Journal DAO: User-Incentivized Autonomous Decentralized Scientific Publishing in Web3

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***Abstract*—The academic publishing industry is currently undergoing significant growth but also faces several challenges, mainly including the lack of transparency in the peer review process and the limited rights of authors. The rise of Web3, emphasizing decentralization, openness, and user control over data, opens up new perspectives for academic publishing. This article introduces an innovative academic publishing model, named Journal DAO, leveraging emerging Web3 technologies such as blockchain and decentralized autonomous organization (DAO). First, by recording articles on the blockchain rather than a specific database, Journal DAO can ensure data security and traceability of the articles. Second, through the governance framework of DAO, tokens are distributed among all the participants of Journal DAO based on the their contributions, safeguarding the rights of each role in the publishing process. Third, effective incentive mechanisms are proposed to reward all participants, ensuring the sustainability of the framework and its autonomous functionality. This work proposes a prospective academic publishing model that aims to reshape the industry through the application of blockchain and DAO in Web3, making a significant contribution to future academic publishing.**

***Index Terms*—Decentralized autonomous organizations, blockchain, Web3.0, decentralized funding, decentralized science**

I. Introduction

THE academic publishing industry is currently facing several pressing challenges. First, the traditional system, often conducted anonymously, fails to ensure fairness and impartiality, leading to a compromised review process that undermines both credibility and integrity. This lack of transparency can undermine the credibility and integrity of the review process. Second, the authors often lack control over associated data of their articles, since the ownership often rests with publishers or electronic databases [1]. This challenges authors in retaining rights, deciding on data use, and hampers their ability to fully leverage research, limiting collaborative opportunities and further advancements in their field. Third, the restrictions on data sharing hinder the free flow of knowledge and inhibit potential collaborations, which limits authors from fully benefiting and making discoveries that could contribute to the scientific community.

The emergence of technologies such as Decentralized Autonomous Organizations (DAOs) [2] and blockchain [3], [4] presents significant opportunities for the advancement of the academic publishing industry. DAOs offer a groundbreaking approach to organizational governance, decision-making, and fund management for academic publishing [5]. Unlike traditional hierarchical structures, DAOs operate without central authorities, relying on transparent and automated processes governed by smart contracts and consensus protocols [6]. This decentralization can provide a transparent and auditable decision-making process, enhance accountability, and facilitate efficient funds distribution for the current academic publishing system. The decentralized and tamper-resistant nature of blockchain can provide a secure and transparent environment for intelligent journals. By integrating blockchain technology into intelligent journals, the data transparency and authenticity can be realized. Through blockchain-based smart contracts, the reliability of data can be steadfastly guaranteed, thereby eliminating the necessity for third-party oversight [7]. This innovative approach not only enhances the credibility of information but also streamlines the process, fostering trust and efficiency within the realm of intelligent journals.

In the literature, the applications of blockchain-based decentralized technologies in academic publishing have received researchers' great attention [8]. Blockchain technology was used to solve the security and efficiency concerns in the distribution and management of open journal systems, ensuring precise distribution, enhancing reputation and trust, and safeguarding paper management against potential hacker threats [9]. Through decentralized InterPlanetary File System (IPFS) and blockchain technologies, the authenticity, trust and reliability of online publications can be ensured, which can effectively address the challenges related to security and privacy in online publications [10]. By leveraging blockchain-based decentralized technologies, a decentralized scientific

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publishing platform is established, which utilizes Ethereum smart contracts to expedite the publication process, reduce biases in peer review, and lower publication costs [11]. The platform can ensure complete traceability throughout the publication processes, and all the participants including the editors, reviewers, and authors will receive system tokens as rewards for their contributions.

However, these existing studies primarily concentrate on specific aspects, such as the use of blockchain to address security and efficiency concerns or enhance transparency in the academic publishing process. They do not comprehensively address the multifaceted challenges prevalent in the current academic publishing landscape. This article proposes an innovative academic publishing model called Journal DAO, which applies emerging Web3 technologies, such as blockchain and DAO, to address these challenges. First, by recording articles on the blockchain, all operations are conducted on the chain rather than belonging to a specific database, ensuring data security and traceability. Second, through the DAO framework, tokens are distributed based on role contributions, protecting the rights of researchers. Third, by designing effective incentive mechanisms, with the consideration of rewarding each participant according to their contributions to the article, which can realize a fully autonomous and economically sustainable Journal DAO ecosystem [12].

The rest of this paper is arranged as follows. Section II introduces the framework of Journal DAO framework. Section III discusses the design and implementation of the incentive mechanism in Journal DAO. Section IV presents experimental results validating the effectiveness of the implemented incentive mechanism. Section V concludes the paper.

II. Framework of Journal DAO

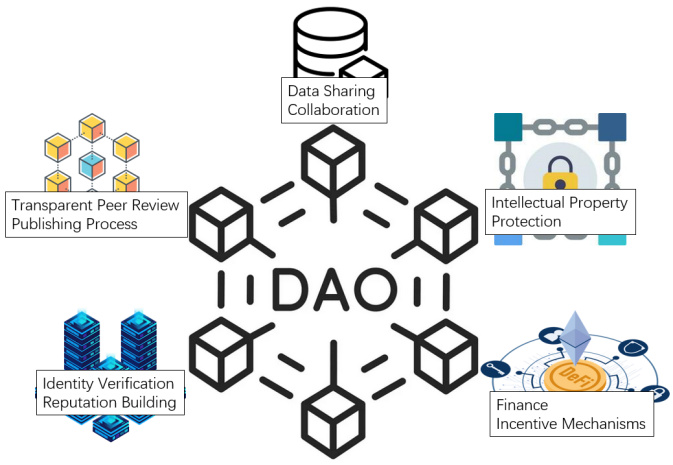

Fig. 1: Application of DAO in Article and Journal

According to the development of district DAO, related blockchain technology, the following DAO to Decentralized Scientific (DeSci) framework can be summarized as shown in the figure 1.It aims to establish a decentralized scientific publishing platform using blockchain and smart contract technology [13], enabling fair, transparent, and efficient scientific research dissemination [14] [15] [16].

