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# Quality Evaluation of Scientific Journals in the Open Science Context

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## Introduction

Open science is a global initiative aimed at enhancing the quality, transparency, and societal impact of scientific research. It seeks to foster reproducibility, informed policymaking, and public trust in science (UNESCO, 2021). As the open science movement grows, academic journals—key platforms for disseminating scholarly knowledge—must adapt by aligning their operations with open principles. However, this shift has introduced concerns about journal quality, especially regarding peer review rigor, ethical standards, and the potential prioritization of commercial interests over scientific integrity.

Scientific and technical journals, which frequently lead in open access adoption due to the nature of their content, bear particular responsibility. They reflect a country's scientific capacity, contribute to international competitiveness, and influence the direction of research and policy. If these journals compromise on quality, the consequences can be severe, including misleading scholars and decision-makers and eroding public trust in scientific communication. As such, evaluating and improving journal quality in the context of open science is both urgent and essential.

Traditionally, journal evaluation has relied on citation metrics or alternative bibliometric indicators. While these are useful for measuring scholarly impact, they provide only a partial view and are often outcome focused. They fail to capture the entire publishing lifecycle and overlook key elements such as openness, transparency, service quality, and ethical practices. Therefore, a more comprehensive and process-oriented evaluation system is necessary.

This study aims to construct a multidimensional framework for assessing the quality of scientific journals under the open science paradigm. It considers the full lifecycle of scholarly publication—from manuscript submission and peer review to dissemination and societal influence—allowing for a more nuanced understanding of journal performance.

## Construction of the Evaluation Framework

To align with the open science agenda, this study began by reviewing definitions, policies, and practices from academic literature and major publishers (Vicente-Saez & Martinez-Fuentes, 2018; Elsevier, 2025; Saha et al., 2003). Based on this foundation, a preliminary set of evaluation indicators was drafted. The Delphi method was used to solicit feedback from 30 experts with experience in open science, leading to a refined indicator set through two rounds of expert consultation. The framework is rooted in the principles of Total Quality Management (TQM), dividing journal quality into two overarching dimensions: product and service.

The product dimension assesses the openness and integrity of research outputs published by the journal. The service dimension evaluates the journal's efforts to support authors, readers, and the broader public through open science practices and knowledge dissemination.

## Expert Evaluation and Weighting

Using the Delphi method, the indicator system was refined through two rounds of consultation with 30 experts. In round one, 12 valid responses were received. While all indicators were retained, experts suggested clearer definitions and broader coverage. In round two, 7 experts affirmed the improvements. Indicators were then assigned

weights using the Analytic Hierarchy Process (AHP), based on the averaged importance scores. A consistency check ensured the validity of the final weighting scheme. The final indicators and their weights are shown in Table 1.

## Empirical Analysis: Open-Access Journals in Optics

To validate the framework, an empirical study was conducted using open-access journals in the field of optics. Journals were retrieved from the DOAJ database using the keyword "Light" and cross-referenced with the 2022 Journal Citation Reports (JCR). Of 28 initially identified journals, 19 met the inclusion criteria (available website and JCR index).

Each journal was assessed according to the framework. Binary scoring (1 = present; 0 = not present) was applied for qualitative indicators based on website information. Academic impact was measured using normalized impact factors. Social impact was derived from Altimetric scores calculated for papers published between 2020–2022. Publication transparency and other services were evaluated based on publicly available editorial and operational information.

## Results

The top three journals—*Optica*, *Optics Continuum*, *and Optical Materials Express*—are all published by the Optica Publishing Group. These journals consistently support open peer review, require data availability statements, and promote publications through comprehensive outreach. They exemplify strong alignment with open science principles across both product and service dimensions.

Mid-tier journals, including *EPJ Quantum Technology and Photoacoustics*, performed reasonably well but lacked features like publication bias statements or robust open review processes.

