Viewing the Paradigm Shift in Library Resource Development Through the SCOAP3 Model

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Abstract

This paper introduces the basic model, content scope, and operational mechanism of the SCOAP3 funding consortium for converting high-energy physics academic papers to open access publishing, points out that the open access funding model it represents is more suitable for the digital network era and can more effectively and economically ensure knowledge access, emphasizes that this model likewise serves the essential goal of libraries in ensuring information access, and provides new space for libraries to expand information services and enhance their own status and role.

Full Text

A Paradigm Shift in Library Collection Development: Perspectives from the SCOAP3 Model

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Abstract

This paper introduces the basic model, content scope, and operational mechanisms of the SCOAP3 consortium, which aims to convert high-energy physics academic papers to open access publishing through collective funding. We argue that the open access publishing funding approach represented by SCOAP3 is better suited to the digital and network age, enabling more effective and economical knowledge access. This model serves the same fundamental goal of libraries—ensuring information accessibility—while providing new opportunities for libraries to expand information services and enhance their position and role in the scholarly communication ecosystem.

Keywords: SCOAP3; high-energy physics; open access publishing; resource subscription; collection development; open access

The publishing and dissemination of scientific and academic papers is undergoing fundamental transformation, with open access scholarship gradually becoming mainstream academic resources [**?**]. The number of open access journals continues to grow, with traditional publishers—including major commercial houses—launching open access titles. Research and educational institutions are establishing institutional repositories, domain-specific disciplinary repositories are expanding, and the volume of openly accessible academic papers is increasing rapidly. Simultaneously, national research funding agencies are increasingly supporting open access publication and continuously improving various support mechanisms for open publishing.

Among these initiatives, SCOAP3 (Sponsoring Consortium for Open Access Publishing in Particle Physics) [**?**] represents a collaborative effort that unites funders, research institutions, universities, and libraries worldwide in high-energy physics to convert subscription fees into open access publishing service fees. This initiative transitions all high-quality papers in high-energy physics to open access publishing while eliminating both subscription fees and article processing charges. This model poses unavoidable and direct challenges to traditional library collection development models. This paper analyzes these challenges and proposes recommendations for how academic libraries should respond to this development trend.

1 The SCOAP3 Model

1.1 Basic Mechanism

SCOAP3 was initiated in 2006 by CERN (European Organization for Nuclear Research), the German Physical Society, the German Electron Synchrotron (DESY), the UK' s Science and Technology Facilities Council, Italy' s National Institute for Nuclear Physics, France' s National Center for Scientific Research (CNRS), and other organizations. Currently, more than 100 high-energy physics research institutions and major libraries from 29 countries—including the Chinese Academy of Sciences—participate in the consortium, covering the vast majority of institutions publishing research in high-energy physics globally [**?**].

The fundamental approach of SCOAP3 involves joint funding from high-energy physics funding agencies, research institutions, universities, national libraries, and major specialized libraries. Based on negotiated conditions, the consortium purchases open access publishing services from publishers of high-energy physics journals. All published content is permanently open access, with papers licensed under Creative Commons Attribution (CC-BY) to enable broad reuse. Authors no longer pay article processing charges. Papers are made openly accessible immediately upon publication through publishers' websites, while publishers automatically deposit them into the SCOAP3 consortium repository and authors' institutional repositories for long-term preservation and open access. All

institutions that previously subscribed to these journals or databases simultaneously cancel their subscription fees or reduce them accordingly.

In essence, SCOAP3 transforms the traditional post-publication literature procurement model into a pre-publication payment for open access publishing services. It shifts from individual library subscriptions to journals or databases to collective negotiation of open access publishing service terms by the high-energy physics community, effectively achieving immediate open access to academic papers for everyone, enabling flexible reuse and long-term preservation.

1.2 Content Coverage

SCOAP3 open access publishing covers two categories of papers:

1. **SCOAP3 Journals**: Peer-reviewed journals that primarily publish high-energy physics papers, defined as those in which more than 60% of annual publications (e.g., in 2011) are submitted by authors to the "High Energy Physics (HEP)" category on arXiv.org. These journals are integrated into the SCOAP3 program in their entirety, with the SCOAP3 consortium paying open access publishing service fees for all papers in these journals.
2. **SCOAP3 Papers in Select Journals**: Individual high-energy physics papers published in peer-reviewed journals that are not primarily high-energy physics journals but contain papers submitted to the arXiv.org "High Energy Physics (HEP)" category. These individual papers are proportionally funded by the SCOAP3 consortium for open access publishing.