- **Transparent Peer Review and Publishing Process:** Blockchain can be used to create a transparent academic publishing platform, ensuring transparency throughout the peer-review and publishing processes. [17] Smart contracts can manage review, publication, and payment procedures, ensuring traceability and fairness.
- **Protection of Intellectual Property:** Blockchain and smart contracts can safeguard authors' intellectual property, ensuring their works are not copied or distributed without permission [18].
- **Identity Verification and Reputation Building:** Blockchain can be employed to establish scholars' identities and reputations [19]. Smart contracts can automate the validation of scholars' achievements, storing them on the blockchain.
- **Data Sharing and Collaboration:** Blockchain and smart contracts can facilitate data sharing and collaboration among scholars, ensuring data integrity and traceability [20].
- **Finance and Incentive Mechanisms:** DAO and cryptocurrencies can be used to support research finance and incentive mechanisms.Funds can be allocated according to token weights [21].

These application examples highlight the potential value of blockchain, smart contracts, and DAO technology in academic publishing and journal management. They enhance transparency, protect intellectual property, verify identity, automate processes, and encourage collaboration. As these technologies continue to evolve, they hold promise for further innovation and efficiency in academia [22].

A. The Framework with Blockchain and DAO

Based on the depicted framework in Figure 2, it is evident that the operational flow of the blockchain and DAO framework, along with the roles of various participants [23], can be succinctly understood.

Initially, authors generate manuscripts that can be submitted for publication. However, unlike conventional websites where manuscripts reside solely on publishing servers, this framework ensures their credibility by immutably recording the publication process on the blockchain.

Subsequently, manuscripts undergo a rigorous peer review process, involving multiple reviewers who diligently evaluate them. Only manuscripts that successfully pass the review are considered for publication. In cases where revisions are necessary, manuscripts are returned to the authors accompanied by specific feedback. Importantly, this entire review process is transparently recorded on the blockchain, thereby ensuring objectivity and effectiveness in the evaluation. In the event of manuscript rejection, authors have the opportunity to resubmit their work for publication, with this resubmission process meticulously documented on the blockchain. This traceability feature guarantees complete transparency throughout the submission process.

Upon successful completion of the review process, approved manuscripts are published. This publication is also recorded on the blockchain and subsequently integrated into the DAO

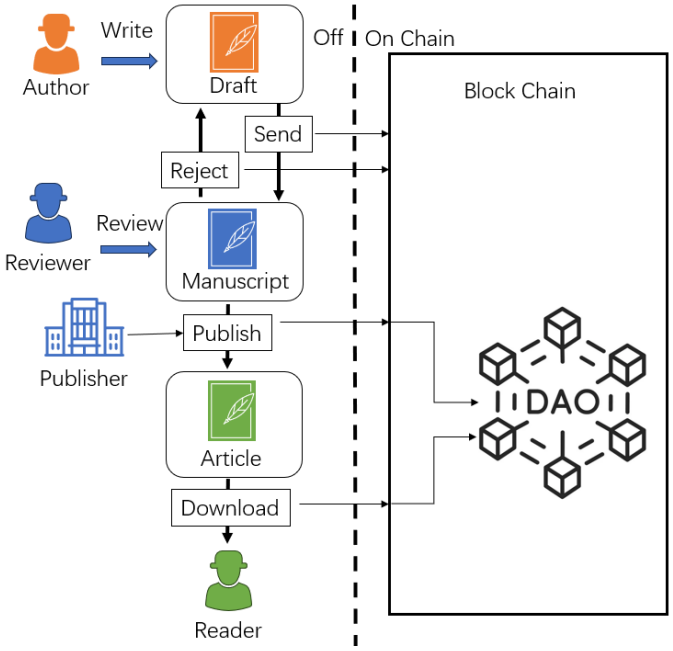

Fig. 2: Framework of Blockchain.

framework, where contribution allocation occurs in accordance with established procedures [24]. Readers can access and download published articles, with this downloading process also being recorded on the blockchain. Such a record ensures an accurate reflection of article downloads and citations. Furthermore, downloads and citations are incorporated into the DAO framework, facilitating the equitable allocation of contributions. Readers, being pivotal in determining the value of articles, receive corresponding contributions within the framework.

