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## Boosting High-Quality Development of Academic Journals through Blockchain Technology (Post-print)

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### Abstract

In the environment of the digital era and open science, academic journals must adhere to high-quality development to preserve long-term vitality and sustained influence, and the power of technology cannot be overlooked in this process. Blockchain technology serves as the cornerstone of digital era development, holds great potential for facilitating high-quality development of academic journals, and will bring revolutionary impact to the academic journal industry.

### Full Text

#### Preamble

**Title:** Harnessing Blockchain Technology to Propel High-Quality Development of Academic Journals

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**Abstract:** In the digital age and open science environment, academic journals can only maintain long-term vitality and sustained influence by adhering to high-quality development, a process in which technological power cannot be overlooked. As a cornerstone of digital era development, blockchain technology holds great promise for facilitating high-quality development of academic journals and will bring revolutionary impact to the academic journal industry.

**Keywords:** blockchain; academic journals; academic publishing; AntChain; journal management

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In the digital age and open science environment, China's academic journals face new challenges and development opportunities. Only by insisting on high-quality development can academic journals achieve long-term stability and maintain lasting vitality and sustained influence, with technological power playing a crucial role in this process. As one of the most disruptive technologies of the digital era, blockchain is considered the cornerstone of digital economic development and has attracted widespread attention in academic and industry circles both domestically and internationally in recent years.

As the cornerstone of digital economic development, blockchain technology serves as a bridge connecting the real and virtual worlds, with its significance lying in the reconstruction of a trust mechanism. In 2015, *The Economist's* cover article dubbed blockchain technology “the trust machine.” As a machine for transmitting trust, blockchain can render the entire knowledge production and management process of academic journals—from data collection and peer review to author publication and user access—transparent, real-time, dynamic, and shared. This will fundamentally transform the conventional submission and review workflows and knowledge discovery methods in academic research. In an open science environment, academic journals confront copyright risks in open-access publishing, academic information security issues, and crises of trust in peer review. Blockchain technology, with its characteristics of immutability, decentralization, smart contracts, and transparency, can help journals reconstruct academic integrity systems and achieve transformation of academic evaluation systems. In short, establishing trust through technology represents the greatest value of blockchain in facilitating the digital transformation and high-quality development of academic journals.

In China, since the emergence of AntChain, blockchain technology has gradually moved toward practical application. In April 2020, AntChain independently developed and officially released to the public the world's first commercially deployable on-chain privacy protection technology, which received the highest scientific research recognition from ACM SIGMOD, a top-tier conference in computer databases [1]. Presently, blockchain technology has evolved through the 1.0 era of digital currency and the 2.0 era of smart contracts into the 3.0 era of intelligent society—a stage characterized by extensive innovative applications. We can observe that increasingly mature blockchain technology, with its decentralization, immutability, and openness, can effectively address various problems in the academic journal field and provide theoretical perspectives and technical support for building academic trust. Application cases already exist abroad, and it is foreseeable that blockchain technology will have tremendous potential in facilitating high-quality development of academic journals and will bring revolutionary impact to the academic journal industry.

## 2.1 Applications of Blockchain in International Academic Publishing

Currently, some international academic publishing institutions have begun experimenting with blockchain technology in journal management and publishing workflows. Among them, *Ledger* journal, founded in 2015 through collaboration between the University of Pittsburgh and the MIT Media Lab and published online by the University of Pittsburgh's library system, represents the most prominent academic journal internationally that has integrated blockchain into academic publishing [2]. *Ledger* journal is dedicated not only to open-access publishing of research articles on cryptocurrency, blockchain technology, and peer review but also to the practical application of blockchain technology in peer review and journal publishing management processes.

ARTiFACTS, established in 2018, is the first researcher-dedicated platform built on blockchain technology. It has introduced a “ledger of research records” for academic publishing that creates and outputs immutable records, enabling all research findings to be linked and searched while achieving secure sharing and thus enhancing access to important information outcomes [3]. It is reported that the prestigious British scientific journal *Nature* has joined this project and begun using the ARTiFACTS citation management system to manage its digital library. Furthermore, the European startup Orvium launched a new operational project related to academic journal publishing in 2019, offering new business models for academic paper publication. Orvium is the first scientific management platform to utilize blockchain technology to manage the lifecycle of academic publications and related data, aiming to achieve open, fully traceable, and trustworthy recording of the publishing process at minimal cost while enabling functions such as author submission, peer review, data sharing, and establishment of decentralized journals [4].

### 1.1 The Essence of Blockchain

The concept of “Block Chain” was first proposed by Satoshi Nakamoto, and its essence is a decentralized, distributed shared ledger and database. In blockchain systems, nodes trust each other through consensus mechanisms without requiring intermediaries. Data records are stored synchronously across all nodes in a timeline format, making them public, transparent, and difficult to tamper with. Consequently, using blockchain technology to store data is more secure and trustworthy.

