ANSO
Alliance of National and International Science Organizations for the Belt and Road Regions

Highlight

Open Science

Open Science: From UNESCO Recommendation to Practice

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Abstract

The adoption of the UNESCO Recommendation on Open Science in 2021 marked a historic step in the global governance of science. For the first time, 193 Member States agreed on a shared definition, values and principles for Open Science, together with broad lines of action to make scientific knowledge more accessible, transparent and collaborative worldwide. The critical question now is how to translate this normative framework into actual practices, infrastructures and incentives that can be implemented across diverse regions and development contexts. This article traces the emerging trajectory "from Recommendation to practice." It first outlines key elements of the UNESCO framework and highlights major international trends since 2021, including the expansion of Open Science platforms, the convergence of FAIR and CARE principles, and growing attention to the needs of the Global South. It then presents a practical, lifecycle-based model for Open Science and illustrates how it is being implemented through concrete initiatives. Together, these efforts show how Open Science is evolving from an aspiration into a shared practice, and how regional alliances such as ANSO can help ensure that this evolution is inclusive, human-centred and globally balanced.

Introduction: A Decisive Moment for Open Science

Science today is both more powerful and more interdependent than ever before. Digital technologies, data-intensive methods and global networks have enabled unprecedented collaboration, while planetary crises—from climate change to pandemics—underscore how deeply societies depend on timely, reliable and accessible scientific knowledge.

From a Shared Vision to Practical Demands

The UNESCO Recommendation on Open Science responds to this context by defining Open Science as an inclusive construct that combines a range of movements and practices—open access, open data, open methodologies, open source, open educational resources and citizen science—to make scientific knowledge more widely available and reusable, and to open up the processes of knowledge creation and evaluation beyond traditional academic boundaries. Yet norms alone do not change how research is actually done. The real work lies in embedding Open Science in policies, infrastructures, workflows and incentive systems. This is particularly challenging—and also most needed—in regions where digital and knowledge infrastructures remain uneven, and where new models must be designed to support both excellence and equity.

ANSO Secretariat
Add: No. 16 Lincui Road Road, Chaoyang District, Beijing, China
Email: anso-public@anso.org.cn; Tel:86-10-84097121

Compiled by Invited Contributor Prof HUANG Jinxia and her Open Science Research Center, National ScienceLibrary, Chinese Academy of Sciences (NSLC).

Alliances as Bridges from Norms to Practice

Regional and cross-regional alliances play an important bridging role here. ANSO, working with partners, has begun to experiment with ways of turning the Recommendation into practice, especially in and with the Global South. The following sections explore this transition, moving from global frameworks and trends to practical models and concrete initiatives.

From Normative Framework to Action

The UNESCO Recommendation

The UNESCO Recommendation on Open Science (2021) provides the first globally endorsed framework for transforming scientific systems toward openness, equity and collaboration. It is anchored in four core values—quality and integrity, collective benefit, equity and fairness, and diversity and inclusiveness—and guided by six principles emphasizing transparency, equality of opportunity, responsibility, participation, flexibility and sustainability.

UNESCO Recommendation on Open Science

To translate these values into practice, the Recommendation identifies seven strategic areas of action. These include:

(1) Promoting a common understanding of open science, associated benefits and challenges, as well as diverse paths to open science;
(2) Developing an enabling policy environment for open science;
(3) Investing in open science infrastructures and services;
(4) Investing in human resources, training, education, digital literacy and capacity building for open science;
(5) Fostering a culture of open science and aligning incentives for open science;
(6) Promoting innovative approaches for open science at different stages of the scientific process;
(7) Promoting international and multi-stakeholder cooperation in the context of open science and with a view to reducing digital, technological and knowledge gaps.

Despite broad consensus, significant implementation challenges remain—ranging from uneven infrastructure and connectivity to persistent language barriers and evaluation systems that prioritize traditional outputs. Realizing the Recommendation therefore requires operational models that embed openness across the research lifecycle, federated infrastructures that bridge regions, and cooperative mechanisms that allow countries to share tools, expertise and governance responsibilities.

Global Trends in Open Science (2021–2025)

The years since the adoption of the 2021 UNESCO Recommendation mark a transitional period in which Open Science has evolved from an aspirational concept to an emerging global practice. The first consolidated implementation report, drawing on submissions from 77 Member States, offers the most comprehensive picture to date of this shift. It reveals a dynamic but uneven landscape, where growing political momentum meets persistent structural constraints.

Awareness Is Expanding, but Interpretations Diverge

A broadening awareness of Open Science is one of the clearest developments. Member States have disseminated and translated the Recommendation widely, and many now integrate Open Science into their national science, technology and innovation agendas.Yet conceptual interpretations diverge: in some contexts, Open Science is understood holistically—including data, software, public engagement and equity—while in others, it remains largely synonymous with open access publishing. This variation shapes the pace and scope of national implementation.

Policy Uptake Is Growing, yet Still Uneven

Policy uptake is advancing, though unevenly. Several countries have established national strategies or coordination bodies for Open Science, while many others rely on institutional practices or early-stage consultations. The report highlights a gradual shift from fragmented initiatives toward systemic planning, but coherence across ministries, funding agencies and research institutions remains a work in progress.

