Academic Misconduct in Peer Review: Blockchain-Based Prevention and Response

Authors: Wang Zhijun, Ying He, He Ying

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Abstract

Objective: To utilize blockchain technology to prevent and address academic misconduct in peer review, providing reference for the construction of a trust system in academic publishing. Methods: This study analyzes the manifestations of academic misconduct in peer review and the current methods and means for its prevention and control. Based on the technical characteristics of blockchain, blockchain can be adopted to address academic misconduct. Results: With the aid of blockchain technology, the currently applied institutional, model-based, and technical prevention and control measures can be better implemented, effectively preventing both academic misconduct caused by subjective intentions and technical academic misconduct resulting from objective factors in traditional peer review. Conclusion: By leveraging blockchain technologies such as asymmetric encryption, consensus mechanisms, and smart contracts to improve open peer review, and by addressing both institutional and technical aspects to regulate scholar behavior, the current situation of academic misconduct in peer review can be effectively improved, thereby contributing to the realization of responsible research and innovation.

Full Text

Academic Misconduct in Peer Review and Blockchain-Based Preventive Responses

Wang Zhijun He Ying
School of Management, Tianjin Normal University
393 Binshui Road, Xiqing District, Tianjin 300387, China

Abstract

[**Purpose**] This study explores the use of blockchain technology to prevent and respond to academic misconduct in peer review, providing a reference

for constructing a trust system in academic publishing. [**Methods**] We analyze the manifestations of academic misconduct in peer review and examine current prevention and control methods, then propose blockchain-based solutions tailored to the technical characteristics of distributed ledgers. [**Findings**] Blockchain technology can better implement existing institutional, model-based, and technical prevention measures, effectively addressing both intentional academic misconduct arising from subjective motives and technical academic misconduct caused by objective factors in traditional peer review. [**Conclusions**] By leveraging blockchain's asymmetric encryption, consensus mechanisms, and smart contracts to improve open peer review, we can regulate scholar behavior through both institutional and technical means, effectively mitigating academic misconduct in peer review and contributing to the realization of responsible research and innovation.

Keywords: Peer review; Academic misconduct; Blockchain

Introduction

Since the medieval period of scientific exploration, when Pythagoras integrated science and ethics under religious norms, scientific conduct has been subject to regulatory frameworks. Following the modern scientific revolution, which stripped science of its religious character, scientific norms emerged among scientists to constrain scientific behavior. The American sociologist Robert K. Merton first defined these norms in his book *The Sociology of Science*, identifying them as the ethos of science, which later evolved into Merton's four principles of scientific norms: universalism, communism, disinterestedness, and organized skepticism. However, as science and technology have accelerated, a rift has emerged between technological development and ethical values, with issues such as data fabrication, ethical violations, and evaluation metric abuse entering public consciousness through numerous cases.

Terms such as "research integrity," "research misconduct," "academic misconduct," and "academic anomie" have been proposed, and scholars have investigated their conceptual distinctions, classifications, and causes. Most studies, however, analyze specific incidents or examine scientific research from particular fields, rarely focusing on detailed analysis of specific research processes. Jin Cheng and Li Xingen have explored academic misconduct in peer review through book reviews and practical experience, respectively, but their work remains theoretical without integrating technical solutions, and neither distinguishes clearly between "academic misconduct" and "academic anomie."

This study aims to more accurately understand the connotation and specific manifestations of academic anomie in peer review through literature investigation. By analyzing existing countermeasures and integrating them with blockchain technology, we propose targeted and actionable solutions.

1. The Nature and Manifestations of Academic Misconduct in Peer Review

China's policy documents first introduced concepts related to "academic ethics" in 2002, when the Ministry of Education issued "Several Opinions on Strengthening Academic Ethics Construction," which mentioned "unhealthy academic atmosphere and academic ethics anomie." Subsequent policy documents have introduced terms like "academic misconduct" and "academic anomie," but these have only defined the involved behaviors without clarifying the concepts and boundaries. As cases related to academic ethics have gained public attention, scholars have begun exploring the boundaries and relationships between "academic misconduct" and "academic anomie," though consensus has not yet been reached.

