieve all the features mentioned above is the concept of Decentralized Autonomous Organization.

4. The concept of Decentralized Autonomous Organization

In the opinion of the author of this article, the concept that fits into the process of transformation of management structures outlined above is the concept of Decentralized Autonomous Organizations (DAOs) based on the use of blockchain technology for the purpose of creating organizations managed with the use of smart contracts (Hassan, DeFilipi, 2021).

DAOs are also defined as a new form of organization that operate on a blockchain network and are governed by a set of rules encoded in smart contracts (Buterin, 2014). These smart contracts automatically execute and enforce the rules and procedures of the organization, enabling decentralized decision-making and removing the need for intermediaries (Pereira et al., 2019). DAOs use blockchain technology to provide a decentralized and transparent way of managing an organization (Wang et al., 2019). The transparency of the blockchain allows for greater trust among members of the organization (Singh, Kim, 2019; DuPont, 2017). Smart contracts, which are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code, are used to encode the rules and procedures of the organization into the blockchain. What's more, DAOs can enable more efficient and transparent management by allowing for the creation of autonomous and decentralized organizations that can adapt to changes in the environment and take advantage of external opportunities (Panetta, 2019). Additionally, it can be said that DAOs can provide a new way of organizing online activities and transactions, by enabling the creation of decentralized applications and smart contracts, which can provide a more efficient and transparent way of governance (Morkunas et al., 2019). In the opinion of the author of this article, DAOs have the potential to revolutionize the way organizations are run and adapt to the changing environment.

Over the years, the DAO concept has taken various forms, which allows us to indicate three stages of its development (Cointelegraph, 2022):

- DAO 1.0 – a concept for a smart home. It was an early example of a DAO that used smart contracts to automate and manage the functions of a home (Dilger, 1997). The concept proposed that a smart home could be run by a set of rules encoded in smart contracts, which would automatically execute and enforce the rules for the home's operation. The smart contracts would manage various functions of the home, such as heating, lighting, security, and energy management. For example, the smart contract could automatically adjust the thermostat based on the outside temperature, or automatically turn off lights when no one is in the room. The smart home would also be connected to the internet, allowing for remote monitoring and control. Users would be able to access the smart home's functions through a web interface, and make changes to the rules and settings encoded in the smart contracts. The main goal of DAO 1.0 was to provide a more efficient and automated way to manage the functions of a home.

By using smart contracts, the smart home would be able to operate autonomously and make decisions based on predefined rules, without the need for human intervention. This concept was a precursor for the current trend of smart homes and Internet of Things (IoT) devices, and also an early example of how blockchain technology and smart contracts can be used to create DAOs (Cointelegraph, 2022).

- DAO 2.0 - the second stage of the evolution of DAOs, which builds upon the concept of DAO 1.0 and introduces new features and capabilities. One of the most notable examples of DAO 2.0 is Ethereum, which is a decentralized platform that allows for the creation of smart contracts and decentralized applications (Buterin, 2014). Ethereum's smart contract platform allows for the creation of more advanced and sophisticated DAOs. It provides a more flexible and powerful programming environment for creating smart contracts, which can be used to implement complex decision-making logic, decentralized governance, and other advanced features. One of the key features of DAO 2.0 is the ability to create decentralized autonomous organizations that can operate autonomously and make decisions based on predefined rules encoded in smart contracts.
- DAO 3.0 - a potential direction of the DAO revolution that aims to take the concept of decentralized autonomous organizations to the next level. It is not a well-established term and there is not a clear consensus on what exactly it would entail, but it is generally believed to be the next step in the evolution of DAOs that builds on the advancements of DAO 2.0. One potential feature of DAO 3.0 is the integration of Artificial Intelligence and Machine Learning capabilities to the smart contracts and decision-making process. This would allow for the creation of DAOs that are able to learn from past experience and make decisions based on data and patterns, rather than predefined rules. Additionally, DAO 3.0 could also include the integration of new technologies such as the Internet of Things (IoT), 5G networks, and edge computing. These technologies could provide DAOs with more capabilities to interact with the physical world, and also enhance their scalability and performance (Cointelegraph, 2022).

The principle of operation of the DAO

DAO, as a modern structure of the organization's operation, assumes new rules of its functioning from the very moment of its establishment. In a few steps, it can be presented how the DAO works:

1) The founders (The Team) of a DAO create the concept and the Whitepaper (White Book - a set of rules; Constitution) is being prepared as a main document describing the rules of a given DAO. A DAO typically has a team of developers and other stakeholders who are responsible for creating and managing the organization. The team is responsible for creating the smart contracts that will govern the organization, as well as for building the user interface and other tools that will be used to interact with the DAO. A whitepaper is a document that describes the goals and objectives of the DAO, as well as the technical

details of how it will work. The whitepaper typically includes information about the team, the technology that will be used, and the token economics of the DAO.