**Table 1. Evaluation Indicator Framework for Scientific Journals in the Open Science Context.**

| Dimension | Indicator and Weight (%) | Explanation |
|---|---|---|
| Product | Open Research Process (10.83) | Supports pre-registration of research and ensures transparency in the entire research process, from the start of the project to its completion. This includes research work, implementation plans, technical routes, analytical methods, experimental processes, and public engagement. |
| | Preprint Licensing (19.61) | Allows authors to publicly share manuscript drafts on designated preprint platforms before formal publication, based on well-established preprint copyright, licensing, ethics, privacy, and general guidelines. |
| | Open Peer Review (15.06) | Disclosure of reviewers' identities, public review comments, and the opportunity for broader community input in evaluations. |
| | Open Scientific Outputs Related to Publications (8.10) | Includes raw research data, software, source code, materials, hardware designs, protocol workflows, images, charts, multimedia materials, and other related scientific outputs. |
| | Open Repository (7.31) | A platform that offers access to relevant materials (e.g., research data, scientific outputs) in formats that are user-friendly, machine-readable, and interoperable with open research infrastructures. |
| | Paper Content Quality (2.50) | Strict checks for academic misconduct, ensuring that all published papers adhere to strict data citation rules and quality standards. |
| | Academic Impact (2.88) | The use of papers, including views, downloads, and citations of abstracts and full text. |
| | Social Impact (8.71) | The number of shares, retweets, likes, and other forms of engagement on new media, along with political and economic impacts. |
| Service | Author Open Policy Service (3.96) | Describes the journal's open policies in the submission guidelines and provides a checklist of submission requirements under these policies, including explanations for special cases. |
| | No Publication Bias Statement (4.58) | The journal declares that the significance and novelty of research results are not the sole criteria for publication. During the review process, the journal does not consider the outcomes of the research. It accepts replication studies and registered reports of innovative research, treating these as regular submission options. |
| | Publication Transparency (1.96) | Provides detailed information about the process from submission to peer review to final publication, including initial decision times, average review times, number of reviews, and geographical distribution of editors and reviewers. |
| | Diverse Publication Formats (2.50) | A variety of publishing formats, such as XML/HTML web publishing, multimedia publishing, semantic publishing, enhanced publishing, etc. |

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|---|---|---|
| | Diverse Promotion Services (3.12) | Comprehensive use of various promotional methods, such as targeted email campaigns, promotion via different new media platforms, and hosting public academic conferences and outreach activities to promote academic exchange and collaboration. |
| | Online Communication Platform (2.62) | Provides online platforms or social media for the public to discuss research processes, data, methods, and publications. |
| | Open Science Outreach Activities (3.07) | Collaborates with universities and research institutions to offer lectures or training sessions that explain open peer review, open publishing, and other related topics to improve the utilization of open academic resources. |
| | Open Resource Usage Instructions (3.20) | Provides readers with detailed explanations of the open resources available, including guidelines for using the resources, ensuring accessibility and ease of use. |

Lower-ranked journals such as *Light: Science & Applications* demonstrated limited engagement in key areas like open research processes and community outreach, despite offering open access.

Common weaknesses across all journals included insufficient support for pre-registration, limited use of multimedia formats, and the general lack of open peer review practices. These gaps suggest a need for broader adoption of open science infrastructure and cultural changes in publishing norms.

## Conclusion and Future Work

This study presents a comprehensive, empirically tested framework for evaluating journal quality under the open science paradigm. It integrates both outcome-based and process-based metrics and accounts for the full lifecycle of research dissemination. The results underscore the importance of transparency, data sharing, and community engagement as essential elements of journal quality in the digital age. By embracing a multidimensional evaluation perspective, journals can better align with the principles of open science, thereby fostering a more transparent, equitable, and impactful scholarly communication ecosystem.

In subsequent research, the indicator framework will be further improved, its empirical scope broadened through evaluations of scientific and technological journals across various fields, the definitions and applications of each indicator will be continually refined and specified, and by comparing it with existing evaluation models, the credibility and generalizability of the indicator framework will be enhanced. Additionally, comparative empirical analyses of journals from different countries could be conducted, drawing on best practices to promote the development of high-quality open science journals.


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