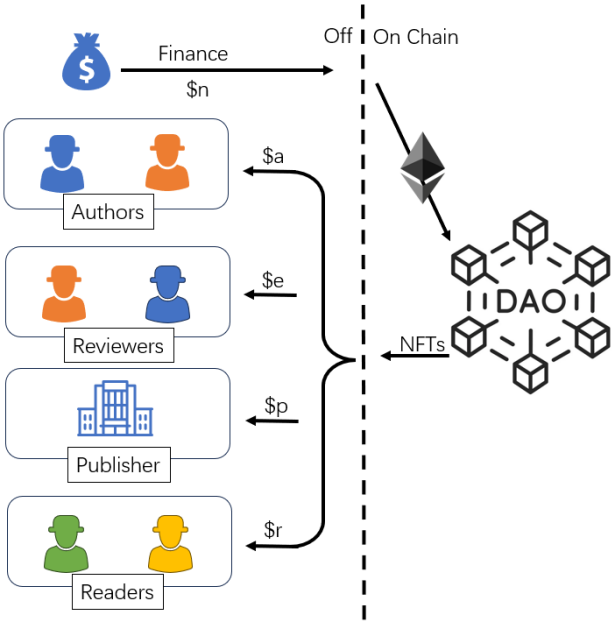

Fig. 3: Distribute Finance by Tokens

In the DAO framework, as illustrated in Figure 3, token allocation follows a process where all participants, including authors, reviewers, readers, and publishers, are assigned contributions represented by tokens. This allocation is carried out based on the established procedures within the framework. Within this context, Non-Fungible Tokens (NFTs) can be utilized as a means to determine the distribution proportions of tokens. NFTs are unique tokens that represent specific assets or contributions [25]. By employing NFTs, the token allocation process becomes more granular, allowing for a more precise distribution based on the individual contributions of each participant. When finance is generated within the framework, it is distributed among all token holders according to the predetermined token allocation mechanism. The allocation is determined by the proportion of tokens held by each participant, reflecting their respective contributions and responsibilities within the framework. By implementing token allocation based on NFTs and distributing finance according to the token distribution mechanism, all stakeholders in the DAO framework receive their fair shares in proportion to their token holdings. This incentivizes active participation and ensures that contributors are rewarded appropriately for their contributions within the framework.

B. The Operation Process

In the practical implementation of the Journal DAO, this paper leveraged the Aragon framework to establish a decentralized and transparent infrastructure for academic publishing. The execution of the DAO involved several key steps to ensure a seamless and fair distribution of tokens among participants [26]. In a DAO, the concept of incentive mechanisms plays a crucial role in driving active participation and contributions. These mechanisms are designed to provide incentives and rewards to individuals or entities involved in the DAO's activities. By offering tangible benefits such as token rewards, governance rights, or recognition, participants are motivated to actively engage and contribute to the DAO's growth and development. Effective incentive mechanisms foster collaboration, maintain long-term motivation, and encourage innovation within the DAO community. The incentive design of journal dao promotes collaboration, maintains long-term incentives, and promotes innovation within the DAO community in the following aspects.

1) Author Rewards:
   Authors receive tokens based on the evaluation provided by reviewers during the submission process. The more constructive and impactful the reviews, the higher the token allocation to the authors.
2) Reviewer Incentives:
   Reviewers are rewarded with tokens for their valuable contribution to the peer-review process. This includes providing insightful feedback and assisting in maintaining the quality of published work.
3) Publication and Download Rewards:
   Upon successful publication, both authors and users who download the papers are granted tokens. This encourages not only the creation of quality content but also its dissemination and accessibility.

4) Citation Bonuses:
Authors receive additional tokens when their published work is cited by other researchers. This incentivizes the production of influential and impactful research that contributes to the academic community.

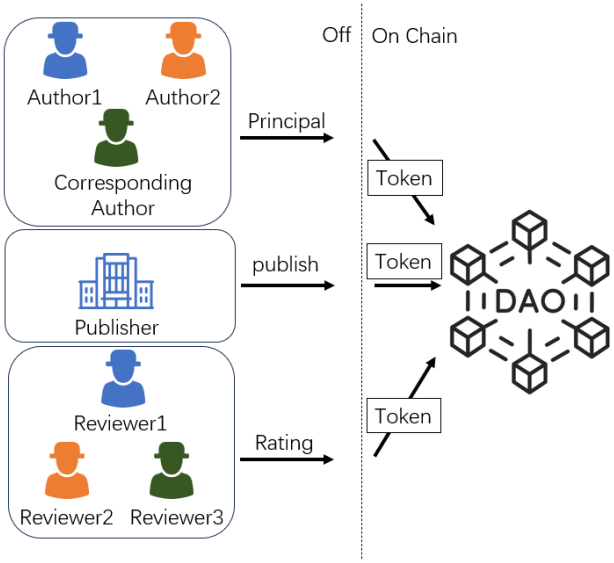

Fig. 4: Distribute Token by DAO When Publishing

The workflow of the DAO, as shown in Figure 4 depicted in the diagram begins with the submission of a manuscript by the user for publication. As the DAO initiates the token minting process, specific rules guide the allocation of tokens. Authors are categorized into corresponding roles such as corresponding author, first author, second author, and third author, and so on, each receiving a different token allocation based on their contributions and responsibilities within the manuscript. Similarly, reviewers play a crucial role in the token allocation process. Their allocation is determined by their role in the review process and the ratings they provide for the submitted manuscripts. The publisher, as the platform responsible for facilitating manuscript publication, also receives a certain allocation of tokens due to their administrative role in managing the manuscripts.

This meticulous token allocation mechanism ensures that each contributor, be it an author or a reviewer, receives fair rewards based on their specific contributions and responsibilities [27]. By implementing such a structured system, the DAO creates a transparent and equitable environment, aligning the incentives for authors and reviewers. This not only cultivates a sense of fairness within the system but also encourages active and meaningful participation from all parties. Guided by DAO principles, the workflow fosters seamless integration of all stakeholders, ensuring a well-functioning and self-sustaining ecosystem.

In this system, authors, reviewers, publisher, readers(who download the papers or references) all possess a specific quantity of tokens. These tokens are considered as NFTs due to their unique nature. Once finance is generated, such as when a user pays to download a paper as Figure 5, the system allocates this finance based on the number of tokens held by the

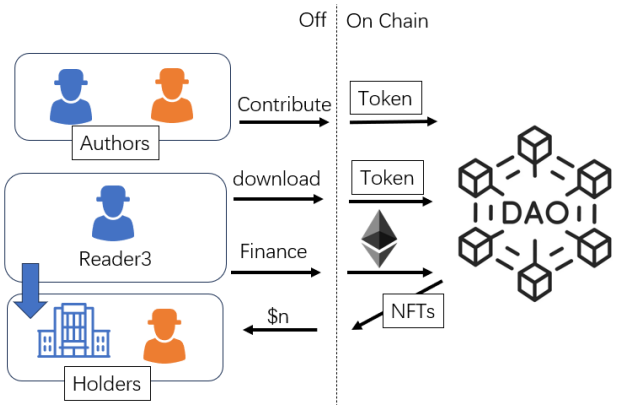

Fig. 5: Distribute Token and Dinance by DAO When Downloading

respective parties.This design ensures objectivity, fairness, and transparency within the system. Each participant's contribution is reflected in a specific number of tokens, and the allocation mechanism operates according to the quantity of these tokens. Such a design not only enhances the fairness of the incentive mechanism but also makes the entire system more transparent, allowing participants to clearly understand the relationship between their contributions and rewards.This NFT-based token system provides tangible and verifiable returns for contributors while establishing an effective and operable incentive mechanism for the entire ecosystem [28]. This fair and transparent allocation method is expected to drive collaboration and development in the academic community, creating a mutually beneficial environment for all stakeholders.

