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The Decentralized Autonomous Organization – Applications and Potentials for IT Projects

Hans Peter Rauer[1], Daniel Schröder[2]

Abstract: The DAO is an innovative, blockchain-based platform to virtually manage organizations. Thereby, it challenges traditional project funding and hierarchical (project) management concepts. This paper introduces the DAO, its general functionality and the overall purpose of blockchain technology. Then, current applications of DAOs are depicted. Finally, we draft opportunities and challenges in the application of DAOs for project management with the aid of a model of project classification. Managerial implications of these findings are presented by recommending the DAO for selected IT project management scenarios.

Keywords: Decentralized Autonomous Organizations; Blockchain; Classification; Project Management; Project Organization; IT Projects.

1 Introduction

With the emergence of web3, the concept of Decentralized Autonomous Organizations (DAO) has gained attention in areas such as crypto currency and digital arts, both being driven by the rise of the blockchain technology. Now, we want to conceptionally assess its usefulness for IT project organizations. Henceforth, the term DAO shall be defined as "a blockchain-based system that enables people to coordinate and govern themselves. It is mediated by a set of self-executing rules deployed on a public blockchain, and whose governance is decentralized" [HD21], i.e., not controlled centrally. In contrast to traditional organizations, DAOs lack hierarchical structures and usually are fully democratized. All decisions are majority votes and there is no central authority or ownership. Once a set of rules is implemented and executed on a blockchain, changes need to be agreed on by the voting members and implemented in the underlying code. All rules and activities are visible, transparent and publicly stored in the blockchain.

This paper discusses the question of what classes of IT projects qualify to be operated by a decentralized, self-governed and structured organization as an alternative to traditional top-down organizations. This discussion is paying specific emphasis to IT projects.

The remainder of this paper is structured as follows. First, we introduce the DAO as a platform for IT project management. Then, in section 3, we define and classify projects employing several frameworks to characterize different kinds (classes) of projects against each other. In section four, we assess whether a certain class of project might be suitably organized by a DAO-based scenario. Finally, we conclude and give recommendations for

[1] FH Bielefeld, Campus Gütersloh, Fachbereich Ingenieurwissenschaften und Mathematik, Langer Weg 9a, 33330 Gütersloh, hrauer@fh-bielefeld.de
[2] HUK-COBURG, Abteilung Digitale Services, Bahnhofsplatz, 96444 Coburg, daniel.schroeder@huk-coburg.de

which categories of projects DAOs yield benefits and how such projects might look like.

2 Decentralized Autonomous Organizations

In May 2016 the news portal TechCrunch reported that DAOs may have the potential for a fundamental disruption for economic organizations [Ba16]. This conclusion resulted from the successful formation of "The DAO" [Ba16], then raising more than $150mn in assets back in 2016 [WR21]. It is granting full financial control to its members through tokens on the Ethereum blockchain [Ba16]. Ever since, the concept of DAOs has emerged and a variety of projects were established.

A DAO is based on a series of votes by ballot that are cast by its members to make a decision that affects the community or its assets, i.e., the DAOs cryptocurrencies. A decision can only be adopted after a majority of the DAO members have digitally agreed to it. Therefore, the nature of a DAO is democratic and ownership equals membership. Decision-making frequently is based on votes, executed via governance tokens using dedicated platforms like snapshot.org for instance. Their underlying technology for voting is frequently an Ethereum-based blockchain. A blockchain is a shared ledger to record transactions and track assets and – in our case – past ballots of a DAO. The blockchain is a "ledger (…) a sequence of blocks (…) that contains a set of transactions already performed. Each block points to the previous block in the ledger, forming a chain" [FAH21]. It is publicly transparent and irreversible with respect to changes [DS20]. Blockchains "are tamper evident and tamper resistant digital ledgers implemented in a distributed fashion (…) without a central authority (…). On a fundamental level, the blockchain enables a community of users to record transactions in a shared ledger within that community" [Ya19]. With these specific features blockchains offer openness, decentralization, security and the ability to preserve user privacy [Gh21]. Benefiting from this, a DAO, is not only decentral, and democratized, it is in addition transparent due to the public nature of the used blockchain [Ya19]. All decisions and activities of the DAO in consequence then are permanently documented on the blockchain [FAH21].

