OPEN SCIENCE RECOMMENDATIONS TO STAKEHOLDERS

19 02 2023

Circle U.
European University Alliance

Co-funded by the Erasmus+ Programme of the European Union

This project has received funding from the European Union's Erasmus+ Programme under grant agreement No. 101004062

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FOREWORD

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1 INTRODUCTION

Open Science can shortly be described as the movement to make scientific research, data and dissemination accessible to all levels of an inquiring society [1]. It covers all academic disciplines. Much has been written about Open Science and its aims. Hence, this report will not rephrase what has been perfectly presented in various documents such as [1 - 13]. The focus will be on political commitment and actions to promote open science at all levels in Circle U. The report aims to provide strategies and key actions that might be implemented by institutions to foster Open Science. Some of them addresses high-level initiatives; others focus on capacity building; still others address the development or the reinforcement of infrastructure. It is not a prescriptive list but a means to encourage institutions and decision makers - at all levels - to support Open Science from the perspective of their own context and specificities.

2 WHAT IS OPEN SCIENCE ?

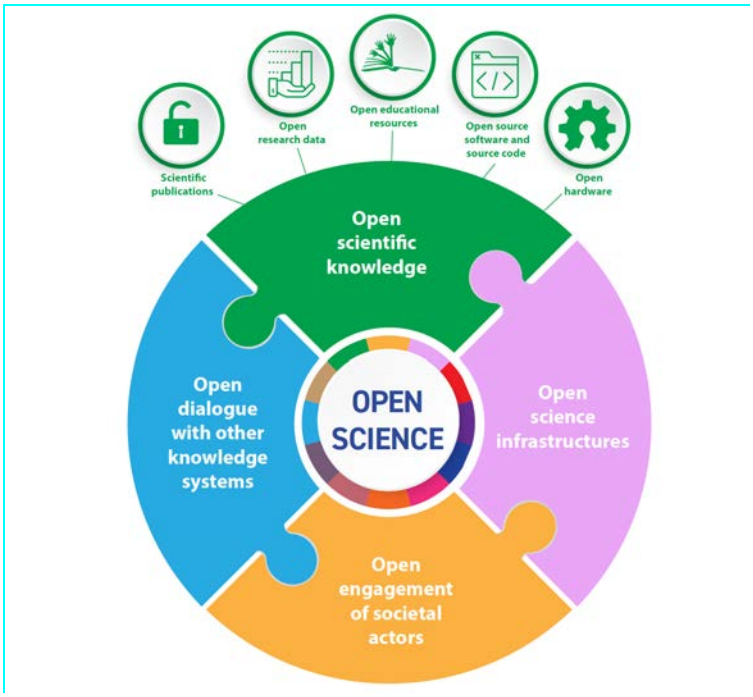
Open Science is an umbrella term encompassing a multitude of assumptions about the future of knowledge creation and dissemination [20]. Open science may cover various concerns such as access to knowledge, technological architectures, alternative impact measurements, collaborative research, and making science accessible to citizens.

UNESCO recently presented a broad vision of Open Science where Open Science *"combines various movements and practices aiming to make multilingual scientific knowledge openly available, accessible and reusable for everyone, to increase scientific collaborations and sharing of information for the benefits of science and society, and to open the processes of scientific knowledge creation, evaluation and communication to societal actors beyond the traditional scientific community. It comprises all scientific disciplines and aspects of scholarly practices, including basic and applied sciences, natural and social sciences and the humanities, and it builds on the following key pillars: open scientific knowledge, open science*

infrastructure, science communication, open engagement of societal actors and open dialogue with other knowledge systems" [2, p.7].

The proposed four dimensions are then subdivided in different themes:

- *Open scientific knowledge*: scientific publications, Open research data, Open educational resources, Open source, Open hardware.
- *Open science infrastructure*: virtual and physical.
- *Open dialogue with other knowledge systems*: indigenous people, marginalized scholars, local communities.
- *Open engagement of societal actors*: crowdfunding, crowdsourcing, scientific volunteering, citizen and participation science.