Based on completed tendering processes [**?**], 12 journals from 10 publishers will participate in the SCOAP3 program and transition to open access publishing in 2014, as shown in Table 1 .

Table 1 Participating Publishers and Journals in SCOAP3

Publisher	Journal(s)
American Physical Society	Physical Review C; Physical Review D
Elsevier	Physics Letters B; Nuclear Physics B
Hindawi	Advances in High Energy Physics
IoPP/Chinese Academy of Sciences	Chinese Physics C
IoPP/SISSA	Journal of Cosmology and Astroparticle Physics
IoPP/Deutsche Physikalische Gesellschaft	New Journal of Physics
Jagiellonian University	Acta Physica Polonica B
OUP/Physical Society of Japan	Progress of Theoretical Physics
Springer/Società Italiana di Fisica	European Physical Journal C
Springer/SISSA	Journal of High Energy Physics

SCOAP3 has also expressed its commitment to actively promote the conversion of high-level journals, including *Physical Review Letters*, to open access

publishing for their high-energy physics papers.

1.3 Operational Mechanisms

SCOAP3' s core involves converting literature procurement funds into open access publishing service fees, addressing several key issues [**?**]:

1.3.1 Overall Budget Control

SCOAP3 estimates that the annual number of high-energy physics papers is between 6,000 and 7,000. Based on cost calculations for publishing services, the consortium controls its overall budget at €10 million. Naturally, this budget will fluctuate with changes in paper volume and price levels. However, SCOAP3' s collective negotiation mechanism and its representation of the high-energy physics research community—both supporting and constraining research paper publishing—will keep the overall budget within an appropriate range of variation.

1.3.2 Open Access Publishing Service Fees

For each journal, open access publishing service fees are paid to publishers on a per-article basis, negotiated through triennial contracts with annual publication volume analyses.

1.3.3 Institutional Contribution Shares

Within the SCOAP3 overall budget, each country contributes a share proportional to its publication output in the covered content areas. To subsidize poorer countries and those with minimal publication output, member countries additionally contribute 10% extra funding. Therefore, each country' s contribution equals "overall budget × country' s publication proportion × 1.1." Specific national support mechanisms vary: some are covered by national science funding agencies, some by specialized high-energy physics research institutions, and others are shared among multiple institutions (with each institution' s share proportional to its contribution to the country' s total publications).

1.3.4 Subscription Fee Reduction Methods

SCOAP3 requires publishers to reduce subscription fees for all institutions subscribing to SCOAP3 content, ensuring no double-charging for SCOAP3-funded content. Specific measures include: reducing subscription prices for SCOAP3 journals to zero; proportionally reducing subscription prices for journals containing SCOAP3 papers; and making corresponding deductions for database subscriptions containing SCOAP3 papers. This enables libraries to convert funds previously used for procurement into SCOAP3 support funds.

Given that many institutions participate in database package or consortium subscriptions, SCOAP3 has proposed corresponding deduction guidelines and continues to refine diverse deduction templates through a technical working group. The consortium is establishing a coordinated arbitration mechanism for reference to help participating institutions implement subscription fee reductions.

2 How SCOAP3 Enhances Information Access for Research and Education

2.1 A More Effective Information Assurance Model

SCOAP3' s ultimate goal is essentially the same as library collection development: serving readers through resource construction. However, it adopts a more effective information assurance capacity-building model.

The fundamental purpose of library literature procurement and collection building is to provide information assurance for their institutions or communities, enabling users to obtain needed documents on demand. In the print era, libraries had to purchase, catalog, and store materials in advance to ensure users could retrieve and access specific documents when needed. In the digital commercial publishing era, users can already search for needed literature online and obtain it instantly through pay-per-view and other methods. However, due to economies of scale and the inconvenience of individual payment, the mainstream approach for educational and research institutions to "ensure digital information supply" remains advance subscription to databases by libraries (thus constituting a "collection") with authentication and authorization mechanisms to ensure users can instantly obtain needed literature via the network.

