Insight into Voting in DAOs: Conceptual Analysis and A Proposal for Evaluation Framework

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***Abstract*—Driven by the development of blockchain infrastructures and the promotion of Web 3, more than 4000 Decentralized Autonomous Organizations (DAOs) have been developed as online organizations jointly owned and managed by their members who work for the same interests. Voting mechanisms as the democratic administration of DAOs without the involvement of central authority, are crucial to both the development of the DAO community and the protection of individual interests. This paper is one of the first analyses of the critical role of voting mechanisms in DAOs' operation. In the absence of systematic studies of voting mechanisms in DAOs, we propose five tiers of decentralization in DAO voting which marks the critical difference between DAO voting and conventional voting. We also define four dimensions to comprehensively evaluate the performance of DAO voting mechanisms, which identify the demands and characteristics of DAO voting and put forward clear design guidelines for voting mechanisms in DAOs. Finally, we take seven typical voting mechanisms as examples and analyze their performance in our proposed evaluation schemes.**

***Index Terms*—Decentralized Autonomous Organizations (DAOs), Voting, Blockchain, Smart contracts, Web 3.**

I. INTRODUCTION

Decentralized autonomous organizations (DAOs) as the pioneering entities forming crucial user networks in Web 3 have received extensive attention from the industry, with over 4000 DAOs have been established by June 2022 [1] since the very first DAO, *The DAO* was implemented in 2016. The original concept of DAOs was coined by the Ethereum community in 2014: transforming manual management organizations into autonomous organizations enabled by long-term smart contracts to encode the constitution of the entire organization [2]. Currently, DAOs are generally described as internet-native organizations/networks with transactions and rules encoded by smart contracts and collectively managed by all members to pursue common goals [3].

Unlike centralized and hierarchical structures with a few people at the core of decision-making and a reputation-based trust environment in most conventional organizations, the DAO networks provide an alternative decentralized and autonomous management architecture supported by smart contracts and collective voting. While smart contracts have been in the spotlight in almost every discussion of DAOs, the voting mechanisms have not received enough attention. The lack of attention to DAO voting threatens the entire operation of DAOs. First, since DAOs are open networks, flawed voting mechanisms can lead to high-security risks, such as speculation and malicious manipulation, allowing attackers to harm members' interests. Second, if the voting mechanism cannot allocate voting power properly, it is likely to lead to short-sighted or unprofessional decisions [4], as each member has limitations in expertise and knowledge [5]. Third, as the rules written in smart contracts can only be managed by voting, a flawed voting mechanism may bring unwise or even malicious changes to the established system, which is a huge hidden threat to DAOs. Finally, it should also be considered whether the voting mechanism conforms to the feature of decentralization in DAOs. In particular, simply replicating voting mechanisms in conventional organizations may lead to centralized decision-making. For example, a shareholding-like voting mechanism tends towards plutocracy, breaking the decentralized and non-hierarchy pursuit of DAOs.

Defective voting mechanisms have serious implications for the development of DAOs, but many DAO voting mechanisms still simply follow the majority rules, which adopt decisions approved by the majority. Some researchers in the DAO industry have noticed the need for improvements in the DAO voting mechanisms, and they have promoted improvements and innovations in DAO voting mechanisms, to name a few *Holographic Consensus* [6], *Knowledge-Extractable Voting* [7]. Unfortunately, academic research on DAO voting is limited. A few related studies have recently been presented. [7], [8] and [9] have made a general survey of DAOs. [8] and [9] mainly contributed to the statistical analysis of the prominent DAOs platforms, and [7] provided an overview on the concept, the architecture and the application of DAOs. However, voting in DAOs was briefly introduced. Specified on DAO voting, two papers provided voting analysis using specific DAO platforms as examples. [6] focuses on the scalability performance of *Holographic Consensus* in DAOs built on *DAOstack*, while [10] showed the impact of two types of decision-making on platform *MakerDAO*. [4] analyzed the voting power distribution in three prominent DAOs and provided the impact of voting power distribution on decision-making, which is a valuable discussion specified on DAO voting design combined with the decentralized property of DAOs. Still, systematic studies on DAO voting are absent. So far, the only relatively comprehensive overview of voting in DAOs is [11], which introduced basic components of the voting system and several voting methods but with limited deep discussion.

