

Behavioral Characteristics of International Academic Journal Publishers in Response to Open Science: A Case Study of Five Major Publishers (Postprint)

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Abstract

【目的】 To analyze the characteristics of international major academic journal publishers' responses to open science initiatives, and to explore development pathways for open publishing of Chinese academic journals. **【方法】** Through literature and website investigation, comprehensively collate and analyze the latest progress and practices of major publishers in response to open science, including the open policies and practices of five major international academic journal publishers in areas such as open access implementation pathways, open platform construction, open peer review, and open strategies and initiatives. **【结果】** The five major international academic journal publishers have essentially completed the transition from traditional publishing to open access; they emphasize research data sharing and have relatively comprehensive policies for data submission, storage, and utilization; they actively participate in the formulation of and compliance with relevant sharing policies; they continuously develop new publishing ecosystems and expand their business types. **结论** Chinese academic journals should strengthen intensive development and promote the OA transformation of journals; formulate standardized guiding principles and emphasize the openness and utilization of research data; adjust service and functional layouts and expand academic service types.

Full Text

Research on the Behavior Characteristics of International Academic Journal Publishers in Response to Open Science: A Case Study of Five Major International Academic Journal Publishers

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Abstract

[Purpose] This study analyzes the behavioral characteristics of major international academic journal publishers in response to open science and explores potential pathways for developing open publishing in Chinese academic journals. **[Methods]** Through comprehensive literature review and website investigation, we systematically organized and analyzed the latest developments and practices of large publishers in response to open science, examining the open access implementation pathways, open platform construction, open peer review, and open science strategies and initiatives of five major international academic journal publishers. **[Findings]** The five major international academic journal publishers have essentially completed their transformation from traditional publishing to open access. They emphasize research data sharing and have established relatively comprehensive policies for data submission, storage, and utilization. These publishers actively participate in the formulation and implementation of relevant sharing policies while continuously developing new publishing ecosystems and expanding their business portfolios. **[Conclusions]** Chinese academic journals should strengthen intensive development to promote OA transformation, formulate standardized guidelines with greater emphasis on the opening and utilization of research data, and adjust their service and functional layouts to expand academic service offerings.

Keywords: Open Science; International Academic Journal Publishers; Behavior Characteristics

Introduction

Open science has become the new direction and major trend in global scientific research development. In 2021, UNESCO released the *Recommendation on Open Science*¹, encouraging the implementation of open licenses and even recommending that countries enact necessary legislation to provide an environment for open science development. In 2022, the Open Society Foundations released “BOAI20,” strongly supporting open data, open metadata, open protocols, open books, open papers, open licenses, open peer review, and more². Numerous international organizations, major scientific and technological countries, and academic groups have regarded open science as a transformative strategy and proposed a series of policy measures to promote its development³. According to ROARMAP (The Registry of Open Access Repositories Mandatory Archiving Policies), over 1,100 institutions and organizations have issued their own open policies⁴, with many mainstream academic research groups in the United States and Europe establishing clear open science policies. A survey report by the European University Association (EUA) shows that 91% of universities have or are developing open science policies⁵.

The rapid development of open science, with increasing participation from academic institutions, non-profit research funders, and national/regional entities in infrastructure construction, has created requirements for open access to funded research projects. These actions have broken the previous monopoly of publishers over academic publishing and impacted traditional publishing businesses. However, to adapt to the new academic ecosystem, academic publishers have continuously monitored open science developments and adjusted their business structures, participating in the open science process through various forms.

Chinese scholars have conducted numerous studies on how academic publishers respond to open science. As an important component of open science, open access first attracted attention from Chinese scholars, initially primarily from the library perspective—examining driving factors for open access⁶, quality evaluation and selection of open access journals⁷, libraries in the open access environment⁸, and institutional repository construction⁹, among others. Library scholars mostly focused on how journal open access affected literature resource construction, with less attention to impacts on the publishing industry. Ou Hongye et al.¹⁰ investigated perceptions of open access among publishing professionals, initiating research on open access within the publishing community. Scholars subsequently conducted systematic research from multiple perspectives, including introductions to foreign publishing models, development trends, stakeholder interest 博弈¹¹, and citation advantages of open papers¹². Sun Chaoyuan et al.¹³ argued that open peer review represents an improved model of traditional peer review.

