Scientific Commons—A Decentralized Scientific Publishing Mechanism for Post-prints

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Abstract

[Objective] This paper introduces "commons theory" into the domain of scientific publishing to investigate its potential value in facilitating open sharing of scientific resources and optimizing scientific publishing workflows, thereby providing theoretical underpinning and practical reference for the construction of a high-level scientific journal system. Method: By integrating technologies including decentralization, smart contracts, and incentive mechanisms, we propose a systematic framework for "science commons," establishing a scientific publishing mechanism co-governed by multiple stakeholders such as authors, reviewers, academic editors, and arbitration committees. Result: Science commons primarily encompasses a submission mechanism that synergizes preprints and journals in a complementary fashion, a review mechanism that promotes diversification of participants, and a post-review mechanism for journal quality control. Science commons subverts the traditional scientific publishing paradigm, transfers power from publishers to scientists, achieves genuine sharing of scientific resources, and reduces interference from non-scientific factors in the review process. Conclusion: This innovative publishing model provides a reference for sustainable development in the scientific publishing field, propelling it toward a more open, fair, free, and democratic scientific publishing system.

Full Text

Scientific Commons: A Decentralized Scientific Publishing Mechanism

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Abstract

[**Purposes**] This study introduces "commons theory" into the domain of scientific publishing to explore its potential value in promoting open sharing of scientific resources and optimizing scientific publishing processes, thereby providing theoretical support and practical reference for constructing a high-level scientific journal system.

[**Methods**] We propose a systematic framework for "Scientific Commons" that integrates decentralization, smart contracts, incentive mechanisms, and other technologies to establish a scientific publishing mechanism governed by multiple stakeholders including authors, reviewers, academic editors, and arbitration committees.

[**Findings**] Scientific Commons primarily comprises three components: a collaborative submission mechanism that complements preprints and journals, a review mechanism that promotes stakeholder diversification, and a post-review mechanism that ensures journal quality control. This framework subverts traditional scientific publishing models by transferring power from publishers to scientists, achieving genuine sharing of scientific resources and reducing interference from non-scientific factors in the review process.

[**Conclusions**] This innovative publishing model provides a reference for the sustainable development of scientific publishing, advancing it toward a more open, fair, free, and democratic scientific publishing system.

Keywords: Scientific Commons; Academic Publishing; Decentralized Autonomous Organization; Open Access; Preprints

[**Author Contribution Statement**]: YAN Zhaoping: Drafted the manuscript, designed research ideas and framework, revised the paper; SHI Jin: Proposed research direction, designed research ideas, revised final version; SHAO Bo: Revised final version; XU Tianyi: Designed research ideas and scheme, participated in revision; CHU Haoyan: Designed research ideas and scheme, participated in revision.

1. Introduction

Globally, the current scientific journal publishing industry has formed a monopolistic market centered around a few large academic publishers. Although this development trajectory has facilitated worldwide knowledge flow, its profit-maximization-oriented business model restricts the broad dissemination of scientific knowledge and equitable academic exchange, resulting in underutilization of scientific resources. Journal subscription fees remain prohibitively high, placing enormous financial pressure on research institutions and scholars who struggle to access the latest scientific resources, thereby affecting the quality and efficiency of scientific production. Furthermore, publisher-dominated centralized publishing systems may cause high-quality research to be overlooked. These issues demonstrate that existing scientific publishing models not only waste academic

resources but also introduce numerous non-scientific factors into processes such as publication and review, creating a series of challenges for the entire academic ecosystem [1].

To address the ineffective utilization of scientific resources, researchers have proposed various solutions. Among these, open access is considered an effective approach to promoting resource sharing [2]. This model makes academic literature freely available to the public, lowering information access barriers and facilitating widespread dissemination of scientific knowledge. While open access has improved information accessibility to some extent, it has not fundamentally altered the commercial logic of resource acquisition—it merely shifts costs from readers to authors. Preprint literature can be rapidly released through open access, but papers lacking rigorous peer review may suffer from quality uncertainties [3][4]. This raises concerns among researchers about paper quality and credibility while enabling rapid scientific communication. Consequently, although open access and preprints provide new avenues for broader dissemination of academic resources, they fail to fundamentally achieve resource sharing or ensure sustainable and high-quality academic exchange.

