Received: 15 October 2020 | Revised: 24 February 2022 | Accepted: 5 March 2022

DOI: 10.1002/joom.1179

RESEARCH ARTICLE

WILEY

Task management in decentralized autonomous organization

Xi Zhao[1] | **Peilin Ai**[1] | **Fujun Lai**[2,3] | **Xin (Robert) Luo**[4] | **Jose Benitez**[5]

[1]School of Management, Xi'an Jiaotong University, Xi'an, China

[2]Research Center for Smarter Supply Chain, Dongwu Business School, Soochow University, China

[3]College of Business and Economic Development, University of Southern Mississippi, Long Beach, Mississippi, USA

[4]Anderson School of Management, University of New Mexico, Albuquerque, New Mexico, USA

[5]EDHEC Business School, France

Correspondence
Xin (Robert) Luo, Anderson School of Management, University of New Mexico, Albuquerque, NM 87131, USA.
Email: xinluo@unm.edu

Fujun Lai, College of Business and Economic Development, University of Southern Mississippi, Long Beach, Mississippi 39503, USA.
Email: fujun.lai@usm.edu

Funding information
National Natural Science Foundation of China, Grant/Award Numbers: 72132007, 91746111; Key Research and Development Program of Shaanxi Province, Grant/Award Number: 2020ZDLGY09-08; Slovenian Research Agency, Grant/Award Number: Research Core Funding P5-0410; Regional Government of Andalusia, Grant/Award Number: A-SEJ-154-UGR18; European Regional Development Fund (European Union) and the Government of Spain, Grant/Award Number: ECO2017-84138-P

Handling Editor: Guangzhi Shang

Abstract

In the emerging platform economy, blockchain technologies are reshaping the digital economy. Moreover, disintermediation and decentralization have broken new ground for platform organizations and management mechanisms and instigated the concept of a DAO (*Decentralized Autonomous Organization*). Recent literature on operations management has called for further research on governance issues related to DAOs. In response to this call, we explore the relationship between DAO management efforts and platform performance in this study. Specifically, we propose and theoretically articulate decentralized voting tasks in DAOs as a new form of organizing. Harnessing both online and on-chain data from seven sources, we empirically examine how voting task division, task allocation, reward distribution, and information provision affect platform performance in the context of MakerDAO (an Ethereum-based stablecoin issuance platform). Our findings reveal that strategic decisions arrived at through voting have a positive impact on platform operational performance under certain conditions, whereas operational decisions resulting from voting have a negative impact. Moreover, we elucidate the moderating effects of voting task execution characteristics on the relationship between completed decision tasks and operational performance. These findings have important implications from both theoretical and practical perspectives. We also share all the raw data we use to promote the development of blockchain-related empirical research.

KEYWORDS

blockchain, cryptocurrency, decentralized autonomous organization, decentralized finance, governance token, non-fungible token, operational performance, platform governance, stablecoin

Highlights

- We developed a flowchart to describe the process of DAO performing voting tasks.
- We found that strategic decisions via DAO voting have a positive impact on platform operational performance under certain conditions, whereas operational decisions resulting via DAO voting have a negative impact.

- We found that task allocation, reward distribution, and information provision moderate the relationship between DAO management efforts and platform operational performance.

1 | INTRODUCTION

Given their paramount impact on today's economy, online platforms have gained increasing momentum and piqued global attention. Prevalent platforms typically take the form of websites and mobile apps, which act as intermediaries between two or more interdependent user groups (Farrell et al., 2018) and are categorized into five types: resource sharing, matching, crowdsourcing, reviews, and crowdfunding (Chen et al., 2020).

In recent year, blockchain-based online platform has emerged to provide the community with a plethora of promising and exciting research issues (Babich & Hilary, 2020). In essence, blockchain-based platforms are online platforms that have their backend code stored and executed by a blockchain system such as Ethereum (Badr et al., 2018; Dannen, 2017), which are referred to herein as decentralized applications (DApps). In contrast to traditional platforms running on centralized servers, the infrastructure of blockchain-based platforms is based on decentralized peer-to-peer networks. Thousands of these DApps have been developed and deployed on public blockchains in fields such as decentralized finance (DeFi), non-fungible token (NFT), games, exchanges, social media, and marketplaces.[i] Importantly, they differ from their predecessors in two main ways. First, they have inherited trust property from blockchains, whereby codes and data are stored on-chain, rendering them transparent, traceable, and immutable. In contrast, online platforms maintain their transaction logs in-house, making them prone to tampering. Second, as a digital representation of rights or assets, tokens enable a fundamental transition in platform logic in terms of business models, organizational structures, and operations management (Voshmgir, 2020).

From a pragmatic perspective, many DApps are governed by their associated decentralized autonomous organization (DAO), which is a new form of organization that embarks on the blockchain (Wright, 2021). Cooperation and coordination among DAO members are enforced by machine-based automation, whereby a set of tamper-resistant rules is predefined and deployed on blockchains as smart contracts (Wang et al., 2019). Furthermore, DAOs issue tokens to grant governance rights to their members, while blockchain users can obtain membership of DAOs (with associated governance rights) by trading in these governance tokens. Accordingly, DAO members can contribute to organization-level goals by making distributed operational or strategic decisions. To reach a decentralized consensus on these decisions, on-chain voting can be adopted. Specifically, these decisions are made based on the votes of DAO members, who are tallied using governance tokens and aggregated through smart contracts (Singh & Kim, 2019). The price of governance tokens is expected to increase as a result of such costly voting participation, which represents DAO members' management efforts for decentralized applications. Since the governance of DAOs is based on a community (rather than on executives and boards), pressing practices remain unexplored. These include improving governance effectiveness, allocating voting rights, and balancing individual and organizational interests.

From an epistemological perspective, the number of studies on online platform operations has increased exponentially since 2016 (Shi et al., 2021), covering topics such as platform pricing strategies (Dou et al., 2016), information disclosure (Hagiu & Hałaburda, 2014), value creation (Jiang et al., 2017), and bundling strategy (Lin et al., 2020). Recent research has focused on operations and supply chain management that utilize blockchains in terms of process tracing (Hastig & Sodhi, 2020), data sharing (Wang et al., 2021), and product authenticity verification (Pun et al., 2021). Specifically, Cai et al. (2021) explored how blockchains could tackle moral hazard issues by improving visibility and transparency in the supply chain process. In addition, Chod et al. (2020) suggested that blockchain-enabled transparency in supply chains would facilitate securing favorable financing terms with lower signaling costs. However, transparency is not limited to the operational processes of blockchain-based platforms, as it also exists in the management activities implemented by DAOs. There have also been studies on concepts similar to DAOs, such as government decentralization (Rondinelli, 1981), decentralized decision-making (Negandhi & Reimann, 1973), and decentralizing governance (Cheema & Rondinelli, 2007), although research on blockchain-based DAOs has only recently appeared (DuPont, 2017; Jentzsch, 2016; Norta et al., 2015). However, these are primarily qualitative analyses (or case studies) that focus on the conceptualization (Singh & Kim, 2019), modeling (Norta et al., 2015), and application (Hsieh et al., 2018) of DAOs. Although review studies have stressed the challenges and potential research opportunities of DAOs (El Faqir et al., 2020; Rikken et al., 2019; Wright, 2021), state-of-the-art DAO investigations remain at a preliminary stage. Hence, there are critical operations management (OM) issues to be resolved, one of which is the governance mechanism of decentralized applications that employ DAOs (Babich & Hilary, 2020). In addition, although any decisions made by DAO members can directly affect short- and long-term operations, there is still no evidence to explain whether and how blockchain-based governance affects the operations of decentralized applications (Wright, 2021). Thus, unveiling the efficacy and influence of DAOs is crucial to enable understanding blockchain-based platforms from an OM standpoint.

In this study, we attempt to bridge the abovementioned research gap (Babich & Hilary, 2020) through an empirical study that is among the first to use quantitative analysis to explore how the new form of DAOs' organizing affects decentralized application performance. According to organizing theory, DAOs exist as a solution to four organizing problems: task division, task allocation, reward provision, and information provision (Puranam et al., 2014). As stated previously, the governance tasks of DAOs are accomplished through on-chain votes. These voting tasks can be classified into different categories based on the content of the proposals, such as strategic and operational voting tasks. Furthermore, task allocation is based on self-selection, in which each DAO member decides whether to participate in a particular vote. Moreover, DAO members who participate in the voting are rewarded in terms of the price appreciation of governance tokens. In addition, information on each voting task is provided through voting webpages that contain links to related discussions on decentralized application forums. However, there are few studies on how these solutions affect the performance of decentralized applications. Thus, in an effort to advance this line of research, the aim of this study is to answer the following questions:

> **RQ1.** *How does the voting task division of blockchain-based platforms affect operational performance?*

> **RQ2.** *How do voting task allocation, reward distribution, and information provision moderate this effect?*

By addressing these questions, this study constitutes an early attempt to systematically and empirically uncover how DAO governance activities affect the operational performance of platforms. To resonate with recent research calls for technology-disrupting operations, we propose a research model and choose the Maker platform, which produces a *stablecoin* (i.e., DAI) through collateral-backed lending business, as the context for empirical research. For this study, data from seven on- and off-chain sources were collected from November 23, 2019, to November 30, 2020, and 378 votes were involved. Our empirical findings indicate that strategic and operational voting tasks have different effects on the operational performance of DAO-governed platforms. Furthermore, decision-making characteristics have moderating effects on their relationships. These results advance blockchain technology with regard to organizational management research in the field of OM and provide novel insights into the development of DAOs and the platforms they govern.

In the following, we introduce the institutional background of DAOs and the specific DApp scenario (Maker) in Section 2. We then discuss how the theoretical framework coined by Puranam et al. (2014) applies to our research context and present our hypotheses in Section 3. Our analysis methods and data are presented in Section 4, followed by a presentation of our empirical findings in Section 5. Finally, we articulate our major contributions to OM and future research directions.

2 | INSTITUTIONAL BACKGROUND OF DAO

The term DAO refers to a scalable and self-organizing community supported by blockchain-enabled coordination mechanisms (Singh & Kim, 2019) to govern its corresponding DApp. The rules and principles of DAO are specified in preset algorithm codes and deployed immutably as smart contracts on the public blockchain, where they automatically and transparently coordinate the on-chain activities of DAO members. These activities primarily entail strategic and operational decision-making through a voting procedure (Hsieh et al., 2018).

2.1 | The role of DAO in platform governance and operations

In addition to a traditional frontend–backend IT architecture that is similar to the current Internet platform, DApps have backend codes (smart contracts) running on decentralized networks. This migrates some of their operational data and processes from centralized, closed servers to public blockchains, allowing the operations of decentralized applications to inherit the characteristics of transparency and immutability from decentralized technology (Badr et al., 2018). These technological idiosyncrasies further lead to a new type of technology-supported user trust in the operational data and processes of decentralized applications, which alters the user–platform relationship. Accordingly, decentralized application users can take advantage of this information transparency and form opinions on how to improve platform operations, thus constituting the groundwork for DAOs.

Decentralized applications are initially governed in a similar way to traditional centralized methods, whereby the project team takes primary responsibility for DApp development, decision making, and decision implementation. However, since the launch of DAOs, the project team and Internet strangers have collaborated to form a community that governs DApps in a decentralized manner, combining small basic teams with a large-scale community (Wang et al., 2019). Subsequently, the original project team evolved into the basic team of the DAO, with all its members having delegated governance power.

Importantly, a DAO usually issues its own governance token (Chod et al. 2022) as proof of governance power. The token's value is similar to a share price, relating to the long-term development of its corresponding decentralized application. Moreover, DAO members can profit from this development by either reaping dividends or benefitting from token price appreciation. As a result, these tokens serve as a medium for unifying the interests of DAO members and as an incentive for DAO members to participate in DApp governance.

Although the rights conferred by tokens are homogeneous, the DAO members who hold tokens can be heterogeneous, resulting in a basic–general organizational structure. Furthermore, DApp projects are mostly initialized by founding teams that also make the decision to adopt a DAO for governance. These members usually possess a proportion of governance tokens before they are circulated, while other members can obtain them through peer-to-peer transfers or by trading on token exchange markets. Following the formation of a DAO, the founding teams gradually hand over the governance rights to the DAO member community, improving the decentralization of platform governance. A basic team is then established that is responsible for managing the decision-making process and implementing any ensuing decisions, such as organizing discussions, conducting risk assessments, and implementing smart contracts. By comparison, general DAO members are in charge of drafting DApp improvement proposals, participating in online discussions, and voting on the proposals formally on-chain. Since the tasks of the basic teams are relatively routine and fixed, we will focus on decision-making tasks related to general DApp governance.

Decisions are made by DAOs through voting, with token-weighted voting being the most common approach (Tsoukalas & Falk, 2020). From a work-based perspective (Browning, 2020), we can frame the organization of voting activities as the management of work. To explain DAO-style management, we depict the typical journey of a voting proposal in Figure 1.

