The Rise of National-Level Open Access Agreements and Their Impact on the Global Academic Ecosystem (Postprint)

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Abstract

[Purpose/Significance] As the open access movement continues to advance, several European countries have successively initiated strategic research on formulating national-level open access agreements. By examining the content and characteristics of open access agreements across different countries, as well as their impact on the global academic ecosystem, this study proposes countermeasures for China to address the emergence of national-level open access agreements.

[Method/Process] This paper focuses on analyzing the content of national-level open access agreements in Germany, Norway, and France, with particular emphasis on introducing and analyzing the content, initiation background, vision and objectives, and primary operational mechanisms of these three countries' agreements. It also presents the national-level open access developments in Finland, Sweden, the Netherlands, and Switzerland. Based on this analysis, the study summarizes the main characteristics of national-level open access agreements and their influence on the global academic ecosystem.

[Results/Conclusion] Regardless of whether China adopts the national-level open access agreement model, it should promptly establish relevant research initiatives and adopt responsive measures: First, expeditiously initiate strategic assessment and research on China's national-level open access agreements; Second, cultivate globally competitive journal publishers; Third, intensify support for high-value academic journals; Fourth, actively take the lead in establishing an East Asian Three Countries Open Access Agreement Project Team; Fifth, enhance support for libraries and other document service institutions.

Full Text

The Rise of National Open Access Agreements and Their Impact on the Global Academic Ecosystem: An Analysis

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Abstract: *[Purpose/Significance]* With the continuous advancement of the open access movement, several European countries have successively launched strategic research on formulating national-level open access agreements. By examining the content and characteristics of open access agreements in different countries and their impact on the global academic ecosystem, this paper proposes countermeasures for China to respond to the emergence of national open access agreements. *[Method/Process]* Focusing on the analysis of national open access agreements in Germany, Norway, and France, this study elaborates on the content, initiation background, vision, and main working mechanisms of these three countries' agreements, while also introducing the national open access processes in Finland, Sweden, the Netherlands, and Switzerland. Based on this analysis, the main characteristics of national open access agreements and their influence on the global academic ecosystem are summarized. *[Result/Conclusion]* Regardless of whether China adopts the national open access agreement model, relevant research should be established early and response measures should be taken: (1) promptly initiate strategic assessment of national open access agreements in China; (2) cultivate globally competitive journal publishers; (3) increase support for high-value academic journals; (4) actively lead and establish an East Asian Tripartite Open Access Agreement project team; and (5) strengthen support for documentation service institutions such as libraries.

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In recent years, subscription prices from journal publishers have gradually escalated, forming a monopolistic situation that has become intolerable for academic institutions. Surveys indicate that Elsevier holds 24% of the academic journal market, while Springer Nature and Wiley-Blackwell each hold 12%, with the three combined accounting for half of the entire market [1]. Due to this monopoly position, Elsevier's total revenue in 2017 reached $3.17 billion, with net income of $1.17 billion—a profit margin of nearly 37%, far exceeding that of Apple, Google, and Amazon. Conversely, traditional publishers must bear multiple costs to produce a quality journal, including author payments, edito-

rial fees for commissioning, processing, and proofreading, as well as distribution logistics to subscribers and retailers. Consequently, their total costs are substantial, and even well-managed journals only achieve net profit margins of 12-15% [2]. Moreover, paradoxically, researchers who publish papers must also pay subscription fees to read their own work, creating a situation where suppliers must pay for the products they provide.

In response to these issues, the open access (OA) movement has been developing rapidly worldwide. Open access journals operate online, with scientists only needing to prepay partial editorial fees to ensure permanent access to published research for anyone [3]. In 2001, the non-profit scientific publishing organization "Public Library of Science" (PLOS) was founded by several renowned scientists including Nobel laureates. With its seven open access journals (*PLOS ONE*, *PLOS Biology*, etc.), PLOS quickly became a driving force in the open access movement [4]. While actively entering and transforming the publishing industry, the academic community itself also began to take action. In March 2016, the Max Planck Society in Germany initiated the OA2020 initiative, joined by 114 institutions from 36 countries or regions, to support and urge traditional subscription journals to transition to open access models. Seven campuses of the University of California system, including UC Berkeley, UC San Francisco, and UC Davis, were among the participants [5]. In September 2018, a more ambitious open access plan emerged in Europe: major research funding agencies from 11 European countries including France, the UK, the Netherlands, and Italy, with support from the European Commission, jointly signed Plan S (by November 2019, the number of participating funding agencies had increased to 16). This plan requires scientists funded by these agencies to abandon opportunities to publish in top subscription-based journals such as *Nature*, *Science*, *Cell*, and *The Lancet* from 2020 onward—unless these journals change their business models to become fully open access [6]. According to Scopus database data from 2016, only 15.2% of journals currently meet Plan S requirements. If the remaining 85% do not change, they will likely be "sidelined" by many European research institutions in the near future [2].

