Postprint: Strategies for Improving Peer Review in the Context of Big Data

Authors: Jiang Jianbin

Date: 2023-10-08T00:00:00+00:00

Abstract

This article analyzes the main problems in peer review through literature research and case analysis, and proposes improvement strategies. The effective conduct of peer review in most scientific and technological journals is hindered by factors such as improper reviewer selection, an insufficient reviewer pool, and delayed review cycles. To address this, eight improvement strategies are proposed to enhance the level of peer review, including optimizing the double-blind review system, enhancing review process management, and establishing a dynamic reviewer database. Driven by big data and artificial intelligence technologies, scientific and technological journals should improve the quality and efficiency of manuscript review from two aspects: strengthening the construction and management of reviewer databases and improving the peer review mechanism.

Full Text

Strategies for Improving Peer Review in the Context of Big Data

ChinaXiv Cooperative Journal
Strategies for Improving Peer Review Against the Backdrop of Big Data
(China Engineering Cost Association, Beijing 100037)

Abstract: This paper analyzes the main problems in peer review through literature research and case studies, and proposes improvement strategies. For most scientific journals, ineffective peer review is hindered by factors such as inappropriate reviewer selection, insufficient reviewer pools, and delayed review cycles. To address these issues, we propose eight improvement strategies to enhance peer review quality, including optimizing the double-blind review system, deepening review process management, and establishing a dynamic reviewer

expert database. Driven by big data and artificial intelligence technologies, scientific journals must improve paper review quality and efficiency by strengthening reviewer database construction and management and reforming peer review mechanisms.

Keywords: big data; scientific journals; academic papers; peer review; review cycle
Chinese Library Classification: G311
Document Code: A
Article ID: 1671-0134(2021)08-111-05
DOI: 10.19483/j.cnki.11-4653/n.2021.08.034
Citation Format: Jiang Jianbin. Strategies for improving peer review in the context of big data[J]. China Media Technology, 2021(08): 111-115.

The advent of big data and artificial intelligence technologies has accelerated scientific development, leading to exponential growth in the total volume of knowledge and a rapid increase in both the quality and quantity of technological innovations and academic papers. This deluge of manuscripts has placed unprecedented pressure on scientific journal editorial departments and reviewers, making effective peer review and improved review quality a central concern in the scientific publishing community [**?**]. The National Press and Publication Administration' s notice on "Strictly Implementing the Journal 'Three-Review System' and 'Three-Proofreading and One-Reading' System to Ensure Publication Quality" mandates that journals must strictly enforce the "three-review system," properly conducting preliminary, secondary, and final reviews, with peer review occupying a crucial position in this process [**?**, **?**].

For most scientific journals, the most commonly adopted and proven effective method is the double-blind review system. Taking *Engineering Cost Management* as an example, the journal has adhered to a strict three-review system for over 30 years since its founding, emphasizing the role of peer review and evolving from single-blind to double-blind review while now experimenting with expert recommendation-based review. The review process involves an initial review by the responsible editor, who then selects appropriate external reviewers based on the manuscript' s subject matter for secondary review (the double-blind peer review). After receiving the reviewers' comments, the responsible editor makes decisions on rejection, revision and resubmission, or approval. Some controversial manuscripts undergo extensive discussion by the editorial board before final submission to the chief editor for final review and publication decision. The entire process takes approximately 40 working days: 7 days for initial review, 15–21 days for peer review (accounting for about 46% of total review time), and 12 days for final review. While manuscripts approved through peer review generally meet the journal' s publication standards, approximately 9% of reviews annually fail to meet quality requirements, primarily because some reviewers provide simplistic, vague conclusions without specific revision suggestions, leaving editors and authors without clear direction. Additionally, about 17% of

reviews exceed the 30-day deadline, adversely affecting subsequent publication schedules. Such inefficiencies in peer review disadvantage both journals and authors, undermining author confidence and damaging journal reputations.

Drawing on the review experience of *Engineering Cost Management*, this paper analyzes the main problems in peer review under the current big data context and proposes solutions to enhance review quality and effectiveness.

1. Factors Affecting Peer Review Effectiveness

As gatekeepers of paper quality, peer reviewers are expected to ensure correct, objective, and fair evaluations through their professional standards and ethics, providing review opinions that serve as the basis for acceptance or revision decisions [**?**]. However, practical implementation often encounters numerous problems: thin reviewer pools that make it difficult to find ideal experts, inconsistent review quality, significant disparities in expert competence leading to divergent opinions, difficulties locating reviewers for niche, frontier, or interdisciplinary research directions, delayed review cycles that prevent timely feedback, insufficient reviewer accountability and unfamiliarity with journal requirements resulting in overly lenient or strict reviews, and ethical deviations where reviewers reject authors based on prejudice or misappropriate their innovative ideas. These issues demand urgent attention from editorial colleagues.