In essence, a voting proposal can be regarded as a task that DAO members should complete compared with using agents in traditional companies. Any user who is concerned about the development of the relevant platform can submit comments, suggestions, and initial proposals in an online platform-specific forum. These proposals could address operational or strategic aspects of the platform's DAO and DApp, such as modifying operational parameters, supporting new markets, or introducing new functionalities. Other members can discuss initial proposals in a variety of ways (such as by text, video or telephone conferences, or online forum votes) to gauge sentiments and gather opinions. The decision on whether a proposal is included for formal on-chain voting is usually made by the basic team, which forms a formal voting proposal for ideas that have received widespread attention and support during preliminary discussions. The forms and parameters of voting (i.e., the duration or option settings) are determined by the basic team based on preset templates and voting content.

On-chain voting is a critical component of task execution in a DAO, with members voting voluntarily to convey their opinions on a proposal. The more governance tokens a member temporarily freezes for voting, the more weight their opinion holds. Moreover, the vote results can be determined based on the opinions of all participating members. On-chain voting is fulfilled by voting smart contracts and the process and records incurred are both transparent and immutable. Once approved through voting, proposals are implemented by the basic team and deployed on chain, which incorporates parameter fine-tuning of operational smart contracts, new smart contract coding, and on-chain deployment. Delays are usually included between the end of voting and the execution of the voting result so that the negative consequences of voting attacks can be mitigated.[iii] This execution will affect the platform's business processes and consequently affect the performance of the decentralized application.

It should be noted that the aforementioned journey of a proposal or decision-making process for a DAO is transparent for auditing purposes. This means that DAO members and any other interested users can access pertinent information with detailed voting information available on the websites of the platform and the chain data explorer.[iv] The platform also discloses summarized voting management information and voting results on social media. Accordingly, holding governance tokens has no effect on the ability of users to observe, track, and audit the voting process.

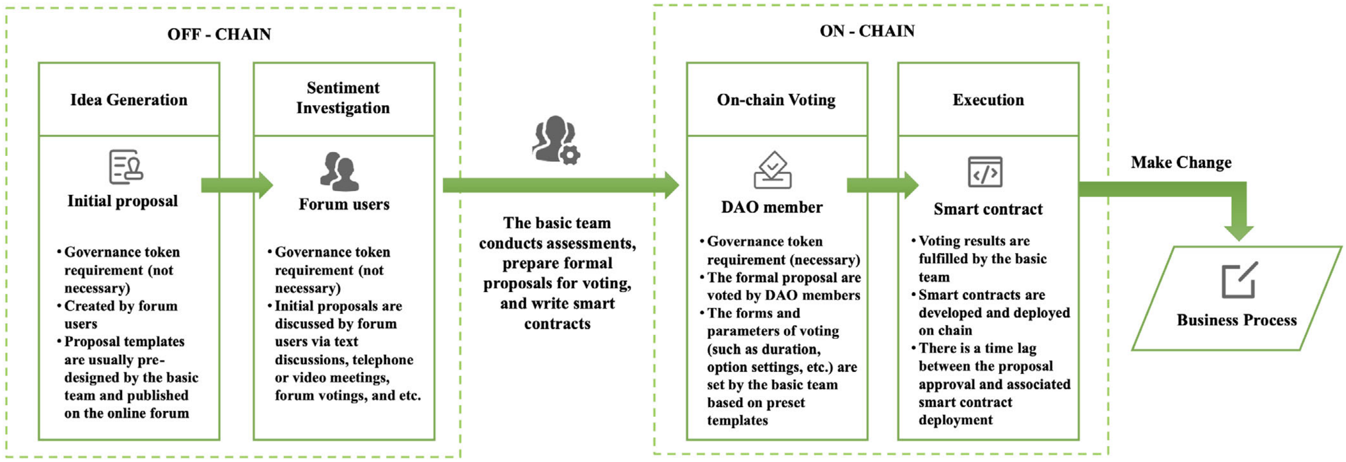

FIGURE 1 The typical journey of a DAO voting proposal[ii]

Given the fast-evolving on-chain market environment, DApp operations necessitate a significant amount of decision-making effort. Moreover, since DAO members are usually required to handle multiple voting tasks simultaneously, the number of active proposals can be regarded as the task volume. The workload of platform operations is dictated by task volume and level of difficulty. The primary factor that drives the participation of DAO members is the potential for token-based financial gains. Members believe that there is a positive correlation between the performance of a well-operated platform and governance token price (Gitcoin DAO and Bankless DAO, 2021). Hence, through management efforts, they strive for good operational performance together with profits from token price appreciation. In essence, a DAO has the potential to solve agency problems in centralized management, whereby agents have decision-making authority, and the profit is mainly dispersed to the principals.

2.2 | MakerDAO as an example

In this section, we use MakerDAO as an example to explain the role of DAOs in platform operations and management.

Maker is one of the pioneering blockchain-based platforms (or DApps), providing innovative financial products on the Ethereum blockchain. It produces DAI, which is a crypto-assets-backed stablecoin pegged to US dollars. While DAI can be bought and sold directly on the trading markets, new DAI can only be issued through the collateral-backed lending process of the Maker platform.[v] Maker also issues a governance token (MKR) and forms a corresponding decentralized autonomous organization termed MakerDAO.

Well-known crypto-assets (such as Bitcoin and Ether) can suffer from high volatility in their value, rendering them unsuitable for monetary exchange. Thus, users prefer to adopt stablecoins for on-chain value exchange because their purchasing power is relatively consistent and predictable (Mita et al., 2019). As depicted in Figure 2, Maker is a decentralized application that allows users to obtain stablecoins through collateral-backed lending. Specifically, users can open an on-chain vault in which they can secure their crypto-assets, choose their loan parameters (i.e., collateralization ratio or DAI amount to create), and transfer DAI to their public blockchain accounts on the Maker website. This technological process enables users to obtain liquidity for their crypto-assets, which they can subsequently monetize via token exchange markets in fiat US dollars. Conversely, when users opt to unlock their crypto-assets (either partially or completely), they can simply pay back the corresponding amount of the DAI loan and the stability fee, which is continuously accruing interest on their loan. It should be emphasized that users must set appropriate loan parameters or repay their loans on time to ensure that they keep their collateralization ratios above the liquidation ratio set by the platform as a risk control mechanism. Collateralization ratios decrease with the depreciated value of the crypto-asset in their vault, thereby increasing the risk that the loan will be liquidated.

Because Maker establishes an Ethereum-based technological infrastructure as a factory for the production of DAI, their issuance can be interpreted as peer production (Benkler, 2017). Several automatic production lines are run on-demand to produce DAI. These are implemented by the sequences of smart contracts, with each line ingesting a certain type of crypto-assets as its raw material (such as one line for Ether and another for USDC). A massive number of users provide their crypto-assets to these lines to obtain liquidity while retaining ownership of their assets. The key objective of operating this DApp is to control the quality of production, which is reflected in stable DAI values.

From an OM perspective, Maker is governed by its own DAO (MakerDAO) and issues its own governance

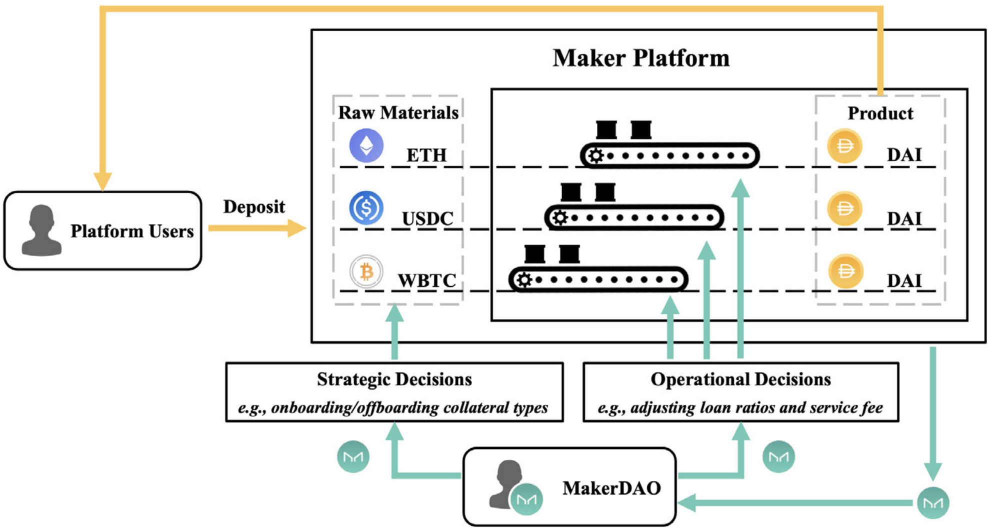

FIGURE 2 Maker platform operations

token (MKR). Consequently, MakerDAO members use the MKR to make decisions collectively. The major challenge is to design, adjust, and implement mechanisms for the production lines to improve their resilience to drastic fluctuations in raw material values. Moreover, platform operations generate revenue streams, including stability fees from DAI loans and fines from liquidated vaults. These revenues are sold through a Surplus Auction after accumulating to a certain amount. MKR are collected in the auctions and autonomously destroyed, thereby reducing the total MKR supply. Accordingly, the price of MKR increases as supply decreases, allowing MakerDAO members to profit from token price appreciation.

To achieve the aforementioned operational goals, MakerDAO members participate in decentralized voting, including onboarding/offboarding new collateral types and adjusting loan ratios and service fees. When the price of DAI increases, this indicates that the current market demand for DAI exceeds supply. Hence, MakerDAO could initiate a vote to reduce the stability fee and stimulate users to generate more DAI. Further, to increase the market cap while lowering overall operational risks, Maker continues to vote and onboard new types of collateral. Vote settings vary depending on the substance of the vote (in terms of duration and options), and the entire on-chain voting process and results are fulfilled and recorded by a voting smart contract. To avoid governance attacks by malicious MKR holders, the basic team implements the winning options with a time delay, the length of which is also determined through voting.

To cope with the high-dynamic, complex, on-chain market environment, MakerDAO members need to handle multiple voting tasks simultaneously. To gain voting rights, they also need to freeze a certain amount of MKR in voting smart contracts. The more MKR they freeze, the more weight their vote option gains. However, the cognitive load for voting tasks and the financial costs involved can prevent many MakerDAO members from participating in voting. By November 30, 2020, ~1% of MKR holders had participated in voting activities, while many merely trade and hold the governance token as an investment tool and remain silent on matters of platform governance. It should be noted that DAO membership can only be proved on-chain. If a user simply purchases MKR in a centralized token exchange market (such as Coinbase[vi]) and holds MKR in their centralized market account, they are not considered a MakerDAO member. Furthermore, although these users can sell MKR for profit, they cannot participate in voting. Only if the user transfers MKR from their centralized market account to their on-chain Ethereum address can MakerDAO membership be approved for voting.

Overall, although the workflows and tasks of DAOs vary with the platforms they govern, they have decision-making power in the operation and management processes of their platforms. Moreover, decisions from decentralized voting have an important impact on the platform's operational performance. In this study, we focus on the voting activity of DAO because it is the core collaboration mechanism for all DAOs. In the following section, we begin by proposing a new decision-making theoretical framework for DAO and then use MakerDAO data to validate our theory. A definition table (Table 1) is provided to explain the concepts used in this study.

3 | THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

3.1 | The role of organizing in the academic domain of operations management

Prior literature has demonstrated that organization theory and practice play important roles in OM (Anand &

TABLE 1 Conceptualization

Key terms	Definition
Ethereum	A public, decentralized, open-source blockchain with smart contract functionality.
Ether (ETH)	The currency of the Ethereum public blockchain, which can also be considered a type of crypto-assets.
Blockchain-based platforms / Decentralized applications (DApps)	Online platforms whose backend code is stored and executed by a blockchain such as Ethereum.
DAO	A scalable and self-organizing community supported by blockchain-enabled coordination mechanisms.
Token	A digital representation of rights or assets on chain resisting doubling-spending problems, usually existing in the online environment.
Maker	One of the pioneering decentralized platforms that provide innovative financial products in Ethereum; an exemplar of decentralized applications.
DAI	A type of crypto-asset-backed stablecoin pegged to US dollars.
MakerDAO	The decentralized autonomous organization governing Maker DApp.
MKR	The governance token issued by MakerDAO that represents the delegated governance power of Maker and can be traded on token exchange markets.

Gray, 2017; Ketchen Jr & Hult, 2007). For example, Chen et al. (2015) found that autonomy can improve team flexibility, thereby having an impact on both operational and job outcomes. Moreover, as indicated by Babich and Hilary (2020), governance issues of institutions associated with blockchain technology have become relevant for OM scholars. Accordingly, an understanding of decentralized decision-making structures (i.e., an ingredient of organizational activities) is especially valuable for decentralized application managers and paves the way for theory development for OM in the decentralized Web 3.0 environment.

As mentioned previously, the DAO is an innovative organizational form that is gradually demonstrating its potential for coordination and cooperation with Internet strangers. While the concept of decentralized organization has long been proposed as a theoretical governance model and used to be compared with the centralized organization (Siggelkow & Levinthal, 2003), the potential role of blockchain technology in enabling this organizational form has rarely been examined.