Infrastructure Is Developing, but Gaps Remain Wide

Infrastructure development is accelerating but marked by disparities. Most Member States operate repositories, open access platforms or national research information systems, yet challenges persist in interoperability, sustainability, connectivity and long-term funding. Low-resource countries face particular constraints. Although the vision of federated, standards-based infrastructures is widely endorsed, real-world implementation varies significantly.

Capacity Building Has Momentum, but Expertise Is Scarce

Capacity-building continues to surface as a universal priority. Training efforts in data stewardship, FAIR principles, open methodologies and digital literacy are expanding, driven mainly by universities and research institutions. However, shortages of specialized human resources—especially data stewards and research software engineers—slow the adoption of open data practices and reproducible research workflows.

Assessment Reform Has Begun, but Systems Change Slowly

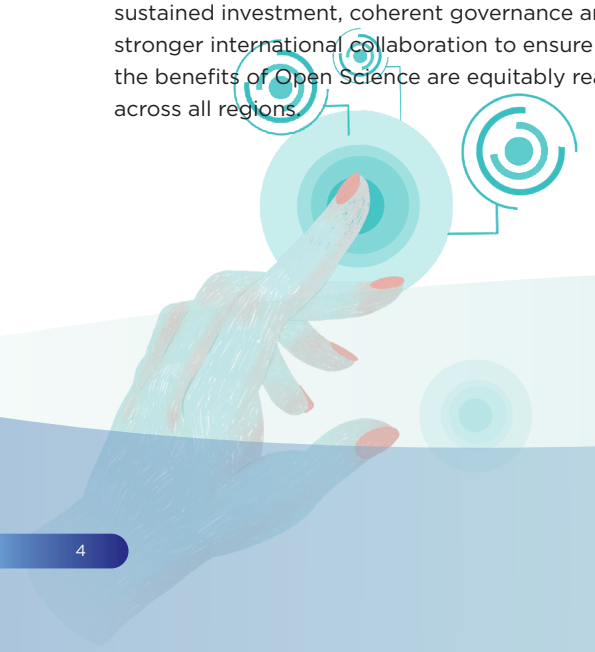
Reforms in research assessment are emerging but remain at an early stage. Member States increasingly acknowledge that incentive structures must reward openness, collaboration and diverse research outputs. Pilot initiatives such as narrative CVs, recognition of datasets and software, and revised promotion criteria show promising direction, yet systemic transformation is still limited and institutional cultures change slowly.

Innovative and participatory practices—citizen science, open hardware, open-source tools and AI-enabled research workflows—are gaining visibility. Nonetheless, institutional and funding support for such approaches remains insufficient, constraining their ability to scale and to contribute systematically to research ecosystems. In many countries, these practices are still driven by individual projects rather than embedded in mainstream research programmes.

International Cooperation Is Recognized, but Remains Underdeveloped

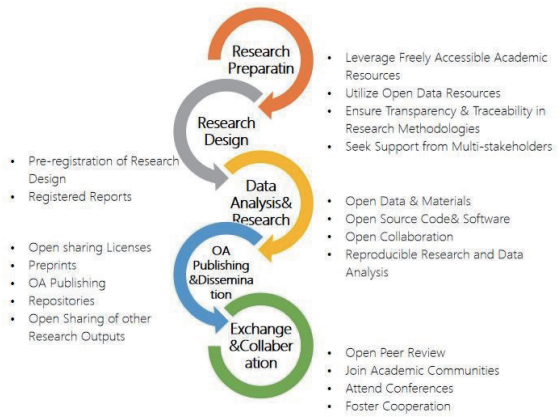
International cooperation is widely recognized as essential, but current mechanisms remain underdeveloped. While political commitment is strong, cross-border funding schemes, shared infrastructures and coordinated capacity-building programmes are still rare. Persistent digital, technological and knowledge divides underscore the need for more structured and inclusive cooperation models.

Taken together, these trends depict a global community moving steadily toward the institutionalization of Open Science, but at markedly different speeds. The foundations—awareness, policy interest, emerging infrastructures and growing experimentation—are taking shape. Yet the path from principle to practice requires sustained investment, coherent governance and stronger international collaboration to ensure that the benefits of Open Science are equitably realized across all regions.



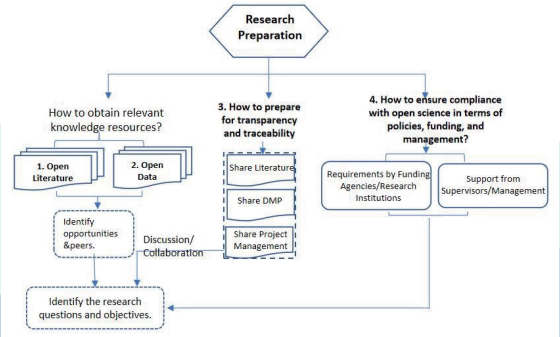
A Lifecycle Model for Implementing Open Science

Moving from principle to practice requires tools that researchers can apply directly. The Protocol on Open Science, developed with ANSO support, offers such a model. It describes Open Science as a five-stage lifecycle, embedding transparency, reproducibility and collaboration into each phase of the research process.