Regarding the current state of Chinese scientific journals, their competitiveness remains insufficient with relatively low international influence, leading to substantial outflow of valuable academic resources [5]. According to the *Blue Book of Chinese Sci-Tech Journals Development (2022)*, Chinese-authored papers account for 27.40% of total SCI papers, yet fewer than 4.67% are published in domestic SCI journals [6]. This severe outflow of excellent manuscripts not only threatens the security of Chinese scientific literature but also affects the independence and security of scientific information [7]. The *2022 China Statistical Report on Science and Technology Papers* indicates that China ranks first in high-quality international papers and second in highly-cited papers. Despite these high academic contributions and influence, China still lacks discourse power on the international academic stage [8]. Therefore, China urgently needs to break away from the Europe- and America-dominated academic, evaluation, and discourse systems to construct a scientific publishing mechanism that meets China's research capacity needs, promotes resource sharing, and ensures transparency.

In the current era of digitalization and informatization, the rise of blockchain technology and the spread of decentralization ideology are fundamentally transforming industries such as finance, logistics, and healthcare [9]. The emergence of decentralized technologies enables new scientific publishing mechanisms, creating novel paradigms for open, transparent, and efficient dissemination of academic research [10][11][12]. In such mechanisms, academic review is no longer limited to a few editors or review groups but achieves consensus through broad participation, granting researchers greater autonomy and involvement. This decentralized scientific publishing mechanism promises to incentivize academic innovation, promote globalization of academic exchange, and facilitate broader dissemination and sharing of research outcomes. Researchers worldwide have ex-

plored decentralized scientific publishing mechanisms. Tenorio-Fornés et al. designed a workflow for decentralized scientific publishing [13]. Swan examined blockchain applications in scientific publishing, emphasizing enhanced academic transparency and data immutability [14]. Domestic research has focused on blockchain's impact on traditional publishing models. Xu and Tian compared decentralized and traditional publishing mechanisms from a process perspective [15]. He and Teng discussed application frameworks for blockchain-based digital publishing platforms for scientific journals [16]. Zhi analyzed advantages of decentralized publishing platforms in peer review [17]. These analyses demonstrate that decentralized scientific publishing has attracted widespread scholarly interest, yet domestic research remains concentrated on comparing existing platforms without in-depth theoretical exploration or empirical studies. Critical issues such as effectively applying blockchain technology and decentralization concepts to improve scientific publishing, and establishing effective incentive and reputation systems, require further investigation.

Based on this analysis, this paper proposes the concept of Scientific Commons, integrating decentralized autonomous organization principles to establish a fair, free, open, and democratic scientific publishing ecosystem. In this system, key stakeholders including authors, reviewers, academic editors, and arbitration committees participate collectively in governance to advance scientific progress. The primary research objective is to construct a decentralized scientific publishing system through a decentralized autonomous organization model, achieving co-governance in scientific publishing. This paper focuses on: (1) elaborating the connotation of Scientific Commons and its key nodes; (2) constructing a systematic framework for Scientific Commons, designing a decentralized architecture including relevant technologies and specific functional modules; (3) designing key process mechanisms. The innovation lies in adopting a decentralized autonomous organization model that transfers power to scientists, achieving co-governance in scientific publishing. This model helps eliminate centralized authority in traditional publishing, optimize allocation of scientific resources, improve decision-making transparency and fairness, promote broader dissemination and sharing of academic research, foster academic innovation and continuous knowledge development, and thereby construct a world-class scientific journal system with Chinese characteristics.

2. Main Problems in Traditional Publishing Mechanisms

Current scientific publishing faces a series of challenges that affect not only efficiency and quality but also potentially hinder academic progress. Through synthesis of existing research, this paper identifies three primary problems: resource monopolization by large publishers, non-scientific factors in peer review, and a "credibility crisis" in published work. These issues involve key stages including publishing subscriptions, peer review, and post-review processes, collectively revealing deficiencies in traditional publishing mechanisms.