However, in the absence of systematic research to provide guidance and reference for the design of the DAO voting mechanism, any specific analysis and innovation design of the voting machines are very likely to bring hidden dangers and loopholes. Therefore, we ask two questions: **What is the role of voting in DAOs? As an important element of the decentralized governance of DAOs, what properties do DAO voting mechanisms require?** Only by answering

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these two questions can DAOs become truly trustworthy organizations. To answer the two questions, this paper provides one of the first conceptual analyses and evaluation frameworks of DAO voting mechanisms. The main contributions can be summarized as follows.

- We propose a DAO governance triangle to locate the key role of the voting mechanism in DAOs. The mutual constraints between DAO voting mechanisms and smart contracts are discussed in detail.
- We analyze the impact of decentralization ethos on DAO voting and propose a five-tier decentralization scheme to identify the decentralization in entities of DAO voting.
- We abstract the key metrics for DAO voting mechanisms, i.e. security, efficiency, effectiveness and decentralization, named SEED, to systematically evaluate the performance of DAO voting.
- We summarize seven typical voting mechanisms in DAOs. Their basic procedures are summarized and their performance is analyzed following the guidance of key metrics in SEED.

II. The role of voting in DAOs

In the extensive discussion of DAOs, voting receives little attention and is recognized as a decision-making method that naturally emerges from decentralization. In contrast, smart contracts and distributed ledger technology applied in DAOs have received much attention. However, as the primary decision-making method of DAOs, voting deeply affects the soundness of the entire DAO network. Therefore, before analyzing how to design the voting mechanism, we first discuss the role and impact of the voting mechanism in the entire DAO system and propose a DAO governance triangle.

The two prominent governance functional entities in DAO are the smart contract and the distributed ledger. Featured as automatic execution, predictable outcomes, public records, privacy protection, and visible terms, smart contracts can convert the rules and contracts based on human maintenance in conventional organizations into programs writing contracts as codes that are automatically executed. The distributed ledger is responsible for recording key activities in DAOs to the blockchain, ensuring that the recorded information is immutable.

The smart contract and the distributed ledger release the human maintenance requirements and reputation-based trust in the governance. However, they are not sufficient for all governance tasks, especially when it comes to decision-making. On the one hand, the requirements and transactions of DAOs are complex and vary over time and environment. Smart contracts are rules for predictable situations that are hard to cope with changing circumstances. On the other hand, due to the strict execution of smart contracts, leaving no room for change can create enormous pressure when contracts are set. Therefore, human decisions are inevitable and crucial in most DAOs to deal with unpredictable events and bring flexibility to the written stipulations in smart contracts. To maintain the decentralization in DAOs, all events requiring human decisions are decided by collective votes managed by voting mechanisms in current DAOs.

Voting mechanisms importantly complement the smart contract to maintain non-hierarchy governance in DAOs. The governance architecture of DAOs can be described as a triangle between distributed ledger, smart contracts, and voting mechanisms. Their relationship is shown in Fig. 1. Smart contracts are responsible for overseeing and implementing all the rules and contracts in DAOs, which of course, include rules and procedures in voting mechanisms. However, conversely, voting is the only formal way to change the rules already defined by smart contracts and add new rules to smart contracts. Smart contracts and voting mechanisms not only jointly build management in DAOs, but also co-constraint each other, and they are both critical to the healthy operation of DAOs. Critical activities performed by voting mechanisms and smart contracts are recorded in a distributed ledger database. The distributed ledger is not only aligned with the requirements of decentralization but also provides consistent and immutable records. The interactions and constraints between distributed ledger, smart contracts, and voting mechanisms form a stable governance system for DAOs.