Among the limited qualitative studies on DAO, Ziolkowski et al. (2020) suggested that DAOs are a promising approach to the development of blockchain governance. Further, Lumineau et al. (2021) emphasized the potential of DAO in organizing collaborations, while Beck et al. (2018) discussed the innovation aspects of DAO governance in terms of decision rights, accountability, and incentives. Focusing on the mechanism of DAOs, Andersen and Bogusz (2019) discussed how a DAO was generated from blockchain infrastructure by self-organizing, and Tsoukalas and Falk (2020) studied token-weighted voting using a modeling methodology. The practice of DAOs has also recently appeared in the real world, drawing attention from scholars of organization theory. However, very few empirical studies have discussed the decision-making features of DAO governance and its impact on platform operations. In reality, decision-making in DAO governance is achieved by a group of members who are anonymous, strangers, and with diverse backgrounds. Therefore, an investigation is required on how DAO members cooperate through voting and how aggregated voting decisions affect the performance of their decentralized applications. This is the general theoretical gap that we aim to cover in this study.

3.2 | Theoretical framework and hypotheses development

We refer to Puranam et al. (2014) as an institutional theory to study how DAOs provide a new form of organizing and how this affects the operational performance of platforms. Specifically, they proposed that any organization should solve four problems through some form of organizing: task division, task allocation, reward provision, and information provision. These aspects describe how an organization divides common goals into executable work tasks and assigns them to members of the organization, complete with incentives and the information required for task execution.

As mentioned in Section 2, the governance tasks of a DAO are based on on-chain voting. These voting tasks address issues related to DAOs and their decentralized applications at different levels, from which a unique set of execution processes are gradually formed, with voting at their core. During the execution of these voting tasks, task allocation is based on self-selection, with each DAO member deciding whether (and in which voting task) they will participate. The rewards are provided to DAO members through price appreciation of the governance tokens. The information for each voting task is scattered across multiple on-chain (e.g., transaction history recorded on-chain) and off-chain (e.g., discussions on decentralized application forums) channels. Some of these channels are provided directly in voting proposals to facilitate the execution of voting tasks. Above is a brief description of a DAO's solutions to the four organizational problems raised by Puranam et al. (2014), although the effectiveness of such a new form of organizing has not yet been verified. Accordingly, we propose a research model to study the management efforts of a DAO. Specifically, we propose that a DAO's governance tasks can be divided into two types of voting tasks (strategic and operational), which can have different impacts on the operational performance of decentralized applications. The execution of strategic voting tasks can improve operational performance, while the execution of operational voting tasks can worsen operational performance. Moreover, task allocation, and reward and information provision should be based on task division. However, these three aspects can have different effects on different voting tasks since a goal of DAO organizing is to match labor with these tasks. Therefore, we propose that the way in which a DAO performs task allocation, reward distribution, and information provision leads to different results in the execution of strategic and operational voting tasks. In turn, this can affect the relationship between these two types of voting tasks and operational performance. Specifically, we propose that DAO-style task allocation and reward distribution weaken the positive effects of strategic voting tasks on operational performance, while DAO-style information provision strengthens such positive effects. With regard to the negative relationship between operational voting tasks and operational performance, DAO-style task allocation and information provision alleviate their negative relationship, while it is worsened by DAO-style reward distribution. The proposed research model is shown in Figure 3.

3.2.1 | Task division

Usually, a DAO's task division and execution processes are initially constructed by basic teams and then gradually clarified and standardized under the joint efforts of its members. Regardless of task type and content, a prominent feature is that a DAO's task execution is based on voting. In actual platform governance, tasks for different problems should be assigned with different focuses and then solved using alternate solutions. Scholars have tended to study different types of management issues separately. Frequently, the method employed is to divide management decisions into strategic issues (with short- and long-term impacts) and operational issues (usually only short-term impacts) (Kortmann et al., 2014; Li et al., 2002). According to the standards mentioned in Vázquez (2004) and Hughes and Thevaranjan (1995), we have examined and classified a DAO's voting tasks into strategic and operational. Strategic voting tasks focus on fundamental issues related to a shared goal among the members of a DAO, while operational voting tasks are more concerned with business processes or logic adjustments. Using MakerDAO as an example, strategic voting tasks would include whether to onboard a new type of collateral, while operational voting tasks would include adjusting loan parameters (such as interest rates).

As a means of outputting governance decisions, both strategic and operational voting tasks can affect the operational performance of the platform. Although more focused on the long-term and overall development of the platform, strategic voting tasks can also affect its operational performance (Ahmad & Schroeder, 2003; Kortmann et al., 2014). In actuality, the disclosure of a major adjustment can have an immediate impact on the market and user behavior before implementation. This is similar to the existing literature on the impact of major decision announcements. For example, Brandon-Jones et al. (2017) revealed that public announcements pertaining to reshoring decisions could attract positive abnormal stock returns. Furthermore, Louis and Sun (2010) stated that large corporate events attract investor attention and result in market reactions. In addition, decisions obtained from operational voting tasks directly affect production and operations management, thereby affecting operational performance. It has been proven that the effectiveness of decision-making results (especially group decisions) is closely related to decision-making methods (Csaszar & Eggers, 2013; Tsoukalas & Falk, 2020). That is, although DAOs always hope to improve platform performance when conducting management efforts, the execution of these two types of governance tasks by voting can result in different decision-making outcomes. Hence, they can elicit different impacts on the operational performance of the platform. In general terms, we discuss the rationality of voting as a method of decision-making that can be employed to execute two types of governance tasks and infer the impact of these on operational performance. We posit that while strategic voting tasks can improve a platform's operational performance, operational voting tasks can deteriorate performance.

Strategic voting tasks determine the development direction of an organization and platform. These issues are often significant and relate to the interests of all DAO members. Compared with traditional organizations, the entry and exit

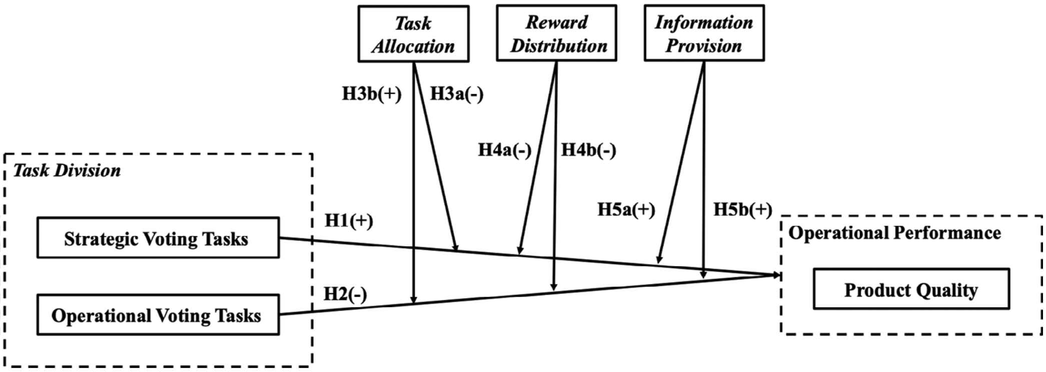

FIGURE 3 Proposed research model

costs of DAO are lower, and a common interest determines who joins and leaves a DAO. In terms of strategic voting tasks, voting is effective because it can collect a wide range of shareholder opinions and ensure that the results are aligned with the majority of their interests. It has also been proven that the acceptance and understanding of a strategic decision among organization members are related to the effectiveness of that decision (Boyer & McDermott, 1999). Thus, we propose that strategic voting tasks can improve the platform's operational performance.

Prior literature has emphasized the importance of analyzing the efficiency and quality of decisions when discussing the effectiveness of decision-making (Laker et al., 2018). Some studies have also indicated the importance of being able to change operating states efficiently in response to uncertain and changing market conditions in operations management (Braunscheidel & Suresh, 2009; Narasimhan et al., 2006). For example, Hock and Raithel (2020) found that quick reactions can alleviate any negative impacts caused by emergencies. Moreover, since operational voting tasks mainly involve some short-term adjustments, daily operational voting tasks usually require strong timeliness. However, the method employed by DAOs to execute voting tasks is usually poor in terms of efficiency because voters need time to react and make decisions. Accordingly, daily operational decisions obtained through voting can fail to help the platform cope with ever-changing market environments and even degrade platform performance due to the execution of outdated policies. Additionally, although the results obtained may be meaningless or even harmful, DAO members still have to spend time on these operational decision tasks. When the number of operational voting tasks is large, it could be inferred that voters might make hasty choices because these decisions are only for the short term. Given that these previously discussed facts are all detrimental to platform performance, we hypothesize the following:

Hypothesis 1. (H1): *Strategic voting tasks improve the operational performance of a DAO-governed platform.*

Hypothesis 2. (H2): *Operational voting tasks deteriorate the operational performance of a DAO-governed platform.*

3.2.2 | Task allocation

Task allocation refers to the process of associating tasks with agents. In the case of DAOs, each voting proposal acts as a voting task that needs to be conducted by its members. Unlike traditional contractual or relational governance, there is no coercive force or social norm to restrict people's behavior in DAO governance. Each voter has their own motivation, purpose, information from different resources, and different decision-making criteria and logic. Moreover, joining and exiting a DAO are not restricted, making it more difficult to ensure DAO members' commitment to a longer-term goal. In addition, although traditional hierarchical structures have been criticized for having some problems, it is undeniable that they achieve a clearer assignment of powers and responsibilities. Selectively matching the expertise of the agents with the requirements of the task has a positive effect on the results of task execution (Boh et al., 2007; Bonner et al., 2021). However, a DAO has no centralized authority that assigns tasks to each member (Lumineau et al., 2021). By contrast, it relies on self-selection and self-control to solve voting tasks, which have been criticized as painfully complicated and ineffective (Ziolkowski et al., 2020). Therefore, it is crucial to match DAO members' needs and efforts with the types of DAO voting tasks. This kind of congruence is called person-job fit (Venkatesh et al., 2017). Moreover, although decentralized governance through voting can effectively pool information (Csaszar & Eggers, 2013), it may not have more advantages in task allocation compared with centralized governance. In other words, under the self-selection task allocation mechanism adopted by DAOs, the matching of voters and voting tasks might not be guaranteed.

For strategic voting tasks, we believe that matching is not particularly important and that excessive matching can even bring negative effects. This is because the execution of strategic voting tasks requires the opinions of a wide range of DAO members to be collected and the needs of more diverse shareholders to be reflected. This ensures that support can be garnered from a wider range of members in the decision-making and execution stages, with the aim of achieving better implementation results. To a certain extent, matching represents the gathering of DAO members with certain characteristics. This may further lead to biased strategic decisions rather than being beneficial to the platform as a whole. However, matching can play an important role in operational voting tasks, which are usually directly related to business details and the need to refer to issues such as complex environmental changes for decision making. Therefore, voters who execute operational voting tasks need to have good background knowledge on the topics involved to make better decisions. Combined with the problem of poor timeliness of operational decisions obtained from voting that was mentioned previously, if voters are sufficiently strategic, they could even be able to consider future changes and make effective decisions. Overall, we propose that task allocation can reduce the positive effect of strategic voting tasks on the platform's performance while suppressing any negative effects of operational voting tasks in this way. Therefore, we hypothesize the following:

> **Hypothesis 3a. (H3a):** *Task allocation weakens the positive effect of strategic voting tasks on the operational performance of DAO-governed platforms.*

> **Hypothesis 3b. (H3b):** *Task allocation weakens the negative effect of operational voting tasks on the operational performance of DAO-governed platforms.*

3.2.3 | Reward distribution

A DAO determines membership and distributes benefits through governance tokens. Moreover, the correlation between the price of governance tokens and the value of the platform becomes the most important incentive for DAO members to participate in voting tasks. However, there is no effective method for measuring user contributions in DAOs, meaning that benefits are distributed to each governance token holder in proportion to their holdings. Accordingly, such incentives are not sufficient to persuade small shareholders (who hold only a small number of governance tokens) to take action. They usually think that their actions are insignificant because their holdings of governance tokens also determine how much decision power they have. Therefore, they can be more inclined to be passive and simply enjoy governance token value appreciation in a zero-cost manner. Even though small shareholders are willing to participate in decision-making, DAO members with a large share of governance tokens have more influence on decision-making results thanks to their governance power. This renders the opinions of minority shareholders rather trivial.

We believe that the proportion of large shareholders participating in task execution can adjust the relationship between strategic and operational voting tasks and the platform's operational performance. Referring to the existing literature, Jiang et al. (2010) found that controlling shareholders could harm the rights of minority shareholders for their own benefit. Considering that blockchains provide an anonymous environment, we believe that the same effect can also happen among DAO members. Large shareholders in a DAO are likely to promote a voting result that is more conducive to their personal interests (e.g., short-time token value appreciation) rather than to the operational performance of the platform.

For strategic voting tasks, although malicious decisions can damage the long-term development of a platform, large shareholders can withdraw before an impact occurs. The severity of changes in the blockchain environment also provides them with an opportunity to make profits by creating short-term prosperity. For example, they can lead some new collateral types to be accepted by the Maker platform. Any expansion of the market size can also help the governance token gain an upward trend and bring benefits to large shareholders, and whether these collaterals involve risks to platform operation and development is not as important to them. For operational voting tasks, malicious adjustment of some parameters can also cause the platform to obtain expanded production in a short time, which may cause an appreciation of the governance tokens. Since operational voting tasks usually do not involve fundamental issues for the platform, manipulating these short-term decisions is an even better choice for large shareholders than manipulating long-term decisions. In this sense, we expect that reward distribution will reduce the positive effect of strategic voting tasks on the platform's performance and reinforce the negative effect of operational voting tasks, doubly deteriorating the effects of voting tasks on platform performance.