2.1 Resource Monopolization by Large Publishers

The European and American scientific journal development model is characterized by monopolization from a few large academic publishers, including Elsevier, Springer, and Wiley. This business model centers on profit maximization and publisher control over journals. According to the *2022 Global OA Journals and APC Monitoring Report* from the Chinese Academy of Sciences, Chinese authors paid a total of $650 million (approximately 4.3 billion RMB) in open access article processing charges in 2022. High journal subscription prices burden university libraries and other subscribers [18]. Research indicates these publishers own numerous high-impact journals, some with profit margins exceeding 30%, enabling them to monopolize substantial shares of the global scientific publishing market.

This model has generated controversies including unreasonable pricing, privatization of academic resources, and misalignment with academic communication goals [19]. On one hand, publishers expect experts to spend considerable time reviewing articles without providing appropriate compensation. On the other hand, publishers may charge authors for publishing their work while universities pay subscription fees to access scientific articles, yet most reviewers receive no proper recognition for their time and effort. Consequently, from the late 20th to early 21st century, scholars advocated for open access development to enable free dissemination of academic knowledge [20]. Open access proponents argue that research outcomes should be disseminated in the most open, transparent, and efficient manner without restrictions from high subscription fees [21]. Recently, organizations have begun resisting high subscription fees: on February 28, 2019, the University of California terminated subscriptions to Elsevier journals; on April 20, 2022, the Chinese Academy of Sciences ceased using the CNKI database, ending a 14-year partnership. Calls for open science have resurged.

Open access aims to break publishers' monopoly and profiteering from academic research information. However, this model faces shortcomings and challenges. First, open access relies on authors or institutions paying publication fees, potentially burdening researchers with limited financial resources, and merely shifts revenue sources from readers to authors without changing the commercial logic of journal publishing. Second, existing for-profit publishers offer green or gold open access with significant price fluctuations and insufficient pricing transparency [5]. Additionally, "predatory journals" that seek economic profit without rigorous peer review or academic standards threaten academic integrity.

2.2 Non-Scientific Factors in Peer Review

Peer review serves as a common quality assurance mechanism in academic research, where domain experts evaluate submitted papers to ensure quality, originality, and suitability [22]. However, this mechanism has several problems. First, peer review may involve excessive review time. The complex process includes expert evaluation, author revision, and re-review, potentially consum-

ing months or even longer, particularly in popular fields or busy journals [23]. Second, peer review may be influenced by reviewers' subjective judgments [24]. Different reviewers may hold varying perspectives based on their academic backgrounds, viewpoints, and experiences, leading to inconsistent results or biases. Furthermore, peer review may exhibit inherent conservatism and innovation suppression. Reviewers may 倾向于 accept manuscripts conforming to traditional viewpoints or research directions while remaining conservative toward breakthrough or disruptive ideas, potentially inhibiting publication of innovative research. Some studies may even be rejected due to inability to recruit sufficient or appropriate reviewers.

In summary, while traditional peer review remains crucial for ensuring academic quality, it suffers from drawbacks including excessive duration, subjectivity, and conservatism that require continuous improvement and exploration of new review mechanisms to address these deficiencies.

2.3 "Credibility Crisis" in Published Work

The "credibility crisis" in published research has become a major focus, with scholars proposing systems to serve as foundations for reproducible research [25][26]. Scientists have found that many published results are not easily replicable, raising concerns within the research community about result authenticity and credibility [27]. This issue involves research robustness and transparency in scientific practice, compelling us to consider how to ensure research reproducibility and verifiability to promote continuous knowledge accumulation.

According to a *Nature* survey of 1,576 scientists, over 70% of researchers could not reproduce other scientists' experiments [28]. Although 52% of respondents agreed that a significant "crisis" of reproducibility exists, fewer than 31% believed that failure to reproduce published results necessarily means the results are wrong, with most maintaining trust in published literature. It is estimated that pharmaceutical companies in the United States alone waste $28 billion annually on irreproducible life science research. In 2016, the top ten biopharmaceutical companies spent $63 billion on R&D [29].

These analyses demonstrate that beyond strictly controlling pre-publication processes like submission and review, current urgent needs include strengthening result verification, replication studies, and stricter experimental and data disclosure. This includes encouraging collaborative research to validate existing results and strengthening quality control to ensure all research stages meet scientific standards. Such measures help establish an open, transparent, and trustworthy academic environment that enhances research quality and credibility.