A broad vision of Open Science [2]

3 STRUCTURE OF THE REPORT

The present document focuses on basic pillars of Open Science related to Open scientific knowledge. Two complementary themes on open scientific knowledge will also be addressed: skills and training, and research evaluation. Open Education, including Open Educational Resources, is handled in a separated document. We suggest that the other three dimensions of the broad vision of Open Science be examined within each institution and perhaps coordinated at the Circle U level.

The following dimensions are addressed in this report:

- Open Access (scientific publication),
- Research Data Management and Open Data,
- Open Source (software),
- Skills and training,
- Research evaluation.

The following sections discuss the different themes. Each section proposes recommendations and actions:

- Recommendations to stakeholders: Recommendations are widely accepted principles for opening scientific knowledge. They should, therefore, be taken account of and adhered to by those concerned by open science deployment.
- Actions to consider for deploying openness: The mode of operationalisation and the implementation of Open Science may vary according to the actors and the contexts. Actions illustrate the ways to implement recommendations. They set out practices to be considered by the key actors involved in open science at stakeholders levels in the institutions.

Some global recommendations and actions on Open Science are first presented.

4 OPEN SCIENCE

Open Science opens up new ways in which research/education/innovation are undertaken, archived and curated, and disseminated across the globe. Open Science, with its different pillar (see other sections) is about greater efficiency and productivity, more transparency, and a set of responses to research needs. According to LERU *"Open Sciences represents challenges but also significant opportunities. […] Successful engagement with Open Science requires a holistic vision by the institution, working together to deliver a set of goals in a complex and evolving mix of themes and priorities, to which all members can commit."* [3].

This section addresses recommendations and key actions related to academic organization aspects and high-level supports and initiatives that can support evolution with respect to Open Science in a way which secures academic quality and integrity.

4.1 RECOMMENDATIONS

1. Place Open Science, in all its dimensions, at the heart of the university's actions.
2. Deploy an Open Science culture at all levels of the institution (teaching, research, service to society); enhance the commitment of the Circle U. community to Open Science.
3. Encourage the obligation to disseminate publicly funded research results and outputs (data, book, articles, software …).
4. Investigate possibilities to integrate Open Science in the student education.

4.2 ACTIONS

- Advocate policy change by governments and funders.
- Contribute actively to national, regional and international networks, projects and initiatives promoting Open Science.
- Participate/Stimulate the development or improvement of Open Science policies at European and national levels.

- Adopt an institutional policy that identifies goals that advocate Open Science and that can be embraced by members to achieve an Open Science approach through the whole institution. If the policy already exists, keep it updated.
- Appoint an Open Science senior manager and a suitable governance to ensure the policy development, the strategy deployment and implementation of Open Science.
- Create specific Open Science institutional structures/roles e.g. create an organizational repository, research data management service, Office for Open Science.
- Provide support to help researchers do Open Science (Open Data, Research Data Management, Open Access, Open Source, …).
- Develop interoperability between open publication archives, disciplinary repositories, institutional repositories, data repositories, software forges as well as good coordination with the scientific publishing sector.
- Support bibliodiversity allowing a variety of OA publishing modes, in order to achieve a more economically sustainable ecosystem.
- Ensure link between Open Science Policy and research ethics/integrity is well understood.
- Regularly monitor progress made on openness within the institution, benchmark itself against partners within Circle U.
- Create awards to recognize faculty, researchers, or students who demonstrate dedication and contribution to open science and share successful impact stories across the institution.

5 SKILLS AND TRAINING

Changing scholarship is complex. Advocacy and development of skills are key levers to develop new practices.

5.1 RECOMMENDATIONS

5 Increasing Open Science skills of the university community: Ph.D. students, researchers, academics and administrative supports.

6 Support training to enable scholars to embrace the change of culture inherent to Open Science.

7 Develop and value Open Science skills throughout the educational and professional careers of students and research staff

5.2 ACTIONS

- Implement a communication plan to familiarize the whole university with the concepts, advantages, and practices of Open Science.
- Propose advocacy activities with university members, at all levels, that open discussion about the benefits of Open Science and its challenges while being realistic about challenges and constraints.
- Develop and propose an Open Science introduction course to all Ph.D. students.
- Analyze needs for training – including staff responsible for providing Open Science services and specialist support and share existing training within Circle U.