III. The ethos of decentralization in DAO voting

The voting mechanisms of DAOs can learn from conventional voting methods but cannot simply copy conventional voting methods. Decentralization, as the most significant feature different from conventional voting, needs to be carefully considered in the design of the DAO voting mechanisms. Otherwise, it may have a strong impact on the overall decentralization performance of DAOs. Fortunately, DAO voting has a naturally well-decentralized foundation. The voting in DAOs aims to make a collective decision normally open to each member, and the decision-making does not mandate specific member participation. Each participant in the DAO voting is strongly independent, and the voting system can withstand the absentee voting of any participant to a large extent. However, this only provides a decentralized foundation for DAO voting, entities such as the voting power allocation and the conditions in the voting process may contain the threat of centralization. The threat of centralization in any entity can override the decentralization feature of the DAO voting system. Therefore, to help DAO voting be truly decentralized, we first conclude the difference between DAO voting and conventional voting affected by decentralization. Then, a five-tier decentralization scheme in DAO voting is proposed, which provides a systematic guide for fulfilling the decentralization in DAO voting.

A. Compare DAO voting and conventional voting

DAO voting shares similarities with voting in conventional organizations, such that they have similar decision-making goals and similar entities. However, following the ethos of decentralization, DAO voting is very different from conventional voting. First of all, affected by decentralization, DAO voting is featured with equal positions among members, while conventional voting usually has hierarchical positions. Second, proposals in DAO voting can be initiated by any member in any aspect generally. In contrast, most members do not

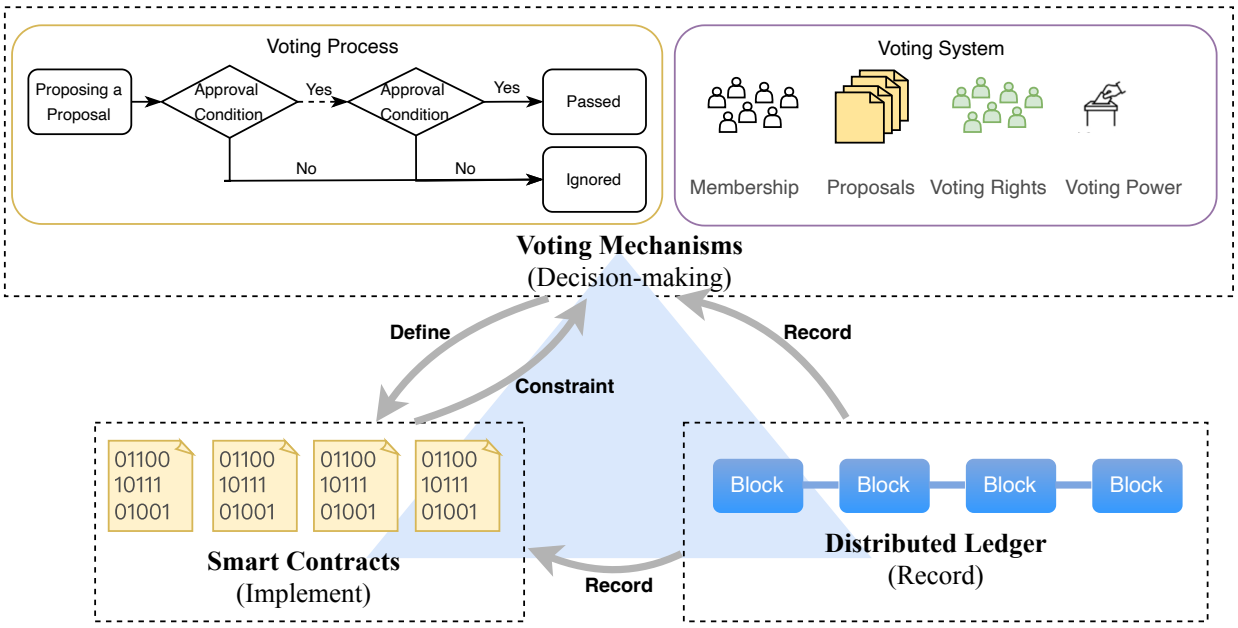

Fig. 1: The DAO governance triangle: the relationship between distributed ledger, smart contracts and voting mechanisms in DAOs

have the right to make proposals in conventional voting and proposals are limited to typical issues. Usually, all members have voting rights, while voting may not be open for everyone in conventional organizations. In terms of voting powers, they are usually token-based and democratically distributed in DAO voting, while voting powers are heavily influenced by status and wealth in conventional voting. Supported by distributed ledgers, voting processes are transparent in DAO voting, while they are limited to the public in conventional voting. A comparison is shown in TABLE I.