What distinguishes SCOAP3 from traditional library literature procurement is that it begins at the source of publication. By paying open access publishing service fees, it achieves open access to academic papers from the origin, guaranteeing information access capacity at the source. Traditional models are relatively passive, collecting and providing access only after publication. As shown in Table 2 , SCOAP3 transforms post-publication procurement into pre-publication publishing service payment, converting individual library subscriptions into collective negotiation by the high-energy physics community.

Table 2 Comparison Between SCOAP3 Model and Traditional Model

Aspect	SCOAP3 Model	Traditional Collection Development Model
Payment Timing	Pre-publication publishing service fee	Post-publication literature procurement fee
Access Model	Immediate open access	Access based on subscription scope
Copyright Management	Authors/institutions retain copyright	Copyright often transferred to publishers
Reuse Rights	Broad reuse permitted under CC-BY	Restricted by publisher terms

2.2 A More Rational Information Dissemination and Access Support Mechanism

Compared to library literature procurement, SCOAP3' s per-article payment for open access publishing services represents a more rational information dissemination and access support model in the digital network publishing environment.

Traditional publishing subscription mechanisms and cost models originated in the print era. In that context, authors (and their funders or employers) relied on publishers to review, edit, typeset, print, and distribute academic papers. Publishing costs included review and editing costs plus access costs, with access costs comprising printing and distribution expenses. Since printing costs were directly related to print volume and distribution costs to logistics expenses for providing print copies to readers, publishers had reasonable justification for charging specific institutions subscription fees to recover corresponding printing and distribution costs. Library subscription fees became an integral component of publishing revenue. Publishers could not recover costs from non-subscribers, so they could reasonably restrict access to subscribing institutions.

In the digital network era, not only have editing and typesetting costs decreased dramatically, but access costs have also become almost negligible. The "marginal cost of access" (the cost required to increase access scope) has nearly dropped to zero. The cost of publishing the first copy of an academic paper essentially constitutes the entire cost of publication and distribution (especially for e-only journals). At this point, the original "subscriber-pays" model loses its rationality, while "per-article publishing fees" become more reasonable [**?**]. Of course, there remain platform and process management expenses for search and retrieval, but these are almost unrelated to access scope and can be fully incorporated into per-article publishing costs.

Therefore, paying publishers article processing charges (APCs) based on services provided during peer review, editing, and publishing has clear economic rationality and helps support the sustainability of open access publishing. This is why SCOAP3 terms the payments to publishers "open access publishing service fees." Continuing to charge based on subscription scope increasingly constitutes "extra charging" and unjust enrichment in most cases.

2.3 Better for Improving Research Efficiency and Information Benefits

SCOAP3' s author-side funding model inherently facilitates overall cost control for information dissemination and access. Having authors (or their institutions) pay open access publishing fees helps avoid the moral hazard [**?**] inherent in traditional subscription mechanisms. Moral hazard refers to the tendency of consumers of a product or service to over-consume or engage in risky consumption when they do not directly bear its costs. For example, an insured driver may take more risks while driving because "the insurance company will cover any accidents," or a patient with health insurance may seek excessive treatment

or unnecessary medications. In literature subscriptions, since researchers who publish papers do not directly pay subscription costs from their specific research project funds, they feel no acute pain from journal price increases and lack motivation to demand reasonable pricing from publishers. Although researchers and their institutions are ultimately the victims of the journal pricing crisis, this moral hazard means they often insist on subscribing to certain expensive journals "essential for research" while being hesitant to resist price increases. Author-side payment directly binds consumers to consumption costs, making them an internal force for controlling expenditures. Although SCOAP3 uses institutional payment based on publishing volume, this direct binding with open access, reuse rights, and long-term preservation creates a direct relationship between publishing investment and information access benefits. This encourages publishing institutions (not just libraries, but also research units, authors, and readers as co-beneficiaries) to more actively assume responsibility for ensuring access.

Supporting open access publishing through research funds helps integrate the responsibility chain and support chain for broad research dissemination. The purpose of scientific research is to advance science, promote social innovation, and improve civic literacy—all of which depend on rapid and broad dissemination of research results. For publicly funded research in particular, taxpayers pay for research conduct, infrastructure, institutional operations, and even researchers' participation in peer review. The resulting research outcomes belong to taxpayers as returns on their investment and should be guaranteed timely, broad, barrier-free, and non-discriminatory dissemination and utilization. However, in traditional publishing and subscription models, investors are isolated from the publishing, dissemination, access, and preservation mechanisms for research outcomes. Taxpayers must pay additional literature procurement fees to access research they already own, often with highly restricted usage rights. This double payment and discriminatory provision is clearly unreasonable.