### 1.2 The Significance of Blockchain for Academic Journal Development

In recent years, social life and production methods have been undergoing digital transformation, with emerging technologies continuously driving high-quality development of academic journals. The Party Central Committee and the State

Council attach great importance to digital economy development and the application of blockchain technology. The innovative development and widespread application of blockchain technology have become critical to the digital transformation of various industries, including the academic journal sector.

## 2.2 Applications of Blockchain in International Academic Evaluation

In the field of academic evaluation, besides *Ledger* journal, institutions such as Decentralized Science, Pluto Network, and Orvium are also working to construct blockchain-based peer review projects and platforms [5]. In 2018, the global technology company Digital Science and data platform Katalysis jointly launched a peer review pilot project. Through protocol development, this project stores publisher-submitted peer review process information within the blockchain, making the entire review process independently verifiable while feeding data back to relevant tools to ensure recognition and confirmation of reviewers. Currently, the project has been joined by multiple research groups, including the German academic publisher Springer Nature and Cambridge University Press [6].

## 3. Conceptualizing Blockchain Applications in China's Academic Journal Sector

Compared with pioneering concepts and bold practices of blockchain technology in academic publishing abroad, China's envisioned application scenarios for blockchain in the academic journal field remain concentrated on copyright confirmation and protection, online infringement evidence collection, online copyright rapid registration, digital knowledge asset preservation, and digital asset monetization. Based on current practical challenges in academic journal development and international blockchain application cases in academic publishing, the author offers preliminary thoughts on re-envisioning future blockchain applications in China's academic journal sector from the following perspectives.

### 3.1 Building Scientific Journal Management Processes

In the digital publishing era, the lack of transparency in traditional academic journals' publishing management processes and expert selection creates information asymmetry among editors, authors, reviewers, and readers during academic communication, leading to a trust crisis for academic journals in content production and peer review. The weakening of academic journals' credibility seriously impedes their high-quality development. Blockchain, as a decentralized and shared distributed ledger technology, can integrate with real-world application scenarios to help academic journals build transparent publishing platforms for processing, verifying, and disseminating research data and outcomes. Therefore, academic journals should leverage new technologies such as blockchain to accelerate digital transformation and enhance management capabilities.

First, publicly record production process content and implement full-process supervision of editorial work. Academic journals can learn from Orvium's publishing management model by using blockchain technology and decentralized storage methods to manage journal lifecycles and related data, achieving open, fully traceable, and trustworthy recording of the publishing process at minimal cost while enabling functions such as author submission, peer review, and data sharing [4]. Once authors upload digitally signed data of their academic papers' original creation process to the blockchain, journal editors can view authors' writing processes through authorization, thereby ensuring academic integrity from the very beginning of the manuscript creation lifecycle. Additionally, rejection letters or revision suggestions received by authors during submission can also be uploaded to the blockchain, enabling real-time recording of the entire editorial workflow. The original data of editorial work can be publicly shared and verified within the blockchain, thus establishing an open academic ecosystem. Overall, reducing management costs for journal editors in content production can accelerate academic paper publication and further optimize the journal's database ecosystem.

Second, share peer review data in real time to standardize reviewers' rights and obligations. Academic journals can draw on Digital Science's publishing management experience, utilizing blockchain's decentralization and immutability to create a distributed reviewer reputation system that automatically and accurately matches manuscripts with qualified experts in relevant research fields while updating and recording the expert resource database in real time to achieve public sharing of peer review information [6]. First, reviewers' behaviors—including the quantity and quality of reviews—are recorded in detail, encrypted, saved, and uploaded to the blockchain. Journal editors no longer rely on past personal experience and subjective judgment to recommend reviewers but instead use indexing tools to intelligently match the most qualified reviewers. Second, review records on the blockchain serve as integrity records, and reviewers lacking professional competence will be removed from the journal's expert database. Third, the public sharing and full-process data tracking and storage of peer review information both standardize reviewers' rights and obligations and ensure the protection of review opinions and data confidentiality. Improved publishing process efficiency makes peer review more targeted and enhances the credibility of academic evaluation.

### 3.2 Improving Peer Review Incentive Mechanisms

Academic evaluation not only affects the fate of academic journals but also influences researchers' topic selection through the supply-and-demand dynamics of core journals [7]. Peer review is the most commonly used academic evaluation method for academic journals. However, the scientificity and rationality of peer review have been questioned in recent years due to the opacity of traditional evaluation standards and systems. If academic journals can uphold transparent and open principles, improve peer review incentive mechanisms, and provide

reasonable compensation for reviewers' contributions, this can positively impact the reconstruction of a reputable academic evaluation system.