To implement Plan S, more than ten EU countries have begun establishing national open access agreements with publishers. The original intention of these national agreements was to negotiate with publishers at the national level and pay certain fees, enabling researchers in that country to publish in specific journals under the publisher without paying additional publication fees, while ensuring their papers are open access. Currently, Germany's Projekt DEAL is particularly prominent, with over 700 German research institutions and libraries participating. On August 22, 2019, Projekt DEAL formally signed an agreement with Springer Nature, under which the German government will pay Springer Nature RMB 280 million annually from 2020 for the publication of more than 13,000 (estimated) OA papers by German authors, with a cost of over RMB 21,000 per paper—marking a milestone event for national open access agreements globally [7]. Currently, the Netherlands, Sweden, Norway, Finland, Switzerland, and Austria are also negotiating with publishers to promote the

signing of their own national open access agreements.

2 Progress and Effectiveness Analysis of National Open Access Agreements in Select European Countries

2.1 Germany

The initiation, negotiation, and signing of Germany's national open access agreement are primarily managed by the Projekt DEAL team, which was proposed by the German Rectors' Conference to conduct negotiations with academic publishers. Projekt DEAL represents more than 700 German academic institutions, including universities, research institutes, and state and regional libraries. All academic and research institutions eligible to join the consortium, as well as national foundations funded by the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG), qualify to participate in the transaction agreement [7]. Projekt DEAL's main objectives are: (1) immediate open publication of all new research papers by German researchers; (2) permanent free access for German researchers to all academic papers published in the publisher's journals; and (3) fair and reasonable pricing of journal services based on the number of papers published.

Projekt DEAL established these objectives to align Germany with the principles of the EU's Plan S and accelerate the achievement of the global OA2020 initiative goals. The project team includes relevant experts from universities and other research institutions and is guided by a project steering committee composed of senior management members from universities and research institutions. The committee's spokesperson is Professor H. Hippler (former chair of the German Rectors' Conference). The project contacts are Dr. A. Kellersohn, Director of the University of Freiburg Library, and F. Scholze, Director of the Karlsruhe KIT Library. The core working group primarily consists of literature departments from major German libraries, including the University of Freiburg Library, German Central Library, Bavarian State Library in Munich, Max Planck Digital Library in Munich, KIT Library, and Berlin University Library [7]. The project team structure is shown in Figure 1 [Figure 1: see original paper].

In terms of implementation effectiveness, Projekt DEAL has achieved remarkable results. On August 22, 2019, Projekt DEAL signed the largest national open access publishing agreement to date with the major publishing group Springer Nature. Under this agreement, the German government will pay Springer Nature RMB 280 million annually from 2020 for the publication of over 13,000 (estimated) OA papers by German authors. Through this agreement, Germany gains OA publishing and full reading rights for papers in 1,900 hybrid journals under Springer Nature. This agreement excludes Nature-branded academic journals (such as the prestigious *Nature* and its sub-journals), fully OA BioMed Central series and SpringerOpen series, and popular science magazines (such as *Scientific American*). However, German researchers can receive a 20%

discount on article processing charges for publishing in BioMed Central and SpringerOpen series . Projekt DEAL chooses to pay the OA publication fees (typically page charges or article processing fees) for its researchers in exchange for reading rights to papers that previously required payment and making their own papers freely accessible to society. The agreement will take effect in 2020, expire in 2022, and includes a one-year extension option [8].

Additionally, Projekt DEAL successfully signed an OA publishing order with Wiley in February 2019, though on a smaller scale, covering publication fees for approximately 9,500 Wiley journal papers. Projekt DEAL hoped that signing agreements with Springer Nature and Wiley would pressure Elsevier into signing a similar agreement, but with limited success. Negotiations with Elsevier began as early as 2015, but no consensus has been reached, leaving hundreds of German research institutions unable to access Elsevier's journals and databases [7].