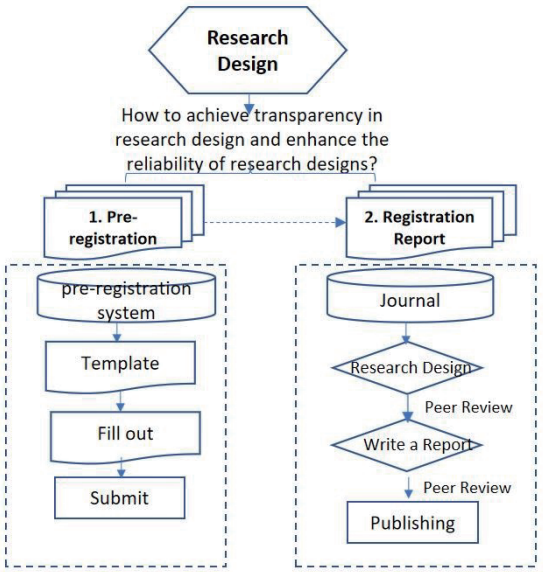
Preparation: Building on Open Knowledge

The lifecycle begins with drawing on openly accessible and trustworthy sources—open repositories, discovery services, shared vocabularies, public datasets and open-source software. Using open resources at this stage broadens the evidence base, reduces duplication, and sets expectations that the project itself will contribute openly to the scientific commons.



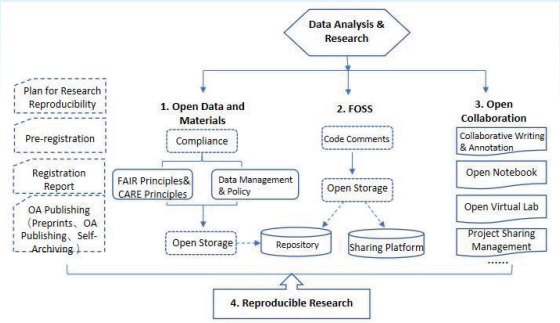
Design: Planning for Transparency and Reproducibility

During the design phase, Open Science encourages pre-registration of hypotheses, methodological plans and analytical strategies. Registered reports and open protocol platforms help make research intentions visible before data collection. This increases transparency, strengthens peer scrutiny, and builds confidence in the credibility of future findings.



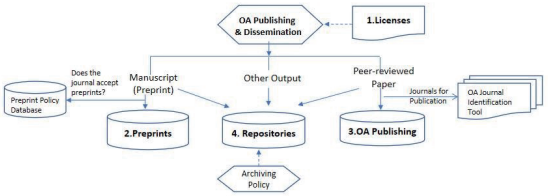
Data, Code and Reproducible Workflows

At the data and analysis stage, the focus shifts to FAIR-aligned data stewardship, well-documented code, and computational workflows that others can examine and reuse. The Protocol highlights version control systems, structured metadata, persistent identifiers, community standards, and appropriate licences. For sensitive data, it emphasizes controlled access and governance models that incorporate ethical and societal considerations.



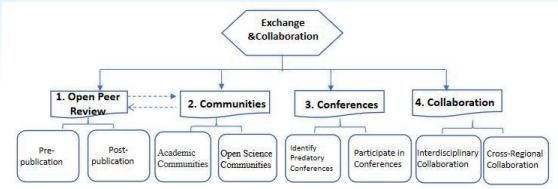
Dissemination: Sharing Outputs Broadly and Responsibly

Dissemination in an Open Science framework extends beyond traditional publications to include datasets, software, workflows, protocols, negative results, teaching materials and policy-relevant outputs. Open access routes—gold, diamond, and repository-based pathways—ensure that knowledge is freely accessible. Creative Commons licences clarify reuse conditions, while repository infrastructures support long-term preservation and global discovery.



Collaboration: Engaging the Scientific Community and Society

The final stage emphasizes collaboration as an ongoing process rather than a one-time output. Open peer review, community feedback, data and software reuse, co-creation with stakeholders, and participation in open platforms and networks help sustain a more inclusive research culture. Collaboration reinforces trust, accelerates innovation, and ensures that knowledge circulates across disciplines, institutions and borders.



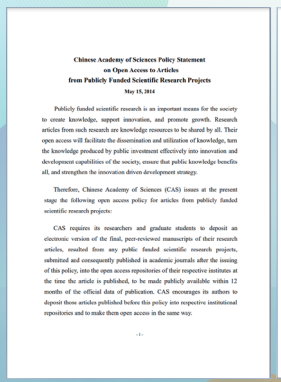
The Protocol's lifecycle does not prescribe a single route to openness; instead, it provides a coherent and adaptable structure for integrating Open Science into diverse research environments. It is particularly valuable for institutions and global collaborations seeking practical methods to operationalize the UNESCO Recommendation.

From Principle to Practice: Selected Initiatives

The transition from Recommendation to practice is best illustrated through concrete initiatives. The following examples, many undertaken with or around ANSO, show how Open Science is being implemented in real settings.

Open Access Policy

In 2003, Dr. Yongxiang Lu, then President of CAS, signed the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities. In 2014, both the Chinese Academy of Sciences (CAS) and the National Natural Science Foundation of China (NSFC) issued Open Access (OA) policies encouraging researchers to make their publications openly available.



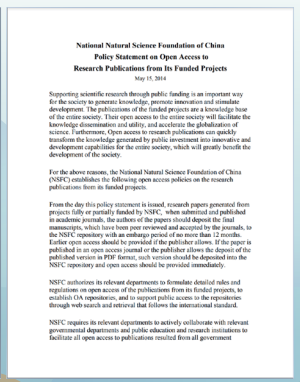
Chinese Academy of Sciences Policy Statement on Open Access to Articles from Publicly Funded Scientific Research Projects

May 15, 2014

Publicly funded scientific research is an important means for the society to create knowledge, support innovation, and promote growth. Research articles from such research are knowledge resources to be shared by all. Their open access will facilitate the dissemination and utilization of knowledge, turn the knowledge produced by public investment effectively into innovation and development capabilities of the society, ensure that public knowledge benefits all, and strengthen the innovation driven development strategy.