2) A distribution of tokens – this is the way of creating communities and raising funds for the development of a given DAO concept. DAOs are typically financed by issuing digital tokens. These tokens can be bought and sold on cryptocurrency exchanges, and they give holders a stake in the organization. The tokens are distributed to stakeholders in an initial coin offering (ICO) or other fundraising events, and they give holders the right to participate in the governance of the organization.
3) Possession of tokens - which is giving the right to make decisions by attending voting and benefit from the development for every DAO member. The right to make decisions in a DAO is typically determined by the number of tokens that a holder has. The more tokens someone has, the more voting power they have in the organization. The holders of tokens can vote on proposals and make decisions collectively, without the need for a central authority.
4) Current operation of the organization based on smart contracts and democratic decision-making by token holders.

In general, DAOs work by using blockchain technology and smart contracts to manage the organization. They are governed by a team of developers and other stakeholders, and are financed by issuing digital tokens which give holders a stake in the organization. The holders of tokens have the right to make decisions in a DAO, and the decision-making process is based on voting power determined by the number of tokens held.

Roles in DAOs

In a DAO there are several key roles that are typically defined (World Economic Forum, 2023):

- Founders - the individuals or group of individuals who initiate the creation of the DAO. They are responsible for developing the idea, creating the whitepaper, and assembling the initial team of developers and stakeholders. They also set the initial rules and governance structure for the DAO.
- Stakeholders - individuals or entities that hold tokens in the DAO. They are the owners of the organization and have the right to participate in the governance of the organization by casting votes on proposals and making decisions collectively. Stakeholders are also impacted by the decisions made in the DAO and may have financial incentives to participate in the governance.

- Validators - they play an important role in maintaining the integrity of the network and ensuring the proper functioning of the organization. Validators are nodes on the network that are responsible for validating transactions and maintaining the state of the smart contract. They do this by validating the transactions that are broadcasted to the network and by maintaining the state of the smart contract, which includes the balance of tokens, the voting rights of the stakeholders, and any other data that is stored on the smart contract.
- Developers - individuals or entities responsible for creating and maintaining the smart contracts that govern the DAO. They are responsible for developing and deploying the smart contracts, as well as maintaining and upgrading the codebase. They also ensure that the smart contracts function as intended and that they are secure.

The basic principles of DAO functioning and the roles assigned to their participants are reflected in the structure of this type of organization, which takes a different form in relation to organizations with a traditional structure. This is schematically depicted in Figure 3.

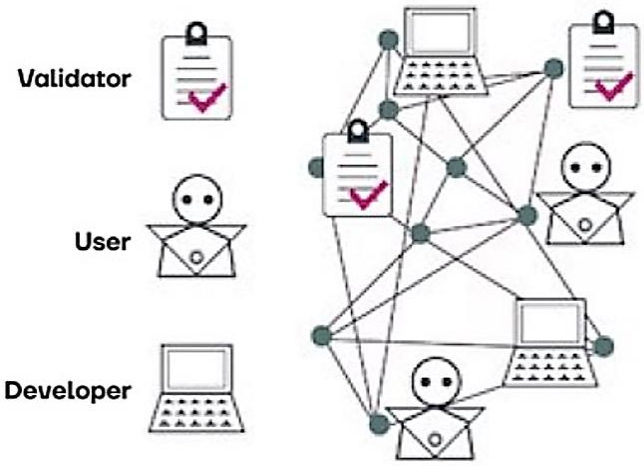


Figure 3. The structure of DAO.

Source: https://blocksize-capital.com/from-defi-to-dao/, 19.01.2023.

All decisions made in the organization require consensus among its participants, and are implemented as a result of the implementation of smart contracts launched as a result of community votes. In the further part of the article, a number of currently existing DAOs are indicated and the current state of development of DAO initiatives is discussed.

5. The current state of DAOs development

Currently, there are many organizations based on the DAO model. In May 2021, approximately 700 active DAOs were registered, and this number increased to approximately 4,000 in mid-2022. Figure 4 illustrates the quantitative structure of DAOs broken down into

categories according to data from August 2022 (Cointelegraph, 2022), while Figure 5 shows the market capitalization of DAOs over the years (7-day moving average) and the market capitalization of the two largest cryptocurrencies (Bitcoin and Ethereum). In Figure 5, you can easily see a strong positive correlation between these capitalizations, as the value of the cryptocurrency market is a key driver of the adoption of solutions based on blockchain technology, such as DAO. Table 2, on the other hand, shows several examples of existing DAOs broken down by application categories, such as: Investment DAO, Grants DAO, Social DAO, DeFi DAO, Media DAO. Specific applications of the DAO model are indicated for illustrative purposes and are not a key aspect discussed in this article, however, they constitute a field for further research focused on the functioning of specific organizations.