3. Connotation, System Architecture, and Key Process Mechanisms of Scientific Commons

An ideal scientific publishing model should satisfy two essential conditions. First, publication and access to scientific publications should face no economic barriers. Scientists write research outcomes not for economic profit but to advance scientific progress. Second, appropriate incentives should exist for reviewers and authors to enable them to fully participate in the scientific publishing system, creating a virtuous cycle [30]. Decentralization technology can liberate scientific resources from current silos, eliminate heavy dependence on for-profit publishers and intermediaries, and address issues like unreasonable pricing and opaque review processes [31]. Based on this, we propose the concept of "Scientific Commons" and elaborate its connotation, system architecture, and key process mechanisms.

3.1 Connotation of Scientific Commons

Commons theory has undergone multiple developmental stages. In 1968, American ecologist Garrett Hardin published "The Tragedy of the Commons" in *Science* [32], coining the term and using overgrazing on common pastures to explore the contradiction between individual selfish behavior and overall resource sustainability in resource-sharing contexts. Nobel laureate Elinor Ostrom subsequently advanced Hardin's research [33], extending commons issues from resource perspectives to social cooperation and governance dimensions, proposing that stakeholder co-governance could resolve resource management and allocation dilemmas.

Increasingly, researchers have connected commons theory with social development, forming a unique research system [34]. As privatization and enclosure of scientific knowledge have intensified, commons theory has entered the scientific domain [35]. Although scholars have begun considering commons theory's application to journal publishing [13][36], effective solutions remain elusive regarding review quality, privacy protection, and copyright management.

This paper aims to combine decentralization technology with journal publishing to propose Scientific Commons. Decentralization technology offers characteristics including transparency, security, autonomy, openness, and scalability, demonstrating tremendous application potential in Scientific Commons.

The proposed "Scientific Commons" is a decentralized scientific publishing mechanism centered on scientists and co-governed by diverse roles including authors, reviewers, editors, and arbitration committees. The concept rests on a core principle: scientific knowledge and research outcomes should be widely shared and freely accessible to all scientists and researchers. This philosophy advocates that scientific publishing processes should be open and transparent, ensuring scientists' equitable rights to publish and access scientific publications. Unlike traditional mechanisms, Scientific Commons comprises four primary nodes—authors, reviewers, academic editors, and arbitration committees—plus system

maintainers and copy editors.

In Scientific Commons, scientists are responsible for content generation and quality control. To achieve the ideal publishing model, they must receive appropriate incentives in a self-regulating market. As shown in [Figure 1: see original paper], Scientific Commons centers on four nodes: authors, reviewers, academic editors, and arbitration committees. Unlike traditional publishing, the publisher node is redefined; publishing processes can be managed by academic communities, research institutions, academic societies, or specialized non-profit organizations.

(1) **Authors**: Authors register to join the organization. New users receive initial points for subsequent submissions and earn reward points for publishing articles, participating in community reviews, and conducting peer reviews.

(2) **Reviewers**: Reviewers voluntarily join or are recommended by the platform. Reviewer points correlate with review quantity and quality. Higher points increase likelihood of receiving new review assignments.

(3) **Academic Editors**: Academic editors emerge from reviewers and are elected through smart contracts. They receive rewards based on workload and quality, and serve as "scientific curators" who can earn points by writing editorials contextualizing publications and performing other tasks that help organize scientific information flow.

(4) **Arbitration Committee**: The committee is elected through voting among reviewers and academic editors, with members' identities kept confidential to prevent collusion. Committee size must be defined in smart contracts or dynamically set as a fixed proportion of stakeholders.

