Second French Plan for Open Science

**GENERALISING
OPEN SCIENCE
IN FRANCE 2021-2024**

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Introduction

Open science refers to the unhindered dissemination of results, methods and products from scientific research. It draws on the opportunity provided by recent digital progress to develop open access to publications and – as much as possible – data, source code and research methods. It is a means for publicly funded research projects to retain control over the results they produce. It builds an ecosystem in which science becomes better substantiated and more transparent, reproducible, effective and cumulative. It aims to democratize access to knowledge, which is useful for teaching and training, and for the economy, public policy, citizens and society as a whole. Finally, it constitutes a lever for scientific integrity and builds citizen trust in science.

The French Plan for Open Science has provided France with a coherent and dynamic policy in the field of open science. It was announced in 2018 by the Minister of Higher Education, Research and Innovation, Frédérique Vidal, and is coordinated by the Committee for Open Science, which brings together the Ministry, the universities and research performing organizations and the scientific community. Substantial progress has been made in the three years since this policy was introduced. The percentage of open access scientific publications in France has risen from 41% to 56%. Once the National Fund for Open Science had been created, it launched two calls for projects to promote open science publication and provided support for international structuring initiatives. The French National Research Agency (*Agence nationale de la recherche*, ANR) and other funding agencies now ask the projects they fund to make the publications available in open access and draw up data management plans. The position of Chief Data Officer has been created in the Ministry and a network of such Chief Data Officers is currently being deployed in the universities and research performing organizations. Around twenty universities and research organisations now have an open science policy. Several guides and recommendations for putting open science into practice have been published.

The progress already made and the changes in the international context induced us to extend, renew and strengthen our commitments by adopting a Second French Plan for Open Science, which will take effect until 2024. With this new plan, France is continuing its ambitious trajectory initiated by the Digital Republic Act of 2016 and confirmed by the Research Programming Law of 2020, which includes open science as one of the missions of researchers.

This Second French Plan extends the scope to include source code from research, structures actions promoting data sharing and openness through the creation of the Recherche Data Gouv platform, it increases the number of transformative levers available to generalise the practice of open science and is divided up into different disciplines and themes. It is firmly attached to a European-wide vision and, in the context of the French presidency of the European Union, proposes to act in favour of open science being effectively taken into account in both individual and collective assessments for research. This involves initiating a process of sustainable transformation in order to ensure that open science becomes a common and shared practice, encouraged by the whole international ecosystem of higher education, research and innovation.
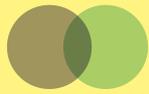
Path One