Hypothesis 4a. (H4a): *Reward distribution weakens the positive effect of strategic voting tasks on the operational performance of DAO-governed platforms.*

Hypothesis 4b. (H4b): *Reward distribution strengthens the negative effect of operational voting tasks on the operational performance of DAO-governed platforms.*

3.2.4 | Information provision

According to a DAO's ideals, its governance should be fully completed on-chain to ensure the authenticity and transparency of the process. However, although voting can be considered a good method of group decision-making in some cases, it is not usually a good means of communication. Therefore, most DAOs adopt a combination of on-chain and off-chain information systems. These provide tools and channels for information sharing and the exchange of ideas among DAO members, in addition to providing a basis for the generation of an appropriate proposal for on-chain voting.

With regard to the distribution of information, DAOs do not set level restrictions. All discussions and information on-chain and on the decentralized application forums are transparent to all blockchain users, including (but not limited to) DAO members. This is different from most traditional organizations, where people can only gain limited information about the tasks for which they are responsible. A high degree of information sharing should have a positive effect on voting-based group decision making, especially for those members who want to contribute to the decision. However, although a high degree of transparency means that any user can monitor and review the activities of a DAO at any time, the information-sharing effort can cause information overload for its members and may not be as useful as expected. Most typically, publicizing the code details of a smart contract does not mean that every member can understand the code. Transparent governance information exists on several data systems as text, videos, and on-chain transactions, creating more time and cognition costs for DAO members to collect and interpret information.

We believe that it may be critical to provide some necessary information directly to voters in the voting proposal. Moreover, some studies have revealed that information sharing can have a negative impact on voting. However, these findings are conditional on the premise that voters have sufficient private information (Da & Huang, 2020). In the decision-making context of a DAO, general members are often inexperienced with complex business problems, ever-changing environments, and serious technical difficulties. To ease this type of difficulty, the basic teams usually help demonstrate the feasibility of a proposal in community discussions and collect relevant information in the voting proposals. Therefore, we believe that for strategic voting tasks, providing voters with information related to voting tasks directly in the voting proposal can help them act rationally when making strategic decisions. This has been proven to have a positive effect on strategic decision effectiveness in prior studies (Elbanna & Child, 2007). Relevant discussion information also helps voters understand the opinions of other DAO members and make decisions that are more beneficial to the overall platform. In this sense, information provision can amplify the positive effect of strategic voting tasks on platform performance. For operational voting tasks, information provision can help voters gain more background and expertise on voting issues with less time costs, enabling them to make decisions that are more conducive to improving the operational performance of the platform. Task-related information provision can thus have a positive effect and improve platform performance by reducing the negative effect of operational voting tasks. Therefore, we hypothesize the following relationships:

Hypothesis 5a. (H5a): *Information provision strengthens the positive effect of strategic voting tasks on the operational performance of DAO-governed platforms.*

Hypothesis 5b. (H5b): *Information provision weakens the negative effect of operational voting tasks on the operational performance of DAO-governed platforms.*

4 | DATA AND VARIABLES

4.1 | Data collection

The study was conducted on the Maker platform, which is governed by MakerDAO. This platform is among the leading decentralized platforms on the Ethereum blockchain and provides abundant operations and governance data, including governance proposals and voting participation. MakerDAO is one of the few mature DAOs and has a large community of active members, rendering Maker an ideal platform for examining DAO governance. To build the dataset for our study, we combined data from seven sources. First, we collected data on the voting history of MakerDAO governance proposals from the MCD Voting Tracker (https://beta.mcdgov.info/), which provides detailed log data regarding voting participation in current and historical governance proposals. Second, since the MCD Voting Tracker does not provide the details of the proposal for each vote, we collected data on the specific content of voting tasks from Maker Governance (https://vote.makerdao.com/), which is the official website for MakerDAO's voting activities. Third, the historical market information of relevant cryptocurrencies was retrieved from CoinMarketCap (https://coinmarketcap.com/). This website provides high-quality market information on thousands of cryptocurrencies and is a popular price-tracking tool in blockchain research. Fourth, Google search popularity for the keyword "blockchain" were collected from Google Trends (https://trends.google.com/), which provides the search trends for a variety of queries in Google Search over time. Social media exposure about "DAI" was retrieved from Santiment (https://santiment.net/), which provides objective information about the on-chain, social media, and development activities of hundreds of cryptocurrencies. Usage data on the collateral-backed lending business of the Maker platform were from DeFi Explore (https://defiexplore.com/), which provides an information query function for the multi-collateral vault. More than three billion transaction records were obtained from the Ethereum blockchain by synchronizing the public Ethereum dataset into our big data computing clusters (http://www.inddigo.io:9930/). Each record includes hashed addresses of senders and recipients, the type and value of tokens transferred, and the timestamps of the transactions.

The data were collected from November 18, 2019, to November 30, 2020. This time period was chosen because of business changes wrought by the Maker platform, which was created in 2017 and initially only accepted the single collateral type of ETH. On November 18, 2019, the Maker platform officially upgraded its system fundamentally to gradually accept multiple collaterals, including WBTC, LINK, USDT, and some other cryptocurrencies. From December, 2020, the type of accepted collateral was extended to financial business on chain (e.g., LP tokens) and even physical assets. Subsequently, the business structure of the Maker platform changed significantly again. This was another reason for limiting our data collection to the chosen period. The price data for DAI are only available from November 23, 2019; hence, data from November 18, 2019, to November 22, 2019, were removed. Figure 4 depicts the data lineage from the data sources to the variables, and detailed data preparation tables (complete with data loss information) are presented in Data S1.

4.2 | Dependent variables

Product quality is an operational performance measurement that is widely used in the literature (Devaraj et al., 2007; Wong et al., 2011). The main product on the Maker platform is the stablecoin DAI, which is pegged to the US dollar (1 DAI ≈ US$1). Therefore, we used the negative absolute value of the deviation between the end-of-day DAI price and 1 US dollar to measure DAI's quality, which is calculated as follows:

$$Quality_t = -\left| DAI\_price_t - 1 \right|,$$

where DAI_price_t is the price of DAI on a certain day. The closer the price of DAI is to US$1, the greater the value of $Quality_t$, and the better the quality of DAI.

4.3 | Voting-related variables

4.3.1 | Types of voting tasks

Different types of tasks are aimed at different decision-making problems and have different tradeoffs between quality and cost. Prior literature (Hughes & Thevaranjan, 1995; Vázquez, 2004) has classified decision-making problems into strategic and operational decisions (or "operating decisions"). The criteria for distinguishing these two types of decisions vary according to the business scenario. For example, Vázquez (2004) studied decisions on the shop floor and defined those related to the company's aim (e.g., purchase of equipment and introduction of new technology) as strategic decisions, while those related to day-to-day decisions (e.g., daily or weekly production plans) are perceived as operational decisions. Hughes and Thevaranjan (1995) focused on manufacturing decisions, whereby operational decisions were related to current production, and strategic decisions affected current production and future profitability.

Through a preliminary summary of the voting proposal content, we classified voting tasks with a longer-term impact (mainly including collateral onboarding, system upgrades, and personnel changes) as strategic voting tasks. By comparison, voting tasks with a shorter-term impact (mainly including adjustments of various parameters in the business process) as operational voting tasks. We conducted two rounds of coding to ensure the accuracy and objectivity of the coding results. In the first

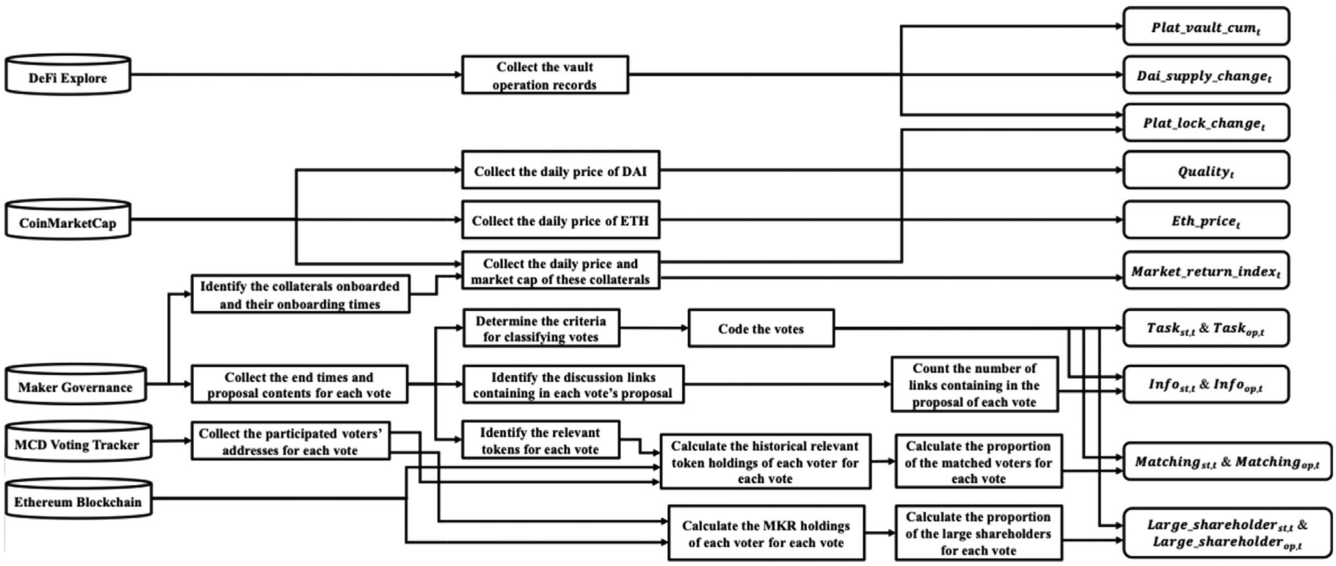

FIGURE 4 Variable computation

round, the author team independently coded the voting proposals according to the classification standards. Proposals with different coding results were further discussed until agreement was reached. In the second round, we recruited two specialists who had used the Maker platform and had a good understanding of both the Maker's business and the MakerDAO's governance model to verify the previous coding results. If a task involved both strategic and operational issues, it was counted into both types simultaneously. A total of 378 votes were classified, of which 188 were strategic voting tasks, 170 were operational voting tasks, and 20 were coded as both. The task type variables were then further calculated as the total number of strategic and operational voting tasks within a rolling seven-day time window:

$$Task_{st,t} = \sum_{i=1}^{7} strategic\_vote_{t-i}$$

and

$$Task_{op,t} = \sum_{i=1}^{7} operational\_vote_{t-i},$$

where $strategic\_vote_{t-i}$ and $operational\_vote_{t-i}$ are the number of strategic and operational voting tasks that ended on day $t-i$, respectively.

4.3.2 | Voter-task matching

Voter-task matching allows for measuring the degree of consistency between the knowledge and interest background of voters and the voting tasks. Specifically, we related the transaction experience of voters on on-chain tokens with the crypto-assets involved in the voting task to obtain a matching degree. If a vote was related to a certain type of crypto-assets, and a voter had ever held this crypto-asset, the voter was regarded as a matched voter to this vote. The voter–task matching variable was further calculated as follows:

$$Matching_{st,t} = \frac{\sum_{i=1}^{n_{st,t}} \frac{matched\_voter\_num_i}{voter\_num_i}}{n_{st,t}}$$

and

$$Matching_{op,t} = \frac{\sum_{i=1}^{n_{op,t}} \frac{matched\_voter\_num_i}{voter\_num_i}}{n_{op,t}},$$

where $n_{st,t}$ and $n_{op,t}$ are the respective number of strategic and operational voting tasks ended within the time window, $voter\_num_i$ is the total number of voters who have participated in vote i, and $matched\_voter\_num_i$ is the number of matched voters of vote i.

4.3.3 | Proportion of large shareholders

This proportion is a measure of the average proportion of voters who held a large share of governance tokens and participated in voting tasks ended within the time window, as follows:

$$Large\_shareholder_{st,t} = \frac{\sum_{i=1}^{n_{st,t}} \frac{large\_shareholder\_num_i}{voter\_num_i}}{n_{st,t}}$$

and

$$Large\_shareholder_{op,t} = \frac{\sum_{i=1}^{n_{op,t}} \frac{large\_shareholder\_num_i}{voter\_num_i}}{n_{op,t}},$$

where $large\_shareholder\_num_i$ is the number of voters whose governance token holdings are more than 1% of the total circulation and have participated in vote i.

4.3.4 | Information provision

Information provision is the amount of voting-related information provided to voters, measured by the average number of webpage links displayed in proposals of voting tasks ended within the time window. These links mainly pointed to discussion posts in the Maker forum and were determined as follows:

$$Info_{st,t} = \frac{\sum_{i=1}^{n_{st,t}} Discussion\_links_i}{n_{st,t}}$$

and

$$Info_{op,t} = \frac{\sum_{i=1}^{n_{op,t}} Discussion\_links_i}{n_{op,t}},$$

where $Discussion\_links_i$ is the number of discussion post links displayed in the proposal of vote i.