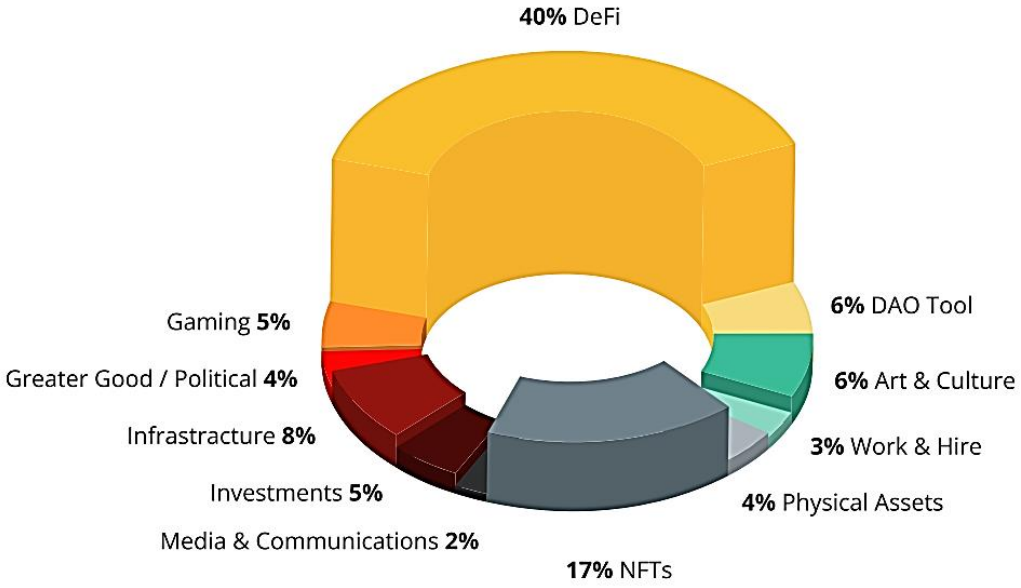


Figure 4. The categories of DAO.

Source:https://research-backend.cointelegraph.com/uploads/attachments/cl9ctvb5i07wzr4qnhgz2eu7v-cointelegraph-research-dao-report-october.pdf, 19.01.2023.

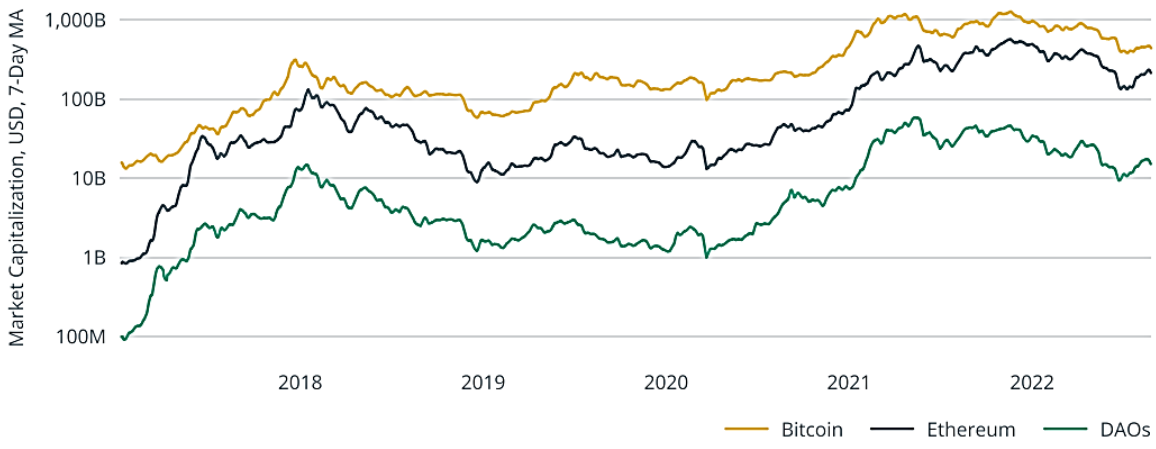


Figure 5. Market capitalization of DAO.

Source:https://research-backend.cointelegraph.com/uploads/attachments/cl9ctvb5i07wzr4qnhgz2eu7v-cointelegraph-research-dao-report-october.pdf, 19.01.2023.

