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Open science for all

Implementing the UNESCO Recommendation on Open Science for an equitable and just transition to open science

Open science is a growing movement toward making science a global public good. Open practices are emerging as a way of transitioning rapidly to more accessible, transparent, and inclusive science to ensure that it also serves the broader society. In recognition of the transformative potential of open science to reduce existing inequalities in science, technology, and innovation, countries worked together within the United Nations Educational, Scientific and Cultural Organization (UNESCO) to map out a path to open scholarship. The 2021 *UNESCO Recommendation on Open Science*[1] provides an international normative instrument that can direct shared progress toward more open and equitable scholarly systems, grounded in shared values and principles. As countries begin implementing the Recommendation, librarians and information professionals have a key role to play in creating solutions and strengthening processes for open scholarship.

Building a global consensus

In the past few decades, open science practices fostering increased access, transparency, and inclusiveness have evolved worldwide, aiming to make scientific knowledge more accessible and verifiable and the scientific process more efficient, reproducible, and reliable as well as more connected to society and societal needs.

A fair and equitable implementation of the concepts of open science, however, requires a common understanding of its potential and its challenges, which vary in different regions and among different groups of stakeholders. This could not be achieved in the current fragmented scientific and policy environment.

That is why UNESCO was tasked in 2019 by its 193 Member States to take the lead in building a global consensus on open science, including as concerns a common definition, a shared set of values, and proposals for action. UNESCO, as the leading United Nations agency on education, science, culture, and communication, places special emphasis on fostering equitable and open access to knowledge resources and knowledge generation.

The *UNESCO Recommendation on Open Science* was adopted by the 41st session of the UNESCO's General Conference in November 2021. This first international standard-setting instrument on open science provides an internationally agreed-upon definition and a set of shared values and guiding principles for open science. It also identifies a set of actions

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conducive to a fair and equitable operationalization of open science for all at the individual, institutional, national, regional, and international levels.

With the adoption of this Recommendation, 193 countries have committed to promoting an enabling policy environment, investing in infrastructure for open science and capacity-building, as well as to aligning incentives and promoting innovation and cooperation to foster open science. This Recommendation

- is the first international normative instrument on open science;
- contains the first internationally agreed-upon definition of open science;
- spells out the consensus core values and guiding principles of open science;
- addresses multiple actors and stakeholders of open science;
- recommends actions on different levels to operationalize the principles of open science;
- proposes innovative approaches for open science at different stages of the scientific cycle; and
- calls for development of a comprehensive monitoring framework.

As defined in the *Recommendation on Open Science*, open science takes on mainstreaming openness throughout the entire research cycle, not simply releasing the end products of scientific research. To ensure the best possible quality and to ensure that the research enterprise remains equitable and fair, the scientific community must consider not only who is on the receiving end of scientific knowledge but also who is part of creating, funding, directing, and applying this knowledge.

Open science comprises all scientific disciplines and aspects of scholarly practices, including basic and applied sciences, natural and social sciences, and the humanities.

Addressing inequity in scholarly processes

Multiple existing challenges are hindering equity in the creation and use of scholarly knowledge, including digital and technological divides, uneven capacities for research and levels of investment, as well as disparities in access to scientific knowledge and data between and within countries. Only if it is a truly global and equitable phenomenon will the full potential of open science be possible to harness to succeed in global ambitions, such as the attainment, worldwide, of the Sustainable Development Goals[2] and the advancement of the human right to science.[3]

Openness alone cannot resolve inequities: in fact, there is a risk of some open science practices accelerating the progress of those already in the lead in terms of access to infrastructure and the tools needed to create, share, and benefit from scientific knowledge. For instance, in our efforts to open access to scientific articles and publications, we cannot simply move from a model in which readers pay to one in which authors bear the cost burden of quality publishing and archiving services. Such a system is simply not equitable among scholars and among countries in vastly different economic situations.

Some of the needs for truly open science are technical. Open science infrastructure bolsters access to the tools and information needed to conduct science and access expertise. Addressing the digital divide remains a key challenge to a truly open, accessible global science system.

Other needs are cultural or political. As defined, open science recognises the richness of diverse knowledge systems, of citizen and community involvement, and the generation of knowledge in dialogue among researchers, local people, policy makers, and other actors. In

practice, spaces for such dialogue remain on the fringes of scientific practice. Skills for such engagement are not yet central in scientific curricula or valued in career assessment.

One aspect of science-based decision-making is to identify where people are looking for information and meet them where they are. Collaboration among institutions and disciplines is thus essential to guide people through the landscape of scientific knowledge. In this context, there is an increasingly urgent need to heighten the visibility of knowledge and valuable knowledge-based solutions produced in the Global South.

Working together to open science

UNESCO is currently supporting countries with the implementation of the *Recommendation on Open Science* across seven action areas by supporting policy development, capacity building, sharing best practices, and providing guidance and norms for the equitable development of open science around the world. For example, national and regional policy- and capacity-building workshops targeting policy and science actors from more than 20 countries have been conducted to raise awareness of the Recommendation and the means for its implementation. Recognizing the importance of open science actors beyond the scientific community, the UNESCO Global Open Science Partnership, has been mobilized and expanded to include scientific publishers and associations of open science funders as well as relevant UN agencies and youth associations.

