

Introduction to Open Science for Funders

According to the European Commission's *Digital Agenda for Europe*, Open Science (OS) aims to transform science by making research more open, global, collaborative, creative and closer to society (<https://ec.europa.eu/digital-agenda/en/open-science>).

OS is about the way research is carried out, disseminated, deployed and transformed by digital tools, networks and media. It relies on the combined effects of technological development and cultural change in the direction of collaboration and openness in research.

OS makes scientific processes more efficient, transparent and effective through the application of new tools for scientific collaboration, experiments and analysis; it also makes scientific knowledge more easily accessible. At the same time, OS enables and fosters the emergence of new scientific practices, disciplines and paradigms to respond to the new challenges through global distributed collaborations where citizens and society participate as contributors and direct beneficiaries of scientific knowledge.

To elaborate, a recent OECD report¹ identifies the following six rationales for policies on OS and Open Data:

- *Improving efficiency in science* – OS can increase the effectiveness and productivity of the research system, by: reducing duplication and the costs of creating, transferring and re-using data; enabling more research on the same data; multiplying opportunities for domestic and global participation in the research process.
- *Increasing transparency and quality* in the research validation process, by allowing greater replication and validation of scientific results.
- *Speeding the transfer of knowledge* – OS can reduce delays in the re-use of the results of scientific research, including articles and data sets, and promote swifter development from research to innovation.
- *Increasing knowledge spill-overs to the economy* – Increased access to the results of publicly funded research can foster spill-overs and boost innovation across the economy as well as increase awareness and conscious choices among consumers.
- *Addressing global challenges more effectively* – Global challenges require co-ordinated international actions. OS and Open Data can promote collaborative efforts and faster knowledge transfer for a better understanding of challenges such as climate change, and could help identify solutions.
- *Promoting citizens' engagement* in science and research – OS and Open Data initiatives may promote awareness and trust in science among citizens. In some cases, greater citizen engagement may lead to active participation in scientific experiments and data collection.

In practical terms², OS means that each step of the research lifecycle is becoming more open, for instance through:

1 OECD 2015. *Making Open Science a Reality*. Available at: <https://www.innovationpolicyplatform.org/sites/default/files/DSTI-STP-TIP%282014%299-REV2-for%20declassification%20-%20US%20and%20other%20comments%20addressed-numbers-removed.pdf>.

2 If you want to learn more about Open Science, take the FOSTER course *Introduction to Open Science*. This provides a general introduction to the various components and philosophies of Open Science, which can directly enrich each step of the scholarly lifecycle (Open Notebook Science, Open Data, Open Research Software, Open Access). Available at: <https://www.fosteropenscience.eu/content/open-science-scientific-research>).

- *Open Notebooks* - an emerging practice, documenting and sharing the experimental process of trial and error;
- *Open Data* - managing research data in a way that optimises access, discoverability and sharing for use and re-use;
- *Open Research Software* - documenting research code and routines, and making them freely accessible and available for collaboration;
- *Open Access* - making all published outputs freely accessible for maximum use and impact.

In order to achieve this openness in science, each element of the research process should:

- *Be publicly available*: it is difficult to use and benefit from knowledge hidden behind barriers such as passwords;
- *Be re-usable*: research outputs need to be licensed appropriately so that prospective users know clearly any limitations on re-use;
- *Induce collaboration* between researchers through better access and better online tools;
- *Be transparent and have appropriate metadata* to provide clear statements of how research output was produced, and can be re-used.

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