Therefore, Chinese Academy of Sciences (CAS) issues at the present stage the following open access policy for articles from publicly funded scientific research projects:

CAS requires its researchers and graduate students to deposit an electronic version of the final, peer-reviewed manuscripts of their research articles, resulted from any public funded scientific research projects, submitted and consequently published in academic journals after the issuing of this policy, into the open access repositories of their respective institutes at the time the article is published, to be made publicly available within 12 months of the official date of publication. CAS encourages its authors to deposit those articles published before this policy into respective institutional repositories and to make them open access in the same way.



National Natural Science Foundation of China Policy Statement on Open Access to Research Publications from Its Funded Projects

May 15, 2014

Supporting scientific research through public funding is an important way for the society to generate knowledge, promote innovation and stimulate development. The publications of the funded projects are a knowledge base of the entire society. Their open access to the entire society will facilitate the knowledge dissemination and utility, and accelerate the globalization of science. Furthermore, Open access to research publications can quickly transform the knowledge generated by public investment into innovative and development capabilities for the entire society, which will greatly benefit the development of the society.

For the above reasons, the National Natural Science Foundation of China (NSFC) establishes the following open access policies on the research publications from its funded projects.

From the day this policy statement is issued, research papers generated from projects fully or partially funded by NSFC, when submitted and published in academic journals, the authors of the papers should deposit the final manuscripts, which have been peer reviewed and accepted by the journals, to the NSFC repository with an embargo period of no more than 12 months. Either open access should be provided if the publisher allows. If the paper is published in an open access journal or the publisher allows the deposit of the published version in PDF format, such version should be deposited into the NSFC repository and open access should be provided immediately.

NSFC authorizes its relevant departments to formulate detailed rules and regulations on open access of the publications from its funded projects, to establish OA repositories, and to support public access to the repositories through web search and retrieval that follows the international standard.

NSFC requires its relevant departments to actively collaborate with relevant governmental departments and public education and research institutions to facilitate all open access to publications resulted from all government

Gold OA

In 2024, CAS authors published approximately 29,000 OA papers, the highest among Chinese research institutions and universities, which accounts for 36.7% of all SCI papers in CAS.

Green OA

CAS IR Grid contains over 900,000 full-text papers in total, with around 380,000 being open access.

Preprint

CAS ChinaXiv hosts over 42,000 preprints.

Open Access Transformation

The National Science Library, Chinese Academy of Sciences (NSLC) supports researchers in publishing OA articles and has concluded OA agreements with publishers such as BMC, Annual Reviews and IOP Publishing, providing CAS authors with article processing charge (APC) waivers or discounts. Building on this, NSLC has initiated Open Access transformation through "Read & Publish" models. In 2020, NSLC signed China's first OA transformative agreement with Oxford University Press (OUP), followed in 2021 by a five-year transformative agreement with the Association for Computing Machinery (ACM).

Participation in SCOAP^3

China's engagement with SCOAP^3 has also developed step by step. In July 2012, with the support of the High Energy Physics Division of the Chinese Physical Society and the Institute of High Energy Physics of the Chinese Academy of Sciences (CAS), NSLC signed an institutional Expression of Interest on behalf of CAS to join SCOAP^3. In parallel, CAS worked with other domestic organizations to explore their potential participation in the consortium.

In November 2013, these coordinated efforts helped secure full backing from the Ministry of Science and Technology for China's involvement in SCOAP^3, enabling the country to join as a member institution of the SCOAP^3 Council.

Engagement with OA2020 and Plan S

NSLC's involvement in global Open Access initiatives has developed gradually over the past several years. In October 2017, NSLC and the National Science and Technology Library (NSTL) joined OA2020 by signing the Expression of Interest. This was followed in December 2018 by a joint declaration of support—together with the National Natural Science Foundation of China (NSFC) and NSTL—at the 14th Berlin Open Access Conference, acknowledging the relevance of both OA2020 and Plan S for China's research community.

Since then, NSLC has continued to facilitate dialogue within the country. It has encouraged additional institutions to sign the OA2020 Expression of Interest, with 20 organizations participating to date. On 26 March 2019, NSLC organized a meeting to discuss the draft Plan S implementation guidelines, providing a platform for Chinese stakeholders to exchange views and issue a joint statement reflecting their shared considerations regarding Open Access policies.

OA Infrastructures in CAS

Green OA

Since 2009, NSLC has initiated the development of Institutional Repository Grid.

Gold OA

In 2015, officially launched, GoOA provides a one-stop discovery for high-quality OA journals and papers worldwide

In 2024, COAJ was launched to list the OA journals published in China.

Preprint

In 2016, ChinaXiv (the CAS Preprint Platform) was officially launched.

Public Access

In 2023, PubScholar (Public Academic Resource Platform) was established, providing the search and discovery of public academic resources, content access.

National Scientific Data Infrastructure

China has gradually built a layered national infrastructure for scientific data. Twenty National Science Data Centers are responsible for the collection, curation and sharing of data in key disciplines, as well as providing scientific computing and carrying out research on data technologies. Together, they form a backbone system that supports long-term stewardship and reuse of research data across fields.