A DAO is a digital and democratic evolvement of a distributed organization. However, it is different in its degree of automation and its concluding mechanisms for organizational governance [Bu14]. Besides ballots, DAOs are also based on smart contracts. They contain tamper-resistant rules to structure and facilitate the modus operandi of the organization [DW18]. Smart contracts automatically execute the defined terms and rules and without outside intervention [Lu21]. Thereby, they can ease the casting of ballots for its members, e.g., for small or trivial decisions such as the payment of resources with cryptocurrencies. They act automatically and are so-to-say self-enforcing. In these terms the blockchain technology as the fundamental frame of smart contracts and bylaw execution is inextricable integrated in DAO governance.

Members of the DAO achieve voting rights and ownership by either buying them initially or as a reward for work, participation, or value preposition. The characteristics of a DAO's governance makes it principally interesting for an application in project management. In the literature it was proposed for project task allocation, management or auctioning [Lu21]. DAOs still are an un-majored form of collective work and governance frequently

facing operative challenges [RJR19]. Their efficient setup and design are still being explored and evaluated while governance challenges remain [WR21]. In addition to the present discussion [Lu21] and [RJR19] conducted extensive literature research with regards to blockchain, DAO and project management.

To sum it up, a DAO is a community of independent individuals that are committed to create and share assets regarding an agreed project mission. It is democratically owned by its members and governed by an agreed and automated set of rules, usually based on blockchain technology.

3 Classification of projects

The governing principles behind the DAO make it a principally interesting and innovative platform for many kinds of organizations, IT projects being just one of them. But, as the DAO is not perfect solution for any kind of projects, we deem it necessary to first identify in which kind of project settings they might be beneficial, and how. These project settings are identified with the aid of several classification criteria that distinguish projects by classes, for example by its size, its complexity, etc. As a result, we gain a catalogue of project criteria that are then joined with characteristics of DAO to assess, whether the projects of a certain criterion might be well-suited for employing a DAO to manage them.

The challenge of classifying projects into meaningful and distinct classes has been an open and ongoing debate ever since. As there is no single generally accepted framework [CHT02], some practitioners have taken pragmatic approaches to meet specific needs, e.g., for project portfolio management. The research community, on the other hand, has proposed several classification frameworks. These systems have been identified and were consolidated in [CHT02]. Therefore, we find the following attributes – loosely based on [CHT02] – to be most important for the classification of projects into robust classes:

1. The **classification by size, complexity, and familiarity** reflects attributes of projects that are observable *ad hoc* and have direct impact on effort, risk and the timeline.
2. The **classification by life cycle or sector** depicts the factual deliverable of a project, e.g., either software development or the engineering of physical products as well, e.g., IoT-devices. It also influences the longevity of the project, either short term (e.g., one single release) or long term with a whole product development roadmap.
3. The **classification for contract type and payment terms**, differentiates *when*, *how* and *if* project members are incentivized for their efforts and, moreover, by what kind of *sponsoring* entity or organization and how payments are remitted.
4. According to [El18] the **classification of the geographical distribution** of the project teams has a significant impact. The distribution is differentiated in two extremes: either locally or globally/dispersed in a remote or virtual organization.
5. Considering **cultural aspects** is another important aspect that needs to be accounted for [Se20]. For the sake of our classification, we, again, focus on two extreme positions: there is either only one or many different cultural circles. The similarity of cultural circles shall be described with Hofstede's Cultural Dimensions [Ho80].
6. The **classification with respect to project methodology** is another important criterion for our classification. We differentiate between two extremes: on the hand we regard the classical waterfall process types and on the other hand we consider agile

methods which follow an iterative, test-driven approach [Th21].

Although there are certainly many more criteria available to form a framework for classification, we deem these six attributes most suitable. Following the key points (1-6) and the definitions from [CHT02], we are discussing and creating a classification based on these six classes.

4 Assessing the potential of a DAO for project management

In this section we use the classes 1-6 from the third section to assess, which classes of IT projects might be implemented by a DAO as a project management platform.