4.4 | Control variables

The first control variable is the public awareness of blockchain, which was captured as the Google search index on the term “blockchain” ($Google\_blockchain_t$). This indicated the expressed intention to learn about blockchain. Second, we controlled the number of mentions of “DAI” ($Dai\_social\_vol_t$) on social channels. This factor expressed the willingness to engage in conversations about DAI. The third control variable is the daily price of the ETH token (Eth_price_t), which indicated the economic status of Ethereum platforms. Fourth, given that DAI is the main product of the Maker platform, it was necessary to control the operating status of the Maker's collateral-backed lending business. This included the cumulative number of vaults created ($Plat\_vault\_cum_t$), the change in the total value of collateral locked ($Plat\_lock\_change_t$), and the change in the number of DAI that were lent ($Dai\_supply\_change_t$). Finally, the lending business of the Maker platform is closely related to the market value of the collateral. Hence, we included the market return index ($Market\_return\_index_t$) as a control variable. This is calculated as the value-weighted returns of all accepted collaterals at that time. Table 2 summarizes the variables we used, while Table 3 presents the descriptive statistics and the correlation matrix of these variables.

5 | EMPIRICAL ANALYSIS

Hypotheses H1–H5 were tested using hierarchical regressions. Variables were centered and standardized before regression. As a base model, Model 1 only regresses on controls, while Model 2 adds independent variables to Model 1. Models 3–5 add the interaction terms of voter–task matching, proportion of large shareholders, and information provision into Model 2. The estimations are displayed in Table 4.

5.1 | Major results

As shown in Table 4, adding the independent variables, number of strategic voting tasks ($Task_{st,t}$), and number of operational voting tasks ($Task_{op,t}$) ended within 7 days resulted in a .0339 (Model 2, $p < .05$) increase of R^2. Further, including voter–task matching ($Matching_{st,t}$ and $Matching_{op,t}$), the proportion of large shareholders ($Large\_shareholder_{st,t}$ and $Large\_shareholder_{op,t}$), and information provision ($Info_{st,t}$ and $Info_{op,t}$) increased R^2 by .0316 (Model 3, $p < .05$), .0838 (Model 4, $p < .01$), and .0399 (Model 5, $p < .05$).

As shown in Model 2, the number of operational voting tasks negatively affected the product quality ($\beta = -.1801, p < .01$), providing support for H2. Further, the positive effect of strategic voting tasks on product quality was significant in Models 4 and 5 and not significant in Models 2 and 3. These mixed results provided only limited support for H1, suggesting that a more complicated relationship might exist that requires further analysis (see Section 5.2). In Model 3, the matching degree between voters and tasks mitigated the negative effect of operational voting tasks on product quality ($\beta = .1410, p < .05$), providing support for H3b. In Model 4, the proportion of large shareholders further amplified the negative effect of operational voting tasks on product

TABLE 2 List of variables

Name	Definition	Data source
$Quality_t$	Stability of DAI price on a certain day	CoinMarketCap
$Task_{st,t}$	Number of strategic voting tasks ended in the previous 7 days	Maker Governance
$Task_{op,t}$	Number of operational voting tasks ended in the previous 7 days	Maker Governance
$Matching_{st,t}$	Average proportion of the matched voters for strategic voting tasks ended in the previous 7 days	MCD Voting Tracker; Ethereum blockchain
$Matching_{op,t}$	Average proportion of the matched voters for operational voting tasks ended in the previous 7 days	MCD Voting Tracker; Ethereum blockchain
$Large\_shareholder_{st,t}$	Average proportion of large shareholders for strategic voting tasks ended in the previous 7 days	MCD Voting Tracker; Ethereum blockchain
$Large\_shareholder_{op,t}$	Average proportion of large shareholders for operational voting tasks ended in the previous 7 days	MCD Voting Tracker; Ethereum blockchain
$Info_{st,t}$	Average number of discussion post links provided in proposals of strategic voting tasks ended in the previous 7 days	Maker Governance
$Info_{op,t}$	Average number of discussion post links provided in proposals of operational voting tasks ended in the previous 7 days	Maker Governance
$Google\_blockchain_t$	Google search index of "blockchain"	Google Trends
$Dai\_social\_vol_t$	Mentions of "DAI" on social channels	Santiment
Eth_price_t	Price of ETH on a certain day	CoinMarketCap
$Plat\_vault\_cum_t$	Cumulative number of vaults created	DeFi Explore
$Plat\_lock\_change_t$	Changes in the total value of the locked collateral compared with the previous day	DeFi Explore; CoinMarketCap
$Dai\_supply\_change_t$	Changes in the amount of DAI lent from the platform compared with the previous day	DeFi Explore
$Market\_return\_index_t$	Composite market return index of all accepted collaterals	CoinMarketCap

quality ($\beta = -.1062, p < .05$), supporting H4b. In contrast, the matching degree and proportion of large shareholders did not change the strength of the impact of strategic voting tasks on product quality ($\beta = -.0783, .0439, p = .26, 0.40, \textit{respectively}$), suggesting no support for H3a or H4a. Model 5 revealed a positive moderating effect of the amount of information on the relationship between strategic voting tasks and product quality ($\beta = .2822, p < .01$), supporting H5a. Conversely, with respect to H5b regarding information provision influencing the relationship between operational voting tasks and product quality, this was not supported ($\beta = .0315, p = .64$).

Overall, operational voting tasks (decision-making tasks with a short-term impact) had a negative impact on product quality. This is consistent with our hypothesized expectation that using voting to perform operational tasks is not a preferred method. For MakerDAO, operational tasks mainly involve adjusting parameters in the lending process. These adjustments should be based on the actual environment and are often used to respond to unexpected changes. However, operational decisions made through voting are ineffective for stabilizing DAI and can even produce detrimental effects. Meanwhile, strategic voting tasks (short- to long-term impacts) appear to have a positive impact on product quality under certain conditions. On the one hand, this may imply that voting as a decision-making mechanism has limitations in terms of management issues. On the other hand, this could be because strategic tasks focus on the

TABLE 3 Variable summary statistics and correlation matrix ($N = 374$)

	Variable	Mean	*SD*	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1)	$Quality_t$	−0.01	0.01	−0.09	0.00							
(2)	$Task_{st,t}$	3.88	4.72	0.00	18.00	−.05						
(3)	$Task_{op,t}$	3.55	1.68	0.00	8.00	−.14***	−.24***					
(4)	$Matching_{st,t}$	0.22	0.29	0.00	1.00	−.23***	.24***	.15***				
(5)	$Matching_{op,t}$	0.49	0.27	0.00	0.96	−.09*	−.20***	.65***	.12**			
(6)	$Large\_shareholder_{st,t}$	0.06	0.05	0.00	0.20	−.25***	.43***	−.05	.55***	.09*		
(7)	$Large\_shareholder_{op,t}$	0.09	0.06	0.00	0.37	−.35***	.31***	.14***	.34***	.10*	.58***	
(8)	$Info_{st,t}$	1.46	1.74	0.00	13.00	−.04	.19***	−.16***	.31***	.01	.52***	.26***
(9)	$Info_{op,t}$	0.57	0.78	0.00	3.67	−.23***	.39***	.10*	.45***	.16***	.54***	.58***
(10)	$Google\_blockchain_t$	22.57	2.02	18.00	26.00	.14***	−.03	.07	−.02	.17***	−.06	−.02
(11)	$Dai\_social\_vol_t$	98.55	88.19	24.00	1567.00	−.23***	.14***	−.05	.03	−.04	.10*	.11**
(12)	Eth_price_t	264.03	113.47	110.61	614.84	−.05	.49***	−.23***	.25***	−.07	.48***	.38***
(13)	$Plat\_vault\_cum_t$ $(\times 10^3)$	9.72	4.64	1.44	17.60	−.14***	.60***	−.25***	.36***	−.07	.56***	.45***
(14)	$Plat\_lock\_change_t$ $(\times 10^6)$	3.05	16.18	−64.51	90.57	−.12**	.04	.03	.11**	.04	.16***	.14***
(15)	$Dai\_supply\_change_t$ $(\times 10^6)$	2.71	11.61	−52.08	96.17	−.11**	.10*	.02	.14***	.05	.20***	.12**
(16)	$Market\_return\_index_t$	0.00	0.05	−0.42	0.18	−.12**	−.02	.00	.01	.03	.01	−.07
		(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)		
(9)	$Info_{op,t}$	.58***										
(10)	$Google\_blockchain_t$	.04	−.05									
(11)	$Dai\_social\_vol_t$	−.01	.03	−.13**								
(12)	Eth_price_t	.52***	.54***	.24***	.07							
(13)	$Plat\_vault\_cum_t$ $(\times 10^3)$	.55***	.59***	.03	.08	.88***						
(14)	$Plat\_lock\_change_t$ $(\times 10^6)$	.00	.21***	−.06	.06	.08	.08					
(15)	$Dai\_supply\_change_t$ $(\times 10^6)$	.04	.26***	−.04	.04	.19***	.17***	.77***				
(16)	$Market\_return\_index_t$	.01	−.03	.07	−.02	.08	.03	−.08	.08			

*$p < .1$, **$p < .05$, ***$p < .01$.

TABLE 4 Regression results ($DV: Quality_t$)

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
$Task_{st,t}$		.0578(0.058)	.0928(0.066)	.0969*(0.052)	.1183*(0.061)
$Task_{op,t}$		−.1801***(0.041)	−.1824***(0.063)	−.1237***(0.044)	−.1030**(0.048)
$Matching_{st,t} * Task_{st,t}$			−.0783(0.070)		
$Matching_{op,t} * Task_{op,t}$			.1410**(0.059)		
$Large\_shareholder_{st,t} * Task_{st,t}$				.0439(0.052)	
$Large\_shareholder_{op,t} * Task_{op,t}$				−.1062**(0.047)	
$Info_{st,t} * Task_{st,t}$					.2822***(0.106)
$Info_{op,t} * Task_{op,t}$					.0315(0.067)
$Google\_blockchain_t$	.0572(0.046)	.0783*(0.046)	.0542(0.047)	.0750(0.047)	.0727(0.049)
$Dai\_social\_vol_t$	−.2058(0.185)	−.2138(0.178)	−.2162(0.176)	−.1956(0.156)	−.2106(0.173)
Eth_price_t	.2712**(0.115)	.2499**(0.117)	.2949**(0.126)	.2791**(0.111)	.2590**(0.121)
$Plat\_vault\_cum_t$	−.3488***(0.103)	−.4120***(0.114)	−.4808***(0.144)	−.2663**(0.114)	−.3645***(0.118)
$Plat\_lock\_change_t$	−.1300(0.148)	−.1280(0.147)	−.1167(0.148)	−.0738(0.138)	−.0994(0.142)
$Dai\_supply\_change_t$	.0202(0.142)	.0319(0.142)	.0383(0.142)	.0043(0.126)	.0546(0.137)
$Market\_return\_index_t$	−.1460(0.129)	−.1433(0.127)	−.1520(0.128)	−.1633(0.127)	−.1532(0.128)
$Matching_{st,t}$			−.1308**(0.055)		
$Matching_{op,t}$			.1271*(0.069)		
$Large\_shareholder_{st,t}$				−.0484(0.068)	
$Large\_shareholder_{op,t}$				−.3098***(0.064)	
$Info_{st,t}$					.2295***(0.066)
$Info_{op,t}$					−.2577***(0.072)
Cons	.0000(0.049)	.0000(0.048)	−.0721(0.075)	−.0039(0.055)	−.0565(0.054)
N	374	374	374	374	374
R^2	.1186	.1525	.1841	.2363	.1924
Change in R^2		.0339**	.0316**	.0838***	.0399**

*$p < .1$, **$p < .05$, ***$p < .01$. *SE* in parentheses.

operational performance of the platform, as well as its long-term development, and the interests of DAO members.

For strategic voting tasks, the rich information directly obtained from the voting webpage helps voters make decisions that are more beneficial to the overall platform, resulting in a positive effect on operational performance. The degree of voter–task matching and the participation of large shareholders had no significant effect on the relationship between strategic voting tasks and product quality. This may indicate that the effect of strategic voting tasks is produced through extensive and sufficient communication between DAO members.

For operational voting tasks, we discovered that the participation of voters who are more familiar with the decision content of the voting could help operational voting tasks achieve relatively better results. However, we also revealed that the proportion of large shareholders among total voters worsened the negative impact of operational voting tasks on product quality. One possible explanation for this phenomenon is that large shareholders tend to profit from manipulating the outcomes of operational voting tasks, which could jeopardize the operational performance of the platform. These findings are consistent with our hypotheses.