Within this landscape, the Big Data for Sustainable Development Goals (CBAS) initiative has developed the SDG Big Data Platform—an integrated environment that combines data, computing and online services to deliver intelligent remote-sensing products. The platform now supports more than 540,000 users in 174 countries and regions with data access and analysis services.

Science Data Bank (ScienceDB) serves as an open, trustworthy platform for the storage, publication and long-term preservation of research data. By providing persistent identifiers, metadata services and curated repositories, it is designed to support global open scientific data sharing. In parallel, the Global Open Science Cloud (GOSC) initiative aims to link international, national and regional research infrastructures, creating a more connected digital environment that can support cross-border research and innovation.

Large-Scale Scientific Facilities as Open Platforms

China's large-scale scientific facilities are also becoming important platforms for international collaboration and shared knowledge production. In 2021, the Five-hundred-meter Aperture Spherical Telescope ("China Sky Eye") formally opened to the global scientific community. In the same year, five experimental stations of the comprehensive extreme-conditions facility at the Beijing Huairou National Comprehensive Science Center entered their first phase of open operation.

In particle and plasma physics, the Jiangmen Underground Neutrino Observatory (JUNO) experiment has involved around 300 scientists from 16 countries and regions since 2022. The Institute of Plasma Physics of CAS has established extensive collaborations with nearly 100 research institutions in more than 30 countries, reflecting the increasingly networked nature of frontier experimental research.

At the same time, public engagement has been sustained over the longer term. In May 2025, CAS celebrated the 21st anniversary of its Public Science Day, underscoring a continued effort to connect large-scale scientific infrastructures not only with the research community, but also with wider society.

Open Science Governance

CAS–CERN Seminar on Open Scientific Infrastructure

On 14 December 2023, CAS and CERN co-organized a seminar on open scientific infrastructure at CERN, co-chaired by Su Gang, Director of the Bureau of Frontier Science and Education of CAS, and Julieta Arancio from the Open Research Funders Group (ORFG). The meeting brought together perspectives from both CERN and CAS on how infrastructures, policies and practices can support Open Science.

On the CERN side, Jamie Boyd presented on designing and implementing CERN's Open Data policy, while Julieta Arancio discussed the outcomes of the CERN–NASA Open Science Summit and the broader effort to accelerate the adoption of open science. From CAS, Professor Pu Chen of the Institute for the History of Natural Sciences introduced the overall landscape of scientific infrastructure at CAS. Professor Jinxia Huang from the National Science Library outlined key challenges and policy developments related to Open Science in China, and Professor Mei Lei from the Institute of Geographic Sciences and Natural Resources Research shared a case study on Open Science practices through the analysis of soil pollution hotspots and risk control.

XIANGSHAN SCIENCE CONFERENCES: 758th Academic Seminar—— "Trends and Impacts of Open Science"

The Xiangshan Science Conferences host an academic seminar on "Trends and Impacts of Open Science" from November 4 to 5, 2024, at the Fragrant Hills Hotel in Beijing. The seminar brings together experts and scholars from diverse fields to engage in focused discussions on key topics, including (1) open data infrastructure, (2) open knowledge and science communication, and (3) Open Science policy and governance.

Xiangshan Initiative on Implementing Open Science

- Integrate Open and Inclusive Principles at Every Stage of Research to Foster the Flow and Enhanced Value of Accessible Knowledge.
- Foster a Thriving Scientific Ecosystem through Openness.
- Maximize Accessibility of Publicly Funded Research Outputs.
- Invest in Open Data Infrastructure and Services.
- Enhance Open Science Capacities by Establishing Policies and Management Guidelines at Various Levels.
- Propose Global Scientific Research Agendas and Engage in Global Open Science Governance.

Open Science International Forum at the 2025 ZGC Forum

As a flagship event of the 2025 ZGC Forum, the Open Science International Forum was held on March 28, 2025 and was jointly hosted by the Ministry of Science and Technology of China, the People's Government of Beijing Municipality, and UNESCO under the theme "Open Sharing for Further International Scientific Cooperation." Bringing together over 200 representatives from governments, academia, research institutions, and industry, the Forum focused on the open sharing of research infrastructure and data platforms, the impact of frontier technologies such as artificial intelligence, and the shaping of a global open science culture, with the goal of advancing international cooperation in science and innovation in a deeper and more practical manner.

Research on the Trends and Impacts of Open Science

The project "Research on the Trends and Impacts of Open Science" was launched by the Academic Divisions of the Chinese Academy of Sciences (CAS), with Academician Yang Wei and six other academicians leading the work. The project focuses on open access, open data and the governance of Open Science, as well as the current state of development in China. Its aim is to analyse key governance challenges and priorities in Open Science and to propose a roadmap and action plan for advancing Open Science at the national level. On this basis, the project is also developing the "Open Science Center" platform as a hub for research, monitoring and services.

Within this framework, the team has carried out

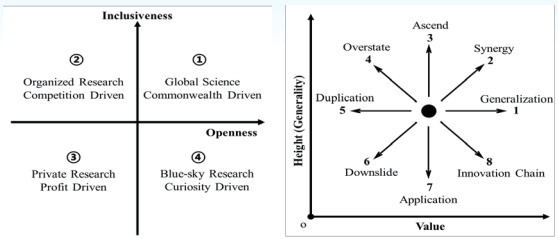


Figure 1. Twin sub-spaces portraying the dimensions of open and inclusive science.
(a) Topological dimensions and quadrants; (b) Dynamic dimensions and drivers of knowledge chains.