Open data, as a crucial component of open science, has received widespread attention from scholars, research funding agencies, and national governments. Cui Yan¹⁴ studied publisher policies on scientific data openness in 2016, though

at that time such policies were still in the initial exploratory stage and had not yet reached scale. Peng Yuanyuan et al.¹⁵ examined open data policies of foreign publishing institutions, while Ma Hanqing et al.¹⁶ compared international scientific journal data repositories to analyze their significance in promoting data openness. Additionally, Guo Huadong et al.¹⁷ advocated strengthening open data infrastructure construction to advance open science development. China's "Science Data Bank" (ScienceDB) launched in 2015, and national-level scientific data management policies have been issued successively, including the *Administrative Measures for Scientific Data* by the State Council in 2018 and, in April 2022, the National Press and Publication Administration's inclusion of paper data management and sharing in academic journal verification requirements. Scholars have also begun examining knowledge transformation pathways for journals in the open science environment¹⁸.

Although Chinese publishing circles have relatively comprehensive theoretical research on journal development in the open science environment, significant gaps remain in practice compared with major international publishers. For instance, among the 250 journals selected for the Excellence Action Plan, only 19 have mandatory data policies, while 148 have no relevant policies. The *Blue Book of China's Science and Technology Journals (2021)* statistics show that among 4,963 Chinese scientific journals, only 1,810 are open access journals, with the vast majority (1,459) being bronze open access. The Open Science Research Office of the National Science Library, Chinese Academy of Sciences, released the *2023 Global OA Journal and APC Monitoring Report* in March 2024, indicating that global OA publishing accelerated in 2023, with more traditional publishers entering the field and the global OA commercialization path becoming evident.

Building on previous research and combining case studies, this study first analyzes the behavioral characteristics of major international academic journal publishers in response to open science. It then summarizes their implementation pathways for open access, open platform construction, open peer review, and open science strategies and initiatives. Next, it distills their innovations in knowledge services and business models. Finally, it proposes reform pathways for Chinese journals in the open science environment from macro and micro perspectives, focusing on policy environments, standardized guidelines, and service function adjustments.

1.1 Research Objects

This study selected five major international academic journal publishers—Elsevier, Springer Nature, Wiley, Taylor & Francis, and Sage—as research objects based on the following reasons: (1) All five are global publishing groups controlling over half of the world's scientific journals and papers across extensive disciplinary ranges, making their behavioral characteristics representative of journal development directions; (2) The five publishers are important drivers of the open science movement, employing multiple approaches to increase OA journal and article numbers. Based on Web of Science searches, 40% of globally

published open access papers from 2000–2023 came from these five publishers; (3) All five are registered in Europe and North America—pioneers in promoting open science where many organizations and nations have established complete open science policy systems, providing favorable policy environments for these publishers to participate in open science processes and promote open access, open data, open peer review, and open platform construction; (4) Although the publishers’ businesses include both journals and books with open policies for both, significant differences exist in publishing processes, content, formats, and monopolistic control. Therefore, this study focuses exclusively on these publishers’ open initiatives in journal publishing, referring to them as the “five major international academic journal publishers.”

1.2 Research Methods

This study primarily employs case analysis to examine open policies on the five publishers’ official websites, supplemented by official news and authoritative registry websites (such as DOAJ, ROARMAP, and ESAC), as well as correspondence with the publishers to obtain their open policies and initiatives. Relevant statistical data were retrieved through Web of Science, DOAJ, and Scopus databases. Based on this information, we compiled, refined, and summarized the publishers’ open policies and practices regarding open access implementation pathways, open platform construction, open peer review, and open science strategies and initiatives.