Generalising
open access
to publications
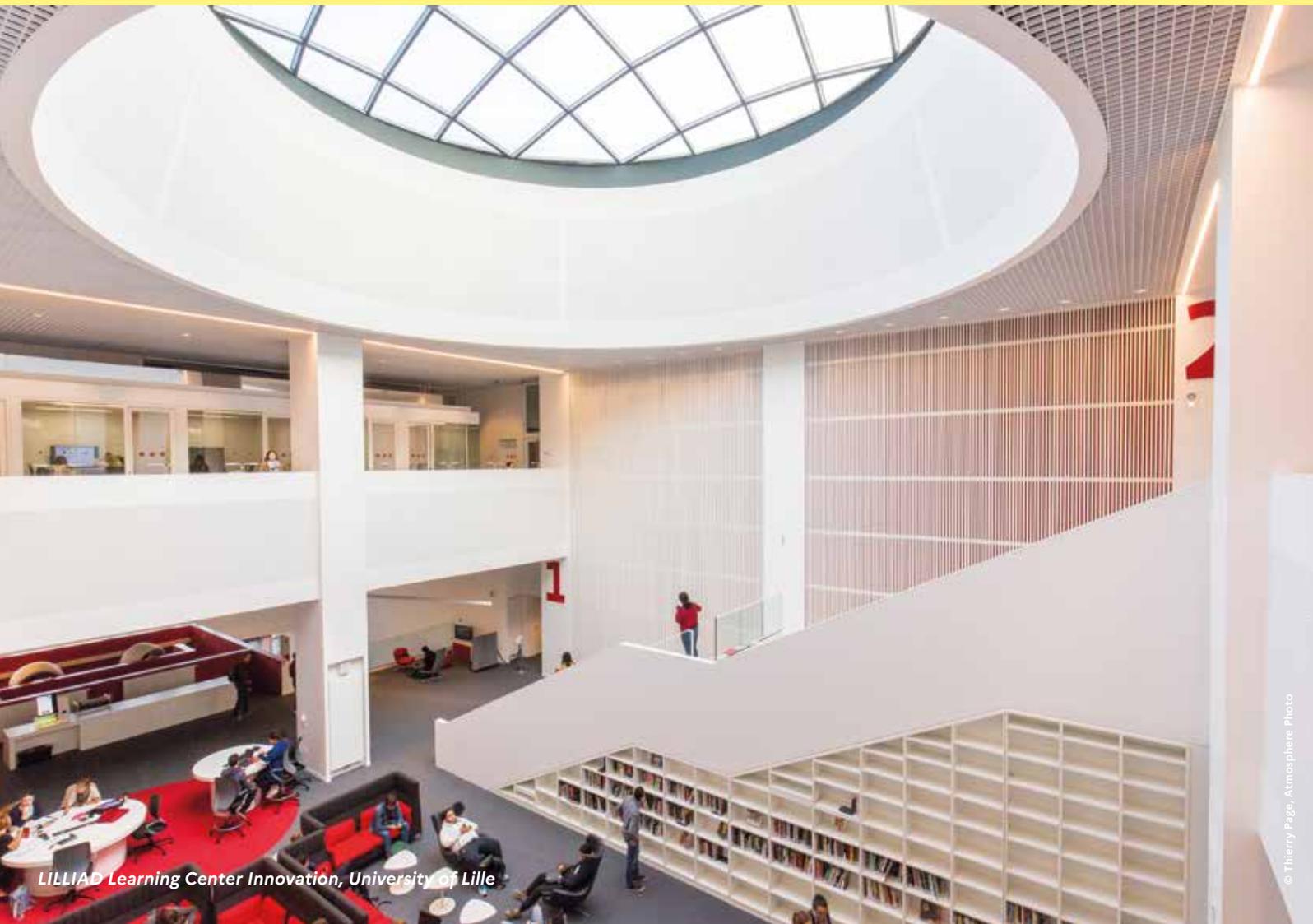
The practice of providing open access to scientific publications should now be inescapable, whether this is done by initially publishing the text as open access or by placing it in an open public archive such as HAL. The aim set by the Research Programming Law is to achieve 100% open access publications by 2030.

The conditions set by the French National Research Agency and the European Union in the context of the Horizon Europe programme contribute greatly to this aim. The obligation to publish as open access should now be generalised to cover all research funding through publicly funded calls for projects, for both books and scientific articles.

Since 2018, many research funding agencies federated in cOAlition S have implemented, through Plan S, a common framework committing them to make all publications from research they have funded immediately and obligatorily available as open access. To achieve this goal, cOAlition S has adopted a rights retention strategy which enables researchers to disseminate their open-source texts without delay, also when publishing in a subscription-only journal. In France we support this new step towards meeting the objectives of Plan S.

In line with the *Jussieu Call for Open Science and Bibliodiversity*, the scientific community should endeavour to build an ecosystem of open, ethical and transparent scientific publishing, involving a plurality of editorial stakeholders, formats and languages. A particularly important issue is that of diversifying the economic models for open scientific publishing. Indeed, the risks associated with the publication fee model (involving the payment of article or book processing charges), such as the budgetary burden, growing inequalities between institutions and disciplines and the race to produce quantity, are being ever better understood.

Our goal is to reach 100% of open access publications

However, 75% of open access journals can be classed as "Diamond" journals. These are steered by the scientific community and are not funded by direct contributions from authors, nor by mandatory contributions from readers. Instead, the publication costs are covered beforehand by the State, a university,

We will support bibliodiversity so that the scientific community can regain control over the publishing system

a consortium of public establishments or a non-profit organisation. The recently produced *OA Diamond Journals Study*, carried out by request of cOAlition S, demonstrated the scope and strategic nature of these journals, and it makes recommendations that France intends to support and enact. The academic presses, attached to universities or research organisations, will be strengthened, modernised and encouraged to join forces to succeed in their transition towards open access. HAL, the French national open archive, will continue to play a key role and will be improved ergonomically and functionally to make it easier for researchers and institutions to use.

Although the *Helsinki Initiative on Multilingualism in Scholarly Communication* stressed the importance of native languages to engender a social anchoring of scientific knowledge and a plurality of thought systems, language barriers impede the international circulation of knowledge, which is just as important. However, recent spectacular progress in translation technologies using artificial intelligence should allow us to resolve this contradiction. Support will be provided for experimentation with translation tools and services for scientific texts, in order to encourage international dissemination of scientific works originally in the French language and to facilitate access to scientific works written in foreign languages for the French-speaking public.