Building on this conceptual work, the project has proposed an Open Science Readiness Index (OSRI) to describe the dynamic status and progression of Open Science in different countries and regions. The index is constructed from three related but distinct dimensions: readiness for open access, readiness for open data and readiness for open policy.

$$R = w_{OA}\bar{R}_{OA} + w_{OD}\bar{R}_{OD} + w_{OP}\bar{R}_{OP}$$

$$w_{OA} + w_{OD} + w_{OP} = 1 \qquad w_{OA} = w_{OD} = 0.4,\ w_{OP} = 0.2$$

$$\bar{R}_{OA} = R_{OA}/R_{OA_{max}},\ \bar{R}_{OD} = R_{OD}/R_{OD_{max}},\ \bar{R}_{OP} = R_{OP}/R_{OP_{max}}.$$

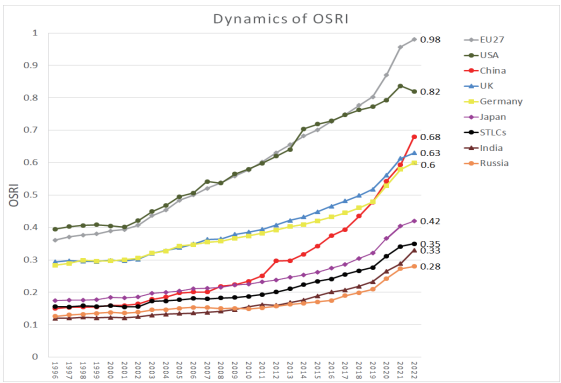
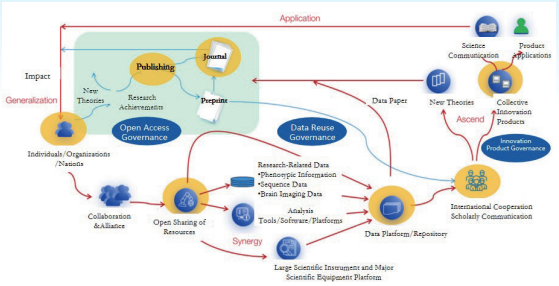


Figure 1 Dynamics of OSRI for EU27, USA, China, UK, Germany, Japan, STLCs, India, and Russia In 2022

In parallel, the project has organized a Call for Open Science Best Practices in China, collecting 142 cases in 2022 and 133 in 2023. Analysis of these cases, together with the Open Science paradigm developed in the project, suggests that elements of an open innovation ecosystem are beginning to emerge in China, linking policy, infrastructure and practice across different scientific domains.



Open science innovation scenarios based on open science jurisprudence and practical cases in China

APCheck and the Annual Global APC Monitoring Report

Building on many years of experience in evaluating global Open Access journals, NSLC has developed an APC rationality model to assess whether article processing charges are reasonably aligned with journal impact. In this model, APC levels are expected to be positively correlated with indicators such as the journal's SCI Impact Factor and Google Scholar H5 index.

On this basis, NSLC created the APCheck tool to monitor the rationality of APCs across journals and publishers. Using data from APCheck, NSLC publishes an annual Global Open Access Journals and APC Monitoring Report, providing evidence to support more transparent, informed discussions on the costs and value of Open Access publishing.

Open for Science 10 (OS10) Initiative

On 28 February 2025, the Executive Committee of UNESCO's International Decade of Sciences for Sustainable Development (IDSSD) officially endorsed China's open science initiative: Towards Open Science Infrastructure Sharing Network: China's Knowledge and Data Sharing Platform — Open for Science 10 (OS10).The initiative is led by Professor Wei Yang, Academician of the Chinese Academy of Sciences, Professor at Zhejiang University, and Chair of the UN Consultative Committee on Open Science and Global Partnership (CCOS) under the China Association for Science and Technology (CAST).

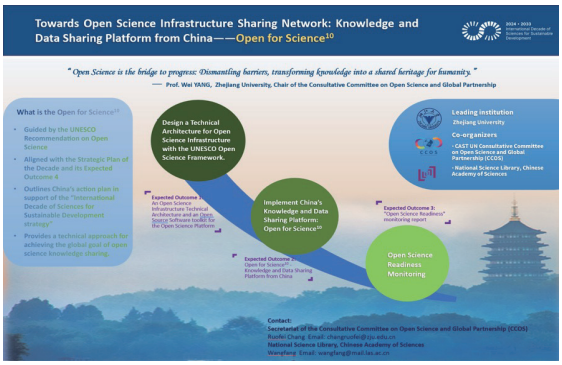
OS10 Vision: To propose China's action plan in support of the IDSSD and to provide a technical solution for achieving the global goal of open science and knowledge sharing.

Three Key Objectives

Objective 1: Design a Technical Architecture for Open Science Infrastructure with the UNESCO Open Science Framework.

Objective 2: Implement China's Knowledge and Data Sharing Platform: Open for Science10.