1.1 Inappropriate Reviewer Selection Leads to Substandard Review Quality Editors may not have in-depth knowledge of selected reviewers, relying only on their past achievements, which can result in ill-prepared experts delivering low-quality, non-referential comments. Particularly in niche peer reviews, non-specialists may produce biased or erroneous judgments rather than high-quality evaluations. Some reviews merely offer perfunctory agreement without constructive suggestions, providing no substantive help to journals or authors. Others are influenced by academic cliques, delivering irrational assessments—either excessive praise or harsh criticism. For instance, a paper on construction cost judicial appraisal titled "Discussion on Construction Cost Claims Under COVID-19" required review by an expert with practical experience in cost dispute cases. When the initially assigned reviewer lacked deep engagement with this topic, they recommended a judicial appraisal expert whose subsequent review not only praised the paper' s relevance but also provided specific structural and professional depth suggestions. This demonstrates that without proper knowledge and judgment, experts cannot offer genuine insights, forcing editorial departments to seek alternative reviewers.

1.2 Insufficient Reviewer Pools Cannot Meet Review Demands Due to operational cost pressures, editorial departments can only engage a limited number of peer reviewers, generally sufficient for ordinary papers but inadequate for forward-looking research that may require 5–7 experts. Many experts, due to age or having left the field, cannot fully track professional development trends,

rendering them unable to make scientific and fair evaluations. This results in clearly insufficient numbers of peer reviewers, particularly as specialization and interdisciplinary integration become increasingly common. For example, when organizing peer review for a series on BIM technology applications in engineering cost management—a field just emerging without established authorities—the journal convened nine experienced practitioners to discuss the topic collectively before reaching a consensus for the editorial board and chief editor' s final decision.

1.3 Delayed Review Cycles Hinder Timely Academic Publication Artificial intelligence is accelerating research cycles and shortening publication timelines, with many journals now advocating digital publishing and online-first publication. This intensifies competition and compels journals to compress review cycles, further straining already time-constrained reviewers and inevitably causing delays that impact subsequent editing and publication processes. *Engineering Cost Management*, as an applied engineering cost journal, invites reviewers primarily from universities, research institutions, and enterprises in the construction engineering cost field—professionals whose own demanding schedules leave limited time for reviewing. With typical peer review cycles of 1–2 months and publication cycles of 3–6 months, delays increasingly fail to meet the demands of digital publishing and online-first models.

1.4 Academic Factionalism and Clique Culture Biases Review Outcomes While defending one' s academic views is legitimate, using review authority to exclude dissenters reflects narrow-mindedness [**?**, **?**]. The 2019 "Opinions on Further Promoting the Spirit of Scientists and Strengthening Work Style and Academic Ethics Construction"issued by the General Office of the CPC Central Committee and the State Council calls for academic democracy, constructive criticism, respect for academic discourse rights, and opposition to portal biases and "academic tyrant" tendencies, particularly against "clique" culture in research. Despite double-blind review, experts can sometimes identify academic affiliations through paper information or references, showing favoritism toward colleagues while harshly criticizing or even fabricating evaluations against rivals. To maintain academic privileges, some reject innovative ideas, abuse authority to suppress emerging achievements, and even deliberately delay reviews to appropriate authors' ideas—violating moral and legal boundaries. Editorial departments must remain vigilant, promptly replace problematic reviewers, and protect authors' rights and journal quality.

1.5 Expanding Chinese Scientific Workforce Triggers Surge in Academic Papers China ranks second worldwide in the number of papers published in the most influential journals across disciplines and fourth in top-tier international journals (2019 China Science and Technology Papers Statistical Results). Facing this geometric growth of knowledge and information in the big data era, Chinese researchers face enormous reading burdens, making it diffi-

cult to evaluate papers comprehensively and accurately. Reviewer fatigue has become a common problem in scientific journals globally [**?**], leading to declining review quality. Additionally, as research directions become more specialized and interdisciplinary boundaries blur, emerging marginal sciences and new theories create pressures for reviewers to update their knowledge systems, hindering timely and effective evaluation of new research findings.

2. Strategies for Improving Peer Review

For scientific journals, finding first-rate experts in relevant fields who can keep pace with theoretical system and knowledge updates in the big data era is essential. Given human and financial constraints, editorial departments must conduct thorough preliminary reviews and only send potentially publishable papers to experts. Academic publishing should emphasize quality, following the internal logic of content, standards, and evaluation—strategic directions that both editors and peer reviewers must consider [**?**].

2.1 Continue Optimizing Double-Blind Review For most scientific journals, double-blind review remains a practical and effective peer review method that requires continued refinement to adapt to big data and AI impacts on research. Double-blind review challenges both editors and reviewers professionally [**?**, **?**, **?**]. Peer review is fundamentally an academic exchange form; editorial departments should rationally consider expert opinions while objectively addressing authors' differing views, which may reflect the vitality of scientific innovation. Since innovation is the lifeblood of scientific journals, editors and reviewers must focus on examining papers' innovative value [**?**]. Double-blind review need not operate in absolute secrecy—when authors dispute review comments, editors can facilitate direct communication between reviewers and authors. For major disagreements, additional reviewers can be invited or editorial board discussions convened to ensure review conclusions withstand scientific and historical scrutiny.