C. Advantages of Finance in Journal DAO

In the current web2.0 landscape, both literature storage and payment systems are typically centralized, controlled by a single entity or organization. However, in the decentralized web3.0 network, article data resides directly on the blockchain [29], with websites serving as interfaces to access this data [30] [31] [32]. In this new framework, payments for article downloads are automated and executed through smart contracts within the DAO framework [33]. This ensures complete transparency and traceability, as the fund distribution process follows predefined rules without centralized supervision [34].

In the Web 3.0 paradigm, this novel model signifies a departure from reliance on traditional intermediaries. Instead, it empowers users with the direct participation in DAO frameworks, utilizing smart contracts for automated and secure fund distribution [35]. This shift not only achieves decentralization in the transaction process but also enhances the efficiency of academic article transactions. In the Web 3.0 environment, articles are directly uploaded to the blockchain. All operations, including payment processing and fund distribution, are seamlessly executed through smart contracts. This innovative framework ensures complete transparency and traceability throughout the entire process. When users pay to download articles, the funds are automatically allocated according to the rules established within the DAO framework, eliminating the need for any centralized oversight.

III. Mechanism Design of Journal DAO

This paper combines the fundamental concepts of DAO to establish a framework for implementing DAO in academic journals. The framework begins with the issuance of tokens, which are allocated to all participants involved in the publication process, including reviewers, authors, and readers, through a specified mechanism. These tokens serve as a means to determine the weightage of proposals, and the framework utilizes the token distribution to allocate financial resources accordingly. By integrating token-based incentives and governance mechanisms, this framework ensures a fair and transparent distribution of resources within the DAO-operated journal ecosystem. Participants holding tokens can actively participate in the processes of all aspects of the article publication, such as send articles, review articles, and download articles, thereby influencing the allocation of financial resources based on their token holdings. Through this framework, the DAO-operated journal can foster an inclusive and democratic environment, empowering participants to shape the direction and priorities of the journal based on their token weightage.

$$\begin{bmatrix} A_t \\ E_t \\ P_t \\ R_t \end{bmatrix} = \omega_{t-1} \begin{bmatrix} A_{t-1} \\ E_{t-1} \\ P_{t-1} \\ R_{t-1} \end{bmatrix} + \omega_{t-2} \begin{bmatrix} A_{t-2} \\ E_{t-2} \\ p_{t-2} \\ R_{t-2} \end{bmatrix} + \cdot + \omega_n \begin{bmatrix} A_n \\ E_n \\ P_n \\ R_n \end{bmatrix} \quad (1)$$

By applying the DAO framework to academic journals in accordance with the proposed Equation 1, each action taken within the system has the potential to alter future benefits. Through a well-structured incentive mechanism, the entire DAO ecosystem can achieve a state of perfect autonomy. This means that the actions and decisions made by participants, including authors, reviewers, and readers, have a direct impact on the overall functioning and success of the journal [36]. With the right incentives in place, the DAO-operated journal can foster a self-sustaining and self-regulating environment, where participants are motivated to actively engage, contribute their expertise, and collectively drive the advancement of scholarly knowledge.

A. Decentralized Governance

DAO, adopting a decentralized governance model, allows token holders to participate in the decision-making process. This ensures community involvement in platform development, creating a democratic and inclusive environment. With robust incentives in place, token holders have made outstanding contributions while also receiving greater rewards. This positive feedback loop forms a self-sustaining ecosystem of active governance [37]. DAOs leverage blockchain technology to provide transparency and trust, recording all proposals, votes, and transactions on the blockchain for public verification. Incentives motivate token holders to actively engage in the governance process, while DAOs offer a meritocratic approach that values expertise. The flexibility and adaptability of DAOs allow them to evolve and respond to the needs of the community. However, challenges such as active participation, governance gridlocks, and power concentration need to be addressed through clear rules and mechanisms. Overall, DAOs empower token holders, foster community involvement, and create a democratic and inclusive environment [38].

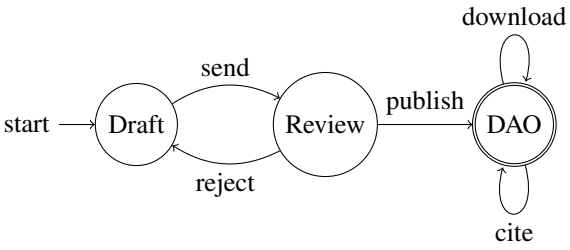

Fig. 6: Events of Article in Framework

The implementation of the Journal DAO (Figure 6) has yielded positive results in terms of increased engagement, quality submissions, and a more inclusive academic ecosystem. The transparent and automated token distribution mechanisms have effectively addressed issues of ownership and reward distribution, fostering a collaborative and fair scholarly environment. In order to create a strong incentive for active participation, a well-designed incentive mechanism is implemented in the decentralized governance framework. After authors publish their papers, the generated finance from user downloads is distributed not only to the publishers but also to all the authors and reviewers, motivating authors to produce high-quality articles and encouraging more individuals to serve as reviewers. To further enhance participation, readers who download the papers are also allocated a share of the revenue. This encourages more people to download the papers, leading to increased revenue for the DAO. As a result, all participants are incentivized to actively engage in the ecosystem, fostering a thriving and automatic academic community. This incentive mechanism ensures that all contributors, including authors, reviewers, and readers, are fairly rewarded for their contributions. It creates a positive cycle where authors are motivated to produce quality work, reviewers are incentivized to provide valuable feedback, and readers are incentivized to access and support the academic content. Overall, this system promotes a healthy and autonomous academic ecosystem within the DAO framework [39].