- Establish training sessions on research data management, open access and open source at all levels, starting from students and taking into account the varying needs of different audiences, different disciplines, etc.
- Create a data-management teaching approach in all disciplines at bachelor level where relevant.
- Increase open science awareness and training programs for senior researchers.
- Develop Open resources and material for skills training in Open Science.
- Use and/or adapt Open resources to spread the word (such as the French initiative guide Passeport for Open Science – A Practical Guide for Ph.D. Student).
- Monitor the take-up and impact of Open Science skills training to determine progress towards its cultural integration in the institution.
- Encourage, incentivize, support and recognize staff and students with regard to Open Science skills development.

6 OPEN ACCESS

Open Access (OA) is the free access to scientific publications and makes their reuse and redistribution possible. OA is a means to an end: a better dissemination of scientific results, a reduced communication time and an increased visibility. Today, many national and EU research funders require OA publication of research but, as stated in [12], *"Roughly 85% of the new research articles published globally are still produced in journals that are behind paywalls, making them inaccessible to all researchers and citizens who cannot afford to pay to access them."* There is no doubt that the future of academic publishing is likely to be different from how we know today, it is up to the international scholarly community and the institutions to take the necessary initiatives to foster this in a way which secures academic quality and integrity.

6.1 RECOMMENDATIONS

8 Make OA a common practice, mastered by the scientific community.

9 Improve the institutional repositories or national open archives of all articles and books produced by funded research (with a possible embargo period).

10 Align OA policy of the institution with national or European funders policy and requirements.

11 Advocate policy change by funders.

12 Consider supporting new high quality forms of scholarly publication from outside parties dedicated to Open Access platforms.

6.2 ACTIONS

- Develop or improve OA policies.
- Critically assess transformative or transitional models to open access with existing or new publishers for reasonable cost which are truly transformative.
- Lobby for legislation that protects intellectual property rights – consider a rights retention policy within your institution.

- Support relevant non-commercial infrastructure for scholarly communication and OA publishing models that do not require the payment of articles or books processing charges (APC).
- Develop, promote and use of national, institutional or shared OA repositories for Green OA.
- Develop in-house human capacity for infrastructure for OA.
- Support relevant non-commercial scholar-led publishing initiatives (Diamond OA), promote publication in open journals – especially in non-profit journals that respect the principles of FAIR OA, on third-party thematic platforms or on institutional open journal platforms.
- Support the transfer or the creation of open journals on open platforms (institutional or third-party platforms).
- Promote new open publishing models (e.g., preprint server, overlay journals), new editorial and peer review models (open peer review, collaborative peer review ...).
- Develop the Open Book and the production and use of Open Textbooks as course materials.
- Avoid (proscribe) paying APCs to hybrid journals.
- Implement monitoring mechanisms on OA usage and APC costs.
- Reduce the amounts dedicated to subscriptions taken out by the university to non-Open Access journals to support the publication costs (APC) of researchers in FAIR Open Access journals.
- Advocate the use of author identifier systems, such as ORCID; integrate them into internal research management procedures and platforms.
- Develop the awareness of scholars about the diversity of publishing formats, OA practices, open licenses and copyrights, intellectual property rights and OA tools.

7 RESEARCH DATA MANAGEMENT AND OPEN DATA

Open (Research) Data aims to provide free access to research data to ensure the reproducibility of scientific results. Open Data are complementary to open access journals and are a needed element to validate and reproduce research outputs. FAIR Data Principles describes how research data should be shared: Findable, Accessible, Interoperable and Reusable are common properties of shared research data. The data should be as open as possible and as closed as necessary.

Researchers should be able to find, reuse, publish and share data via data repositories that implement FAIR data principles and that ensure long-term sustainability of research data; those repositories should be easy to find and use.

Research Data Management (RDM) addresses the entire life cycle of data, covering planning, collection, management, storage, publication, referencing, preservation and sharing of research data, as well as access and reuse rights.

A key element of good data management is a Data Management Plan (DMP).

7.1 RECOMMENDATIONS

13 Encourage policies and actions that favor the reuse of research data.

14 Integrate Open Data/FAIR data (RDM, dissemination and storage strategies) into Open Science policies as well as research management principles and practices of researchers.