3.2 System Architecture of Scientific Commons

[Figure 1: see original paper] Traditional vs. Decentralized Scientific Publishing Models

We divide the Scientific Commons system architecture into six layers: storage layer, network layer, governance layer, incentive layer, operation layer, and application layer. [Figure 2: see original paper] details this six-layer architecture. At the bottom, the storage layer preserves all publication metadata and extensive data generated during review. This layer integrates blockchain gateways and databases, where gateways verify and format data while databases utilize distributed storage technologies like IPFS or Swarm for decentralization. As the system core, the network layer comprises P2P networks, smart contracts, consensus mechanisms, and asymmetric encryption technologies that ensure process transparency and data immutability. Smart contracts execute business logic and automate publishing management operations. The governance layer includes frameworks and strategies for activities like academic editor elections and community participation. The incentive layer comprises strategies for point

issuance, distribution, rewards, and security mechanisms. The operation layer includes distributed autonomous task planning, scheduling, storage, management, and control. The top application layer provides rich user interfaces and interaction tools for uploading, publishing, reading, and commenting on publications, plus key functional modules for reviewer assignment, paper retrieval, point calculation, and review evaluation.

3.3 Key Process Mechanisms of Scientific Commons

[Figure 2: see original paper] Scientific Commons System Architecture

This section examines three characteristic aspects of Scientific Commons process mechanisms: (1) collaborative preprint-journal complementary submission mechanisms; (2) review mechanisms promoting stakeholder diversification; (3) post-review mechanisms for journal quality control.

3.3.1 Collaborative Preprint-Journal Complementary Submission Mechanism In existing journal review systems, post-peer-review rejection commonly extends publication cycles. Consequently, research institutions have launched preprint platforms, yet these lack quality control and cannot guarantee paper credibility and reliability [4][36]. To address this, we propose a collaborative preprint-journal complementary submission mechanism to promote research productivity and reduce resource waste.

[Figure 3: see original paper] details the collaborative submission workflow for preprints and journal manuscripts (with peer review discussed in the next subsection). After completing a manuscript, authors may submit to a journal or first submit a preprint. Author identification is based on the Ethereum wallet address executing the submission transaction or blockchain-based identification systems. Once submitted, preprint platforms conduct preliminary review to ensure format compliance. Approved preprints become publicly accessible resources that authors can revise and update. Platforms enable open community review, returning public review comments when papers are submitted to journals.

If authors choose journal submission, the system recommends suitable journals by analyzing titles, keywords, and abstracts to calculate manuscript-journal matching scores. The system collects open review comments to accompany manuscripts sent to journal editors. If valuable review comments exist, editors may consider independent public review methods and provide final decisions, returning public comments to authors for revision. Otherwise, editors organize a complete peer review process. This approach reduces duplicate peer reviews, accelerates publication, and enables all researchers to participate in preprint peer review, diversifying the reviewer pool.

3.3.2 Review Mechanism Promoting Stakeholder Diversification [Figure 3: see original paper] Collaborative Preprint-Journal Complementary Sub-

mission Mechanism

Journal academic editors and reviewers primarily participate in the peer review process. We improve reviewer recommendation mechanisms and review processes to enhance publishing efficiency. Diversified reviewer recommendation mechanisms can address reviewer shortages and biases, enhancing comprehensive and diverse paper evaluation.

As shown in [Figure 4: see original paper], editors first conduct preliminary manuscript review, then select reviewers from the reviewer pool through: (1) **Random selection**: Readers register as potential reviewers, storing interests and expertise on the blockchain; editors match article topics with reviewer expertise for random selection; (2) **Author recommendation**: Authors may recommend reviewers with justification when submitting manuscripts; (3) **Third-party platform recommendation**: The system integrates platforms like Web of Science, PubMed, and Google Scholar to parse titles, keywords, and abstracts for potential reviewer recommendations. After review, the system records reviewer behavior, evaluates performance, and calculates reputation scores, acceptance rates, and author ratings, with past experience and contributions affecting future selection opportunities.

Additionally, journals introduce incentive mechanisms encouraging community reader participation in review. Community members receive rewards for reviewing, attracting more reviewers and addressing reviewer shortages in some fields. Editors may also invite community members such as domain researchers, scholars, or interested readers to provide feedback without being formal reviewers. Editors can compare community opinions with expert reviewer reports to identify differences or consensus, using this information to decide acceptance or revision opportunities.