Funding agencies represent taxpayers in investing in research, and educational research institutions represent taxpayers in managing research activities. They must be responsible for broad dissemination of research outcomes and ensure the "last mile" is connected to maximize returns on taxpayer investment. Moreover, research shows that funding for open access publishing typically accounts for only 1.25% of research expenditures [**?**], making it even more appropriate to support open access publishing to guarantee broad access benefits for research outcomes.

Currently, in many countries—particularly in Europe—supporting open access publishing is gradually becoming an important component of public science and technology funding policies. For example, the UK Finch Working Group released its formal report in June 2012 [**?**], recommending that supporting open access publication of research outcomes become the primary measure for promoting open sharing of publicly funded academic papers, a recommendation accepted by the UK government [**?**]. In July 2012, the European Commission

proposed that its upcoming €80 billion "Horizon 2020" research program would require all funded project papers to be either open access published or deposited in open repositories [**?**]. Almost simultaneously, the UK Research Councils' open sharing policy also required all funded project papers to be published in open access form or deposited in open repositories [**?**].

3 Leveraging SCOAP3 to Enhance Library Information Assurance

3.1 Better Support for Libraries' Essential Mission

Libraries have historically relied on literature procurement and collection development (virtual or physical) to ensure information access. Under the SCOAP3 model, literature procurement becomes support for open access publishing, and local collections become open resources—posing challenges and even disruption to traditional library information resource development.

To properly address the challenges posed by SCOAP3, we must first clarify libraries' essential functions. Libraries are not fundamentally about literature procurement or collection building, but about providing knowledge acquisition, preservation, and utilization services for their institutions or communities—they are reliable knowledge access mechanisms. However, in the print era and commercial digital publishing environment, libraries needed to procure literature and build local collections to achieve these goals. With technological development, libraries have long used interlibrary loan, document delivery, consortium subscriptions to e-journals and e-books, and collaborative building or maintenance of disciplinary repositories to pioneer and invest in other knowledge access channels. Moreover, in the digital network era, much of libraries' literature budgets are spent on journal database subscriptions, where what libraries actually "acquire" is not physical possession of documents but only network access rights to database content. In this context, library funds purchase knowledge access rights—a transition that has long been occurring and widely accepted by the library community.

SCOAP3 and other open access publishing mechanisms align with digital-era requirements and better enable timely and broad knowledge access. They effectively curb problems in traditional publishing such as double payment and price distortion. Far from conflicting with libraries' essential tasks, these mechanisms better facilitate libraries' fundamental goals. Open access publishing, especially when collectively led by the scientific and educational community, helps maximize knowledge access capacity, knowledge utilization capacity, market influence, and information access assurance benefits while maintaining quality of knowledge production. Simultaneously, by challenging publishers' monopolistic restrictions on knowledge access, high prices maintained through access limitations, excessive profits from restricting content utilization, and control over usage methods that deprives society of technological potential, community-led open access publishing removes the root causes of these problems.

3.2 New Opportunities for Library Information Assurance Services

Under open access publishing mechanisms, while traditional literature procurement and local physical collection development will change, many new tasks are emerging that require libraries to assume new responsibilities and positions. These include:

Representing institutions in open access publishing consortia like SCOAP3 to support open access and ensure information access. Institutional open access publishing service fees or author article processing charges (APCs) are gradually becoming the primary mechanism for supporting open access publishing. However, these payments can be structured in various ways, each with different effectiveness in guiding journal quality, retaining author/funder rights, controlling costs, and managing administrative overhead. As shown in Table 3 , SCOAP3 represents one of the optimal mechanisms. Additionally, consortia like COPE (Compact for Open-Access Publishing Equity) [**?**], composed of Harvard University, Cornell University, MIT, and others, coordinate policies to maximize the comprehensive benefits of open access funding. Therefore, libraries should actively participate in, promote, and even organize open access publishing consortia to achieve economies of scale and maximize benefits.