B. Initial Token Distributions

In the DAO framework, tokens are minted during key events such as article publication, downloads, and citations, and then distributed to participants according to predetermined proportions. All these processes are executed through smart contracts, ensuring transparency and traceability. Having a well-designed token allocation mechanism forms the foundation of the entire framework, enabling a self-sustaining and self-regulating environment. With a fair token distribution mechanism, the DAO framework can create a system where participants are incentivized to contribute and engage actively. The allocation of tokens based on specific events fosters a sense of fairness and encourages collaboration among authors, readers, reviewers, and publishers. The transparent and traceable nature of the smart contract-based processes ensures that

the token distribution is open to scrutiny and can be verified by all participants. In this self-regulating environment, the DAO framework can adapt and adjust dynamically based on the actions and contributions of its participants. The token allocation mechanism serves as a means to reward and recognize the efforts of contributors, fostering a sustainable ecosystem where knowledge sharing and collaboration thrive.

$$\begin{aligned} D_0 &= \sum_{i=1}^{m} x_i \\ 1 &= \alpha_1 + \alpha_2 + \alpha_3 \\ A_0 &= \alpha_1 D_0 \quad (A = \{a_0, a_1, a_2, a_3, \cdots a_n\}) \\ E_0 &= \alpha_2 D_0 \quad (E = \{e_1, e_2, e_3, \cdots e_m\}) \\ P_0 &= \alpha_3 D_0 \quad (P = \{p\}) \end{aligned} \tag{2}$$

Upon publication of an article, a DAO specific to that particular article is established, and tokens are minted and distributed among the authors, reviewers, and the publisher. The total number of tokens minted after this process, denoted as D_0, is determined based on Equation 2, taking into account the distribution proportions among the three parties: α_1, α_2, and α_3. Consequently, the allocation of tokens is as follows: the authors receive $A_0 = \alpha_1 D_0$, the reviewers receive $E_0 = \alpha_2 D_0$, and the publisher receives $P_0 = \alpha_3 D_0$.

$$\begin{aligned} 1 &= \beta_0 + \beta_1 + \beta_2 + \beta_3 + \cdots + \beta_n (\beta_1 \geq \beta_2 \geq \beta_3 \cdots \geq \beta_n) \\ a_i &= \beta_i A \quad (a \in A) \\ a_{i0} &= \beta_i A_0 \quad (a_0 \in A_0) \end{aligned} \tag{3}$$

In the case of having a total of n authors, the allocation of tokens for each author is determined by the proportions specified in Equation 3. In this equation, β_0 represents the token allocation for the corresponding author, β_1 represents the token allocation for the first author, β_2 represents the token allocation for the second author, and so on. The total number of tokens allocated to all authors is denoted as A, and each author a_i receives a portion of tokens distributed according to the respective β ratio.When the article is published, tokens are minted and distributed to all authors. The total number of tokens allocated to the authors is denoted as A_0, and each author a_{i0} receives tokens distributed in the same proportions as determined by the β ratios.

$$\begin{aligned} 1 &= \gamma_1 + \gamma_2 + \gamma_3 + \cdots + \gamma_m \\ e_i &= \gamma_i E \quad (e \in E) \\ e_{i0} &= \gamma_i E_0 \quad (e_0 \in E_0) \end{aligned} \tag{4}$$

The number of reviewers is denoted as m, the allocation of tokens for each reviewer follows the proportions specified in Equation 4. In this equation, the token allocation for each reviewer e_i is determined by the respective γ ratio. The proportions for the reviewers may be determined based on other factors, such as the role the reviewers. The total number of tokens allocated to all reviewers is denoted as E.When the article is published, tokens are minted and distributed to all reviewers. The total number of tokens allocated to the reviewers is denoted as E_0, and each reviewer e_{i0} receives tokens distributed in the same proportions as determined by the γ ratios. The distribution mechanism remains consistent with that of the authors.

C. Token Distributions upon Article Download or Citation

Unlike the singular issuance of tokens associated with article publication, the act of downloading articles by users as readers is a recurring event that perpetually exists within the DAO framework. The act of downloading an article not only represents recognition of the article itself but also serves as recognition of the article's author. Therefore, tokens need to be allocated to the authors, with the primary author and corresponding author, who contribute the most, receiving a larger share. Furthermore, readers who download articles both recognize the value of the article and also receive tokens as a result. This dual recognition mechanism ensures that both authors and readers are rewarded within the DAO framework. By allocating tokens to authors and readers, the system fosters a sense of acknowledgment and incentivizes active participation from all stakeholders involved in the publication and consumption of articles.

$$\begin{aligned} D_1 &= D_{1a} + D_{1r} \\ A_1 &= D_{1a} \\ \Sigma_1^A &= A_0 + A_1 \\ E_1 &= 0 \\ P_1 &= 0 \\ R_1 &= D_{1r} \end{aligned} \tag{5}$$

After the publication of the article, when users read and download the article, additional token minting occurs according to the formula specified in Equation 5. The purpose of this additional token minting is to incentivize authors and provide benefits to readers. In this process, new tokens are allocated to both authors and readers, while the token allocations for reviewers and the publisher remain unchanged.