3.3.3 Post-Review Mechanism for Journal Quality Control [Figure 4: see original paper] Enhanced Review Mechanism Promoting Diversification

In decentralized publishing mechanisms, the arbitration committee resolves disputes, ensures publication quality, and validates publishing process legitimacy. Before article acceptance, the committee addresses disagreements between authors and reviewers, assisting with inconsistent review reports or other issues. The committee also establishes and manages procedures for resolving disputes. Decentralized publishing advocates open access and sharing, making intellectual property and copyright issues particularly important. The committee assists in resolving IP and copyright issues to protect all stakeholders' rights. Through smart contracts, creators can set usage rules and authorization conditions; violations trigger automatic penalties. When copyright disputes arise, the committee serves as a neutral third party for mediation. If mediation fails, the committee can make rulings based on relevant laws and blockchain evidence, using blockchain technology to enforce outcomes such as freezing infringer assets or removing them from the system.

Additionally, this study introduces a post-review module. As shown in [Figure 5: see original paper], after acceptance, authors must submit final manuscripts, data, and code. After data sharing with the community, readers can review papers and validate code. Readers can publicly comment on, flag, or send opinions about published results to journal editors. Editors feedback opinions to authors and commentators; if commentators remain unsatisfied with author responses, they may request committee arbitration. For seriously flawed papers, the platform penalizes authors and reviewers while rewarding commentators, thereby inhibiting academic misconduct to some extent.

4. Discussion and Analysis

[Figure 5: see original paper] Post-Review Mechanism for Journal Quality Control

Aligned with Scientific Commons principles, scholars worldwide have launched numerous preprint platforms to promote open sharing of research resources. Notable foreign platforms include arXiv, BioRxiv, FigShare, and PeerJ Preprints; domestic platforms include ChinaXiv and China Science Paper Online. Most preprint platforms aim to provide open academic exchange platforms for rapid research dissemination, yet their output lacks rigorous quality control. ChinaXiv, as a major domestic preprint platform, includes open review functions allowing authors to widely solicit peer opinions for manuscript revision. However, subsequent submission, review, and publication still follow traditional scientific publishing models, failing to alleviate researchers' time and economic pressures or eliminate non-scientific factors in peer review. Moreover, ChinaXiv only provides open access to pre-submission or submitted manuscript versions, while final versions remain subscription-based from publishers, preventing genuine resource sharing. While ChinaXiv has promoted academic exchange to some extent, it has not fundamentally broken traditional publishing models.

Scientific Commons practice offers a new solution for preprint platforms and open review. In Scientific Commons, preprint functions and open review mechanisms are tightly integrated; review comments feed directly to journal editors who can choose between peer review or independent review based on comments. This improvement saves substantial review time, and post-publication sharing in academic communities further promotes open resource sharing.

Currently, some foreign researchers have proposed decentralized scientific publishing platforms such as Scienceroot, Orvium, and Pluto Network. Scienceroot integrates funding, publishing, and academic evaluation, yet its high registration fees contradict its public welfare mission. Orvium and Pluto Network emphasize transparent review and incentive mechanisms supporting academic activities, but merely use blockchain to trace review processes, leaving academic editor selection and acceptance decisions opaque—failing to achieve true decentralization. These platforms also lack post-review mechanisms and reputation systems to regulate user behavior.

Comparing Scientific Commons with existing platforms reveals its unique advantages in promoting open resource sharing, improving review quality and efficiency, and ensuring research credibility. While renowned preprint platforms have advanced academic exchange, they remain constrained by traditional publishing models and fail to thoroughly resolve resource sharing and review transparency issues. Foreign decentralized platforms propose using blockchain for review traceability but remain deficient in academic editor transparency, post-review mechanisms, and user behavior constraints. [Figure 6: see original paper] compares traditional and decentralized publishing mechanisms, showing Scientific Commons advantages in:

(1) **Promoting open resource sharing**: Traditional mechanisms feature publisher-controlled knowledge monopolies, while Scientific Commons weakens publisher roles through author, reviewer, editor, and committee self-governance, facilitating resource sharing and scholarly collaboration.

(2) **Enhancing review quality and efficiency**: Blockchain's anonymity and decentralization enhance review objectivity and diversity, reducing non-scientific factor interference. Collaborative preprint-journal submission mechanisms significantly reduce review time and improve efficiency. Open community review leverages collective wisdom for academic supervision, reducing individual opinion dominance and improving review quality.