B. Five-tier decentralization scheme in DAO voting

The current designs of DAO voting hardly meet all demands in decentralization, and some DAOs even simply use conventional voting methods, which are largely against decentralization. Therefore, we propose a five-tier decentralization scheme in DAO voting (shown in Fig. 2), breaking the demands of decentralization to five entities in the DAO voting system. The decentralization characteristic of each lower tier entity is the foundation of the upper tier, and centralization at any tier can break the overall decentralization of the voting system.

1) Trust: Voting is a decision-making method involving multiple parties, which requires trust to maintain stability and reliable operation of the mechanisms. Trust also builds members' confidence in the voting system, and members' commitment to the mechanism can be increased in strong trust. Conventional voting usually relies on the maintenance of the voting mechanism by the authority, thus establishing internal trust in voting. Based on the analysis of the DAO governance triangle, the DAO voting mechanism relies on the execution of smart contracts and the recording of distributed ledgers rather than on authority people and databases. DAO voting transfers the trust based on centralized authority in the conventional voting mechanism to blockchain technology featured decentralization. The decentralization of trust is actually the decentralization of voting system maintenance.

2) Membership: Conventional systems are relatively closed with a high threshold for joining the membership. They often have a pyramid-shaped management architecture which means the positions of members is hierarchical in a centralized trend. In contrast, membership in DAOs is usually open and non-hierarchical. Currently, most DAOs are open for the entire Internet with a token-based membership. Tokens are often referred to as cryptocurrencies and each DAO has its native tokens. Owning the native token means becoming a member in most cases. The decentralization of membership aims at a relatively equal position among members. The relationship between DAO members is cooperative rather than governance.

3) Voting rights: Voting rights here refer to the rights to propose proposals and vote. In conventional voting, the voting right is more likely to be accessed by senior members with higher levels and status. However, in DAOs, voting rights are accessible to all their members which is a decentralization of voting rights. However, since the membership of most DAOs is permissionless and open, it is not difficult to obtain voting rights in DAOs. Therefore, some DAOs have raised the requirements. For example, only members who have accumulated a certain reputation are eligible to make proposals in some cases [7].

4) Voting power: Voting power is the value/number of votes of a member on a proposal, and the voting power allocation varies in both conventional and DAO voting. In most current DAOs, voting allocation is token-based, which means that the allocation of voting power is largely dependent on the number of tokens held by a voter. One token one vote (1T1V) is a special case of token-based voting power allocation and is the most widely used in current DAOs due to its simplicity. 1T1V implies that one token can be transferred into one unit of the voting power. However, although the 1T1V scheme is simple

TABLE I: A Comparison of DAO Voting and Conventional Voting

DAO Voting	**Conventional Voting**
Equal position among members.	Hierarchical positions.
Generally, proposals can be initiated by any member in any aspect.	Proposals are for typical issues and most members do not have the right to make proposals.
Usually, all members have voting rights.	Voting may not be open for everyone in the organization.
Voting processes are automated through smart contracts.	Voting processes usually require manual handling and rely on internal trust.
Voting powers are usually token-based and democratic distributed.	Voting powers are heavily influenced by status and wealth.
Voting processes are all transparent.	Voting processes are limited to the public.

and seems fair enough, it is inevitable to appear plutocratic control, tactical voting, voting power lending market, etc., which is contrary to the decentralization pursuit of DAOs. The most decentralized voting power allocation scheme is one person one vote (1P1V), which assigns equal voting powers to each voter. However, it is rarely used in DAOs since it cannot support funding-based proposals in great numbers in DAOs. In terms of the forms of voting power allocation, DAO voting is similar to conventional voting; for example, token-based voting is similar to conventional stake-based voting. Still, we need to pay more attention to the demand for decentralization when designing the allocation of voting power in DAOs. The overwhelming voting power of minor members degenerates the collective voting into a centralized decision which disintegrates the decentralized design of the entire voting system.