Although we hoped that information provision would help voters of operational voting tasks become more knowledgeable, we found no significant effect of the information provided on the relationship between operational voting tasks and product quality. According to Lee et al. (2011), the interpretation of new information can be influenced by how much knowledge has

TABLE 5 Robustness check—Alternative measure of product quality

	$DV: Quality\_MSD_{t,1h}$				$DV: Quality\_MSD_{t,30m}$				$DV: Quality\_MSD_{t,10m}$			
	Model (1)	Model (2)	Model (3)	Model (4)	Model (1)	Model (2)	Model (3)	Model (4)	Model (1)	Model (2)	Model (3)	Model (4)
$Task_{st,t}$	.1117*(0.061)	.1325**(0.064)	.1629***(0.056)	.1927***(0.061)	.1161*(.062)	.1385**(0.065)	.1692***(0.056)	.1980***(0.061)	.1153*(0.061)	.1399**(0.065)	.1659***(0.056)	.1966***(0.061)
$Task_{op,t}$	−.1642***(0.040)	−.1546***(0.059)	−.1020**(0.044)	−.0572(0.047)	−.1712***(.041)	−.1637***(0.060)	−.1074**(0.044)	−.0625(0.047)	−.1686***(0.041)	−.1692***(0.061)	−.1041**(0.044)	−.0594(0.047)
$Matching_{st,t} * Task_{st,t}$		−.0561(0.072)				−.0590(0.073)				−.0610(0.074)		
$Matching_{op,t} * Task_{op,t}$		.1371**(0.062)				.1386**(0.062)				.1369**(0.062)		
$Large\_shareholder_{st,t} * Task_{st,t}$			.0236(0.054)				.0171(0.055)				.0290(0.054)	
$Large\_shareholder_{op,t} * Task_{op,t}$			−.0904*(0.049)				−.0908*(0.050)				−.0956*(0.050)	
$Info_{st,t} * Task_{st,t}$				.1886*(0.110)				.1886*(0.113)				.1735(0.112)
$Info_{op,t} * Task_{op,t}$				.0262(0.072)				.0314(0.072)				.0300(0.072)
$Google\_blockchain_t$	.0662(0.050)	.0457(0.054)	.0544(0.051)	.0416(0.053)	.0600(0.051)	.0389(0.055)	.0478(0.052)	.0351(0.054)	.0706(0.050)	.0481(0.054)	.0599(0.050)	.0439(0.053)
$Dai\_social\_vol_t$	−.2277(0.181)	−.2295(0.178)	−.2093(0.158)	−.2301(0.170)	−.2230(0.174)	−.2248(0.170)	−.2044(0.150)	−.2256(0.163)	−.2251(0.175)	−.2271(0.172)	−.2059(0.151)	−.2285(0.164)
Eth_price_t	.3062***(0.109)	.3500***(0.118)	.3419***(0.097)	.3360***(0.108)	.3165***(0.109)	.3616***(0.116)	.3544***(0.097)	.3449***(0.107)	.2922***(0.109)	.3397***(0.116)	.3273***(0.096)	.3231***(0.107)
$Plat\_vault\_cum_t$	−.4557***(0.101)	−.5213***(0.127)	−.3039***(0.089)	−.4068***(0.096)	−.4764***(0.101)	−.5445***(0.124)	−.3298***(0.089)	−.4272***(0.096)	−.4532***(0.102)	−0.5267***(0.125)	−.2946***(0.091)	−.4028***(0.096)
$Plat\_lock\_change_t$	−.1470(0.093)	−.1368(0.091)	−.0904(0.078)	−.1121(0.084)	−.1446(0.092)	−.1344(0.090)	−.0870(0.076)	−.1095(0.083)	−.1459(0.092)	−.1359(0.090)	−.0873(0.076)	−.1109(0.083)
$Dai\_supply\_change_t$	.0016(0.110)	.0072(0.108)	−.0223(0.093)	.0357(0.101)	−.0089(0.108)	−.0033(0.106)	−.0340(0.089)	.0257(0.098)	−.0094(0.108)	−.0044(0.105)	−.0351(0.088)	.0253(0.098)
$Market\_return\_index_t$	−.1459*(0.088)	−.1541*(0.089)	−.1639*(0.087)	−.1602*(0.088)	−.1324*(0.079)	−.1408*(0.080)	−.1510*(0.077)	−.1467*(0.079)	−.1342*(0.079)	−.1428*(0.080)	−.1534**(0.077)	−.1488*(0.079)
$Matching_{st,t}$		−.0979*(0.056)				−.0997*(0.057)				−.0967*(0.057)		
$Matching_{op,t}$		.0915(0.070)				.0966(0.072)				.1074(0.074)		
$Large\_shareholder_{st,t}$			−.1160*(0.064)				−.1085*(0.066)				−.1071(0.066)	
$Large\_shareholder_{op,t}$			−.2732***(0.063)				−.2771***(0.064)				−.2939***(0.063)	
$Info_{st,t}$				.2596***(0.073)				.2645***(0.074)				.2569***(0.074)
$Info_{op,t}$				−.3592***(0.082)				−.3640***(0.084)				−.3667***(0.083)
Cons	.0000(0.048)	−.0749(0.073)	.0025(0.055)	−.0383(0.054)	.0000(0.048)	−.0752(0.073)	.0053(0.055)	−.0388(0.054)	.0000(0.048)	−.0736(0.074)	.0009(0.054)	−.0358(0.054)
N	374	374	374	374	374	374	374	374	374	374	374	374
R^2	.1687	.1922	.2544	.2296	.1703	.1944	.2553	.2333	.1705	.1937	.2633	.2333

*$p < .1$, **$p < .05$, ***$p < .01$. *SE* in parentheses.

already been accumulated on the same subject. Moreover, because on-chain environments are highly complicated, some operational tasks could necessitate a higher level of professionalism. When combined with the revealed positive effects of voter-task matching, this may indicate that it is difficult to become a well-informed decision-maker by learning during shorter periods in blockchain environments.

5.2 | Robustness analyses

The robustness of our results is tested via several additional analyses by using alternative measures, parameters, and modeling. These robustness tests indicate our results are not unduly influenced by those factors, suggesting the reliability of our results. These alternative analyses are presented as follows.

5.2.1 | Alternative measures

When measuring the product quality of DAI, we used the end-of-day DAI price and calculated the negative absolute value of its difference from 1. In fact, the changes during the course of a day can be quite drastic. Ideally, the DAI price should remain at 1, which could be understood as the theoretical highest quality. Thus, we used an alternative quality measure that was calculated as the mean squared deviation of the DAI price from 1 throughout a single day. We calculated this measure at the hour- ($Quality\_MSD_{t,1h}$), 30 min- ($Quality\_MSD_{t,30m}$), and 10 min-levels ($Quality\_MSD_{t,10m}$), then performed hypothesis testing. As before, we use the negative value of these variables in the regression to increase the readability of the result. These results are presented in Table 5 and are consistent with the main results in Table 4.

In addition, when measuring the proportions of matched voters and large shareholders, we first calculated the proportion value for each vote and then calculated the simple arithmetic average across votes, as in Sections 4.3.2 and 4.3.3. However, this calculation could cause information loss in the averaging process. Therefore, we re-calculated the weighted moderation variables with the number of voters who participated as the weight.[vii] The results (see Table 6) obtained by using weighted moderation variables were consistent with those obtained by using a simple average.

TABLE 6 Robustness check—Alternative measures of moderation variables ($DV: Quality_t$)

	Model (1)	Model (2)
$Task_{st,t}$	.1048(0.071)	.1024**(0.052)
$Task_{op,t}$	−.1855***(0.063)	−.1226***(0.043)
$Matching\_weighted_{st,t} * Task_{st,t}$	−.0606(0.066)	
$Matching\_weighted_{op,t} * Task_{op,t}$	.1638***(0.060)	
$Large\_shareholder\_weighted_{st,t} * Task_{st,t}$		.0240(0.058)
$Large\_shareholder\_weighted_{op,t} * Task_{op,t}$		−.1483***(0.047)
$Google\_blockchain_t$	.0482(0.048)	.0800*(0.047)
$Dai\_social\_vol_t$	−.2175(0.178)	−.1912(0.152)
Eth_price_t	.2998**(0.124)	.2472**(0.109)
$Plat\_vault\_cum_t$	−.5094***(0.139)	−.2569**(0.112)
$Plat\_lock\_change_t$	−.1207(0.146)	−.0968(0.143)
$Dai\_supply\_change_t$	.0346(0.141)	.0455(0.137)
$Market\_return\_index_t$	−.1539(0.127)	−.1574(0.122)
$Matching\_weighted_{st,t}$	−.1123**(0.054)	
$Matching\_weighted_{op,t}$	.1422**(0.070)	
$Large\_shareholder\_weighted_{st,t}$		.0283(0.071)
$Large\_shareholder\_weighted_{op,t}$		−.3576***(0.078)
Cons	−.0863(0.078)	.0101(0.055)
N	374	374
R^2	.1827	.2291

*$p < .1$, **$p < .05$, ***$p < .01$. SE in parentheses.

TABLE 7 Robustness check—Alternative parameter of rolling windows ($DV: Quality_t$)

Rolling window	3 days	5 days	9 days	11 days	13 days
$Task_{st,t}$	0.0516(0.040)	0.0733(0.045)	0.1271*(0.066)	0.1182*(0.066)	0.1129*(0.065)
$Task_{op,t}$	−0.0607(0.046)	−0.0747*(0.045)	−0.1151***(0.043)	−0.1600***(0.044)	−0.1457***(0.043)
$Google\_blockchain_t$	0.0598(0.046)	0.0616(0.047)	0.0762(0.047)	0.0862*(0.047)	0.0860*(0.047)
$Dai\_social\_vol_t$	−0.2069(0.187)	−0.2047(0.185)	−0.2166(0.181)	−0.2120(0.184)	−0.2097(0.183)
Eth_price_t	0.2717**(0.116)	0.2725**(0.116)	0.2651**(0.117)	0.2437**(0.114)	0.2353**(0.114)
$Plat\_vault\_cum_t$	−0.3752***(0.106)	−0.3999***(0.111)	−0.4544***(0.120)	−0.4496***(0.119)	−0.4425***(0.113)
$Plat\_lock\_change_t$	−0.1288(0.149)	−0.1368(0.153)	−0.1235(0.148)	−0.1272(0.149)	−0.1297(0.146)
$Dai\_supply\_change_t$	0.0172(0.143)	0.0291(0.147)	0.0224(0.142)	0.0285(0.142)	0.0274(0.139)
$Market\_return\_index_t$	−0.1430(0.130)	−0.1421(0.129)	−0.1388(0.125)	−0.1428(0.126)	−0.1379(0.127)
Cons	0.0000(0.049)	0.0000(0.049)	0.0000(0.049)	0.0000(0.048)	0.0000(0.048)
N	374	374	374	374	374
R^2	0.1242	0.1278	0.1411	0.1526	0.1482

*$p < .1$, **$p < .05$, ***$p < .01$. *SE* in parentheses.

TABLE 8 Robustness check—Alternative modeling

	$DV: Quality_t$, Model (1)	$DV: MKR\_price_t$, Model (2)
$Task_{st,t}$ *proportion*	.2793*** (0.070)	
$Total\_task\_volume_t$	−.1255** (0.058)	
$Task_{st,t}$		.2396*** (0.043)
$Task_{op,t}$		−.1398*** (0.031)
$Google\_blockchain_t$	.0645 (0.046)	.0315 (0.029)
$Dai\_social\_vol_t$	−.2023 (0.184)	−.0182 (0.020)
Eth_price_t	.2735** (0.118)	1.5578*** (0.099)
$Plat\_vault\_cum_t$	−.4936*** (0.122)	−1.2838*** (0.069)
$Plat\_lock\_change_t$	−.1266 (0.148)	−.0206 (0.059)
$Dai\_supply\_change_t$	.0246 (0.142)	−.0019 (0.052)
$Market\_return\_index_t$	−.1485 (0.127)	−.0052 (0.037)
Cons	.0000 (0.048)	.0000 (0.029)
N	374	374
R^2	.1444	.6849

*$p < .1$, **$p < .05$, ***$p < .01$. *SE* in parentheses.

5.2.2 | Alternative parameter

In the main experiment, we chose 7 days as a rolling window. This was chosen because, although there was not a relatively stable voting cycle during our research period, DAO members usually initiated and organized discussions on a weekly basis. This is also congruent with people's living and working calendars. To test the stability of the results, we calculated the number of strategic voting tasks and the number of operational voting tasks across a rolling time window of 3, 5, 9, 11, and 13 days. According to the results (shown in Table 7), the negative effect of operational voting tasks on operational performance is generally persistent throughout the rolling windows, whereas the positive effect of strategic voting tasks on operational performance becomes stably significant with relatively larger time windows.

5.2.3 | Alternative modeling

The robustness was further checked by testing two alternative models. The first alternative model was to replace the sheer number of strategic voting tasks with the ratio of strategic voting tasks relative to the total voting tasks. The second alternative model was to replace the dependent variable of product quality with governance token value, which is also a performance indicator of DAO-governed platforms. The robustness of our original results was also illustrated by these two alternative models, as reported as follows.

The strategic and operational voting tasks in the main regressions were modeled independently. However, these two tasks could be raised simultaneously as a complete workload for DAO members. To participate, members may have to allocate time, financial, and cognitive resources between these two types of tasks. The impact of workload on work performance (Tan & Netessine, 2014) and how managers allocate their efforts toward operational and strategic decisions (Hughes & Thevaranjan, 1995) have also been examined in the literature. Our previous analyses demonstrated limited support for H1 regarding the influence of strategic voting tasks on product quality. We speculate that the proportion of strategic voting tasks relative to the whole workload is more important than the sheer number of strategic voting tasks. To verify this conjecture, we calculated the proportion of strategic voting tasks relative to all voting tasks ($Task_{st,t}$ *proportin*) and examined its impact on product quality. The results (Table 8, Model 1) indicated that higher strategic task proportion led to higher product quality ($\beta = .2793, p < .01$), while total task volume (*Total_task_volume*) had a negative impact on product quality ($\beta = -.1255, p < .05$).

Similarly, a regression of the two types of voting tasks on the value of the governance token (*MKR_price*) was conducted. The results (Table 8, Model 2) indicated that strategic voting tasks had a significant positive impact on the governance token value ($\beta = .2396, p < .01$), while operational voting tasks had a significant negative impact ($\beta = -.1398, p < .01$).