What is agreed upon is that behaviors related to "academic misconduct" are all motivated by self-interest and possess the characteristic of subjective intention. According to Merton's theory of social anomie, "anomie" refers to a state where individuals or groups cannot achieve goals through normalized paths, leading to behavioral conflicts. The emergence of anomie may result from unformed or problematic normalized paths, or from group non-recognition of these paths. Therefore, "academic anomie" is not necessarily intentional.

Consequently, "academic anomie" has a broader scope, encompassing both subjective violations of academic norms (i.e., "academic misconduct") and objective factor-induced violations, which some scholars define as "technical academic anomie." Thus, academic misconduct behaviors in peer review can be divided into academic misconduct and technical academic anomie.

[Figure 1: see original paper] Manifestations of Academic Misconduct in Peer Review

1.1.1 Fake Peer Review

The "three-tier review system" of editorial preliminary review, external expert peer review, and chief editor final review is widely adopted in academic publishing activities both domestically and internationally. The expert review stage is the decisive link and also the most vulnerable to exploitation by academic misconduct perpetrators. Three main actors—authors, reviewers, and editors—may all be involved.

First, authors may impersonate reviewers or exploit "academic cliques." As interdisciplinary research increases, editors urgently need "small peers" in specific fields to conduct reviews and often ask authors to recommend reviewers. Some authors take this opportunity to forge reviewer identities, providing false email addresses to forward reviews to themselves and orchestrating the review process. Alternatively, they recommend familiar scholars from their "academic cliques" for mutual evaluation within the group, often resulting in direct acceptance or trivial suggestions that manipulate the review process.

Second, reviewers may conduct negative or passive reviews. In single-blind review, reviewers may develop bias after learning the author's identity. Even in double-blind review, given the current degree of research field specialization, reviewers can likely identify the author through research content. Some scholars argue that completely masking author information is impossible. Moreover, whether single-blind or double-blind, reviewers' identities are fully protected, making review fairness, authenticity, and timeliness dependent solely on reviewers' moral bottom lines without institutional regulation. The current number of reviewers is not proportional to the exponentially growing number of papers, leading reviewers to claim time constraints for passive reviewing. Additionally, some invited reviewers lack proper training or familiarity with the review field, resulting in uneven review report quality.

Third, editors may violate professional ethics or simplify reviews for journal economic interests. As intermediaries between authors and reviewers, editors may engage in academic misconduct due to personal relationships and interests, such as revealing identities, consciously selecting reviewers, or ignoring reviewer opinions to influence review outcomes. The development of open access (OA) has led to predatory journals that exploit the author-pays model for quick profits, with editors skipping peer review entirely and accepting all papers regardless of quality.

1.1.2 Improper Citation

Some scholars have analyzed the phenomenon of reviewers recommending literature citations in their comments, finding that while some reviewers genuinely aim to improve manuscript quality, others who only recommend their own group's papers may have improper motivations. In current evaluation systems, citation counts remain important metrics for evaluating researchers and journals, leading editors or reviewers to use their positions to "recommend" specific citations. The National Press and Publication Administration's 2019 "Academic Publishing Standards: Definition of Academic Misconduct in Journals" explicitly states that "using review rights for personal gain should be defined as seeking improper benefits." Therefore, reviewer- or editor-guided improper citation constitutes a form of academic misconduct in peer review.

Authors also subjectively engage in improper citation, which some scholars define as "fraudulent citation," including: extensively or minimally citing one's own or one's group's papers that may be broadly relevant but lack specific citation value; citing papers by familiar authors for mutual benefit; or citing papers from target journals or those associated with editors. These behaviors lack academic ethics and constitute academic misconduct for personal gain.

1.1.3 Theft of Academic Priority

Acquiring priority in scientific discovery is a fundamental motivation for academic communication. For a paper to enter academic exchange, it must first

undergo peer review, making editors and reviewers generally the first readers. Editors and reviewers are responsible for confidentiality, but weak awareness and lack of professional ethics can have severe consequences. In 2019, Retraction Watch reported a case where a reviewer failed to provide comments for nine months, after which the original author discovered their manuscript had been secretly submitted to another journal. After five months of rights protection efforts, the paper was successfully retracted, but during that period, it had been cited 17 times, including eight self-citations. Such behavior not only harms the original author but also damages the entire academic community's reputation, causing researchers to doubt and distrust the peer review process and hindering academic exchange.