To ensure a transparent, inclusive, and accessible multi-stakeholder process able to feed into a global dynamic open science framework in the context of the *Recommendation on Open Science*, UNESCO has mobilized more than 700 experts and stakeholders across the different regions. These experts are currently engaging in five Open Science Working Groups that are meeting regularly to discuss the five high-impact areas that have been identified as critical to the operationalization of open science worldwide, namely, policy development, capacity-building, infrastructure, funding and incentives, and monitoring of open science.

These ad-hoc open working groups have been valuable and unique international multi-stakeholder platforms to discuss the status and trends of open science and propose ways forward for ensuring the fair and equitable operationalization of open science. As a result of the work of the Open Science Working Groups and with inputs from multiple partners, the UNESCO Open Science Toolkit[4] has been developed to assist the Member States in raising awareness of open science and addressing priority challenges. In addition to guidance documents, tools include an index of infrastructures for open access and sharing of data and information on UNESCO's science priority areas, including water, oceans, biodiversity, climate change, disaster risk reduction, and geological and Earth sciences. An Open Science Capacity Building Index has been created with the Working Groups to guide users to available training resources—a next step is to collectively define a core skills framework for open science.

By adopting the Recommendation, 193 countries have also committed to regular assessments of their progress of implementation, using shared standards. The monitoring group has supported the drafting of a questionnaire to assist Member States in their reporting, thereby shaping the way open science is assessed and tracked around the world.

These fora have been beneficial particularly in terms of advancing collective understanding and engagement with the uneven development of open science in differing local contexts. Even within the groups, creative solutions must be built to further expand representation and engagement beyond the conventional knowledge society primarily working in English.

New participants are welcome. Any individual can join one or more of these groups by registering for an upcoming Working Group meeting on the website[5] or by emailing open-science@unesco.org.

Strengthening the role of libraries

November 2023 marks two years since for the adoption of the *UNESCO Recommendation on Open Science*. The present authors consider it important that librarians and information professionals be part of the conversation on how to provide guidance, set priorities, and create the requisite tools for implementation of open science in various local contexts. Libraries will also be part of the response by national governments for tracking and reporting on their implementation of the Recommendation, with UNESCO Member States reporting every four years from 2025 onward.

Libraries are, for many, the forefront of knowledge exchange. They also play a central role in producing, collating, and delivering training materials for scholars. In the context of open science, creating and maintaining related infrastructure becomes a crucial function of libraries.

Open access is a gateway to open science for many academics and information professionals. Libraries serve as a visible space for accessing this information, including by hosting scholarly repositories, creating their own technological solutions for information management, and by training others in knowledge management. Their voice is influential in developing contracts and framework agreements at many levels. For instance, the not-for-profit Electronic Information for Libraries is currently working with library consortia in 40 countries in Africa, Asia, the Pacific, and Europe to build capacity and advocate for open access to knowledge.

Yet the role of libraries can reach far beyond open access and delve further into opening the scientific process. Libraries can create and host multiple activities that directly advance open science, such as training, open engagement with societal actors, open dialogue across knowledge systems, open publishing, and science communication, broadly defined.

The transformation to open science will require both a cultural shift and a new set of skills. Librarians and information professionals have a critical role to play in investing in the training needed for open science to prosper. Transforming scientific practice to enable it to adapt to the challenges, opportunities, and risks of the digital era will require research, education, and training in the requisite skills for new technologies and modes of collaborative work. A core set of data science and data stewardship skills, skills related to intellectual property law, as well as skills needed to ensure open access and engagement with society should be incorporated into the curricula of higher education in research-related fields, including information management.

Many libraries are already taking on open publishing through collaborative mechanisms. They can also help encourage multilingualism in the practice of science. Ensuring diversity in scholarly communication, strengthening transparent and equitable access, and supporting non-commercial and collaborative publishing models without article processing charges are some of the ways in which libraries can foster open science.

Libraries also play a key role in building a culture conducive to open science. There are some key questions to ask on the path to open science. Are the scholarly practices in your community open by default? Are the innovators in your institution encouraged and incentivized to make their practices and products open? Are newcomers to your institution

introduced to open science early on? The *UNESCO Recommendation on Open Science* plays its part as a normative instrument by outlining shared values and principles, yet these are turned from words into reality only when institutions and individuals take up these shared values and principles at the local level.

Libraries are a bridge between local contexts and the global scholarly community. As potential advocates for inclusive open science, library and information professionals could identify and call out existing inequalities, bring together diverse stakeholders, and drive the cultural and practical shifts that will be necessary to advance open science.

Access to knowledge will be pivotal to accelerated progress toward shared goals. Access to the collective *processes of knowledge creation* will be pivotal not only to create relevant information but also to define those shared goals in a way that is more equitable and more representative of communities around the world.

Notes

1. UNESCO, *UNESCO Recommendation on Open Science*, UNESCO General Conference (Paris: UNESCO, 2021), https://doi.org/10.54677/MNMH8546.
2. UN General Assembly, *Transforming Our World: the 2030 Agenda for Sustainable Development*, October 21, 2015, A/RES/70/1, https://documents-dds-ny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf.
3. United Nations, *Universal Declaration of Human Rights*, United Nations General Assembly, Resolution 217 A, December 10, 1948, https://www.ohchr.org/en/human-rights/universal-declaration/translations/english.
4. UNESCO, "Open Science Toolkit," https://www.unesco.org/en/open-science/toolkit.
5. UNESCO, "Implementation of the UNESCO Recommendation on Open Science," last updated September 21, 2023, https://www.unesco.org/en/open-science/implementation#open-science-working-groups.