2.1.1 Diversified Approaches to Increasing OA Journal Numbers

The five major international academic journal publishers employ different strategies to capture market share in open publishing. Elsevier primarily launches new journals, introducing its first gold OA journal in 2009, followed by 60 new titles in 2019, 70 in 2020, and over 100 in 2022. By December 2023, Elsevier’s total gold OA journals reached over 700 (data from DOAJ). These journals feature a distinct “mirror journal” model (e.g., *Materials Letters: X* as the mirror of subscription journal *Materials Letters*). The mirror concept’s uniqueness lies in having the same editorial team process all submissions through peer review, applying identical editorial standards to all content. Authors can choose between the parent or mirror journal at submission and reconsider their choice during revision, enabling clear and transparent separation between subscription and open access content. Additionally, Elsevier’s gold OA journals leverage existing subscription journals’ influence and editorial teams to enhance their visibility. The publisher has also signed open access agreements with Finland, Norway, Poland, Hungary, Sweden, France, Carnegie Mellon University, the University of California system, Switzerland, Ireland, the Netherlands, Qatar, South Korea, the University of Florida, UK research institution Jisc, US NERL (aiming to coordinate optimal licensing terms and pricing for electronic resources), and the Japan University Library Electronic Resources Consortium (Elsevier’s first open access agreement in the Asia-Pacific region). Through these multiple ap-

proaches, nearly all 2,800 Elsevier journals now support open access publishing, making it one of the world's largest open access publishers.

Springer Nature, Taylor & Francis, and Wiley primarily increase their fully OA journal portfolios by acquiring established OA publishers, such as Springer Nature's merger with BMC, Taylor & Francis's merger with Dove Medical Press, and Wiley's merger with Hindawi. They have also adopted approaches similar to Elsevier's transformative agreements and new journal launches to achieve substantial OA journal growth. Furthermore, all five publishers employ delayed OA models, with Elsevier offering delayed OA for 156 journals with embargo periods ranging from 6 to 60 months.

Through acquisitions, cascades, conversions, new journal launches, and cooperative publishing, the five publishers have all achieved OA journal proportions exceeding 94% as of December 2023. The basic OA status of each publisher's journals is shown in Table 1 .

Table 1 Basic OA Status of Journals from Five Major International Academic Journal Publishers

Note: Data compiled from journal lists provided by each publisher. Elsevier's figures represent its core Freedom Collection journal count. The asterisk indicates 193 renamed journals, 195 discontinued journals, 71 merged journals, and 31 resold journals, all of which achieved OA at different times.

2.1.2 Status of Transformative Agreement Signings

As open science has developed, European, North American, and some East Asian countries have implemented national- and institutional-level open access transformation practices¹⁹. The five publishers have shifted from initial 观望 to vigorously promoting transformative agreement signings. Although this study focuses on open access implementation and transformative agreements involve various models such as read-and-publish and publish-and-read—with Plan S alone recommending seven transformation models²⁰—all these models ultimately aim for open access, so this study does not distinguish between them. The numbers of transformative agreements signed and articles involved from 2021–2023 are shown in Table 2 .

Table 2 Transformative Agreements Signed by Five Publishers (2021–2023) and Article Numbers

Note: Data compiled from ESAC (Efficiency and Standards for Article Charges) website registrations (as of December 2023).

Statistics from the ESAC website show²¹ that the numbers of transformative agreements and open access articles for Elsevier, Sage, Springer Nature, Taylor & Francis, and Wiley are all trending upward. The five publishers' agreements account for approximately 20% of total registered agreements, but their converted article proportion exceeds 80%, demonstrating absolute dominance.

Their transformative agreements are also flexible, including offsetting agreements, read-and-publish agreements, publish-and-read agreements, and other types, with terms modified according to research funder requirements and different implementation plans developed around institutional needs.

By signing transformative agreements with national-level and large academic organizations, the five publishers have not only captured the open access market (accounting for 40% of global open access articles from 2000–2023) but also locked in the output of excellent academic groups. With over 80% of converted articles and agreements primarily signed with organizations like the University of California system and the Chinese Academy of Sciences, these agreements ensure that authors from these groups publish their research in relevant journals, further strengthening the publishers' position in the open access market.