As to be observed in Figure 5, the market capitalization of DAOs has been strongly correlated with the prices of Bitcoin and Ethereum for several years. Periods of price increase (and market capitalization) of the leading cryptocurrencies translate into increased interest in blockchain technology by managers of modern organizations. In these periods, there is also a noticeable increase in the labor supply of smart contract developers, which may affect the development trends in the field of DAOs.

Table 2.
Examples of currently operating DAOs

DAO category	Practical example
Investment DAO	Contitution DAO
Grants DAO	MetaCartel, Ukraine DAO
Social DAO	BoredApe YachtClub
DeFi DAO	Uniswap, MakerDAO
Media DAO	Bankless DAO

Source: own study.

Among the examples of currently existing DAOs, several categories can be observed. Most often, contemporary DAOs are involved in collecting funds to support various types of initiatives (investment DAOs), providing grant support (grants DAOs), gathering communities around a jointly defined financial goal (social DAOs), or offering modern, decentralized financial services (DeFi DAOs), as well as the promotion of solutions based on blockchain technology.

6. Summary

To summarize**,** DAOs offer several benefits over traditional centralized organizations. A few key the benefits of DAOs could be listed as below:

- Financial gains - holders of tokens in a DAO have the potential to earn a financial gain through the appreciation of their tokens. However, the value of tokens is subject to market conditions and can fluctuate, so there is also a risk involved.
- Real impact on the fate of the project - the holders of tokens in a DAO have a real impact on the fate of the project by having the ability to vote on proposals and make decisions collectively. This gives them a sense of ownership and responsibility for the success of the project.
- A sense of belonging to a community - being a part of a DAO gives holders a sense of belonging to a community of like-minded individuals who are working towards a common goal.

- A sense of satisfaction: Being able to participate in the governance of an organization and make decisions that have a real impact can give holders a sense of satisfaction and fulfillment.
- Sharing success: The holders of tokens in a DAO share in the success of the organization, as the value of their tokens is tied to the success of the project.
- No intermediaries - DAOs operate on a decentralized network and are governed by a set of rules encoded in smart contracts. This eliminates the need for intermediaries such as banks, legal entities and other third parties, which can provide a more efficient and cost-effective way of managing an organization.
- Flow transparency (by the use of blockchain technology) - the transparency of the blockchain also allows for greater trust among members of the organization.

On the other hand, there are also some drawbacks connected with the usage of DAOs. A few risks associated with the development of DAOs are listed below:

- Regulatory uncertainty - DAOs operate on a decentralized network and are not subject to traditional regulatory frameworks. This can create uncertainty for stakeholders and developers, as it is unclear how regulatory authorities will treat DAOs in the future. This uncertainty can make it difficult to predict the long-term viability of a DAO.
- Low speed of decision making process - decentralized decision making in a DAO can be a slow process because of the need for consensus among stakeholders. This can make it difficult to make quick decisions and respond to changes in the environment.
- Security doubts - smart contracts and blockchain technology are still relatively new, and there are security risks associated with them. These risks can include hacking, bugs in the code, or human error. As a result, there is a risk that a DAO may be compromised, which could result in the loss of funds or other assets.

DAOs are a modern organizational structure that uses blockchain technology and smart contracts to manage an organization. They provide a decentralized and transparent way of decision-making, removing intermediaries, and enabling more efficient and transparent management. DAOs have the potential to revolutionize the way organizations are run and adapt to the changing environment. However, despite the potential benefits of DAOs, the majority of projects in this area have failed. This is not uncommon for innovative solutions, as the majority of new projects fail due to various reasons such as lack of funding, lack of interest from users, or technical difficulties. Nonetheless, a few successful projects have emerged, such as the DAO, Ethereum, and MakerDAO, which have shown that DAOs have the potential to change the way organizations are managed and to create new opportunities in various fields.

In the opinion of the author of this publication, the topic worth taking up is the application of the DAO concept in the context of the development of initiatives in the field of public management, crowdfunding and supply chain management. This article was intended to present the concept of DAO in the context of changes in the traditional perception of the organization,

especially in the face of the increasing role of the use of the Internet and modern technologies such as blockchain and smart contracts. The author's opinion on decentralizing the management of modern enterprises and social structures is clearly positive. Although there are numerous risks associated with the development of innovative solutions, such as incorrectly created smart contracts due to the early stage of technology development, or the existence of solutions that lead to the loss of funds by investors (abuse, scams), this is a situation typical of solutions at a very early stage stage of the life cycle. The regulations of supervisory institutions, which are appearing to an ever greater extent, should contribute to reducing the risks and increasing the adoption of the solutions described in this article.

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