5) Voting process: Proposing a proposal, collecting votes, verifying with approval conditions, and executing results are the backbone structure of all the DAO voting processes. Normally, the voting process starts with a proposal. After the proposal is successfully submitted, it is open for voting until it reaches the voting power threshold or the time limit. The final voting result will be automatically generated according to the proposal passing criteria written in the smart contract.

Based on this framework, various conditions can be added in sequence during the voting process. We name them approval conditions. To pass a proposal, it must satisfy all the approval conditions in a voting process. To maintain decentralization, an adequate proportion of members are expected to participate in the voting. However, with some simple approval conditions, a proposal may pass with a small number of member participants. A decision cannot be regarded as decentralized with limited attention in the voting system.

C. Challenge of decentralization in DAO voting

Some current DAO voting mechanisms try to improve decentralization but only act at one of the decentralization tiers we propose. If the centralization feature is not controlled at other tiers, the decline of decentralization will result in the entire voting system. Current trends in the centralization of voting power and defects in the voting process are clear examples.

The current power control of the DAO voting mechanism is seriously centralized. Since voting power allocation in most DAOs is token-based, typically one token one vote (1T1V), the large disparity in token ownership creates a large disparity in voting power among members. According to the investigation of 10 major DAOs in [12], less than 1 % of the members in a DAO currently hold 90 % of the voting power. Although the DAO provides each member with the right to vote, the decision-making power of voting is centrally held by a small number of people.

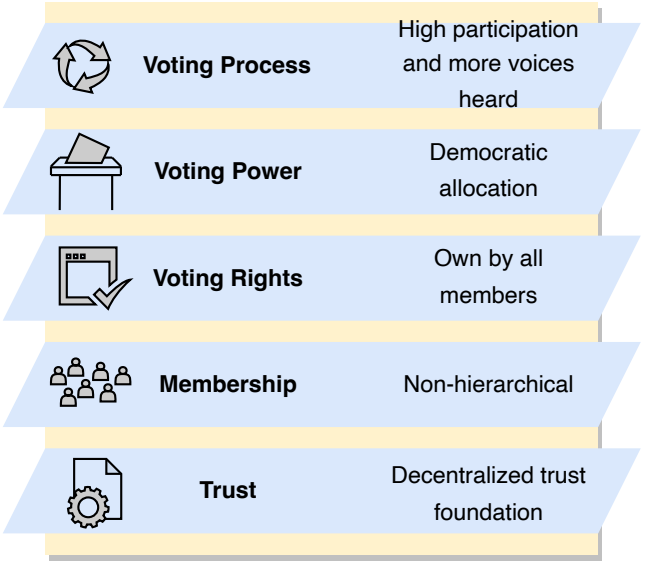

Fig. 2: Five-tier decentralization in DAO voting

Most of the current voting mechanisms have good decentralization performance in the first three tiers, trust, membership, and voting rights, thanks to the open, cooperative ethos and support from smart contracts and distributed ledger. However, such a highly centralized allocation of voting power directly undermines the decentralization of DAO voting. First of all, the non-hierarchical membership relationship cannot be achieved if some members have overwhelming decision-making power, even if DAOs do not have clear hierarchical position systems. Second, although the DAO provides each member with voting rights, for most members with limited voting power, their opinions have little or no impact on the voting results, and many people may gradually withdraw from participating in voting. Thankfully, some researchers and DAO participants have taken notice and proposed improved token-based voting to mitigate this effect. Typical examples can be referred to *Quadratic Voting* in Sec. V-C.

IV. SEED: Metrics of DAO voting

Decentralization is not the only demand in the DAO voting system. Other important performance metrics are also crucial to DAO voting. To provide a comprehensive design guideline broadly applicable to DAO voting, we identify three key DAO voting metrics besides decentralization, including security, efficiency and effectiveness. Together, we name the metrics of DAO voting as SEED (shown in Fig. 3), and SEED provides a systematic measure of voting mechanisms in existing DAOs and guidance for designing new DAO voting mechanisms. While additional metrics may also be found to be valuable in future designs, the four dimensions included in SEED overcome most of the threats in current DAO voting by succinct criteria.