2.2 Norway

In 2017, the Norwegian government issued the "National Guidelines for Open Access to Scientific Articles by the Norwegian Government," explicitly stating that Norwegian institutions pay more than 330 million Norwegian kroner annually to journal publishers for reading academic papers, including those authored by Norwegian researchers. To address high publishing costs and promote open access to scientific papers, Norway announced its participation in Plan S in 2018 and authorized the Directorate for ICT and joint services in higher education and research (Unit) to initiate national open access agreement negotiations. In 2018, Unit began negotiations with 11 publishers, including four of the five most influential international scientific journal publishers (Elsevier, Springer Nature, Wiley, and Taylor & Francis), with the goal of achieving open access for all publicly funded research publications by 2024. Norway's negotiation principles are: papers by Norwegian researchers should be open access at publication; open access publishing should not increase total costs; and researchers must be granted permanent access rights to papers published in subscription journals. Based on these principles, Unit signed a national open access agreement with Wiley in March 2019 and announced a two-year national open access agreement with Elsevier in April 2019. Under this agreement, the Norwegian government pays Elsevier €9 million in subscription fees and approximately €1 million in open access publishing fees, granting 46 Norwegian universities and research institutions participating in the agreement reading rights to 2,800 Elsevier academic journals. These institutions can also publish 1,850 open access papers annually in Elsevier journals, representing approximately 90% of all papers published by Norwegian scholars in Elsevier journals. However, this agreement does not cover about 400 Elsevier society journals, nor does it include the *Cell* and *Lancet* series. Compared to previous agreements, Norway must pay an additional 3% for journals such as *Cell* and *Lancet* [9].

2.3 France

Couperin is France's unified coordination agency for universities and research institutions to obtain digital publications. As a non-profit association, it is responsible for negotiating digital resource purchases with major publishers. In April 2019, Couperin signed a four-year agreement with Elsevier. The agreement stipulates a 13% reduction in subscription fees over four years, a 25% reduction in author article processing charges (APCs), and an annual increase in APCs not exceeding 3.5%, with specific annual reductions shown in Table 1 [10].

Unlike other European countries, France adopted a different strategy in its national open access agreement negotiations. First, it did not demand full open access but only required green open access (self-archiving), which facilitated successful negotiations to some extent. Second, instead of immediately canceling subscription fees, France adopted a year-by-year reduction approach. Through this method, some prestigious journals were included in the agreement scope, unlike in Germany and other countries where they were excluded. The agreement also permits green open access, allowing French researchers to self-archive their published papers after 6-12 months. The agreement with Elsevier covers all Elsevier journals, including the prestigious *Cell* and *Lancet* series.

2.4 Finland and Sweden

In 2016, the Finnish government established FinELib, a consortium of Finnish universities, research institutions, and public libraries. In August 2016, FinELib officially launched negotiations with journal publishers on Finland's national open access agreement, aiming to achieve comprehensive open access by 2020. FinELib is also part of the OA2020 initiative and actively supports LIBER's principles for open access negotiations [11].

In 2016, Sweden's Bibsam consortium initiated negotiations with Elsevier for a Swedish national open access agreement. Since the negotiations were postponed in July 2018, Swedish libraries have been unable to access Elsevier journals. In October 2018, the Bibsam consortium announced that academic research disruption due to failed negotiations with Elsevier was much less than expected and decided to delay subsequent negotiations [12].

2.5 The Netherlands

The Netherlands is one of the earlier countries to research national open access agreements. Since 2014, the Association of Universities in the Netherlands (VSNU) has represented Dutch universities and medical centers in negotiations with major publishers. In 2016, the Netherlands also released the "Dutch Open Access Roadmap 2018-2020," planning to achieve 100% open access for books and Dutch-language journal articles. According to one study [13], in 2016, nearly 42% of peer-reviewed papers published in the Netherlands were open access. VSNU is confident in achieving the goals set by the national open science plan, namely 100% open access by 2020.

2.6 Switzerland

In 2016, the Swiss government designated the Swiss National Science Foundation to develop a national open access strategy and initiate negotiations with major publishers. The foundation released the Swiss Open Access Action Plan in 2017 and set action targets. Currently, among the 33,600 journals where Swiss universities mainly publish, 30% are open access (16% green open access through self-archiving, 11% gold open access, and 3% hybrid models). The Swiss government plans that by 2024, all publications by researchers from Swiss universities and universities of applied sciences must be open access. Since April 2018, Switzerland has negotiated with Springer Nature and reached an interim solution for transitioning to open access, while negotiations with Wiley and Elsevier began in January 2019 [14].