Regarding the first project classification, by **size, complexity, and familiarity,** we argue that a DAO is suitable for large projects, mainly due to the high setup costs. For instance, setting it up is reported as being an enormous effort that "requires highly specialized knowledge about blockchain programming" [El20]. To decrease the technical effort of setting up a DAO, as-a-service platforms have emerged. For example, Aragon, DAOstack, DAOhaus and Colony save users the trouble of programming and hosting their own DAOs in the form of smart contracts, that are implemented in a blockchain. Instead, they allow a user to set up a pre-built DAO that is based on templates that are customized and then deployed [Kr19]. For example, Aragon makes suggestions on how to set up voting rights with tokens as well as payment schemes with templates such as "hedge fund" or "charity" [Ar21]. Besides the *technical efforts*, which might be tackled with bespoke as-a-service platforms, there is also considerable *organizational effort* during a project setup phase. For example, it is required to first define the stakeholders of the organization and their rights, second to set up smart contracts and third to integrate functions for voting and payments [Cr22]. These two sources of effort can only be justified in major projects with a certain degree of domain knowledge.

The second project classification, by **life cycle or sector**, is – once again – influenced by the considerable setup effort of a DAO. This can only be justified in mid- and large projects which usually, are also mid- or long-term projects. Thus, we cannot recommend DAOs for small, short-term or ad hoc projects [Cr22]. However, when it comes to long-term projects, especially with a focus on product development, DAOs come to shine. For example, the DAO *Metafactory* is a community-owned creator of apparel that lets designers collaboratively develop and refine products (e.g., shirts, hoodies etc.). By means of governance tokens, so called $ROBOT-tokens, member-incentivization and profit-sharing is implemented. For example, *Metafactory* covers all manufacturing, marketing and administration costs of a new line of apparel. After the go to market, designers are rewarded with tokens with respect to the commercial success of the products [Kr19]. To sum it up, we perceive DAOs to be well-suited for mid- and long-term development projects especially in cases with an initial invest or an asset requirement (e.g., as product development and software development). Especially in risky scenarios its transparent means of risk sharing can facilitate accruing the necessary funding.

The third project classification, by **contract type and payment terms**, differentiates *how* payments are made and *by whom*. Currently, schemes such as "cost plus" or measurement-based approaches such as "bill of materials" are common among project sponsors. Of

course, DAOs could use such schemes as well, if its members vote to do so. But they offer a new payment option with smart contracts to execute customizable, programmable actions that depend on previously agreed rules [Lu21]. This allows project stakeholders or managers to *a priori* tailor payouts or voting rights to contractors if certain results are met (the so-called token-incentive). In addition, by employing DAOs, the management and the collection of funding for a project is diversified towards a bigger audience, not only one single *sponsoring organization* (usually a bank or a corporation), but also "different kinds of organizations (non-governmental organizations, nonprofits, foundations)" [Dh17]. Thereby, it becomes possible to attract multiple sponsors to invest different magnitudes of sums into the project [El20].

The fourth project classification, by **geographical distribution**, features two hypothetical extreme variants: either a project – and its members and stakeholders – work *locally* in one single area or they are *dispersed* over a wider area or globally. In this case they are unable to directly communicate to each other face-to-face, often being under different areas of jurisdictions. Whereas locally organized projects may benefit from a DAO, it can truly display its advantages in dispersed settings as implied by its name – decentralized. DAOs support many mechanisms that enable digital and decentralized working, for example: Decisions are made through digital voting, not face to face meetings.

The fifth project classification, with respect to **cultural aspects,** focuses circumstances that are not related with deliverables, products being built, the technology involved, the level of expertise, the capabilities of the project manager, but due to intercultural factors [Is15]. Various sources of risk arise from this background, for example language difficulties, misunderstandings, conflict resolution strategies, a lack of communication and many more. Although managing intercultural projects is a daunting task, once more a DAO might deliver useful support by implementing the guidelines from [Ze10]: it can assign tasks in smart contracts, and it can create an equal balance of power in the project team.

Finally, the sixth project classification examines whether a DAO better supports an agile **project methodology** or classic waterfall approaches as a project management platform. The immutability of the blockchain and smart contracts makes it complicated to change a specific DAO, once it is deployed [Mi20]. Since it runs on publicly available financial platforms, e.g., Ethereum, that are based on pay-per-transaction scheme, changing smart contracts *ex post* is extremely expensive or outright impossible [Mi20]. As smart contracts need to be set up in a very exact and specific manner, we deem it very impractical to set up the long-term project plans that are necessary for classic waterfall-style planning. For example, what happens to a faulty smart contract that is not required and more? In contrast to that, agile approaches favor short-term planning on a very detailed basis and, therefore, might be easily depicted by a DAO.