A. Security

For organizations like DAOs that own digital assets and conduct a large number of transactions, security is an indispensable basic condition [13]. The security of DAO voting we discuss does not consider the security of transactions and verifications of digital assets, as this is a security issue addressed by cryptocurrencies and non-fungible tokens (NFTs). We rather analyze the possible security risks posed by vulnerabilities in the voting mechanism, as well as the possible ways in which an attacker may manipulate voting. Combined with the current design of DAOs, we point out three representative security issues.

The first threat is the slip-through passed proposals, meaning that a proposal may pass without the knowledge of most members. Since DAOs are causal participant communities, it can be difficult for members to keep an eye on every proposal, especially in large-scale DAO organizations with a large number of proposals. An attacker could exploit this vulnerability to pass harmful proposals. If the harmful proposal is related to public digital assets, the consequences are severe for DAOs. The security threat of the slip-through passed proposals is often caused by voting mechanisms not designed to require sufficient voting participation and attention. The most typical example is *Permissioned Relative Majority* (details refer to Sec. V-A), which only relies on the relative majority to decide whether a proposal is approved or not without any requirement on the participant amount in each voting process. Adding a requirement for adequate attention in approval conditions is a straightforward method to avoid the slip-through passed proposals. Several specific methods can refer to Sec. V-B and Sec. V-G.

The second security issue is voting power lending. Although the voting power in DAOs cannot be transferred, a secondary voting power lending market may be created. An attacker can gain a large number of voting powers in a short period by renting them. To avoid such a situation, some token-based DAOs link voting power conversion with time, which means the longer a member holds a token, the higher the corresponding voting power of the token.

The reversal result is the third security issue, which indicates a dramatic reversal of voting results at the end of the voting period. While a reversal of voting results before the end of the voting period may be reasonable, it cannot be ruled out that malicious members deliberately retain substantial voting power to change the voting results near the end of the voting period without allowing other members to act on the reversed results. Therefore, requiring the voting result to remain unchanged for a period before the voting closes to be a valid result is a safety measure that can be considered.

Although these three security issues may not cover all the vulnerabilities of DAO voting, it is obvious that the current design of the DAO voting mechanism has obvious security loopholes. Since the consequences of security issues are serious, security should be the primary consideration when designing a DAO voting mechanism. A secure voting mechanism is the basis of the stability in DAOs.

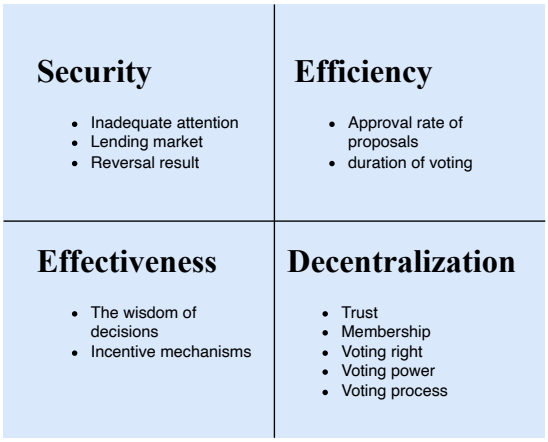

Fig. 3: SEED: four dimensions to evaluate DAO voting

B. Efficiency

The efficiency of the voting mechanism can be measured from two aspects: the approval rate of proposals and the duration of voting. The quality of proposals in current DAOs is mixed, so a high proposal approval rate is unreasonable and cannot be used as a symbol of high efficiency. However, a low proposal approval rate does affect the decision-making efficiency of an organization works. Although the overall quality of the proposal and the voting habits of members can affect the proposal approval rate, a low voting participation rate with a high attention threshold and the limited attention of each member on the large number of proposals in large-scale DAOs increase the difficulty for proposals to pass.

The duration of voting is usually specified, but a reasonable voting duration is affected by the level of activity of DAOs. As organizations with no obvious entity, DAOs cannot easily maintain close ties between members and the organization. An inadequate voting duration may largely decrease the approval rate of proposals. However, the duration of voting directly affects efficiency, and short-duration voting is necessary for time-sensitive and opportunistic decision-making. Since voting is the most important way to adjust and promote DAOs, insufficient and untimely changes caused by low proposal approval rates and long voting duration can profoundly limit the development of the organizations.