2.2 Status of Open Research Data and Platform Construction

All five publishers support open research data and provide a relatively standardized set of data sharing policies covering data storage platforms, open data types, sharing objectives, FAQs, and sharing guidelines. Their open research data platforms, types, and objectives are shown in Table 3 .

Table 3 Open Research Data and Platform Construction of Five Major Publishers

Note: Information compiled from official publisher websites and news.

Except for Elsevier and Springer Nature, the other three publishers have not built their own data storage platforms but generally recommend general or discipline-specific data repositories and link their database literature with data platforms to facilitate research data sharing. Their definitions and objectives for research data are largely similar. Although Springer Nature's data policy does not include software, it acknowledges software and code's importance for result reproducibility and transparency, with some publishers conducting data peer review activities.

The publishers have also made considerable progress in open data practices and research. Elsevier joined the Open Group OSUD to accelerate data standardization and digital transformation in the energy sector; collaborated with Harvard Medical School to establish the Research Data Management Librarian Academy (RDMLA) focused on research data management; granted Germany's OA Monitor access to its publishing data to help document German academic institutions' publishing output and analyze subscription and OA publishing fee developments; and partnered with ECDF to promote diverse and insightful ideas on responsible research data use and how to support innovation, research, and entrepreneurship, with attention to transparent and diverse utilization of research data in the digital age.

Springer Nature believes data should be open, accessible, and reusable, requiring data availability statements for all primary research articles (including

Springeropen, Nature, and BMC journals) and publishing data storage guidelines. It tracks data sharing practices and has released multiple white papers on data sharing (including “The Future of FAIR,” practical challenges researchers face in data sharing, and five essential factors for data sharing). In collaboration with Digital Science, it has studied researchers’ attitudes and experiences regarding open data and supports organizations like the Digital Preservation Coalition (DPC) and Research Data Alliance (RDA). The publisher also offers specialized journals *Scientific Data* and *BMC Research Notes* for data publication.

Wiley journals’ attitudes toward data sharing fall into four categories: encouraging, expecting, mandating, and authorizing data sharing, plus peer-reviewed data, with standard templates provided for authors in each category. Wiley also partners with Dryad to provide data storage and sharing services for authors. Taylor & Francis became a signatory of Transparency Openness Promotion (TOP), following TOP guidelines to advocate for open research and promote open publishing policy formulation and data sharing. While not mandating data openness, Taylor & Francis encourages authors to choose repositories that provide persistent identifiers. Sage is also a TOP signatory and member of the STM Research Data Group, supporting FAIR principles. Sage journals vary in their methods and requirements for research data sharing, but most follow minimum standards encouraging authors to share their research data.

2.3 Status of Open Peer Review

Transparent peer review will ultimately reduce fraudulent reviews and resulting retractions, improving research integrity and reproducibility. Importantly, it also provides greater visibility and recognition for reviewers’ efforts. Consequently, major publishers are taking measures to support open peer review. Elsevier’s International Center for the Study of Research (ICSR) stores versions of articles from over 2,000 journals at different stages and peer review metadata, which researchers can access through its ICSR Lab platform specifically built to support systematic study of peer review.

Springer Nature’s BMC journals have practiced open peer review since their establishment in 1999, with 68 journals currently offering open peer review in various forms including patient peer review, registered report (study protocol) peer review, result-free review, terminated re-review, automated peer review, and portable peer review within or between publishers. Wiley, in partnership with Publons and ScholarOne (part of Clarivate’s Web of Science), launched a transparent peer review pilot program with over 60 participating journals. F1000Research, part of Taylor & Francis, operates an innovative peer review process that conducts peer review after article publication, fully open and transparent, encouraging authors to publicly respond to peer review reports. Sage currently has only 10 journals offering open peer review, allowing research publication in fully open formats while preserving article versions from each stage. Its open peer review operates through ScholarOne’s “Transparent Peer Review Initiative,” with some journals allowing reviewers to opt in or out and submit

reviews under real names or anonymously.