Measures

1

Generalise the obligation to publish in open access all articles and books resulting from publicly funded calls for proposals

2

Support open access economic publishing models that do not require the payment of articles or books processing charges ("diamond" model)

3

Encourage multilingualism and the circulation of scientific knowledge by translating publications by French researchers

Continue developing the HAL national open archive

→ **Simplify** the process of making submissions to HAL for researchers publishing on other open access platforms across the world (CorHAL project).

→ Implement HAL's **shared governance** and long-term financing model as voted by the Open Science Steering Committee.

→ Develop the **integrated service** for self-archiving, automatic collection of publications and coordination with research data (winning project of the call for expressions of interest in Structuring Equipment for Research in the framework of the Investments for the Future Programme – *Programme d'investissements d'avenir* – PIA).

Building bibliodiversity

→ **Reaffirm the French commitment to cOAlition S**, support the **rights retention strategy** to provide immediate open access to

scientific publications and make it easier for researchers to do so. Invite universities and research performing organizations to adopt this strategy when negotiating with the publishers.

→ **Support the diversification of economic models** enabling a transition from subscription towards open access with no publishing fees, notably the "subscribe to open" model.

→ If **publication fees** still apply, they should be exclusively for publications with complete open access, and **refused for hybrid journals**.

→ **Create Open Science Badges** to qualify the evaluation methods of open access publications, to enhance their enrichment by associated data and codes, and to display their user licences.

→ **Develop and support publishing innovations**: preprints, open peer review, executable papers (*Jupyter notebooks*), data papers, overlay journals, etc.

Extend the global influence of French research publications

→ Develop tools to support multilingualism using **semi-automatic translation** and linguistic and discipline-specific expertise.

→ Issue an **international call for research into automatic translation** as part of the European Research Area Network.

→ In partnership with Wikimedia France, encourage the use of findings from French research in the global collaborative **Wikipedia** encyclopaedia.

Structure, support and modernise French scientific publishing

→ Introduce a **scientific publishing support plan**, in line with the commitment in the Research Programming Law.

→ Create an **alliance of public scientific publishers** committed to open science so as to promote the role they play, coordinate their initiatives and encourage resource pooling whenever possible.

→ Develop and support a **public body for the dissemination and distribution of printed and digital books**, to improve their visibility, particularly in bookshops.

→ Create a **Scientific Publishing Observatory** to bring together stakeholders in public and private scientific publishing, research, and scientific information.

→ Support **multiplatform publishing**, in XML, notably through Métopes, Lodel, and the Public Knowledge Project, and explore the potential for shared access to services for **detecting plagiarism** and monitoring **manuscript submissions** (editorial workflow).

SUPPORT OPEN SCIENCE IN HUMAN AND SOCIAL SCIENCES

— Support **open access book** publishing through the National Fund for Open Science

— Implement a scheme for widespread collective licenses to permit the **use of images** protected by copyright in open access scientific publications, under a non-profit structure (article 28 of the Research Programming Law)

— Support the **national infrastructures for research in the human and social sciences**, and develop a range of services to connect data and publications in human and social sciences, using OpenEdition, Huma-Num and Métopes (winning project of the call for expressions of interest in Structuring Equipment for Research by the PIA)

Raman analysis of a Chinese statue's pedestal at the Cernuschi museum in Paris
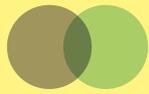
Path Two

Structuring, sharing and opening up research data

Data retrieval from a GEONOR station, near Mount Everest, Nepal

Our aim is to ensure that the data produced by French public research is progressively structured to conform to the FAIR principles (Findable, Accessible, Interoperable, Reusable), safely preserved and, wherever possible, open to all.

The obligation to open up public research data, required in the Digital Republic Act of 2016, should now be enacted in scientific practice with the help of appropriate infrastructures and support services. This obligation is limited by legitimate exceptions as defined by the law. For example, exceptions can be made for professional confidentiality, industrial and trade secrets, personal data and copyright-protected content. In these cases, data sharing practices should still be encouraged by defining the procedures to follow.

In order to implement the national policy on data, algorithms and source code as requested by the Prime Minister, a national Chief Data Officer will mediate a network of similar Chief Officers working in the executive team of the higher education and research institutions. Through their coordinated actions, the data, source code and algorithms from French public research will be preserved, referenced, described and promoted under open licenses.