$$\begin{aligned} 1 &= \beta_{1,0} + \beta_{1,1} + \beta_{1,2} \\ a_{1,0} &= A_1 \beta_{1,0} \\ a_{1,1} &= A_1 \beta_{1,1} \\ a_{1,2} &= A_1 \beta_{1,2} \end{aligned} \tag{6}$$

According to Equation 6, the tokens generated through the user's download behavior will be allocated to the corresponding author, first author, and second author in certain proportions. However, the token allocations for other authors remain unchanged.

$$\begin{aligned} D_2 &= D_{2a} + D_{2r} \\ A_2 &= D_{2a} \\ \Sigma_2^A &= A_0 + A_1 + A_2 \\ E_2 &= 0 \\ P_2 &= 0 \\ R_2 &= D_{2r} \\ \Sigma_{r1} &= R_1 + R_2 \quad if \quad R_1 = R_2 \quad (r_1 \in R) \end{aligned} \tag{7}$$

According to Equation 7, if a user cites a previously downloaded article in their own article, it triggers token minting. The tokens generated in this case are allocated to both the authors of the cited article and the user who made the citation.

D. Finance Distributions by Token

By employing token allocation based on NFT principles, the framework ensures a fair distribution of rewards among token holders. Through transparent smart contracts, the DAO framework establishes a self-regulating environment that incentivizes active participation and contribution. The implementation of this token-based distribution mechanism requires tracking token ownership and automated distribution of finance.

$$
\begin{aligned}
1 &= \frac{A}{D} + \frac{E}{D} + \frac{P}{D} + \frac{R}{D} = \alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 \\
F &= finance \\
F_A &= \alpha_1 F \quad (A = \{a_0, a_1, a_2, a_3, \cdots a_n\}) \\
F_E &= \alpha_2 F \quad (E = \{e_1, e_2, e_3, \cdots e_m\}) \\
F_P &= \alpha_3 F \quad (P = \{p\}) \\
F_R &= \alpha_4 F \quad (R = \{r_1, r_2, r_3, \cdots r_i\})
\end{aligned} \tag{8}
$$

According to Equation 8, the token allocation ratios for authors, reviewers, publisher, and readers are denoted as α_1, α_2, α_3, and α_4, respectively. Once finance is generated, it is distributed to all token holders based on these ratios. To respect intellectual property rights, many publishers require users to pay for downloading articles. In such cases, finance enters the DAO and is distributed to all authors, reviewers, publisher, and readers according to their token ratios. Articles typically attract a significant number of downloads, with exceptional ones garnering even more. Importantly, this distribution mechanism enables sustained earnings, thereby incentivizing authors to produce higher quality articles. While users initially act as consumers when downloading articles, they also become partial owners of the downloaded articles. As a result, they are eligible to receive a portion of the generated finance based on their token ratios. Motivating readers is crucial as it encourages them to willingly pay for article downloads, ultimately creating more finance and fostering a real automated organization. By implementing this approach, all participants receive fair allocations for their contributions. The autonomous nature of the framework drives authors to produce outstanding articles and incentivizes readers to pay for downloads, thereby generating more finance and establishing a virtuous cycle within the system.

IV. A Case Study

In addition to the theoretical framework, there need conducted simulations to evaluate the effectiveness of the proposed DAO system [40]. Table I presents results from 20 simulated downloads, illustrating the distribution of finance among holders. This simulation provides a comprehensive overview of how finance is allocated to holders based on their token holdings [41]. And did data visualization processing [42]. Within the DAO framework, authors, as the owners of the articles, experience an increase in their tokens and ownership ratio when their articles are downloaded or cited, leading to higher profits. Reviewers, as participants in the article review process, initially receive tokens that do not increase over time. Although their ownership ratio gradually decreases, their profits continue to increase. The accuracy of their ratings directly benefits themselves. Readers, during the process of downloading and citing, also receive tokens, albeit in smaller quantities and with lower ownership ratios. However, as the articles are downloaded or cited, their overall profits increase. Additionally, the profit margin gradually decreases, meaning that readers who download and cite the articles in the early stages will benefit from higher profits, thus incentivizing the early identification of outstanding articles.

A. Proportion of Trend

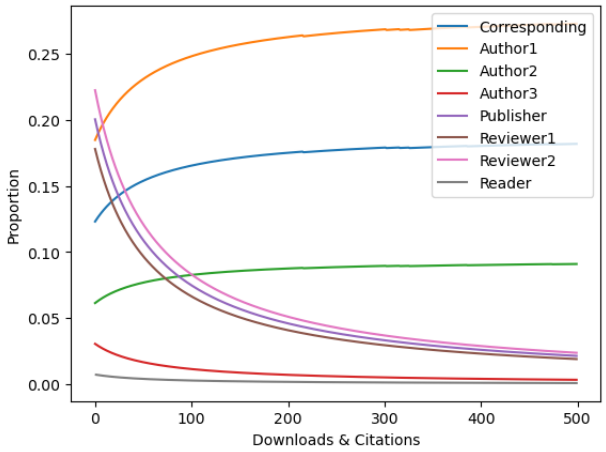

Fig. 7: Proportion of All.

Integrating DAO technology into the realm of academic journals holds immense potential for benefiting authors, reviewers, and readers alike. Look at Figure 7. Authors, being the rightful owners of their published works, would reap the most substantial rewards from such a system. By leveraging the decentralized nature of DAOs, authors can secure a greater share of the financial gains associated with their articles. As time progresses, their earnings could potentially increase, providing a long-term incentive for continued contributions. Reviewers, as the gatekeepers and custodians of scholarly integrity, would also stand to gain from the implementation of DAOs in journals. Initially, they would hold a higher proportion of benefits, reflecting their crucial role in the early stages of article evaluation. However, as time progresses and articles are published, their share of benefits may gradually diminish, ensuring a fair distribution of rewards among all stakeholders. Readers, as active participants in the scholarly discourse, would also have the opportunity to benefit from DAO-operated journals. While their gains may be comparatively lower than authors and reviewers, early engagement with the DAO ecosystem could yield higher returns. By accessing articles and participating in the DAO's governance processes,

TABLE I: Finance for DAO.