15 Provide tools and services to researchers for a broader dissemination of research data they produce.

7.2 ACTIONS

- Promote the use of Open Data infrastructure such as EOSC.
- Promote the exchange of good practices in FAIR research data management between Circle U.'s.
- Enhance, create, or maintain data repositories when their absence limits the ability of researchers to share their research data.
- Make the use of Open Data infrastructure free of charge, except for very large datasets.
- Create a joined catalogue of published and stored data, as is done with publications.
- Promote the visibility of Circle U.'s Open Data (quality of metadata, search engines, automatic indexing in national and international directories).
- Organize help and support to researchers (legal aspects, DMP, metadata), for instance through trained data stewards.
- Develop templates for the DMP for PhD students.

8 OPEN SOURCE

An Open Source software allows anyone to use it, study it (through access to the source code), modify or adapt it, and redistribute it, with minimal restrictions. When researchers contribute to open-source community, making software source code publicly available for reuse, replication and improvement, they contribute to Open Science as much as when they publish in OA and publish Open and/or FAIR Data.

8.1 RECOMMENDATIONS

16 Promote Open Source code produced by researchers

17 Provide legal assistance to researchers in the choice of licenses and distribution of software resulting from research.

18 Recognize and support the dissemination of software under an Open Source license.

19 Highlight the production and use of Open Source code from higher education, research and innovation.

8.2 ACTIONS

- Create and publicize guidelines, policies, and practices for publishing code under Open Source licenses.
- Create a community of practice (user group) within the Circle U. community to benefit from each other's experiences with Open Source.

- Develop/Propose institutional forges or international archives (such as software heritage) as a showcase for the diffusion of Open Source software developed within institutions.
- Encourage the use of Open Source software.
- Encourage the use of Open Source tools, programming languages and software in teaching curricula, support reuse, widest impact.
- Promote innovation and encourage authors who wish to distribute code openly under existing Open Source licenses.

9 RESEARCH EVALUATION

Research assessment combines qualitative and quantitative practices that evaluate the impact and the quality of research activities. Research assessment is therefore part of academic assessment and should reflect scholarly values in a broad way. The current academic reward system is in many fields heavily based on the Journal Impact Factor and mostly on quantitative metrics. Assessment practices should evolve in such a way that they ensure the transformation of the current scholarly publishing system and the integration of Open Science into researchers' activities.

9.1 RECOMMENDATIONS

20 Develop flexible, fair and robust research evaluation approaches that recognize and reward Open Science contribution.

21 Recognize differences in the academic areas and in interdisciplinary research.

22 Move away from inappropriate use of metrics. Consider new generation metrics, adopt and embed alternative principles (such as DORA, CoARA agreement on reforming research assessment [21]) into institutional processes for promotion, reward and research evaluation.

9.2 ACTIONS

- Value the diversity of scientific productions, including Open Science production, in the assessment of researchers and projects.
- Do not use journal-based metrics, such as Journal Impact Factors, as a surrogate measure of the quality of individual research articles in the academic assessment or funding decisions.
- Develop and adopt metrics for assessing the impact of non-traditional research outputs, such as open data, open publications, open software, open educational materials, and research behaviour and ethics. Be explicit and transparent in the criteria used for hiring, promotion and funding decisions.
- Move to a more balanced approach between the quantitative and the qualitative evaluation of research, by strengthening the qualitative research assessment indicators while developing the responsible use of quantitative indicators
- Align the assessment and training policies so that the benefits of Open Science are fully understood.
- Support coalition of research funding organisations, research performing organisations, and assessment authorities, willing and committed to reform the

current research assessment system along commonly agreed objectives, principles and actions ('Paris call on research assessment')
- Raise awareness of junior researchers for a responsible use of biometrics.

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GLOSSARY

Article Processing Charge (APC) - a fee charged to the author, creator, or institution to cover the cost of an article, rather than charging the potential reader of the article. APCs may apply to both commercial and Open Access publications. APCs are sometimes charged to authors in order to cover the cost of publishing and disseminating an article in an Open Access scholarly journal.

Citizen science - Citizen Science is the involvement of the non-academic public in the process of scientific research – whether community-driven research or global investigations (citizenscience.org) [7].