1.2.1 Misconduct Due to Lack of Necessary Knowledge

Since its inception, peer review has served as the primary quality control method for journal articles. Publishers, as the main organizers, propose and update normative policies for reviewers. Some prestigious journals provide structured review report templates to improve quality and efficiency, but variations in these detailed norms across publishers can confuse reviewers and cause technical academic anomie.

Domestic and international scholars agree that reviewer training participation is currently low, and reviewers are generally selected based on scholars' qualifications and research achievements, sometimes without matching their specific subfield to the reviewed article. This leads some reviewers to lack awareness of ethical norms or proper review methods, non-subjectively affecting review quality. Additionally, some authors submit papers opportunistically without clear knowledge of academic writing standards or ethics and without training, also causing technical academic anomie such as improper citation.

1.2.2 AIGC-Related Technical Anomie

Since 2022, AI-Generated Content (AIGC) represented by ChatGPT has entered public view, meaning AI can become a creator, potentially replacing humans. While AIGC applications can bring opportunities to scientific research, such as improving reading and writing efficiency, their abuse without clear norms can cause technical behavioral anomie.

First, digital copyright issues arise. AIGC products essentially result from extensive data collection, continuous adjustment, and integration according to user needs. The definition of authorship and copyright ownership remains unresolved. Many academic publishers (e.g., *Nature*, arXiv) have declared that articles with large language model tools (e.g., ChatGPT) as authors, alone or jointly, will not be accepted, and any use should be disclosed in appropriate sections. The U.S. Copyright Office states that whether AI-generated content can be protected depends on specific circumstances, particularly how generative AI tools operate and how authors use them.

Second, content authenticity problems exist. AI models may be trained on biased or false data, requiring caution about generated content's truthfulness and accuracy. AIGC errors can be difficult to detect, and subjective issues lacking sufficient verification may lead researchers to adopt incorrect answers.

2. Current Countermeasures Against Academic Misconduct in Peer Review

Academic misconduct in peer review—including reviewers' negative reviews due to workload and time constraints, editors and reviewers inducing improper citations, and theft of authors' academic priority—ultimately stems from problems in research evaluation systems: review reports cannot serve as evaluation materials, and reviewers' contributions go unrewarded, while citation frequency remains a key metric for assessing scholars. Therefore, current efforts focus on top-level institutional reforms.

In 2021, China's State Council issued "Guiding Opinions on Improving the Evaluation Mechanism for Scientific and Technological Achievements," emphasizing the need to break the "five only" evaluation system and recognize reviewers' contributions. Platforms like Publons have partnered with universities to allow review reports to count as research contributions. To address technical academic anomie from insufficient knowledge, publishers have begun training peer reviewers. Taylor & Francis, in collaboration with Chinese university journal associations and research institutes, has conducted peer review training in China through online and offline formats, enabling reviewers to conveniently and comprehensively acquire necessary knowledge. For authors, the International Committee of Medical Journal Editors (ICMJE) has repeatedly revised its "Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals," with member journals encouraging uniform formatting and standards.

2.2 Model Innovation

In traditional peer review, editors serve as the central hub connecting reviewers and authors, playing a primary role in most academic misconduct behaviors. Therefore, publishers and academia are exploring new models.

First, transparent peer review where reviewers can choose to disclose their identities, and open peer review where identities are fully public, both feature publicly available review reports, open participation, and open interaction between authors and reviewers, maximizing information transparency. Public supervision enhances responsibility among the three actors, increases engagement, breaks academic barriers, and weakens editors' roles, enabling direct communication between authors and reviewers and reducing implicit power hierarchies.

Second, collaborative peer review and select crowd review are group-based methods ensuring fairness and transparency. In anonymous environments, authors,

reviewers, and editors all participate in exchanges, with reviewers conducting mutual evaluations and authors responding to questions. This collective discussion creates group supervision among reviewers, yielding more objective and accurate results.

Third, "preprint + self-organized review" and post-publication peer review both aim to "publish first, review later," protecting authors' academic priority. Editors conduct preliminary quality checks before publication, after which reviewers evaluate the work, with review reports published alongside papers. From initial publication, the public can comment on the review process and author responses.

These different peer review models each have advantages and disadvantages, with various publishers implementing and continuously improving them.

2.3 Technology Introduction

Technological development provides strong support for preventing academic misconduct in peer review, with publishers adding functions or building platforms for detection and prevention.