3 Impact Analysis of National Open Access Agreement Development on the Global Academic Ecosystem

3.1 Characteristics of National Open Access Agreements

(1) **Targeted selection of open access journals.** Most countries have conducted thorough investigations to identify the main fields and journals where their researchers publish. These findings facilitate negotiations with publishers, helping to minimize purchase expenses while ensuring scientists can meet open access publishing requirements and reducing the number of journals needed—an optimal strategy for successful negotiations. For example, Germany's agreement with Springer Nature covers 1,900 journals, primarily concentrated in science and engineering fields, while Switzerland and the Netherlands include a significant portion of social science journals. Thus, detailed and meticulous investigation of domestic research publishing patterns is the key foundation for reaching national open access agreements.

(2) **Negotiations with Elsevier are the most challenging.** Since Elsevier holds over 24% of the market share and possesses relative monopoly advantages, it has greater leverage in national open access agreement negotiations. Germany, Norway, the Netherlands, and other countries have struggled in negotiations with Elsevier, forcing them to suspend or delay proceedings. Meanwhile, most countries have adopted a strategy of isolating Elsevier by actively reaching open access agreements with Springer Nature, Wiley, and Taylor & Francis, thereby creating negotiating pressure on Elsevier. This approach has proven effective, as Elsevier has made concessions in some smaller markets by signing transitional or full open access agreements with countries like Norway, while maintaining a hardline stance in major research nations like Germany.

(3) **Most high-value prestigious journals remain excluded.** From the publishers' perspective, national open access agreements reduce opera-

tional costs to some extent by eliminating the need to promote, market, and maintain operations with individual research institutions or universities. With fewer workflow steps such as paid publishing, publishers can also reduce human resource investment. Additionally, driven by the EU's Plan S, publishers are willing to negotiate national open access agreements with countries. However, examining agreements from several major European countries reveals that high-value prestigious journals such as *Cell*, *Lancet*, and *Nature* are not included. On one hand, this allows publishers to maintain their monopoly advantage in high-end scientific knowledge discovery; on the other hand, it serves as an important bargaining chip in negotiations, potentially driving agreement prices higher.

(4) **Libraries and similar institutions play a pivotal role.** Using Germany as an example, both the steering committee and negotiation team of Projekt DEAL are composed primarily of influential library directors and their staff, covering major German library institutions such as the University of Freiburg Library, Karlsruhe KIT Library, German Central Library, Bavarian State Library in Munich, Max Planck Digital Library in Munich, and Berlin University Library. Libraries serve several key functions in national open access agreement negotiations: (1) investigating national researchers' publishing fields and journal distributions, which forms the important foundation for negotiations; (2) developing negotiation strategies, as libraries' long-term engagement with publishers provides deep knowledge of different publishers' strengths, journal coverage, and future strategic layouts; and (3) assisting researchers in journal selection, guiding them toward journals covered by national agreements through policy advocacy and training, thereby maximizing economic benefits and preparing for future price negotiations.

3.2 Impact on the Global Academic Ecosystem

(1) **May disrupt the national balance of academic publishing ecology.** While national open access agreements can promote global open access development, they also contain risks of disrupting the academic publishing ecology. In the traditional ecosystem, journals decide whether to publish a paper based primarily on academic quality. However, once national open access agreements are signed, journals may tend to favor papers from signatory countries, thereby disrupting the national balance of academic publishing. In the next negotiation phase, increased publication numbers from a country indicate greater funding allocation from the national open access agreement. From the publisher's perspective, they welcome such phenomena, as once journals favor scholars from certain countries, other nations must sign agreements to gain equal advantages—often at higher per-paper costs. The country offering higher agreement fees or per-paper charges is more likely to have its researchers' papers accepted, creating a vicious cycle that triggers inter-country price competition. From a na-

tional perspective, countries also welcome such publishing biases, as simply increasing national open access agreement prices can secure publishing advantages for their scholars. After signing the agreement with Springer Nature, Projekt DEAL spokesperson Dr. A. Kellersohn, Director of the University of Freiburg Library, explicitly stated that the agreement would enhance German scholars' global influence. Based on this, many major research nations initiated relevant agreement development in 2015. If this trend continues, some large countries will gain absolute advantages while medium and small countries will suffer academic publishing discrimination due to financial constraints.