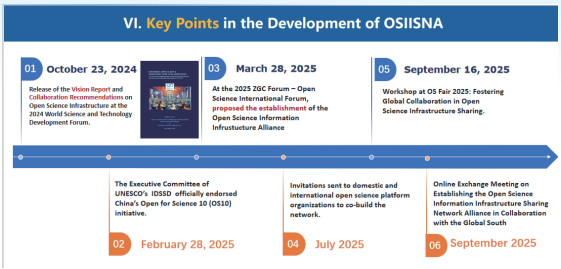
Objective 3: Open Science Readiness Monitoring.



At the 2025 World Science and Technology Development Forum, during the Open Science Parallel Forum, we launched the Open for Science platform (open4science.cn). Using the Chinese Academy of Sciences' science and technology resource governance system as a demonstrative model, the platform enables knowledge and data sharing and application, while serving as a foundation for building an international cooperation platform for Open Science.

Building a Global Open Science Information Infrastructure Sharing Network Alliance

At the 2025 ZGC Forum's Open Science International Forum, NSL, CAS proposed the initiative: Advocate for the Establishment of the Open Science Information Infrastructure Sharing and Collaboration Network Alliance



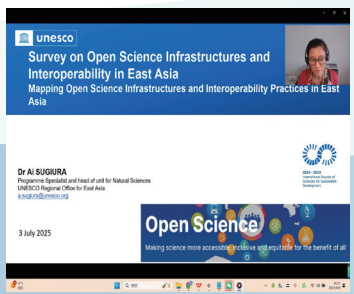
Workshop in the OSFair 2025: "Fostering Global Collaboration in Open Science Infrastructure Sharing"

At the invitation of the organizers of Open Science Fair 2025, the National Science Library, Chinese Academy of Sciences (NSLC), together with the CAST UN Consultative Committee on Open Science and Global Partnerships (CCOS) and the UN International Decade of Sciences for Sustainable Development (2024–2033, the "Science Decade"), co-hosted the workshop "Fostering Global Collaboration in Open Science Infrastructure Sharing" on 16 September 2025 at CERN in Geneva, Switzerland. As the first thematic workshop on the main programme, it marked the first occasion on which a Chinese-led initiative formally set out the concept of an Open Science Information Infrastructure Sharing Network Alliance, drawing close attention and an enthusiastic response from international stakeholders.

Chaired by Dr. Jinxia Huang, Professor and Deputy Director of NSLC's Open Science Research Center, the workshop featured keynotes by Dr. Huang, Professor-level Senior Engineer Jing Xie, and Associate Research Librarian (Associate Professor) Fang Wang, who presented the background and progress of China's "Open for Science10" initiative and outlined next steps for the proposed Alliance. In a panel moderated by Associate Research Librarian (Associate Professor) Man Xiao, experts from South Africa's National Research Foundation, COAR, OpenAIRE, and the Pubscholar team at NSL-CAS discussed federated open science infrastructures, collaborative governance, and pathways for alliance-based collective action. As the first thematic forum organized by China's scientific community at a major international open science conference, the workshop showcased China's sense of responsibility and concrete contribution to the global open science agenda, laying a solid foundation for the Alliance and adding new momentum to South–South cooperation and more equitable global access to knowledge.

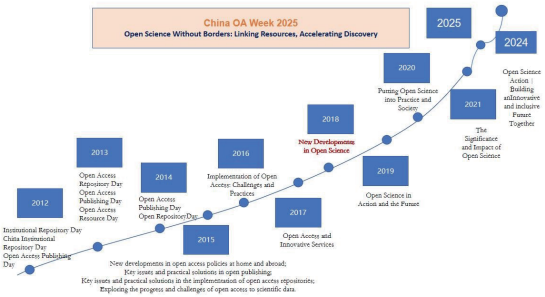
"Design and Delivery of Mapping Open Science Infrastructure and Interoperability Practices in East Asia" ——UNESCO Regional Office for East Asia

This survey project represents a significant step towards strengthening open science implementation mechanisms in East Asia. By collating data from diverse countries and stakeholder groups within the region, this project aims to provide a robust scientific foundation and strategic guidance for the future evolution of open science in East Asia.



China Open Access Week 2025

Since 2012, China Open Access Week has been held in step with International Open Access Week and has now completed twelve successful editions. It has become China's most influential platform for exchange on open science and a key window showcasing the country's latest progress in this field.



From 11 to 14 November 2025, in response to the international open science cooperation initiative jointly proposed by China, Brazil, South Africa and the African Union, the National Science Library, Chinese Academy of Sciences (NSL), together with the Chengdu Documentation and Information Center and other partners, hosted China Open Access Week 2025 under the theme "Open Science Without Borders: Linking Resources, Accelerating Discovery." The event followed a "main forum + sub-forums" format, focusing on the sharing and application of key open science resources and attracting over 300 participants from China and abroad. During the event, the Chinese and English editions of the Protocol on Open Science for Early-Career Researchers—developed under the Open for Science 10 (OS10) Programm

Challenges and Opportunities in Scaling Open Science

Despite these advances, considerable challenges remain in scaling Open Science practices and infrastructures in a fair and sustainable manner.

Challenges

Infrastructure inequalities

Many institutions and countries lack robust connectivity, storage, computing resources or repository services. Without mechanisms for sharing and supporting infrastructures, Open Science risks creating new divides.

Incentive misalignment

Evaluation systems often still prioritize traditional metrics such as journal impact factors and pay limited attention to data sharing, software development, collaboration or community-building. This makes it difficult for researchers to justify investing time in Open Science activities.