2.2 Strengthen Review Process Management Effective review process management promotes orderly peer review and helps experts review efficiently: (1) **Control review rounds**: Editors remind reviewers to make careful decisions and provide specific comments to help authors improve quality. To enhance efficiency, papers generally undergo no more than two rounds of peer review, with second-round reviews focusing only on whether authors addressed initial comments rather than raising new issues. (2) **Control review volume**: External reviewers are part-time with limited time and energy. To ensure quality, editors generally assign no more than two papers per month, allowing reviewers to schedule their time and concentrate on each manuscript. (3) **Scrutinize review conclusions**: When reviewers repeatedly provide empty, non-constructive comments, editorial departments record these instances and subject such experts to stricter evaluation, potentially terminating their reviewing qualifications.

2.3 Establish a Dynamic Reviewer Expert Database The importance of reviewers in peer review is self-evident. Building a systematic, high-quality reviewer database is crucial for editorial departments. Breaking conventional thinking requires continuously enhancing reviewer diversity and dynamic management, selecting experts with different research styles from multiple perspectives [**?**]. Choosing experts with profound academic foundations, high ethical standards, and keen innovation awareness ensures paper quality, builds author and reader confidence, and reduces doubts. Editorial departments can identify and recruit experts through renowned academic databases and websites, tracking their disclosed academic achievements and publications. As technological specialization intensifies and marginal and interdisciplinary fields emerge, increasing numbers of niche papers require editorial departments to track disciplinary development and accumulate reputable niche reviewers to ensure targeted, scientific, objective, and authoritative evaluations.

2.4 Organize Reviewer Training Since experts come from diverse fields, editorial departments must provide training to establish evaluation norms and effective incentive mechanisms [**?**, **?**, **?**]. Training should clarify the journal' s paper requirements, column characteristics, and establish standardized review processes, timelines, and specific review forms that 明确要求审查指标 covering research innovation, scientific rigor, objectivity, language standards, and structural precision. The more standardized the requirements, the better the review quality guarantee. Without systematic requirements, the review process becomes arbitrary and rough, compromising journal quality. Therefore, editorial departments must organize reviewer training, clarify responsibilities, and establish effective review systems and processes.

2.5 Support Reviewers to Address Concerns and Shorten Review Cycles Given reviewers' busy schedules with research, teaching, and conferences, editorial departments should create personalized review schedules for part-time reviewers. When deadlines are exceeded, editors gently remind reviewers while maintaining regular contact to understand their work and life characteristics, fostering familiarity that facilitates open communication and enables stricter requirements when appropriate. This approach enhances reviewer enthusiasm [**?**]. Since reviewers may not thoroughly examine papers due to time constraints, editors should remind them to provide specific, constructive comments to help authors improve quality [**?**].

2.6 Recruit Outstanding Young Experts as Reviewers While editors often prefer industry leaders, these senior experts may not be optimal reviewers in terms of time and energy. Conversely, many young professional PhDs and researchers have deep industry knowledge, serve as academic leaders and technology pioneers, and are often interdisciplinary talents with profound insights [**?**]. They possess sufficient energy and deliver high-quality reviews [**?**, **?**]. Editors should actively recruit such young experts into reviewer databases with

dynamic management, particularly for cutting-edge papers where they can focus on examining innovation, completeness, and logical coherence to produce objective, valuable review conclusions.

2.7 Have Editorial Boards or Reviewers Recommend Papers To comprehensively showcase academic achievements in engineering cost management, *Engineering Cost Management* requires editorial board members to write or recommend papers (at least one authored and 1–2 recommended papers every two years) while inviting reviewers to contribute or recommend quality manuscripts. These submissions undergo the same three-review process to ensure objectivity and fairness. However, editorial departments may adopt more transparent peer review methods for these papers, even organizing public editorial board discussions for questionable topics and disclosing review comments to authors, who then actively participate in revision. This transparent academic discussion allows prospective theoretical viewpoints to undergo comprehensive examination before publication [**?**].

2.8 Adapt Peer Review to the Big Data and AI Era To ensure fairness, scientific rigor, and improve review quality and efficiency, many domestic journals are innovating peer review methods beyond single double-blind review, experimenting with internationally popular open peer review approaches. New forms include using DingTalk, Tencent WeChat, and other video conferencing platforms for manuscript or thematic reviews. As big data and AI technologies develop, peer review will become increasingly efficient, transparent, and open, facilitating academic exchange, open access, and sharing [**?**]. In the era of media convergence, scientific journals must adhere to "content is king" to maintain initiative amid diversified and fragmented reading conditions [**?**, **?**, **?**, **?**, **?**]. This paper comprehensively analyzes factors affecting peer review effectiveness and proposes eight practical strategies that will help improve peer review quality. As big data and AI technologies advance, peer review will become increasingly open, transparent, and intelligent, further enhancing scientific journal quality and review efficiency [**?**].

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Author Biography: Jiang Jianbin (1974-), male, from Quanzhou, Guangxi, Deputy Editor-in-Chief of *Engineering Cost Management* journal, Senior Industrial Artist, research interests: engineering cost industry books, journals, and digital media publishing and promotion.

(Responsible Editor: Zhang Xiaojing)

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