C. Effectiveness

Decentralization, security and efficiency in voting do not guarantee the decision voted by the member is a good decision for the development of the organization. Therefore, effectiveness which emphasizes the quality of the voting is also indispensable for DAOs. Limited by perceptions of information, knowledge, and expertise, it is difficult to make effective judgments when members are faced with issues in unfamiliar territory. Therefore, it is not convinced that collective decision-making made under a decentralized, secure and efficient voting mechanism is wise, especially when voting right is easily available in most DAOs. Therefore, only informed and professional decision-making is more likely to make effective decisions that can sustainably contribute to the development of DAOs. A feasible way to improve the effectiveness of voting is to assign more voting weight to professional members in proposals related to their expertise, which is a typical approach used in *Knowledge-Extractable Voting* (refer to Sec. V-E) to solve this problem.

V. Typical voting mechanisms

The key metrics of DAO voting provide an evaluation scheme. As a step forward to apply metrics of DAO voting, we conclude seven typical voting mechanisms and analyze their features according to the metrics of DAO voting. We visualize the performance of each mechanism on four metrics in Fig. 4. Since not every mechanism has a significant effect on every metric, we establish a baseline with a dashed line in Fig. 4. Affected metrics fluctuate, and unaffected metrics remain on the baseline.

A. Permissioned Relative Majority (PRM)

PRM is the simplest and the most widely used voting mechanism so far. The mechanism is remarkably highly efficient, clarifying the approval condition as a majority supporting voting power, which means a voting pass threshold is clearly notified as 50% among all the voted power spent in this voting. However, the mechanism can be easily manipulated when dangerous proposals do not get enough attention from members. Without any attention requirement, PRM has a high-security risk of the slip-through passed proposal threat proposed in Sec. IV-A. This problem may be alleviated in small-scale organizations with high activity, but its low security will certainly affect the long-term development of the organization.

B. Token Based Quorum Mechanism (TBQ)

TBQ is another major mechanism applied in DAOs. The core rule is the same as PRM, which is to listen to the majority, but it requires a higher level of participation from the organization. Participation can be enhanced by adding an attention threshold to a relative majority or simply substituting the relative majority threshold with the absolute majority threshold. The participation requirement largely reduces the slip-through passed proposal threat which increases the security of the voting with the member's attention playing a safeguard role. However, it is a trade-off that the voting process likely extends the time to collect sufficient attention, and the proposal passing rate may be reduced due to the more strict approval conditions, thereby, the voting efficiency will largely decline compared to PRM. In addition, the attention requirement involves more members in voting which increase the decentralization feature to some extent.

C. Quadratic Voting

Quadratic Voting is an improved voting power allocation scheme that balance 1T1V and 1P1V with a marginal cost increase design. The original quadratic voting was proposed by Edward H. Clarke [14] and applied in democratic politics. *Quadratic voting* in DAOs applied the same method that Edward proposed: the marginal cost increases as a user repeatedly votes on the same option [14]. For example, for the same option voting choice from one user, 1 vote requires 1 token, 2 votes require 4 tokens, 3 votes require 9 tokens, etc. The number of votes from each user equals the square root of the tokens paid. Compared with the commonly used 1T1V, the decentralized metric is significantly improved by mitigating the overwhelming voting power of a small number of enormous token holders. At the same time, it is more reasonable and flexible compared to the 1P1V.

D. Liquid Democracy

Liquid Democracy is a voting scheme commonly discussed in political science, which can also benefit voting in DAOs. In *Liquid Democracy* scheme, voters are allowed to vote directly or delegate their voting rights to a representative who is usually an expert in the community, which can improve the effectiveness of the voting. It is also notable that the delegation is allowed to be multi-level, which means representatives can also delegate to other representatives with all the votes they have been delegated as well. The representative is normally much more active than ordinary voters, so the efficiency of voting will be greatly improved due to the rapid processing of a large number of delegated votes. However, delegation may cause a setback for decentralization since a delegation voting structure tends to be hierarchical and centralized. Fortunately, the liquid feature is designed to emphasize that voters can change their delegation at any time, and voters can delegate different issues to different experts or partially delegate their voting rights. Thereby the trend of centralization can be alleviated. However, the impact of liquid democracy on decentralization cannot be ignored, which is a trade-off for improved efficiency.