(3) **Ensuring research credibility**: Current journal publishing systems cannot adequately guarantee credibility and reliability. This study's post-review mechanism incentivizes readers to verify publication reliability, ensuring reusability of published results and addressing academic misconduct.

[Figure 6: see original paper] Comparative Analysis of Different Publishing Mechanisms

This study first proposes the Scientific Commons concept and elaborates its key process mechanisms. Theoretically, Scientific Commons broadens research perspectives on scientific publishing mechanisms by introducing commons theory to encourage open resource sharing and self-governance, while combining decentralization technology to optimize traditional publishing processes and effectively resolve issues like difficult resource access and low review quality/efficiency. Practically, Scientific Commons lowers information access barriers, supports rapid preprint release, and enables researchers to share results more quickly. It also encourages diversified academic publishing practices, including academic community platforms, bringing new possibilities and promoting innovation and adaptability in academic publishing. Although this paper proposes the Scientific Commons concept and key mechanisms, limitations remain regarding refinement of reputation point calculations and academic performance metrics. Future research will further explore and improve incentive and security mechanisms, constructing a decentralized scientific publishing system to safeguard Chinese scientific literature security and enhance cultural soft power.

References

[1] Wang Zhijun, He Ying. Academic misconduct in peer review and its prevention through blockchain technology [J]. *Chinese Journal of Scientific and Technical Periodicals*, 2023, 34(09): 1138-.

[2] Gu Liping, Li Haibo, Lu Cainü. Research on standards and norms for open science [J/OL]. *Journal of Library Science in China*: 1-28[2023-11-24]. http://kns.cnki.net/kcms/detail/11.2746.g2.20230330.1250.002.html.

[3] Zheng Ang, Zeng Jianxun. Research on the collaborative development mechanism between preprint platforms and open journals [J]. *Library and Information Service*, 2023, 67(16): 13-21.

[4] Fang Qing, Zheng Ang, Zeng Jianxun. Evolution of preprint academic exchange models and development strategies for China [J]. *Journal of Library Science in China*, 2023, 49(04): 56-71.

[5] Xu Jie, Wang Zixian. Research on the cluster development of Chinese sci-tech journals from the perspective of commons theory [J]. *Publishing Research*, 2022(01): 47-53.

[6] Content summary of *Blue Book of Chinese Sci-Tech Journals Development (2022)—Special Topic on Academic Publishing and Exchange Platforms in the Digital Economy Era* [J]. *Chinese Journal of Scientific and Technical Periodicals*, 2023, 34(07): 962-966.

[7] Ma Tianyi. Risk hazards and governance countermeasures facing scientific data publishing [J]. *Journal of Intelligence*, 2023, 42(12): 168-173+179.

[8] Liu Jingjing, Li Xinren, Tian Hong. Reflections on building world-class sci-tech journals in China under the context of Chinese-style modernization [J]. *Chinese Journal of Scientific and Technical Periodicals*, 2023, 34(09): 1097-1103.

[9] Yuan Hongping, Zhang Li, Cao Bingbing. Research on privacy protection and reputation maintenance decisions in gift product supply chains empowered by blockchain technology [J/OL]. *Chinese Journal of Management Science*: 1-12[2023-10-23]. https://doi.org/10.16381/j.cnki.issn1003-207x.2023.0496.

[10] Lin Qinghua, Wang Keyuan. Solution and prototype system implementation for preventing duplicate submission and confirming manuscript copyright using blockchain technology [J]. *Chinese Journal of Scientific and Technical Periodicals*, 2021, 32(09): 1105-1110.

[11] Song Xuefei, Li Ling, Liu Hao. Path for deep integration development of academic journals—Construction of a collaborative innovation platform based on blockchain technology [J]. *Publishing Science*, 2023, 31(01): 72-80.

[12] Zhang Xiaoqiang, Cao Xinyu. Research on models and paths for blockchain technology empowering deep integration development of academic journals [J]. *Chinese Journal of Scientific and Technical Periodicals*, 2022, 33(08): 999-1012.