5 Conclusion and discussion

In the prior section, we mapped the six classification criteria of projects (cf. section 3) to show, under which circumstances a DAO might exhibit advantages as a project management platform. The areas of project management, where we deem a DAO a suitable instrument, are large projects due to the DAOs high setup costs (class 1) that at least feature

a mid-term or long-term duration (class 2). With respect to the contract type and payment terms (class 3) we recommend it for projects with an extrapreneur or heterogenous ownership structure and a geographically dispersed project team (class 4). With respect to cultural aspects (class 5) a DAO leads to a clear and transparent setup of key project management data, i.e., tasks, incentives and decisions, helps to mitigate potential conflicts. However, in classic waterfall project settings (class 6) problems around the immutability of data and source code are not yet solved satisfactory. Thus, we recommend a DAO in agile project settings.

Although, DAOs can solve several problems, aspects of security and legality of smart contracts under various jurisdictions are still an area of discussion [DW18]. DAOs limitations as legal vehicles restrict the usability for commercial cases [Pr22]. However, for open-source and not-for profit organizations we see great potential. DAOs are furthermore recommended as platforms for internal startups, i.e., in an extrapreneur role, as well as entities to which parts of the value chain are outsourced to [Li20].

Regarding the weaknesses of this paper, we feel that the true advantageousness of the DAO is not yet properly reflected in this research. The main reasons for a DAOs creation (e.g., transparency, integrity and availability [Lu21]) are not yet part of our classification in section 3. Furthermore, the classification's result depends on the choice of the criteria. These criteria were mostly derived from one joint classification/coding session done by the two authors. It would have been desirable to extend the coding sessions and the number of coders as well to extend the objectivity of the project classification.

To extend this paper for future research, we see the possibility to first apply the classification framework to a specific instance of a DAO, e.g., Aragon [Kr19]. Second, a field test or experimental design could encompass a real-world project executed on that platform. Third, we appeal to the research community to devise new methods of project management that better suite DAOs.

Literature

[Ar21] Aragon: How to Start a Hedge Fund (from your Bedroom), https://blog.aragon.org/how-to-start-a-hedge-fund-from-your-bedroom/, Stand 23.6.2022.

[Ba16] Bannon, S.: The Tao of "The DAO" or: How the autonomous corporation is already here. https://techcrunch.com/2016/05/16/the-tao-of-the-dao-or-how-the-autonomous-corporation-is-already-here, Stand: 16.7.2016.

[Bu14] Buterin, V.: Ethereum: A Next-Generation Smart Contract and Decentralized Application Platform, https://ethereum.org/669c9e2e2027310b6b3cdce6e1c52962/Ethereum_White_Paper_-_Buterin_2014.pdf, Stand: 16.11.2014.

[CHT02] Crawford, L.; Hobbs, J. B.; Turner, J. R. Investigation of potential classification systems for projects. In (Project Management Institute, Hrsg.) Proc. PMI Research Conference 2002: Frontiers of Project Management Research and Applications, Seattle, 2002.

[Cr22] Cryptopedia: Aragon (ANT): DAOs for Communities and Businesses, https://www.gemini.com/cryptopedia/aragon-crypto-dao-ethereum-decentralized-government, Stand 20.3.2022

[DW18] De Filippi, P.; Wright, A.: Blockchain and the Law - The Rule of Code. Harvard University Press, Harvard, 2018.

[Dh17] Dhillon, V. et al.: Decentralized Organizations. In (Dhillon, V., Hrsg.): Blockchain Enabled Applications - Understand the Blockchain Ecosystem and How to Make it Work for You. Apress-Verlag, Berkeley, S. 47-66, 2017.

[DS20] Di Angelo, M.; Salzer, G.: Tokens, Types, and Standards: Identification and Utilization in Ethereum. In: Proceedings of 2020 IEEE International Conference on Decentralized Applications and Infrastructures (DAPPS), Oxford 2020.

[El18] El Bajta, M. et al.: Software Project Management Approaches for Global Software Development: A Systematic Mapping Study. In (Sun, J., Hrsg.): Tsinghua Science and Technology, 23/6, S. 690-714, 2018.