First, identity verification integrates submission systems with databases like Web of Science ResearcherID or ORCID, linking author and reviewer accounts to ensure authentic identities and building comprehensive scholar profiles from multiple platforms.

Second, review monitoring systems like ScholarOne Manuscripts and Editorial Manager feature reviewer performance reports that track review times and quantities, enabling identification of potentially problematic reviews based on average durations.

Third, content integrity checks use algorithms like Stat Reviewer, AIRA, and UNSILO, which integrate natural language processing and machine learning to analyze papers across fields and formats, checking for language and content completeness issues and generating preliminary review reports.

Fourth, third-party peer review platforms separate peer review from publication platforms, cutting interest relationships and making peer review's purpose more pure—evaluating whether papers advance their fields rather than making journal-specific judgments. Publishers or authors pay reviewers, enhancing author/editor supervision and reviewer motivation. Review Commons exemplifies such platforms, enabling reviewers to focus on academic evaluation and helping authors improve their papers through transparent processes.

3. Blockchain-Based Preventive Responses

The rapid progress of information and communication technologies has complicated academic exchange, making single-track approaches from institutional,

model, or technical perspectives insufficient to completely avoid academic misconduct in peer review. Practices in economics and finance demonstrate that technology can serve as an effective control mechanism. Therefore, establishing a mechanism supported by technology that integrates institutions and models is necessary for true effectiveness. Blockchain technology, widely applied in economics and finance, can fuse institutions and models through its distributed storage, consensus mechanisms, smart contracts, and hash encryption to prevent academic misconduct in peer review.

3.1 Asymmetric Encryption for User Identity Protection

As the key technology enabling cryptocurrency, encryption algorithms are essential guarantees in blockchain. In peer review, the selective disclosure of reviewer information significantly affects participation. Both authors' and reviewers' information comprises basic information (real names, contact details) and academic information (review records, submitted manuscripts, selected expertise areas). Blockchain encryption algorithms separate these categories. When users first join, their basic information undergoes hash calculation, producing a unique identity identifier that binds to their subsequent academic information. Accessing basic information requires a private key held only by the user, and hash values cannot be reverse-engineered, preventing brute-force attacks. During review, zero-knowledge proofs enable identity matching confirmation—reviewers can provide review reports and authors can upload manuscripts without revealing personal basic information, while convincing others of ownership. This ensures data privacy while enabling sharing and prevents identity impersonation for fake reviews.

Academic information generated during use continuously updates users' expertise areas and submission records, gradually improving scholar databases. Blockchain's immutable nature ensures all user records are truthfully presented, authentically displaying scholars' academic ethics, research capabilities, and sense of responsibility. This enables reviewer selection without knowing users' backgrounds, effectively preventing fake reviews orchestrated by authors through "academic cliques" or by reviewers and editors through personal relationships.

3.2 Timestamping for Review Process Traceability

Information asymmetry is a major cause of misconduct in peer review, and decentralization is blockchain's fundamental characteristic. In blockchain, all nodes are equal and independent, capable of generating new blocks that are added to the chain after verification. This flat, open structure makes authors, reviewers, editors, and the public equal users with identical rights and responsibilities. Any verified user can upload academic achievements, browse any paper or review report, and become an evaluation subject to verify other nodes' achievements, achieving decentralized power, collective supervision, and high autonomy. Users' awareness of blockchain's immutability and transparency pro-

vides psychological oversight, encouraging accurate, authentic, and reproducible research data from authors; timely, professional, and high-quality reviews from reviewers; and transforming editors from intermediaries into information integrators and problem identifiers who help authors gather diverse perspectives.

Blockchain assigns unique time sequences—timestamps—to all uploaded data, which is then stored in blocks. Any user can access this information, making all data sources traceable. Both papers and review reports have their academic priority protected, enhancing academic reputation and influence. Users also gain new insights through sharing and exchange. During conception, they can check for duplicated ideas to avoid plagiarism during writing. They can also search existing information to understand research status and progress. Furthermore, when authors revise according to review reports, modifications are automatically recorded, timestamped, and presented on the blockchain, enabling other nodes to promptly detect any attempts by reviewers or editors to induce improper citations.