Table 3 Impact of APC Payment Models on Open Access Journals

Payment Model	Quality Guidance	Rights Retention	APC Price Control	Management Cost
Funder Pays	Strong	Strong	Strong	Medium

Coordinating and managing open access publishing support service processes for institutions. Supporting open access publishing may require evaluating and selecting open access journals, negotiating APC prices with publishers on behalf of institutional authors, organizing collective payments or assisting authors with payments, helping authors determine, select, and properly retain their copyrights, depositing open access papers into institutional repositories for long-term preservation and open utilization, and organically integrating open access resources with subscription resources to provide an integrated discovery and access mechanism. These involve complex tasks requiring specialized professional support that any moderately sized research and education institution needs. Libraries' professional knowledge in information dissemination and their public service position make them the optimal department to assume these responsibilities, including strategic planning, policy formulation, mechanism building, and coordination among stakeholders.

Coordinating the transition from literature subscription budgets to open access publishing service fees. This is an unshirkable duty for libraries

because they are more familiar with these processes than other departments in research and education institutions, understanding the details and key issues. According to open sharing policies from the European Commission and UK Research Councils, a significant portion of publicly funded research papers will be published through open access, meaning literature subscription funds originally used for these papers will be transferred to pay for open access publishing fees. This transition involves many complex issues. For example, when some journals in a database convert to open access or when some papers in a journal become open access, the proportion of subscription fees to be deducted must be determined based on the proportion of open access papers—proportions that may fluctuate over time. Libraries have a responsibility to maintain stable and reliable literature resource supply while simultaneously deducting all content that has become open access from subscription fees. This obviously requires meticulous work.

3.3 New Spaces for Library Information Service Expansion

SCOAP3 and other open access publishing mechanisms bring new possibilities for developing information infrastructure and services. When supporting open access, funding agencies and author institutions require retention of author copyrights, deposition of open access papers in institutional repositories for long-term preservation, and permission for rich reuse of paper content. Under such policy mechanisms, libraries can regain preservation rights over their institutions' key knowledge outputs. They can conduct text mining and linked retrieval using academic papers without being constrained by publishers, flexibly organize academic paper resource systems for their institutions and partner organizations, and integrate academic paper resources with scientific data, technical reports, dissertations, and educational resources into new knowledge resource systems embedded in research and teaching processes. This flexibility and richness are only possible when liberated from traditional subscription mechanisms and publishers' control over content rights and usage methods.

Moreover, SCOAP3 and similar mechanisms provide opportunities for libraries to play more extensive roles across the information communication chain, including working closely with research communities to promote transformation of scholarly publishing and participating in the publication and dissemination of research outcomes [**?**]. This allows libraries to intervene at the source and participate throughout the entire process of the scientific information exchange system, rather than being confined to historically defined roles and stages. Leveraging their rich professional knowledge, user relationships, service networks, and collaborative capabilities, libraries can organize the entire spectrum of knowledge creation, publishing, dissemination, access, utilization, and preservation. Libraries can also utilize the open and collaborative mechanisms provided by the open access environment to participate in international cooperation, support the globalization of scientific research and education, and organize the global dissemination and utilization of scientific information resources.

For a long time, libraries have sought to fully disseminate knowledge and flexibly utilize various rights and opportunities. Open access publishing and its collective support mechanisms enable libraries to continue and expand their excellent tradition of serving readers while realizing new possibilities. As dedicated information dissemination and knowledge service departments with long-standing collaborative experience, the library community should play a leading and central role in shaping and developing the new scholarly communication environment, helping and even representing the scientific community to regain dominance in academic information exchange and ownership of knowledge outcomes.

Of course, if libraries merely pay lip service or bury their heads in the sand, unwilling to give up the "possession satisfaction," "business authority," and "historical legacy" brought by literature procurement and collection building, research and education institutions may establish alternative structures. Other departments (such as research offices or network centers) could plan and coordinate open access publishing, gradually reducing library subscription budgets accordingly. In this scenario, the library community' s inaction in developing new academic information exchange mechanisms would be perceived as incapacity, potentially risking loss of position in the new knowledge environment. This is presumably not a scenario the library community wishes to see.

4 Conclusion

Libraries have always been active forces supporting broad knowledge dissemination and utilization. However, we must recognize that the digital network environment is rapidly transforming the entire knowledge exchange and dissemination system. In this transformation, libraries—whose operational mechanisms largely 延续 traditional print-era models—must also change, even experiencing a phoenix-like rebirth. SCOAP3 provides a valuable development perspective and opportunity for libraries.

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