(2) **May facilitate regional-level open access agreements.** Currently, the largest geographical span for open access agreements is at the national level. As research competition among countries intensifies, small and medium-sized countries may struggle to gain advantages, making regional-level open access agreements possible. Although the EU's Plan S has not explicitly stated it will conduct regional negotiations in the EU's name, as Germany, the Netherlands, France, and other countries have successively reached national open access agreements, and with the rise of China and other countries in academic publishing, an EU-level open access agreement is highly likely to materialize, expanding European researchers' global influence while reducing related publishing costs. Furthermore, regional agreements such as the EU, Asian Union (or East Asian Union, or China-Japan-Korea Union), African Union, and North American Union may emerge in the future. Regional alliance agreements would transform the current multi-party game into an oligopoly game—for example, four regional alliances negotiating with three major publishers (Elsevier, Springer Nature, Wiley-Blackwell). This would significantly reduce communication costs, making it easier for publishers to form tacit pricing agreements and potentially further driving up subscription fees.

(3) **Beware of further monopolization by academic journal publishers.** National open access agreements originally aimed to curb rising journal subscription fees, but they inadvertently reduce the number of negotiating opponents. Economic principles show that fewer negotiators increase the likelihood of tacit monopolistic pricing. Previously, publishers faced thousands of research institutions and universities worldwide, with numerous opponents increasing communication costs for monopolistic pricing among different publishers. However, as described above, once regional open access agreements form, the three major publishers may only need to set prices for a few regions, drastically reducing communication costs and facilitating tacit pricing agreements that could further increase subscription fees.

(4) **The value of prestigious academic journals will become more prominent.** Although most national open access agreements exclude prestigious journals such as *Cell*, *Lancet*, and *Nature*, these journals maintain

significant influence over open access journals, and their value will become more pronounced. While some countries have signed national open access agreements with Elsevier and Wiley covering most journals, Springer Nature's ownership of *Nature* and other prestigious journals forces many countries to negotiate with Springer Nature as well. Some publishers use these prestigious journals as bargaining chips: subscribing to them alone would be extremely expensive, but bundling them with other journals in open access negotiations makes agreements more acceptable to countries. Thus, the value of prestigious academic journals will become increasingly prominent.

(5) **Impact on academic development in developing countries.** The rise of national open access agreements has not fundamentally changed the traditional academic publishing model, merely shifting from individual payment to national unified payment. During price negotiations, the game changes from multi-party to oligopoly. Developed countries, particularly in Europe, can leverage strong economic power to promote academic monopolies through national open access agreements, which is detrimental to developing countries. This manifests in three ways: (1) developing countries lack financial resources for national open access agreement negotiations; (2) their international publication volume and influence are insufficient to achieve equal negotiating status with publishers; and (3) as European national open access agreements gradually form and Plan S is implemented, academic publishing inequality for developing countries becomes more pronounced, making it difficult for them to counter Plan S alone.

(6) **Whether the national open access agreement model is the only way to promote global open access remains uncertain.** Currently, Europe has chosen the national open access agreement path, with even non-EU member Norway joining the EU's Plan S. However, in the United States, universities are the main driving force behind open access agreements, not the national government. For example, the University of California system conducted eight months of negotiations with Elsevier, requiring all UC-published papers in Elsevier journals to be freely accessible to global readers, along with controlled subscription costs and cancellation of subscription fees in favor of only article processing charges. Unfortunately, these negotiations failed [16]. Given that major US universities' publication volume reaches national levels and their strong economic power, the current US approach of university-led negotiations is understandable. However, as the EU's Plan S continues to advance, whether the US government will intervene in national-level negotiations remains uncertain.

4 China's Response to the Rise of National Open Access Agreements

4.1 Promptly Initiate Strategic Assessment of National Open Access Agreements in China

Using relevant search terms, the author found very few papers in domestic databases such as CNKI researching China's national open access agreements—virtually none. In contrast, some EU countries (e.g., the Netherlands) established corresponding agencies to coordinate national open access agreement advancement as early as 2014. Agencies responsible for negotiating national open access agreements in the Netherlands, Norway, Germany, and France publish annual analysis reports examining their countries' academic publishing status and open access trends, forming strategic perspectives to support government decision-making.