2.4 Status of Open Science Strategies and Initiatives

All five commercial publishers attach great importance to open science development as a key strategic direction. First, they employ multiple means to capture the open access market, with open journal proportions exceeding 94%, making open journals an important profit growth point. Second, all five have dedicated “Open Science” sections on their official websites detailing open science advantages, publishing open science research white papers and open access statements, explaining author options for open access with procedures and FAQs, providing information on transformative journals and agreements, describing methods, storage, and citation for open research data, and offering copyright agreement templates.

Third, they actively join various standard-setting groups, follow authoritative copyright policies, and even serve as founders or active promoters of various policies. For example, as a co-founder of FORCE11, Elsevier participates in developing co-authorship guidelines, FAIR data principles, and data citation implementation principles, and as an active member of the Research Data Alliance develops and adopts infrastructure to promote data sharing and data-driven research, positioning itself with discourse power in open science. Additionally, to adapt to open science development, commercial publishers actively expand new open publishing services, particularly knowledge management, analysis, and evaluation tools.

Elsevier’s Digital Commons helps institutions preserve, share, showcase, publish, and promote academic achievements, enabling researchers to store and share FAIR data and achieve large-scale data collaboration. Data Monitor can utilize millions of research data records in repositories to help institutions understand their researchers’ entire research data output, automatically tracking institutional research data, global research data output and trends across repositories, institutions, and disciplines, and monitoring researchers’ compliance with national and funder policies. The innovative open access workflow management solution Oable, developed in cooperation with Wiley, simplifies administrators’ approval workflows in the open access publishing process, covers cross-publisher transformative agreement management, and provides critical support for researchers and faculty, enabling Elsevier to offer academic research services beyond traditional publishing.

Springer Nature launched the Linked Open Data platform Springer Nature Sci-Graph, aggregating knowledge graphs from multiple data sources to achieve content value addition and knowledge services through knowledge organization. Taylor & Francis partnered with Researcher App to develop an application for tracking Taylor & Francis’s latest research.

Discussion

3.1 Developing OA Journals to Achieve Publishing Model Transformation

The five major international academic journal publishers have all achieved OA journal proportions exceeding 94%, essentially completing their transformation from traditional to open access publishing. Their transformation measures primarily include: (1) launching new fully OA journals leveraging existing journals' high influence to rapidly establish visibility and impact; (2) cooperating with academic institutions to launch new journals, utilizing their academic influence (especially renowned universities and learned societies) for rapid development; (3) acquiring established OA publishers to quickly achieve dominance in the OA journal field; and (4) signing transformative agreements with nations, universities, and academic groups to achieve journal OA transformation. The first three approaches are primary sources of fully OA journals, while the fourth mainly involves hybrid OA models. Table 1 shows that the five publishers have absolute advantages in hybrid OA journal numbers, demonstrating both flexibility in OA policies and their active participation in the open access movement through transformative agreements with global scientific institutions, thereby reducing economic pressure from open access.

3.2 Emphasizing Open Data and Actively Participating in Standard Formulation and Implementation

Scientific research is considered to have entered the fourth paradigm development stage: a data-intensive research paradigm based on massive data collection, processing, analysis, and visualization²². Research data, as important scientific material, has begun receiving attention from all stakeholders, including publishers²³. The five major international academic journal publishers all support open research data and provide relatively standardized data sharing policies, actively participating in open data standard formulation. Elsevier and Springer Nature have even built their own data platforms, helping them gain discourse power in data submission, storage, and utilization.

3.3 Developing New Publishing Ecosystems and Expanding Business Types

As the open science movement deepens, open access, open data, open review, and open licensing have significantly impacted traditional academic publishers' profit models. While transforming their publishing models, the five major international academic journal publishers have actively developed new publishing ecosystems and continuously expanded their business types. They leverage their resource advantages to integrate, correlate, and organize knowledge, developing various knowledge services and academic tools to create new profit models.

