

## OPEN SCIENCE

Open Science is a system change allowing for better science through open and collaborative ways of producing and sharing knowledge and data, as early as possible in the research process, and for communicating and sharing results. This new approach affects research institutions and science practices by bringing about new ways of funding, evaluating and rewarding researchers. Open Science increases the quality and impact of science by fostering reproducibility and interdisciplinarity. It makes science more efficient through better sharing of resources, more reliable through better verification and more responsive to society's needs.

### The eight ambitions of Open Science

Open science policy has developed progressively in the EU. It concerns all aspects of the research cycle, from scientific discovery and scientific review to research assessment, publishing and outreach; its cornerstone being open access to publications and research data. Since 2016, the Commission organises its open science policy according to eight 'ambitions':

- Open Data: FAIR (Findable, Accessible, Interoperable and Re-usable data) and open data sharing should become the default for the results of EU-funded scientific research.
- European Open Science Cloud (EOSC): a 'federated ecosystem of research data infrastructures' will allow the scientific community to share and process publicly funded research results and data across borders and scientific domains.
- New Generation Metrics: New indicators must be developed to complement the conventional indicators for research quality and impact, so as to do justice to open science practices.
- Future of scholarly communication: all peer-reviewed scientific publications should be freely accessible, and the early sharing of different kinds of research outputs should be encouraged.
- Rewards: research career evaluation systems should fully acknowledge open science activities.
- Research integrity: all publicly funded research in the EU should adhere to commonly agreed standards of research integrity.
- Education and skills: all scientists in Europe should have the necessary skills and support to apply open science research routines and practices.
- Citizen science: the general public should be able to make significant contributions and be recognised as valid European science knowledge producers.

## Achievements

- Several pieces of EU legislation facilitate the reuse of research data, notably the European Commission Recommendation on access to and preservation of scientific information (revised in 2018), the revised Public Sector Information Directive (PSI) and the EU Copyright Directive, which applies to publicly funded research data.
- The open-access policy of Horizon 2020 provides for open-access to publications by default, with high levels of compliance from beneficiaries. Horizon Europe will go further in mandating open access to research data by default, yet according to the principle ‘as open as possible, as closed as necessary’.
- The decision to create a European Open Science Cloud (EOSC) was taken under the European Union’s Digital Agenda (2015), followed by an EOSC implementation roadmap in 2018, by a series of dedicated H2020 calls in 2018-2020 to start prototyping the EOSC and the launch of an interim governance structure under the AT Presidency of the EU at the end of 2018. This governance is at work to help in the transition to the EOSC Post 2020.
- A step change in involving citizens and civil society in co-creating R&I content through decisions to co-fund, through Horizon 2020, actions worth around €200 million, including citizen science activities and institutional changes towards responsible R&I.

## At global level

The EU supports bodies and platforms such as Plan S, the Research Data Alliance (RDA), the ISC’s Committee on Data of the International Science Council (CODATA), as well as efforts of the OECD, UN and the G20/G7/Carnegie Groups, with the aim of accelerating the transition to full and immediate open access to scientific publications and of making research data as open and reusable as possible, as soon as possible.

Plan S is an initiative for open access requiring that, with effect from 2021, all scholarly publications on research results funded by public or private grants provided by national, regional and international research councils and funding bodies, must be published in open access journals, on open access platforms, or made immediately available through open access repositories. The plan is supported by cOAlition S, an international consortium of research funders committed to implementing Plan S principles in a coordinated way.

## Next steps

- Horizon Europe will ensure that beneficiaries retain the intellectual property rights they need to comply with their open access obligations.
- Horizon Europe will require research data to be FAIR and open by default (with exceptions notably for commercial purposes).
- Horizon Europe will promote the adoption of open science practices, from sharing research outputs as early and widely as possible, to citizen science, and developing new indicators for evaluation research and rewarding researchers.

- Horizon Europe will engage and involve citizens, civil society organisations and end-users in co-design and co-creation processes and promote responsible research and innovation.
- The European Open Science Cloud (EOSC) will enter its next stage of development in 2021, with stakeholders heavily involved.
- The Commission will fund the development of an open-access publishing platform to host Horizon 2020 (and later Horizon Europe) beneficiaries' publications.
- The Commission will consider how to reflect the principles of Plan S in Horizon Europe.