Fragmentation and interoperability

Repositories, platforms and identifiers are proliferating, but interoperability is uneven. Metadata standards, APIs and governance models vary, making cross-system integration resource-intensive.

Language and cultural barriers

English remains dominant in scientific communication, which can marginalize knowledge produced in other languages and make it difficult for local communities to access relevant research.

Sustainability and governance

Many Open Science platforms rely on project-based funding, with unclear long-term sustainability models. Governance structures may not sufficiently represent diverse communities or regional perspectives.

Ethics and rights

As data sharing expands, issues of privacy, consent, Indigenous data sovereignty and community rights become more urgent. Balancing FAIR and CARE is not trivial and requires context-sensitive guidance.

Opportunities

At the same time, there are important opportunities:

The UN Decade of Sciences for Sustainable Development offers a temporal and political framework for aligning Open Science with long-term global priorities.

South–South and South–North cooperation frameworks, such as OS10, can foster mutual learning and co-development of infrastructures.

The growing recognition of research integrity and reproducibility concerns strengthens the case for Open Science as a pillar of trustworthy science.

Rapid advances in digital tools, cloud platforms and AI methods can be harnessed to support automated metadata generation, translation, summarization and quality checks, easing some of the burdens associated with Open Science practices—provided they are governed responsibly.

The Path Forward: Building a Shared Open Science Ecosystem

Looking ahead to 2030 and beyond, the journey "from UNESCO Recommendation to practice" can be seen as a process of building a shared Open Science ecosystem—one that is technically robust, socially just and globally inclusive.
Several directions stand out:

Embedding Open Science in National and Institutional Strategies

Policy and strategy documents should not only mention Open Science, but also allocate resources, define responsibilities and set realistic milestones. Readiness assessments and monitoring tools can help track progress and guide investment.

Strengthening Federated Infrastructures and Nodes

Rather than aiming for a single global platform, the focus should be on interoperable nodes—repositories, discovery systems, data services and training platforms—that can talk to each other. Initiatives such as Pubscholar internationalization and the proposed Open Science Information Infrastructure Alliance point to how this might be done.

Investing in Capacity and Communities of Practice

Open Science depends on human capacity. Training programmes, mentorship, peer support networks and communities of practice are essential for making openness a lived reality rather than a formal requirement.

Evaluation systems should progressively recognize diverse contributions: data sets, software, protocols, community curation, outreach and capacity-building. Without this alignment, Open Science will remain a secondary activity rather than part of the core of research.

Ensuring Equity and Respect in Data Governance

The convergence of FAIR and CARE principles should guide how data are managed and shared, especially in cross-border and cross-cultural contexts. Collaborative frameworks must avoid extractive data practices and instead promote shared benefit and co-governance.

Leveraging Regional Organizations and Alliances

Organizations such as ANSO, and initiatives such as OS10, are well placed to bridge global frameworks and local realities, especially in the Global South. By convening partners, piloting new models and amplifying regional voices, they can help ensure that Open Science evolves as a truly global project.

Conclusion

The UNESCO Recommendation on Open Science has provided the world with a common language and a shared set of aspirations. But the real work lies in implementation: in building infrastructures, reshaping incentives, training researchers, aligning policies and nurturing alliances that translate principles into practice.

The initiatives highlighted in this article—OS10, the CERN Open Science Workshop, the Protocol on Open Science for Researchers, China Open Access Week 2025, collaborations with UNESCO, CODATA and TWAS, the internationalization of Pubscholar and the early steps toward an Open Science Information Infrastructure Alliance—demonstrate that this transition is already underway. They show how Open Science can move from abstract commitment to concrete action, and how regional and cross-regional collaborations can play a decisive role in that process.

As the world enters the Decade of Sciences for Sustainable Development, Open Science is not an optional add-on, but a foundational condition for making science more effective, more inclusive and more responsive to the needs of humanity and the planet. The challenge and opportunity now is to deepen and expand these efforts, ensuring that the emerging Open Science ecosystem is truly a global commons—shared in its benefits, shared in its responsibilities, and shared in its governance.

The National Science Library, Chinese Academy of Sciences' Role

The National Science Library, Chinese Academy of Sciences (NSLC), is an independent research institution affiliated with CAS and a public institution directly under the central government. NSLC provides science and technology information services to both CAS institutes and the broader national research community, and is authorized to grant master's and doctoral degrees in Information Resources Management, where it plays a leading role in discipline development at the University of Chinese Academy of Sciences (UCAS).

With a staff of more than 300 professionals, NSLC manages 175 databases and supports researchers across 125 CAS institutes. It is an active participant in major global Open Science initiatives such as SCOAP[3] and OA2020, and collaborates closely with international partners including UNESCO, CERN and OpenAIRE. In 2025, NSLC led two initiatives endorsed by UNESCO under the framework of the International Decade of Science for Sustainable Development (2024–2033), further consolidating its role as a key hub for Open Science policy, infrastructure and capacity-building in China and the wider Global South.

The National Science Library, Chinese Academy of Sciences (1950-).

This Special Issue is based on the research, practices and strategic initiatives of the National Science Library of the Chinese Academy of Sciences (NSLC) in the field of Open Science. The content draws on NSLC's recent work, including its contributions to national Open Science policy discussions, its participation in international cooperation frameworks, and its development of platforms, tools and models to support the implementation of the UNESCO Recommendation on Open Science. Permission for compilation, adaptation and publication has been granted to the ANSO Secretariat.

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