Although China may not necessarily adopt the national open access agreement model, real-time monitoring of international developments and understanding of researchers' publishing needs and trends is essential. This would allow price intervention before EU countries complete their negotiations, preventing weakened bargaining power. Otherwise, once major EU publishers complete their agreements, China's negotiating position will be compromised. Additionally, China should actively respond to academic publishing inequality caused by other countries' open access agreements and develop countermeasures for domestic researchers. According to data, China published nearly 400,000 international scientific papers in 2018 [15], and over 500,000 papers including social sciences—approximately 40 times Germany's volume. Based on Germany's agreements, its annual costs with Springer Nature and Wiley approach RMB 500 million. Although no agreement with Elsevier has been reached, its price may approach RMB 300 million. Including other publishers, Germany's annual national open access agreement expenditure could exceed RMB 1 billion. If China adopted the national open access agreement model, a rough estimate suggests China's annual costs could surpass RMB 40 billion. For such a massive expenditure involving China's research competitiveness, earlier and better preparation is essential to avoid passivity.

4.2 Cultivate Globally Competitive Journal Publishers

Currently, the world's three major journal publishers (Elsevier, Springer Nature, Wiley-Blackwell) are all based in Europe and the United States, naturally establishing connections with European and American universities, research institutions, and library documentation agencies. This gives Europe and the US certain advantages in national open access agreement negotiations. Looking forward, publishers' monopolistic positions may not weaken but could strengthen as national open access agreements advance. If negotiations with these three major publishers fail, China lacks corresponding countermeasures, and researchers may face a situation with no papers to read, as occurred when the University of

California system's negotiations with Elsevier failed, leaving UC scientists unable to access Elsevier journals. Given that IEEE placed Huawei on its blacklist, such scenarios are possible. Therefore, China should increase support for domestic journal databases such as CNKI and Wanfang, first integrating domestic Chinese journal resources, encouraging domestic publishers to expand overseas, acquiring academic journals with development potential, and gradually enhancing the global influence of Chinese journal publishers.

4.3 Increase Support for High-Value Academic Journals

European national open access agreements have not yet included high-value academic journals, which are important factors for publishers to influence the global academic ecosystem and conduct agreement negotiations. The more high-value academic journals a country possesses, the more negotiating capital it holds in national open access agreements. For example, if a country has multiple important international journals in the same field, it can encourage researchers to submit to journals from other publishers when negotiations with one publisher reach an impasse. Currently, China lacks world-renowned academic journals in many scientific fields, leaving it in a weak position when negotiating with publishers. Therefore, increasing support for high-value academic journals is crucial.

4.4 Actively Lead and Establish an East Asian Tripartite Open Access Agreement Project Team

As analyzed above, regional-level open access agreements may emerge. Currently, more than ten EU countries have reached national open access agreements with specific publishers, further advancing Plan S. With Plan S launching in 2020, most EU countries will successively reach national agreements, potentially forming an EU-level regional agreement. Once the EU achieves a regional open access agreement, European researchers' global influence will expand. At the Asian or East Asian level, China, Japan, and South Korea are the region's major research powers. Forming a regional open access alliance must consider each country's research, economic, and social development levels, involving substantial communication costs. However, within Asia or ASEAN, countries' research and development levels vary significantly. Therefore, the most likely regional open access agreement to be realized in the near term is an East Asian tripartite agreement. In this trilateral alliance, China should play a more active role, guiding the agreement toward directions that serve both China's national interests and those of alliance partners. This would not only expand Chinese researchers' influence but also build closer research cooperation among the three countries and promote regional research advancement.

4.5 Strengthen Support for Documentation Service Institutions Such as Libraries

Libraries and other documentation service institutions play a significant role in national open access agreements. Given China's vast territory and numerous research institutions and universities, libraries serve as crucial grassroots organizations for understanding frontline researchers' needs and future development directions. They play vital roles in guiding researchers' publication choices, data statistics, and literature resource organization and analysis. Professional and university libraries are particularly important bridges between researchers and publishers. Therefore, China's national open access agreement project team should be structured around major domestic library organizations, similar to Germany's Projekt DEAL. It is recommended that under the leadership of the Ministry of Science and Technology and other departments, the team be formed by the National Science and Technology Library (NSTL), National Library, Chinese Academy of Sciences Documentation and Information Center system, Guangdong Science and Technology Library, and other national and provincial professional libraries. Furthermore, with national support, the project team should continuously track the academic publishing needs of China's basic researchers, use big data analysis strategies to continuously adjust China's national open access strategy formulation, and develop collaborative relationships with other countries to advance the open access movement at the lowest possible cost.

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