6 | DISCUSSIONS

Our study investigated the impact of strategic and operational voting tasks on product quality, as well as the moderating effects of decision characteristics in task processing. By distinguishing between strategic and operational voting tasks, we discovered that they have distinct effects on product quality. Specifically, strategic voting tasks improved operational performance, which was strengthened by information provision. Meanwhile, operational voting tasks worsened operational performance, which was alleviated by task allocation and worsened by reward distribution. Robustness experiments indicated that these results were generally stable. Building on these findings, we articulate the contributions and limitations of the current study in this section.

6.1 | Theoretical contributions

This research provides several significant contributions to the emerging literature on blockchain technology with regard to OM. First, this research is one of the first to investigate the operations of blockchain-based platforms. In essence, we shed new light on the novel governance model spawned by blockchains and connect it to the OM of blockchain-based platforms through empirical research. Currently, the OM field is paying increasing attention to blockchain technology. Blockchains not only provide greater data visibility and traceability (Hastig & Sodhi, 2020), they also offer a variety of digital currencies and new online transaction methods (Liu & Tsyvinski, 2021). The current study focuses on the rapidly evolving decentralized platforms in the blockchain ecosystem, as well as the governance approaches that underpin these platforms. While most existing studies have attempted to explain the platform–user interaction model and value creation logic for a blockchain platform, the current study revealed the effects of DAO decision-making activities on the operational performance of blockchain platforms, laying the paramount groundwork for future blockchain-empowered OM research. In addition, some of our findings, such as how the degree of voter–task matching can alleviate the negative effect of operational voting tasks on product quality, are relevant to OM research on worker specialization (Cui et al., 2021). Accordingly, this empirical research provides epistemological references for the reverification and exploration of existing operational management findings in the blockchain environment.

Second, the current study expands on organization-related research in OM. In recent years, scholars have proposed examining organizational issues from the perspective of OM (Anand & Gray, 2017; Ketchen Jr & Hult, 2007) and have called for broadening the scope of OM research issues from the origins of OM (Browning, 2020). To resonate with this call, the aim of our study was to discover how the decision-making activities of DAO contribute to improving platform performance against the backdrop of blockchain platforms. First, we analyzed the management activities of DAO and its role in overall platform operation from the perspective of work management. Following our discovery that a DAO manages the platform primarily by making decisions on its various strategic or operational tasks, we further analyzed the impact of DAO management through decentralized decision making on the performance of decentralized platforms. Specifically, as a new form of organizing, the voting-based decentralized governance mechanism employed by the DAO provides new solutions for the four important organizational problems proposed by Puranam et al. (2014). Our research also revealed that these novel solutions have important ramifications for the operation of decentralized platforms developed in an ever-changing blockchain environment. Prior to this, research starkly focused on comparing DAOs with traditional organizational or governance models, as well as offering promising application and research directions (Beck et al., 2018; Lumineau et al., 2021; Ziolkowski et al., 2020). These research viewpoints are relatively abstract, and the question of how DAO might be used in real-world operations management has not been discussed. Our research takes the relevant theories of organization management and decision making to explore the management activities of DAO, making contributions to the research paradigm of operation and organization.

Third, this research explored voting-based decision making in the blockchain environment, contributing to the body of knowledge on operational management decision making. The extant literature generally holds that voting can harness the wisdom and effort of the crowd and is an effective method of decision-making (Keuschnigg & Ganser, 2017). In the blockchain scenario, voting is widely used to help DAO members achieve decentralized collaboration. To the best of our knowledge, existing Internet platforms have rarely employed voting so extensively in management decision-making prior to the realization of DAO. Tsoukalas and Falk (2020) also noticed the wide application of voting in the blockchain context, although they focused on predictive accuracy rather than governance issues. Based on the application reality of voting in the blockchain context, we explored and analyzed the real-world operation data of decentralized platforms to determine the impact of voting-produced decisions on the operational performance of the platform. Furthermore, we discovered the important moderating effects of voter–task matching, voting power distribution, and decision-supporting information provision. The findings have reference significance for decision management research in the field of OM.

6.2 | Managerial implications

Following the instructions of Browning (2020), we attempted to unveil and interpret the essence of DAO and its potential impact through the lens of OM. Our theory-driven empirical study has several implications for practitioners.

First, different voting protocols should be designed to correspond to different types of voting (strategic vs. operational). In current practices, all types of voting proposals follow a universal procedure, but our findings suggest that operational voting tasks that follows the universal voting protocol may have a negative impact on operational performance. Our findings also suggest that strategic decisions with far-reaching impacts should gain wider attention from DAO members, as well as adequate communication between them. Therefore, for strategic voting tasks, we recommend designing a voting protocol with a longer voting duration and more discussion sessions. Similarly, it has been found that operational decisions, which are expected to have a short-term impact on the rapidly changing blockchain environment, should be promptly made by the voters with relevant knowledge. Therefore, for operational voting tasks, another type of protocol with a shorter voting duration and voters who have relevant expertise or experience with the proposal should be designed. Overall, the complexity of the blockchain ecosystem should be recognized not only by users of blockchain-based platforms (Ilk et al., 2021; Shang & Ilk, 2020), but also by the managers of these platforms when designing platform governance mechanisms.

Second, allocating more vote-wise power to governance tokens of "matched" members is advised. In current practice, DAOs grant equal voting power to each governance token, regardless of whether the token is held by a "matched" or an "unmatched" member. That is to say, the governance power of DAO members is commensurate with their financial resources (i.e., the number of tokens). However, our findings revealed that the participation of voters who are more familiar with the voting proposal (i.e., "matched" members) could help operational voting tasks achieve relatively better performance. Thus, it is recommended that more governance power be allocated to the tokens held by "matched" members, so that the "matched" members could have more voting power. Based on our empirical evidence, this suggestion is technically feasible. DAO member's tokens are traceable and transparent on-chain and can be censored automatically, so smart contracts could be used to identify the "matched" members and allocate more vote-wise governance power to their tokens.

Third, DAOs should take measures to encourage small token-holders to participate in operational decision-making. Large token-holders may take the initiative to vote because the voting results have stronger impacts on their interests. However, large token-holders have higher voting power (cf. the second implication above), so the voting results may only reflect the interests of a small number of large token-holders while deteriorating the interests of a large number of small token-holders. Our research revealed that the proportion of large token-holders who participated in operational voting tasks has a negative effect; the higher the proportion of large token-holders, the worse the effect of operational voting tasks on operational performance. Therefore, we suggest DAOs take measures to encourage a broader range of small token-holders to participate in operational decision-making. For example, DAOs can airdrop free governance tokens to small token-holders to encourage their participation in operational voting tasks. The tokens airdropped to small token-holders can dilute the voting power of the large token-holders, thus preventing large token-holders from dominating the voting process. The balanced distribution of governance tokens (large vs. small token-holders) may help the decentralized platform achieve better performance and maintain sustainable development.

Finally, DAOs should take action to encourage various forms of communication among DAO members. Our results suggest that pre-voting discussions on strategic decisions are beneficial for operational performance. In traditional business settings, communications on such community forums and social media have been proven to be helpful for a firm's long-term performance (Huang et al., 2015). Therefore, information exchange and discussions among DAO members should be facilitated and encouraged; for example, governance tokens might be awarded to incentivize pre-voting discussions.

6.3 | Limitations and future research

As an early attempt to discover how DAOs conduct management activities and how these activities affect platform performance in the blockchain ecosystem from an operations perspective, our research resonates with recent calls for technology-disrupting operations. However, this study also has certain inevitable limitations.

First, since most blockchain platforms are still in their early stages of development, it is difficult to find other well-governed decentralized applications to perform platform-level empirical studies on DAOs. Overall, we believe that our results apply to most existing DAOs. As the focus of this study, voting is a crucial part of the governance mechanism of DAOs. Moreover, most DAOs have constructs such as the division of voting types, expertise–task matching, right distribution among voters, and information provision. Although the measurement of these constructs may need to be adjusted to specific platform scenarios, our results should theoretically have generality to different DAOs. It is also worth noting that MakerDAO does not set requirements for launching initial proposals or participating in voting, which could result in a significant imbalance in voting rights between voters who participate in the voting. This may further create flaws or manipulations in token-weighted voting. In practice, several DAOs have started to adopt the necessary countermeasures. For example, Compound restricts users who initiate proposals such that only users with more than 1% of their governance tokens can put forward a proposal. Further, DAO members of Dash can vote only if they own at least 1000 Dash tokens. As a further example, the DAOs of Gitcoin and Polkadot adopt special voting rules to restrict the excessive power of users holding a large share of governance tokens. For these DAOs, our conclusions about the moderating effect of the proportion of large shareholders might become less applicable and require further research.

Second, we perceive voting in DAOs as a new organizing form, and we investigated how DAOs address some key issues that affect the impact of their governance decision-making. In this process, we discovered that the characteristics of the voters are crucial to the understanding of a DAO's management activities. However, because this research focuses more on understanding the relationship between DAOs and operational management performance from a macro perspective, we did not gauge the specific behavior of voters. This would include how much decision-making power they invest in different proposals or when they join or exit a DAO. Future research is expected to explore and understand voter behavior to help DAOs establish better governance mechanisms.

ACKNOWLEDGMENTS

We are grateful to the Department Editor Dr. Guangzhi Shang, the Associate Editor, and anonymous reviewers for their developmental comments and suggestions. The assistance of Xiaoni Lu, Zhecheng Wang, and Xudong Cai in data preparation and analysis is also acknowledged. Xi Zhao would like to acknowledge the support from the National Natural Science Foundation of China (Grant # 72132007 and 91746111) and the Key Research and Development Projects of Shaanxi Province (Grant # 2020ZDLGY09-08). Jose Benitez wants to thank the research sponsorship received by the European Regional Development Fund (European Union) and the Government of Spain (Research Project ECO2017-84138-P), the Regional Government of Andalusia (Research Project A-SEJ-154-UGR18), and the Slovenian Research Agency (Research Core Funding No. P5-0410).

CONFLICT OF INTEREST

none.

DATA AVAILABILITY STATEMENT

The full dataset for this study can be downloaded from https://osf.io/kaqu9/?view_only=f2de63736f8b491c84abfcfc3b4f4d73

ORCID

Xi Zhao https://orcid.org/0000-0001-9983-6366
Peilin Ai https://orcid.org/0000-0002-2114-0243
Fujun Lai https://orcid.org/0000-0003-3180-7395
Xin (Robert) Luo https://orcid.org/0000-0003-0122-7293
Jose Benitez https://orcid.org/0000-0002-9142-4508

ENDNOTES

[i] https://dappradar.com/

[ii] We consider the organization of voting activities as management of work. Each vote starts from a platform-specific forum. All forum users have the opportunity to raise initial proposals for further discussion. All initial proposals are discussed by forum users in various forms to gauge sentiments and gather opinions. Some of the proposals are assessed by the basic team and moved forward to the on-chain voting stage, where DAO members freeze their governance tokens to vote. The voting results are then implemented by the basic team as smart contracts and deployed on chain with a time lag.

[iii] The delay duration is also adjusted through voting, which is 48 h for MakerDAO at the time of writing (December 2021).

[iv] https://etherscan.io/

[v] On December 28, 2020, MakerDAO launched a new functional module, "Peg Stability Module," which is also a way of generating a new DAI. However, this research only focuses on the time before the emergence of this function (i.e., on and before November 30, 2020). Hence, the relevant function and influence are not considered in the full discussion.

[vi] https://www.coinbase.com/

[vii] $$Matching\_weighted_{st,t} = \sum_{i=1}^{n_{st,t}} \left(\frac{matched\_voter\_num_i}{voter\_num_i} \times \frac{voter\_num_i}{\sum_{i=1}^{n_{st,t}} voter\_num_i} \right) = \frac{\sum_{i=1}^{n_{st,t}} matched\_voter\_num_i}{\sum_{i=1}^{n_{st,t}} voter\_num_i},$$

$$Matching\_weighted_{op,t} = \frac{\sum_{i=1}^{n_{op,t}} matched\_voter\_num_i}{\sum_{i=1}^{n_{op,t}} voter\_num_i}; Large\_shareholder\_weighted_{st,t} = \frac{\sum_{i=1}^{n_{st,t}} large\_shareholder\_num_i}{\sum_{i=1}^{n_{st,t}} voter\_num_i}, Large\_shareholder\_weighted_{op,t} = \frac{\sum_{i=1}^{n_{op,t}} large\_shareholder\_num_i}{\sum_{i=1}^{n_{op,t}} voter\_num_i}$$

REFERENCES

Ahmad, S., & Schroeder, R. G. (2003). The impact of human resource management practices on operational performance: Recognizing country and industry differences. *Journal of Operations Management*, *21*(1), 19–43.

Anand, G., & Gray, J. V. (2017). Strategy and organization research in operations management. *Journal of Operations Management*, *53-56*(1), 1–8.

Andersen, J. V., & Bogusz, C. I. (2019). Self-organizing in blockchain infrastructures: Generativity through shifting objectives and forking. *Journal of the Association for Information Systems*, *20*(9), 1242–1273.

Babich, V., & Hilary, G. (2020). OM forum—Distributed ledgers and operations: What operations management researchers should know about blockchain technology. *Manufacturing & Service Operations Management*, *22*(2), 223–240.