	Authors				Publisher	Reviewers		Readers	
index	Corresponding	Author1	Author2	Author3	Publisher	Reviewer1	Reviewer2	Download	Cite
0	0.122997	0.184696	0.061298	0.030449	0.200321	0.177885	0.222356	0	0
1	0.124113	0.186367	0.061860	0.029945	0.197006	0.174941	0.218676	0.007092	0
2	0.125194	0.187984	0.062403	0.029457	0.193798	0.172093	0.215116	0.006977	0
3	0.125000	0.187688	0.062312	0.028529	0.187688	0.166667	0.208333	0.006757	0.013514
4	0.126016	0.189209	0.062823	0.028086	0.184775	0.164080	0.205100	0.006652	0.013304
5	0.127001	0.190684	0.063319	0.027656	0.181951	0.161572	0.201965	0.006550	0.013100
6	0.127957	0.192115	0.063799	0.027240	0.179211	0.159140	0.198925	0.006452	0.012903
7	0.128884	0.193503	0.064266	0.026836	0.176554	0.156780	0.195975	0.006356	0.012712
8	0.129784	0.194850	0.064718	0.026444	0.173974	0.154489	0.193111	0.006263	0.012526
9	0.130658	0.196159	0.065158	0.026063	0.171468	0.152263	0.190329	0.006173	0.012346
10	0.131508	0.197431	0.065585	0.025693	0.169033	0.150101	0.187627	0.006085	0.012170
11	0.132333	0.198667	0.066000	0.025333	0.166667	0.148000	0.185000	0.006000	0.012000
12	0.133136	0.199869	0.066404	0.024984	0.164366	0.145957	0.182446	0.005917	0.011834
13	0.133917	0.201038	0.066796	0.024643	0.162127	0.143969	0.179961	0.005837	0.011673
14	0.134677	0.202175	0.067179	0.024312	0.159949	0.142035	0.177543	0.005758	0.011516
15	0.134268	0.201558	0.066978	0.023676	0.155763	0.138318	0.172897	0.005607	0.011215
16	0.134994	0.202645	0.067343	0.023370	0.153752	0.136531	0.170664	0.005535	0.011070
17	0.135701	0.203704	0.067699	0.023072	0.151791	0.134791	0.168488	0.005464	0.010929
18	0.136391	0.204736	0.068046	0.022782	0.149880	0.133094	0.166367	0.005396	0.010791
19	0.137063	0.205743	0.068384	0.022499	0.148017	0.131439	0.164298	0.005329	0.010657
20	0.137719	0.206725	0.068713	0.022222	0.146199	0.129825	0.162281	0.005263	0.010526
Total	2.749313	4.127544	1.371082	0.543292	3.574286	3.173966	3.967458	0.121463	0.214788

readers can contribute to the growth and success of the journal, potentially increasing their benefits over time. The implementation of DAO mechanisms, such as token-based incentives, transparent governance structures, and decentralized decision-making processes, would enable a fair and equitable model for academic journals. This model fosters a sense of ownership, rewards active participation, and ensures the sustainability and long-term viability of the journal ecosystem.

B. Break Even of User Download

Indeed, allowing users to offset their expenses or even earn profits through downloading articles can effectively stimulate user participation. While individual reader earnings may be modest, readers constitute the largest group within the DAO framework, making them a critical factor for the system's autonomy. By providing readers with the opportunity to offset their expenses or earn profits, the DAO framework can incentivize their active engagement. Despite individual earnings being relatively small, the cumulative impact of a large number of readers participating in the ecosystem contributes significantly to the overall success and sustainability of the DAO [43]. As a result, readers play a crucial role in driving the self-governing nature of the DAO framework.

The total revenue for downloading users is depicted in Figure 8. As readers who own the downloaded articles, their total revenue increases with a growing number of users downloading the articles. However, as more readers download the article and become owners, the individual token proportion naturally decreases. Consequently, the per-download revenue gradually declines. To simulate the distribution ratios following scenario, mainly look at the key break-even points [44]: the first reader who downloads the article breaks even when the article is downloaded 559 times; the tenth reader breaks even when the article reaches 651 downloads; and the one hundredth reader breaks even at a staggering 1579 downloads. This incentive mechanism aims to encourage readers to discover exceptional

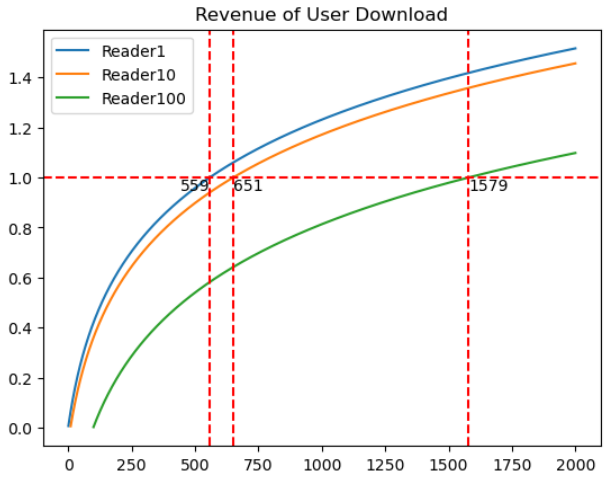

Fig. 8: Revenue of User Download.

articles earlier rather than following the crowd since owning the article no longer yields significant returns. This approach incentivizes readers to identify outstanding articles sooner, as the potential for substantial earnings diminishes once an article has already demonstrated its quality.