Implications for Chinese Academic Journals

4.1 Strengthening Intensive Development to Promote Journal OA Transformation

The five major international academic journal publishers have obtained large numbers of OA journals through new launches, acquisitions, mergers, and conversions, achieving OA proportions exceeding 94%. Their large journal quantities, diverse types, and strong publishing institutions present obvious advantages, particularly through new journal creation, mergers, and transformative agreement signings. In contrast, as of August 2024, Chinese journals in DOAJ numbered only 380, with China's OA journal proportion far below that of the five major publishers. The reasons include China's highly dispersed management, sponsorship, and publishing units. According to the *Blue Book of China's Science and Technology Journals (2023)*, China's 5,163 scientific journals have 1,339 managing units, with 878 units managing only one journal and only 76 units managing ten or more journals—a stark contrast to the thousands of journals managed by the five major international publishers. This dispersion prevents economies of scale for rapid new journal launches and makes transformative agreements, considered crucial steps toward open science²⁴, difficult to implement, as individual publishers cannot provide multi-disciplinary, multi-format open access publishing or negotiate bulk deals, leaving them without discourse power in negotiations with academic institutions.

Open science has become a major national strategy in many countries. We must seize the opportunities that open science development brings for journal publishing model transformation through intensive development, building alliance cooperation networks, and utilizing national, regional, and industry-wide publishing alliances to achieve intensive journal development. Future efforts can leverage scale advantages to secure funding and policy support from academic funding agencies (such as the National Natural Science Foundation, Ministry of Education, provincial funding agencies, and even foreign funders) for open publishing, sign read-and-publish or publish-and-read transformative agreements with libraries, concentrate personnel and funds to explore sustainable open publishing development strategies, and build platforms supporting open science development.

4.2 Formulating Standardized Guidelines with Emphasis on Research Data Opening and Utilization

Data is a core element for developing new quality productive forces²⁵. The five major international academic journal publishers attach great importance to research data openness, with nearly all journals having data openness policies that mandate or recommend data submission and standardization. Although China has issued series of national open data policies and academic groups (such as the Chinese Academy of Sciences) have created data repositories in different fields, academic journals rarely adopt data sharing policies. Among the 250

Excellence Action Plan journals, only 19 have mandatory data policies, while 148 have none, hindering research data storage, standardization, sharing, and utilization. Establishing mandatory measures and standardized principles for data openness will contribute to China's vigorous open science development, particularly regarding research output reusability—from data publication to data reuse, from human-readable to machine-readable formats.

4.3 Adjusting Service and Functional Layouts to Expand Academic Service Types

Recent trends show that open science has posed significant challenges to the five major international academic journal publishers' traditional business models. While actively undertaking OA transformation, their business models have gradually changed, continuously expanding academic service types to address open science development. They have diversified publication content types, offering data, images, videos, and other publishing services; established different storage standards and citation methods for data storage and citation; created universal copyright agreements to accommodate varying open licensing degrees; and leveraged artificial intelligence, big data, and other technologies to provide knowledge management, analysis, and other research academic services. Chinese journal publishing institutions should learn from foreign academic publishers to establish and improve China's open publishing service model with open publishing as the primary goal, providing full-process open science services to promote open sharing of research results.

Conclusion

This study investigated, analyzed, and summarized measures taken by the five major international academic journal publishers in response to open science, finding that they have essentially completed their transformation from traditional to open access publishing; attach great importance to research data sharing, with nearly all journals having data submission, storage, and utilization policies; actively participate in formulating and complying with relevant sharing policies, particularly emphasizing the connection between research data and related studies; and continuously develop new publishing ecosystems while expanding business types. Compared with these practices, Chinese academic journals show obvious gaps, with major challenges including lack of intensive development advantages, incomplete data openness policies, and insufficient policy enforcement. Chinese academic journals should seize the opportunities of the open science era to accelerate transformation from traditional journal publishing and expand academic service types.

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