[13] Tenorio-Fornés Á, Tirador E P, Sánchez-Ruiz A A, et al. Decentralizing science: Towards an interoperable open peer review ecosystem using blockchain [J]. *Information Processing & Management*, 2021, 58(6): 102724.

[14] Swan M. *Blockchain: Blueprint for a new economy* [M]. O'Reilly Media, Inc., 2015.

[15] Xu Lifang, Tian Zhengzheng. Research on blockchain-based decentralized publishing platforms—Taking Scriptarnica as an example [J]. *Publishing Reference*, 2021(04): 18-.

[16] He Chunyu, Teng Chun'e. Construction and application of blockchain-based digital publishing platforms for sci-tech journals [J]. *China Publishing*, 2023(06): 30-35.

[17] Zhi Dandan. Whole-process multi-application of blockchain technology to solve peer review problems—Case studies of Decentralized Science, Orvium, Pluto Network, and Katalysis platforms [J]. *Chinese Journal of Scientific and Technical Periodicals*, 2020, 31(08): 851-858.

[18] Yang Zheng. Analysis of development paths for digital product copyright protection from the perspective of blockchain technology development [J]. *China Publishing*, 2023(11): 45-47.

[19] Chen Ruiyang. New developments in international open science policies and their implications [J]. *Library and Information*, 2022(06): 91-102.

[20] Nosek BA, Alter G, Banks GC, et al. Promoting an open research culture [J]. *Science*, 2015, 348(6242): 1422-.

[21] Wen Liangming, Li Yang, Guo Lei. Practical progress and future exploration of open science at home and abroad [J]. *Library and Information Service*, 2021, 65(24): 109-122.

[22] Shi Jin, Miao Jie, Li Ming. Research on self-organizing peer review and incentive mechanisms for preprint systems [J]. *Modern Information*, 2019, 39(12): 88-100.

[23] Wang Yu. Research on blockchain-based peer review mechanisms for sci-tech journals [J]. *Publishing Science*, 2022, 30(03): 81-88.

[24] Sun Mengting, Zhang Lin. From "element openness" to "open participation": Research on open peer review strategies [J]. *Library and Information Knowledge*, 2024, 41(02): 67-.

[25] Peng R D. Reproducible research in computational science [J]. *Science*, 2011, 334(6060): 1226-1227.

[26] Huber S P, Zoupanos S, Uhrin M, et al. AiiDA 1.0, a scalable computational infrastructure for automated reproducible workflows and data provenance [J]. *Scientific data*, 2020, 7(1): 300.

[27] Tu Zhifang. Construction of scientific data publishing ecosystem and quality control system [J]. *Library and Information*, 2019(01): 125-134.

[28] Mesirov J P. Accessible reproducible research [J]. *Science*, 2010, 327(5964): 415-416.

[29] Niya S R, Pelloni L, Wullschleger S, et al. A blockchain-based scientific publishing platform [C]//2019 IEEE International Conference on Blockchain and Cryptocurrency (ICBC). IEEE, 2019: 329-336.

[30] Qiu J. Identity crisis: Chinese authors are publishing more and more papers, but are they receiving due credit and recognition for their work? Not if their names get confused along the way [J]. *Nature*, 2008, 451(7180): 766-.

[31] Hamburg S. Call to join the decentralized science movement [J]. *Nature*, 2021, 600(7888): 221-221.

[32] Hardin G. The tragedy of the commons: the population problem has no technical solution; it requires a fundamental extension in morality [J]. *Science*, 1968, 162(3859): 1243-1248.

[33] Ostrom E. A general framework for analyzing sustainability of social-ecological systems [J]. *Science*, 2009, 325(5939): 419-422.

[34] Weiser P J, Hatfield D N. Policing the spectrum commons [J]. *Fordham L. Rev.*, 2005, 74: 663.

[35] Nelson R R. The market economy, and the scientific commons [J]. *Research policy*, 2004, 33(3): 455-471.

[36] Bian Xiaolin, Dong Hairong, Wu Yuefeng, et al. Discussion on typical models for collaborative development of sci-tech journals and preprint platforms [J]. *Chinese Journal of Scientific and Technical Periodicals*, 2023, 34(07): 834-840.

Note: Figure translations are in progress. See original paper for figures.