E. Weighted Voting

Weighted Voting is a typical way to increase effectiveness. As the name suggests, *Weighted Voting* add extra weight to the calculation of the utility of the voting power of each member. Usually, reputation and knowledge are the main sources of weight calculation. *Knowledge-Extractable Voting* is an example that gives experts in a certain field more voting power by increasing their voting weight, which is decided by the knowledge token each user has [7]. The knowledge tokens

Fig. 4: The performance of typical mechanisms on key metrics in DAO voting

will reward users if their voting choices match the winning result [7]. On the contrary, the knowledge tokens will deduce if their voting choice is different from the winning result [7]. Basically, the *Weighted Voting* tends to allocate more voting power to experts or experienced members, which increases the possibility of making informed decisions. Therefore, the effectiveness of voting is greatly improved.

F. Rage Quitting

Rage Quitting is very popular in investment DAOs as the mechanism ensures that everyone's interests are not harmed by others. In these DAOs, members are allowed to withdraw from the organization at any time and retrieve their funds in tokens. In *Rage Quitting*, a passed proposal will stay in a grace period before the voting results are executed. In this grace period, the members who are extremely unsatisfied with the result can withdraw from the organization in anger. Giving members a more relaxed right to choose is also a manifestation of the decentralization in voting. Each member is not bound by a collective choice, and it is difficult for an owner with overwhelming voting power to control the assets of others which increases the decentralization of members' rights. However, a grace period clearly slows down the voting process, which has a noticeable negative impact on voting efficiency.

G. Holographic Consensus

All the mechanisms mentioned above have trade-offs between the dimensions of the SEED metrics. Improving all four dimensions at the same time is difficult, but *Holographic Consensus* breaks that dilemma by introducing a staking market outside of the voting system. *Holographic Consensus* was developed by DAO stack, an open-source full software stack for building and running DAOs [6]. *Holographic Consensus* associates each proposal with a prediction market and introduces a betting token GEN specifically for prediction markets [6]. DAO members or the general public can bet on proposals they think will pass or fail by up staking or down staking GENs [6]. Bettors who make predictions consistent with the voting results gain more GENs for reward [6]. *Holographic Consensus* is designed to believe that the voting participation threshold can be reasonably reduced when obtaining great attention from the prediction market. Therefore, proposals have two paths to reaching a valid voting result. In one path, the proposals collecting advocating GENs above a threshold are boosted and enter the boosted state [6]. Then the proposals are only required a relative majority to pass. On the other path, proposals without collecting enough advocating GENs stay in Queued state and require an absolute majority in all voting power voting to pass [6].

The use of GEN is a financial incentive mechanism, which makes the voting flexible and efficient. In terms of decentralization, GENs help people to show their opinions on proposals that they do not have large voting power. However, *Holographic Consensus* is not flawless. Although the quorum participating in voting is very likely to be different from the quorum betting, it is inevitable that people who pay GENs on a proposal have higher motivation to vote on a pass, which may distort the voting results. High approval in the prediction market is considered confidence in the proposal. However, it is hard to tell whether this confidence is an assessment of the bettor's own benefits or an assessment of the organization's development.

VI. Conclusion

As a new type of Internet-native organization in Web 3 relying on blockchain technology, DAOs are promising tools to organize user networks in Web 3. As the prominent decision-making method in DAO governance, voting needs to be carefully designed. This paper analyses the serious role of voting in DAOs and proposes a DAO governance triangle which clarifies the relationship between the smart contract, the distributed ledger and the voting mechanisms in DAO governance. To follow the most important feature, decentralization in DAO voting, a five-tier decentralization scheme is proposed to identify the decentralization demands in DAO voting comprehensively. To design a well-performing DAO voting, the evaluation metrics scheme of DAO voting, named SEED, is proposed in multiple dimensions to conceptually guide the design of DAO voting mechanisms. This paper is an opening remark on the conceptual analysis and the evaluation framework of the DAO voting. The specific voting entities' design and optimization need to be quantified and modelled in future work.

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