C. Real Article simulation

Furthermore, we applied our DAO framework to a real-world case by analyzing a published paper with 2154 downloads and 42 citations. As shown in Table II. By simulating the income distribution within the current DAO structure [45], we observed that download users not only offset their initial payment but also gained additional earnings. The incentivized system encourages users to respect copyright and, more importantly, has achieved a level of autonomy.The provided tables and case study demonstrate the practical application and positive outcomes of our proposed DAO framework. By

TABLE II: Finance of Real Article for DAO.

	Authors				Publisher	Reviewers		Readers	
index	**Corresponding**	**Author1**	**Author2**	**Author3**	**Publisher**	**Reviewer1**	**Reviewer2**	**Download**	**Cite**
0	0.122997	0.184696	0.061298	0.030449	0.200321	0.177885	0.222356	0	0
1	0.124113	0.186367	0.061860	0.029945	0.197006	0.174941	0.218676	0.007092	0
2	0.125194	0.187984	0.062403	0.029457	0.193798	0.172093	0.215116	0.006977	0
3	0.126240	0.189550	0.062929	0.028986	0.190694	0.169336	0.211670	0.006865	0
4	0.127252	0.191066	0.063438	0.028529	0.187688	0.166667	0.208333	0.006757	0
...	...	...	...	...	...	...	...	...	...
998	0.184995	0.277503	0.092486	0.001690	0.011121	0.009876	0.012345	0.000400	0.000801
999	0.185000	0.277511	0.092489	0.001689	0.011111	0.009867	0.012333	0.000400	0.000800
1000	0.185005	0.277519	0.092491	0.001687	0.011101	0.009857	0.012322	0.000400	0.000799
1001	0.185010	0.277526	0.092494	0.001686	0.011090	0.009848	0.012310	0.000399	0.000799
1002	0.185015	0.277534	0.092497	0.001684	0.011080	0.009839	0.012299	0.000399	0.000798
...	...	...	...	...	...	...	...	...	...
2151	0.186032	0.279053	0.093011	0.000803	0.005285	0.004693	0.005867	0.000190	0.000381
2152	0.186034	0.279056	0.093012	0.000803	0.005283	0.004691	0.005864	0.000190	0.000380
2153	0.186036	0.279059	0.093013	0.000803	0.005281	0.004689	0.005861	0.000190	0.000380
2154	0.186038	0.279062	0.093014	0.000802	0.005278	0.004687	0.005859	0.000190	0.000380
Total	392.406327	588.652390	196.160264	6.520750	42.899672	38.094909	47.618636	1.537177	1.768627

aligning incentives with user behaviors, the system not only offsets costs for downloaders but also significantly incentivizes engagement. This not only respects copyright but also establishes a self-sustainable and autonomous ecosystem, providing valuable insights for the future development of decentralized academic publishing.

After voluntarily making a payment, users' ability to participate contributes to a robust incentive mechanism, fostering a sense of autonomy within the entire framework. Through this design, users become direct contributors to financial activities, injecting new value into the framework and creating potential opportunities for self-reward. This decentralized autonomous model empowers users to engage directly in decision-making and contributions, shaping a more open, fair, and virtuous ecosystem. Overall, this autonomous framework cultivates a more positive and sustainable participation experience for users and the entire community. Through the detailed simulations and analyses, the incentive mechanisms within the DAO framework emerge as crucial drivers in shaping the dynamics of authorship and user participation. As downloads and citations increase, the token-driven rewards become a powerful motivator for authors, leading to an accumulation of influence and financial gains. This incentive structure not only acknowledges and rewards the contributions of authors but also establishes a direct correlation between their efforts and the benefits they accrue. Furthermore, users who engage with the system by downloading papers witness a direct impact on their influence and, subsequently, on their earnings. This creates a dual incentive structure, where authors and users are mutually motivated to contribute to and participate in the DAO environment. The concept of decentralized autonomy becomes evident as the system operates independently, fostering a self-sustaining loop of contributions, rewards, and governance. In this context, the DAO framework provides a powerful tool for aligning interests and promoting a fair distribution of rewards based on tangible contributions. The transparency and automation inherent in DAO contribute to a governance model that minimizes external intervention, allowing the ecosystem to evolve organically through the collective actions of its participants. This synergy of incentives and autonomy within DAO not only enhances the overall efficiency of the academic publishing model but also creates a robust and self-regulating environment for authors and users alike [46].

V. Conclusion

This paper extensively explores the framework of DAO and provides a thorough analysis of its potential applications in the academic publishing domain. By placing papers on the blockchain, we have achieved transparency in ownership, allowing authors to have complete control over their works while also creating diverse financial opportunities. The autonomous nature of DAO enables users to directly participate in decision-making and contributions, constructing an ecosystem that is open, fair, and characterized by positive feedback loops. Under this framework, users can not only pay for paper downloads but also receive rewards through participation in financial activities. This novel academic publishing model grants authors greater creative freedom while motivating users to actively engage, contribute, and share knowledge. The decentralized autonomous design brings a more open and fair publishing mechanism to academia, breaking away from the limitations of traditional academic publishing.

Once an article is recorded on the blockchain, it opens up endless possibilities for the future, and the application of DAOs is expected to become increasingly widespread. Starting with the initial use of tokens to govern proposals, the introduction of NFTs, and now the emergence of recursive inscriptions, we are witnessing the continuous development of new applications within the DAO ecosystem. These advancements indicate that the realm of DeSci can also benefit from these innovative applications. The integration of blockchain technology, NFTs, recursive inscriptions, and other emerging technologies within DeSci can revolutionize the way scientific research is conducted, incentivize collaboration, facilitate knowledge sharing, and enhance the overall efficiency and transparency of the scientific process. As the technological landscape continues to evolve, we can expect to see even more novel applications that will further enhance the capabilities and impact of DeSci.

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