Creative Common - A suite of licenses that set out the rights of authors and users, providing alternatives to the standard copyright. CC licenses are widely used, simple to state, machine readable and have been created by legal experts. There are a variety of CC licenses, each of which use one or more clauses, examples of which are given below. Some licenses are compatible with Open Access in the Budapest sense, and some are not.

Data Management Plan - An ongoing plan written at the start of a research project which sets out how the data will be managed covering its collection, documentation, and storage, as well as managing sensitive data, conditions for opening or sharing data, etc. [17]

Diamond Open Access - not-for-profit, non-commercial organizations, associations or networks publish material that is made available online in digital format, is free of charge for readers and authors and does not allow commercial and for-profit re-use [19]

EOSC - European Open Science Cloud - The EOSC aims to provide European researchers, innovators, companies and citizens with a federated and open multi-disciplinary environment where they can publish, find and reuse data, tools and services for research, innovation and educational purposes.

Fair Data - FAIR Data (according to FORCE11 principles and published in Nature Scientific Data) are Findable, Accessible, Interoperable, and Reusable, in order to facilitate knowledge discovery by assisting humans and machines in their discovery of, access to, integration and analysis of, task-appropriate scientific data and their associated algorithms and workflows [7].

Fair Open Access - Fair Open Access is a strict version of scholarly publishing that strives for a non-profit, full, immediate and transparent implementation of OA. Fair OA offers the well-known advantages of OA while at the same time avoiding a costly for-profit business model for scholarly publishing. Furthermore, Fair OA returns control over the publication process to the scholarly community.

Forge – A web-based collaborative software platform for both developing and sharing computer applications. For users, a forge is a repository of computer applications, a place where bugs can be reported, a channel to be informed of security issues, etc. (Wikipedia).

Gold Open Access - Gold open access usually means the immediate, permanent, and free to access availability of the published version of record on the publisher's website and with a license that permits copying and reuse [18].

Green Open Access - A version of the publication is archived online, e.g., in a repository. It can be freely accessed but sometimes only following an embargo period, and there can be barriers to reuse. Green open access is also referred to as 'self-archiving' [18].

Institutionnal repository - An online database designed to collect the intellectual output of a particular institution or university, including digital collections such as electronic theses and dissertations, pre-prints, articles, books data or faculty scholarship, and presents associated metadata regarding these items.

Meta data - Information which enables the standardised description of data or digital documents (e.g. a digital photo's date and GPS coordinates). The quality of metadata ensures sharing and the possibility to reuse data [17].

Open - Open means anyone can freely access, use, modify, and share for any purpose (subject, at most, to requirements that preserve provenance and openness) (Wikipedia).

Open Access - Set of principles and a range of practices through which research outputs are distributed online, free of access charges or other barriers. Barriers to copying or reuse are also reduced or removed by applying an open license for copyright (Wikipedia)

Open Data - Open Data are online, free of cost, accessible data that can be used, reused and distributed provided that the data source is attributed [7].

Open Education - Open Education is a movement to make education more open, inclusive and accessible to as many people as possible. It aims to reduce barriers to access and increase learning opportunities. It supports the production, use and sharing of educational resources and learning pathways

Open Educational Resource - High quality, openly licensed, online educational materials for sharing, use, and reuse. They act as a mechanism for instructional innovation as networks of teachers and learners share best practices.

Open Peer Review – It seeks to make classical peer review more transparent and accountable. It covers open identities (authors and reviewers are aware of each other's identity), open reports (review reports are published alongside the relevant article), open participation (the wider community, and not just invited reviewers are able to contribute to the review process) (Wikipedia). Open peer review may take various forms.

Open Researcher and Contributor ID (ORCID) - The ORCID provides a persistent digital identifier owned and controlled by a researcher, and that uniquely identifies authors and contributors of scholarly communication.

Open Science - Open science is the movement to make scientific research, data and dissemination accessible to all levels of an inquiring society [7].

Open Source - availability of source code for a piece of software, along with an open source license permitting reuse, adaptation, and further distribution (Wikipedia).

Research Data Management (RDM) - RDM addresses the entire data lifecycle by covering the planning, collection, management, storage, publication, referencing, preservation and sharing of research data, as well as access and re-use rights.