[El20] El Faqir, Youssef et al.: An overview of decentralized autonomous organizations on the blockchain. In: 16th International Symposium on Open Collaboration (OpenSym 2020), ACM, New York.

[FAH21] Faqir-Rhazoui, Y.; Arroyo, J.; Hassan, S.: A comparative analysis of the platforms for decentralized autonomous organizations in the Ethereum blockchain. In: Journal of Internet Services and Applications, 12/9, S. 1-20, 2021.

[Gh21] Ghiro, L., What is a Blockchain? A Definition to Clarify the Role of the Blockchain in the Internet of Things", https://arxiv.org/abs/2102.03750 Stand 19.2.2021

[HD21] Hassan, S.; De Filippi, P.: In (Borghi, M., Hrsg.): Decentralized Autonomous Organization. Internet Policy Review, 10/2, 2021.

[Ho80] Hofstede, G.: Cultures consequences. Sage-Verlag, 1980.

[Is15] Isern, G.: Intercultural Project Management for IT: Issues and Challenges. In: Journal of Intercultural Management 15/7, S. 53-67, 2015.

[Kr19] Kronovet, D.: Aragon, DAOstack, Colony, Moloch. http://kronosapiens.github.io/blog/2019/06/16/aragon-daostack-colony-moloch.html, Stand: 19.3.2019.

[La22] Larimer, D.: Overpaying for Security - The Hidden Costs of Bitcoin. https://letstalkbitcoin.com/is-bitcoin-overpaying-for-false-security, Stand: 11.3.2022.

[Li20] Siliämaa, R.: Decentralized autonomous organization as a disruptive innovation in insurance industry. Tampere University, Tampere, 2020.

[Lu21] Luong, H.H.; Huynh, T.K.N.; Dao, A.T.; Nguyen, H.T.: An Approach for Project Management System Based on Blockchain. In (Dang, T.K. et al. Hrsg.): Future Data and Security Engineering. Big Data, Security and Privacy, Smart City and Industry 4.0 Applications. Communications in Computer and Information Science. Springer, Singapore. S. 310-326, 2021.

[Mi20] Miraz, M.H.; Maaruf, A.: Blockchain Enabled Smart Contract Based Applications: Deficiencies with the Software Development Life Cycle Models. In: Baltica Journal 20/33, S. 101-116, 2020.

[Pr22] Pranata, A.R. et al.: The Legality of Smart Contracts in a Decentralized Autonomous Organization (DAO). In: Regulatory Aspects of Artificial Intelligence on Blockchain. IGI Global, New York, S. 112-131, 2022.

[RJR19] Rikken, O.; Janssen, M.; Roosenboom-Kwee, Z.: Governance challenges of blockchain and decentralized autonomous organizations. In: Information Polity, 24/4, S. 397-417, 2019.

[Se20] Seus, F.; Weissenberger-Eibl, M.; Zern-Breuer, R.: Considering representational gaps - how subsidiaries' relationship affects multi-location project management. In (Wang, J., Hrsg.): International journal of project organization & management 12/20, S. 321-345, 2020.

[Th21] Thesing, T.; Feldmann, C.; Burchhard, M.: Agile versus Waterfall Project Management: Decision Model for Selecting the Appropriate Approach to a Project. In (Zheng, J., Hrsg.): Procedia Computer Science, Manchester, 181/21, S. 746-756, 2021.

[WR21] Wright, A.: The Rise of Decentralized Autonomous Organizations: Opportunities and Challenges. Stanford Journal of Blockchain Law & Policy, 2021.

[Ya19] Yaga, D. et al.: Blockchain technology overview. National Institute of Standards and Technology Internal Report 8202, Gaithersburg, 2019.

[Zi19] Zichichi, M. et al.: LikeStarter: a smart contract based Social DAO for Crowdfunding. In: IEEE INFOCOM 2019 - IEEE Conference on Computer Communications Workshops 2019, S. 313-318. 2019.

[Ze10] Zeutschel, U.: Intercultural Project Management. In (Thomas, A. et al., Hrsg.): Handbook of Intercultural Communication and Cooperation. Vandenhoeck & Ruprecht, Göttingen, S. 272-274, 2010.