Badr, B., Horrocks, R., & Wu, X. B. (2018). *Blockchain by example: A developer's guide to creating decentralized applications using bitcoin, ethereum, and hyperledger*. Packt Publishing Ltd.

Beck, R., Müller-Bloch, C., & King, J. L. (2018). Governance in the blockchain economy: A framework and research agenda. *Journal of the Association for Information Systems*, *19*(10), 1020–1034.

Benkler, Y. (2017). Peer production, the commons, and the future of the firm. *Strategic Organization*, *15*(2), 264–274.

Boh, W. F., Ren, Y., Kiesler, S., & Bussjaeger, R. (2007). Expertise and collaboration in the geographically dispersed organization. *Organization Science*, *18*(4), 595–612.

Bonner, B. L., Shannahan, D., Bain, K., Coll, K., & Meikle, N. L. (2021). The theory and measurement of expertise-based problem solving in organizational teams: Revisiting demonstrability. *Organization Science*, 1–17. [Articles in Advance]. https://doi.org/10.1287/orsc.2021.1481

Boyer, K. K., & McDermott, C. (1999). Strategic consensus in operations strategy. *Journal of Operations Management*, *17*(3), 289–305.

Brandon-Jones, E., Dutordoir, M., Neto, J. Q. F., & Squire, B. (2017). The impact of reshoring decisions on shareholder wealth. *Journal of Operations Management*, *49*, 31–36.

Braunscheidel, M. J., & Suresh, N. C. (2009). The organizational antecedents of a firm's supply chain agility for risk mitigation and response. *Journal of Operations Management*, *27*(2), 119–140.

Browning, T. R. (2020). Operations management writ large. *Journal of Operations Management*, *66*(5), 494–500.

Cai, Y. J., Choi, T. M., & Zhang, J. (2021). Platform supported supply chain operations in the blockchain era: Supply contracting and moral hazards. *Decision Sciences*, *52*(4), 866–892.

Cheema, G. S., & Rondinelli, D. A. (Eds.). (2007). *Decentralizing governance: Emerging concepts and practices*. Brookings Institution Press.

Chen, J., Neubaum, D. O., Reilly, R. R., & Lynn, G. S. (2015). The relationship between team autonomy and new product development performance under different levels of technological turbulence. *Journal of Operations Management*, *33-34*(1), 83–96.

Chen, Y.-J., Dai, T., Korpeoglu, C. G., Körpeoğlu, E., Sahin, O., Tang, C. S., & Xiao, S. (2020). OM forum—Innovative online platforms: Research opportunities. *Manufacturing & Service Operations Management*, *22*(3), 430–445.

Chod, J., Trichakis, N., Tsoukalas, G., Aspegren, H., & Weber, M. (2020). On the financing benefits of supply chain transparency and blockchain adoption. *Management Science*, *66*(10), 4378–4396.

Chod, J., Trichakis, N., & Yang, S. A. (2022). Platform tokenization: Financing, governance, and moral hazard. *Management Science*, 1–23. [Articles in Advance]. https://doi.org/10.1287/mnsc.2021.4225

Csaszar, F. A., & Eggers, J. (2013). Organizational decision making: An information aggregation view. *Management Science*, *59*(10), 2257–2277.

Cui, H., Rajagopalan, S., & Ward, A. R. (2021). Impact of task-level worker specialization, workload, and product personalization on consumer returns. *Manufacturing & Service Operations Management*, *23*(2), 346–366.

Da, Z., & Huang, X. (2020). Harnessing the wisdom of crowds. *Management Science*, *66*(5), 1847–1867.

Dannen, C. (2017). *Introducing ethereum and solidity: Foundations of cryptocurrency and blockchain programming for beginners* (1st edition ed.). Apress.

Devaraj, S., Krajewski, L., & Wei, J. C. (2007). Impact of eBusiness technologies on operational performance: The role of production information integration in the supply chain. *Journal of Operations Management*, *25*(6), 1199–1216.

Dou, G., He, P., & Xu, X. (2016). One-side value-added service investment and pricing strategies for a two-sided platform. *International Journal of Production Research*, *54*(13), 3808–3821.

DuPont, Q. (2017). Experiments in algorithmic governance: A history and ethnography of "the DAO," a failed decentralized autonomous organization. In *Bitcoin and beyond* (1st Edition ed., pp. 157–177). Routledge.

El Faqir, Y., Arroyo, J., & Hassan, S. (2020). An overview of decentralized autonomous organizations on the blockchain. In *Proceedings of the 16th International Symposium on Open Collaboration* (pp. 1–8). Association for Computing Machinery.

Elbanna, S., & Child, J. (2007). Influences on strategic decision effectiveness: Development and test of an integrative model. *Strategic Management Journal*, *28*(4), 431–453.

Farrell, D., Greig, F., Hamoudi, A., 2018. The online platform economy in 2018: Drivers, workers, sellers, and lessors. *JPMorgan Chase Institute*.

Gitcoin DAO, Bankless DAO, 2021. DAOs: The new coordination frontier. https://newsletter.banklesshq.com/p/the-ultimate-dao-report

Hagiu, A., & Hałaburda, H. (2014). Information and two-sided platform profits. *International Journal of Industrial Organization*, *34*, 25–35.

Hastig, G. M., & Sodhi, M. S. (2020). Blockchain for supply chain traceability: Business requirements and critical success factors. *Production and Operations Management*, *29*(4), 935–954.

Hock, S. J., & Raithel, S. (2020). Managing negative celebrity endorser publicity: How announcements of firm (non) responses affect stock returns. *Management Science*, *66*(3), 1473–1495.

Hsieh, Y.-Y., Vergne, J.-P., Anderson, P., Lakhani, K., & Reitzig, M. (2018). Bitcoin and the rise of decentralized autonomous organizations. *Journal of Organization Design*, *7*(1), 1–16.

Huang, Y., Singh, P. V., & Ghose, A. (2015). A structural model of employee behavioral dynamics in enterprise social media. *Management Science*, *61*(12), 2825–2844.

Hughes, J. S., & Thevaranjan, A. (1995). Current production targets and strategic decisions by corporate managers. *Journal of Operations Management*, *12*(3–4), 321–329.

Ilk, N., Shang, G., Fan, S., & Zhao, J. L. (2021). Stability of transaction fees in bitcoin: A supply and demand perspective. *MIS Quarterly*, *45*(2), 563–592.

Jentzsch, C., 2016. Decentralized autonomous organization to automate governance: Final draft–under review. https://lawofthelevel.lexblogplatformthree.com/wp-content/uploads/sites/187/2017/07/WhitePaper-1.pdf.

Jiang, G., Lee, C. M., & Yue, H. (2010). Tunneling through intercorporate loans: The China experience. *Journal of Financial Economics*, *98*(1), 1–20.

Jiang, L., Dimitrov, S., & Mantin, B. (2017). P2P marketplaces and retailing in the presence of consumers' valuation uncertainty. *Production and Operations Management*, *26*(3), 509–524.

Ketchen, D. J., Jr., & Hult, G. T. M. (2007). Toward greater integration of insights from organization theory and supply chain management. *Journal of Operations Management*, *25*(2), 455–458.

Keuschnigg, M., & Ganser, C. (2017). Crowd wisdom relies on agents' ability in small groups with a voting aggregation rule. *Management Science*, *63*(3), 818–828.

Kortmann, S., Gelhard, C., Zimmermann, C., & Piller, F. T. (2014). Linking strategic flexibility and operational efficiency: The mediating role of ambidextrous operational capabilities. *Journal of Operations Management*, *32*(7–8), 475–490.

Laker, L. F., Froehle, C. M., Windeler, J. B., & Lindsell, C. J. (2018). Quality and efficiency of the clinical decision-making process: Information overload and emphasis framing. *Production and Operations Management*, *27*(12), 2213–2225.

Lee, J. Y., Swink, M., & Pandejpong, T. (2011). The roles of worker expertise, information sharing quality, and psychological safety in manufacturing process innovation: An intellectual capital perspective. *Production and Operations Management*, *20*(4), 556–570.

Li, L. X., Benton, W., & Leong, G. K. (2002). The impact of strategic operations management decisions on community hospital performance. *Journal of Operations Management*, *20*(4), 389–408.

Lin, X., Zhou, Y.-W., Xie, W., Zhong, Y., & Cao, B. (2020). Pricing and product-bundling strategies for e-commerce platforms with competition. *European Journal of Operational Research*, *283*(3), 1026–1039.

Liu, Y., & Tsyvinski, A. (2021). Risks and returns of cryptocurrency. *The Review of Financial Studies*, *34*(6), 2689–2727.

Louis, H., & Sun, A. (2010). Investor inattention and the market reaction to merger announcements. *Management Science*, *56*(10), 1781–1793.

Lumineau, F., Wang, W., & Schilke, O. (2021). Blockchain governance—A new way of organizing collaborations? *Organization Science*, *32*(2), 500–521.

Mita, M., Ito, K., Ohsawa, S., Tanaka, H. 2019. What is stablecoin?: A survey on price stabilization mechanisms for decentralized payment systems. *2019 8th International Congress on Advanced Applied Informatics (IIAI-AAI)*. IEEE, 60–66.

Narasimhan, R., Swink, M., & Kim, S. W. (2006). Disentangling leanness and agility: An empirical investigation. *Journal of Operations Management*, *24*(5), 440–457.

Negandhi, A. R., & Reimann, B. C. (1973). Task environment, decentralization and organizational effectiveness. *Human Relations*, *26*(2), 203–214.

Norta, A., Othman, A.B., Taveter, K. 2015. Conflict-resolution lifecycles for governed decentralized autonomous organization collaboration. *Proceedings of the 2015 2nd International Conference on Electronic Governance and Open Society: Challenges in Eurasia*. Association for Computing Machinery, 244–257.

Pun, H., Swaminathan, J. M., & Hou, P. (2021). Blockchain adoption for combating deceptive counterfeits. *Production and Operations Management*, *30*(4), 864–882.

Puranam, P., Alexy, O., & Reitzig, M. (2014). What's "new" about new forms of organizing? *Academy of Management Review*, *39*(2), 162–180.

Rikken, O., Janssen, M., & Kwee, Z. (2019). Governance challenges of blockchain and decentralized autonomous organizations. *Information Polity*, *24*(4), 397–417.

Rondinelli, D. A. (1981). Government decentralization in comparative perspective: Theory and practice in developing countries. *International Review of Administrative Sciences*, *47*(2), 133–145.

Shang, G., Ilk, N., 2020. Need for speed, but how much does it cost? Unpacking the fee-speed relationship in cryptocurrency transactions. Available at: SSRN 3767489.

Shi, X., Yao, S., & Luo, S. (2021). Innovative platform operations with the use of technologies in the blockchain era. *International Journal of Production Research*, *1-19*, 1–19.

Siggelkow, N., & Levinthal, D. A. (2003). Temporarily divide to conquer: Centralized, decentralized, and reintegrated organizational approaches to exploration and adaptation. *Organization Science*, *14*(6), 650–669.

Singh, M., & Kim, S. (2019). Chapter four - blockchain technology for decentralized autonomous organizations. In S. Kim, G. C. Deka, & P. Zhang (Eds.), *Advances in computers* (pp. 115–140). Elsevier.

Tan, T. F., & Netessine, S. (2014). When does the devil make work? An empirical study of the impact of workload on worker productivity. *Management Science*, *60*(6), 1574–1593.

Tsoukalas, G., & Falk, B. H. (2020). Token-weighted crowdsourcing. *Management Science*, *66*(9), 3843–3859.

Vázquez, X. H. (2004). Allocating decision rights on the shop floor: A perspective from transaction cost economics and organization theory. *Organization Science*, *15*(4), 463–480.

Venkatesh, V., Windeler, J. B., Bartol, K. M., & Williamson, I. O. (2017). Person-organization and person-job fit perceptions of new it employees: Work outcomes and gender differences. *MIS Quarterly*, *41*(2), 525–558.

Voshmgir, S. (2020). *Token economy: How the web3 reinvents the internet*. BlockchainHub Berlin.

Wang, S., Ding, W., Li, J., Yuan, Y., Ouyang, L., & Wang, F.-Y. (2019). Decentralized autonomous organizations: Concept, model, and applications. *IEEE Transactions on Computational Social Systems*, *6*(5), 870–878.

Wang, Z., Zheng, Z., Jiang, W., & Tang, S. (2021). Blockchain-enabled data sharing in supply chains: Model, operationalization, and tutorial. *Production and Operations Management*, *30*(7), 1965–1985.

Wong, C. Y., Boon-Itt, S., & Wong, C. W. (2011). The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations Management*, *29*(6), 604–615.

Wright, A. (2021). The rise of decentralized autonomous organizations: Opportunities and challenges. *Stanford Journal of Blockchain Law & Policy*, *4*(2), 152–176.

Ziolkowski, R., Miscione, G., & Schwabe, G. (2020). Decision problems in blockchain governance: Old wine in new bottles or walking in someone else's shoes? *Journal of Management Information Systems*, *37*(2), 316–348.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

How to cite this article: Zhao, X., Ai, P., Lai, F., Luo, X. (R.), & Benitez, J. (2022). Task management in decentralized autonomous organization. *Journal of Operations Management*, 1–26. https://doi.org/10.1002/joom.1179