3.3 Smart Contracts for Standard Implementation

Technical academic anomie in peer review partly stems from inconsistent standards, which blockchain smart contracts can address. Smart contracts digitally encode strictly enforceable agreements as preset rule programs, originally designed to protect computer data and enable secure data exchange with reduced third-party participation. In a blockchain-based peer review academic community, users can collaboratively establish norms and form contracts based on actual needs. These norms can include formal standards (manuscript formatting, required review report elements, layout methods) and ethical standards (explicitly listing misconduct behaviors). Once compiled and preset in the blockchain, smart contracts cannot be altered and are automatically executed by any node or uploaded block, achieving data autonomy from a technical perspective.

Specifically, after coordination among authors, reviewers, editors, and the public, formal and ethical standards are digitally integrated into smart contracts before system deployment. The system automatically judges whether uploaded data complies with these contracts before blockchain entry. Formal standards can be directly implemented during data upload, while ethical standards inform all users and are enforced through collective supervision. Applying smart contracts in peer review provides grounds for handling moral norm violations, reduces costs and improves efficiency without third-party trust intermediaries, and combines technology with human oversight to prevent anomie caused by norm deficiencies.

3.4 Token Mechanism for Incentive Cycles

Authors gain fair review through peer review, enabling their academic achievements to enter academic exchange, but reviewers—as the main contributors who endorse authors' work—currently receive only academic reputation, potentially

leading them to engage in misconduct like inducing improper citations or stealing priority for personal gain. Preventing academic misconduct requires not only normative constraints but also rewards to encourage active participation.

Mature blockchain architectures include incentive layers. Under blockchain support, peer review can be viewed as a micro-economy where cryptocurrency token circulation creates incentive cycles. Circulation mechanisms can be written into smart contracts, making tokens a symbol and fair scale for measuring participants' credit, increasing trust and moral constraints. In peer review, tokens can reward reviewers' academic contributions and serve as payment for information exchange within the academic community, carrying the value of research activities. As virtual currency not circulating with real money, tokens can avoid academic commercialization to some extent.

Authors receive reward tokens for uploading manuscripts, while reviewers earn tokens by providing fair evaluations within specified timeframes. Reward systems require penalty systems—when participants violate moral provisions in smart contracts and are identified and verified, announcements are made and corresponding token amounts are deducted.

3.5 Creating a Healthy Peer Review Environment with AIGC

AIGC application in peer review is inevitable, and blockchain can maximize copyright protection for AIGC, with both technologies complementing each other to create a robust peer review ecosystem. AIGC can assist the creative process but has long faced copyright issues. In traditional paper and review report writing, digesting and understanding others' work is essential, and AIGC can assist this process, reducing burdens for authors and reviewers. Since "ideas + AI" form the creation, AIGC-generated content encompasses both others' copyright and creators' idea copyright. AIGC essentially involves machine learning from others' creative achievements, but creators' ideas are also crucial, so both should enjoy rights to the final product. Current controversies focus on original creators not receiving benefits when their work is used for AIGC training. In the art domain, scholars have proposed that all creators voluntarily contribute works to AIGC training libraries, with subsequent users paying fees based on quantified keyword influence, distributing benefits proportionally to original creators—forming a "legitimate content library." Blockchain-supported peer review can combine this approach with incentive mechanisms, motivating original creators from both material and reputational perspectives.

Every information record and interaction in blockchain requires verification, demanding substantial computation. AI can optimize computational processes to ensure information exchange speed. Blockchain can also help guarantee AIGC quality—when reviewers consult AIGC for suggestions, blockchain fully displays the data AIGC used to generate its responses, facilitating better understanding and quality supervision of its recommendations.

Conclusion

In 2013, the EU launched the Horizon 2020 program, introducing the concept of "Responsible Research and Innovation." As academic gatekeepers, peer reviewers must act responsibly. Responsible peer review helps authors gain recognition, maintains journal reputation, and earns reviewers academic prestige. Only by fundamentally solving academic misconduct in peer review and ensuring each participant fulfills their responsibilities can we achieve responsible peer review and responsible research and innovation, enhancing public trust in research outcomes and advancing science.

However, peer review serves to filter rather than select, only screening out problematic research or helping authors improve quality. The peer review system has preventive functions but is not specifically designed to detect and resolve academic misconduct. Therefore, this study only discusses the current state of academic misconduct in peer review and existing countermeasures from a prevention perspective, proposing the concept of using blockchain to improve peer review systems and avoid misconduct. Further research is needed at the empirical and institutional levels.

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