First, create a scoring system through blockchain cryptocurrency to reward high-quality academic review opinions. For instance, the Orvium platform supports collaborative peer review through multi-user discussion tools and has established a token-driven review model where reviewers receive token rewards once their review opinions are accepted by authors [4]. The pan-European team Science Root created a peer review reward model based on a ranking system, where peer review runs through the entire process of research fund applications and paper submission and publication, and reviewers receive reputation or rewards based on performance evaluation [8]. This is a scoring system based on reviewers' reputation and competence, where highly recognized reviewers enter a virtuous cycle of academic evaluation. Overall, blockchain technology, with its immutability, transparency, and decentralization, could establish a decentralized academic recognition system more timely, comprehensive, and transparent than any traditional academic evaluation indicator through token reward values or score accumulation algorithms. In such a system, reviewers can accumulate tokens or scores, gaining reputation while their work is recognized, and academic journals applying high-quality evaluation indicators will also win greater respect and trust from authors and readers.

Second, attempt to allow anonymous submission and review methods to promote diversification of peer review. Specifically, applying blockchain technology in submission and review systems, its distributed ledger characteristics can support peer review, and anonymous public review with identity authentication and credit guarantees becomes more feasible. For example, *Ledger* journal allows authors to submit anonymously under technical support, aiming to encourage researchers to explore immature original, cutting-edge, interdisciplinary academic achievements and even research hypotheses, thereby reducing the constraints of peer review on researchers' pioneering thinking [2]. Moreover, *Ledger* journal's review opinions are also publicly released anonymously, with accepted articles published together with experts' and editors' review opinions and authors' response explanations, thereby motivating journal editors and researchers to actively participate in peer review and promoting academic sharing and collaboration [2]. This open anonymous peer review diversifies review subjects and opinions, making the evaluation process and results more fair and transparent. When evaluation behaviors are incentivized, they enter a virtuous cycle that improves academic journal quality.

### 3.3 Conceptual Applications of AntChain Technology

AntChain is one of China's earliest teams researching blockchain technology. Since 2018, it has solved and implemented over 50 scenarios, and its breakthroughs in core technologies such as privacy protection, security mechanisms, and high-concurrency transaction processing are internationally leading, providing strong technical support for blockchain applications in China's academic

journal field.

First, regarding copyright protection and academic information security. In 2020, AntChain opened its digital copyright service platform to the public. Based on AntChain's BaaS architecture, this platform features high performance and high privacy. Relying on blockchain technology and AI, it provides full-process services for original works from registration to rights protection. AntChain's efficient and low-cost copyright rights protection platform technology can alleviate the enormous risks faced by academic publishing in the open access field under an open science environment and lay the foundation for rebuilding the academic trust system.

Second, regarding data sharing in an open science environment. In building academic exchange platforms and achieving data sharing, AntChain's government GBaaS platform uses internationally standard-certified cross-chain technology to solve the problems of high costs for heterogeneous chain access and difficulties in cross-chain and cross-department data sharing through on-chain data security and sharing platforms, improving access and management efficiency, lowering blockchain application development thresholds, and helping customers achieve zero-code one-click evidence storage. If GBaaS platform technology can be applied to academic journal database construction, it can enable journal editors and researchers to more centrally, efficiently, and conveniently achieve data sharing. Additionally, the platform's characteristics are suitable for creating open-access and collaborative academic exchange platforms. By promoting community exchange and scientific research collaboration in academic fields, it can improve the openness of science to society, enhance the credibility of academic achievements, and thereby create a trustworthy academic ecosystem.

Third, regarding academic fund raising and research project applications. AntChain's charity public welfare platform uses blockchain technology to publicize the flow of donated funds, enabling full tracking of every donation, making fund flows transparent, and enhancing donors' confidence. After gaining donors' trust, it can also improve the credibility of public welfare institutions and recipients, ultimately making public welfare charity develop in a virtuous cycle. If academic fund raising and research project applications can be combined with blockchain technology-based public welfare platforms, it can both optimize fund project application management processes and create an open, transparent, and fairly competitive research environment for scientific and technical workers, enabling scientific research to better serve social needs.

Academic journals carry the important mission of academic inheritance and dissemination, playing a leading and serving role in knowledge innovation and development. In the digital age and open science environment, the new development concept of academic journals should also include bold application of new technologies. With its decentralization, immutability, and openness, blockchain technology can play a tremendous role in transmitting trust, facilitating digital transformation of academic journals, and building reputable academic exchange systems. In the coming years, the integrated development of blockchain with

cloud computing, big data, artificial intelligence, the Internet of Things, and other new technologies will greatly enhance the potential value of the academic journal industry. Only by seizing opportunities can China's academic journals truly achieve high-quality development.

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**(Responsible Editor: Li Jing)**

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

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