We will encourage practices that favor research data reuse

Recherche Data Gouv, a federated national platform for research data, will be created to include all research fields in the active practice of producing open data. Recherche Data Gouv will provide a multidisciplinary data repository to complement the national and European infrastructures already used by some scientific disciplines. It will offer a catalogue that signposts users to data hosted on other trustworthy sites, and when finished, it will provide a single location to promote visibility for all French research data. The repository and

We will create Recherche Data Gouv in order to involve all research fields in active practices of open data

catalogue will be entrusted to INRAE with support from universities and other research performing organisations and will serve the national scientific community as a whole. To support and advise researchers throughout the data lifecycle, "data workshops" will be organised across the country involving a wide range of professions. Thematic reference centres will conceive and issue repositories and best practices for research fields or disciplines. Recherche Data Gouv is founded on shared governance by stakeholders in French higher education and research, and will guarantee that the scientific community retains sovereignty over the data it produces.

The actions involved in managing, preserving, opening up and sharing data also contribute to the progress of scientific research. They make it possible to share the effort of collecting data within the scientific community, and to consolidate and multiply the results of using them. With this in mind, all practices that promote the reuse of research data will be encouraged through the creation of a prize for teams which carry out exemplary work in this domain.

France will continue to provide support for the Research Data Alliance (RDA), an international network that defines best practices in the domain of research data.

Measures

4

Implement the obligation to disseminate publicly funded research data

5

Create Recherche Data Gouv, the federated national platform for research data

6

Promote widespread adoption of data policies that cover the whole lifecycle of research data, to ensure that they are Findable, Accessible, Interoperable and Reusable (FAIR)

Develop and structure the range of support and tools on offer to researchers

→ Create **Recherche Data Gouv** which will offer sovereign and certified (*Core Trust Seal*) storage and signposting for research data, and a **range of support services for researchers**, through:

- a territorial network of endorsed "**data workshops**", involving a wide range of skills and professions to provide local support;

- **thematic reference centres** that define best practices for the management, description and opening up of data, specific to each discipline or research field.

→ Generalise the definition and effective implementation of **data management plans**, which guarantee economical preservation and the opening up and sharing of documented data, thus making it possible to reuse and validate them.

→ Implement the recommendations of the International Committee of Medical Journal Editors (ICMJE) by developing **Data Sharing Statements**, which publicly detail the conditions and procedures for accessing data that cannot be opened.

→ Continue the **certification** process (*Core Trust Seal*) for data repositories.

→ Support the enactment of the European Copyright Directive in the field of **text and data mining (TDM)** to encourage the emergence of new knowledge.

Give recognition to and boost the reuse of research data

→ Encourage best practices in **data citation**.

→ Award an annual **research data prize** to highlight the work of exemplary projects and teams in preparing to reuse or reusing research data.

→ **Track the changing dynamics in opening up** data sets associated with publications that are stored in a selection of repositories, through the Open Science Barometer.

→ Launch a **Europe-wide call for proposals on reusing research data** as part of the European Research Area Network.

Coordinate and promote open data policies

→ Deploy a **research data governance policy and create a specific role for this** through a network of Chief Data Officers in the universities and research performing organizations.

→ Develop a proactive approach to **opening up data associated with articles** and publications in trustworthy thematic data repositories or in Recherche Data Gouv.

→ When providing public funding for **scientific publishing platforms and open archives**, encourage collaboration with Recherche Data Gouv.

ENCOURAGE HEALTH RESEARCH PROJECTS TO SIGN UP TO OPEN SCIENCE

— **Reduce publication bias**, which is the tendency to only publish studies that obtain positive results, to the detriment of inconclusive or negative findings.

● Propose modifications to the national, European and international rules in order **to make it obligatory to declare all individual patient data sets**, whether this entails clinical trials (including non-drug trials) or observational studies.

● Develop a **declaration portal** that is interoperable with the European and international schemes, by **reducing the administrative burden** on researchers through a single declaration. This portal will encourage and facilitate **data sharing statements, data reuse and the publication of negative results**.

— Under the *Plan France Médecine Génomique* 2025 (French Plan for Genomic Medicine), introduce a **tool to collect, process and use large volumes of data** (DCA – Data Collector and Analyser) to serve healthcare and research.

— In response to the coronavirus pandemic, **open up all results** from the EMERGEN programme, which aims to **increase efforts to sequence the variants of the virus** present in the country.

Experiment with samples at the Imagine Institute of Genetic Diseases, Necker-Enfants Malades Hospital, Paris

Path Three

Opening up and promoting source code produced by research

Code optimizing for oceanographic data analysis by the GEOSTAT project-team at Inria
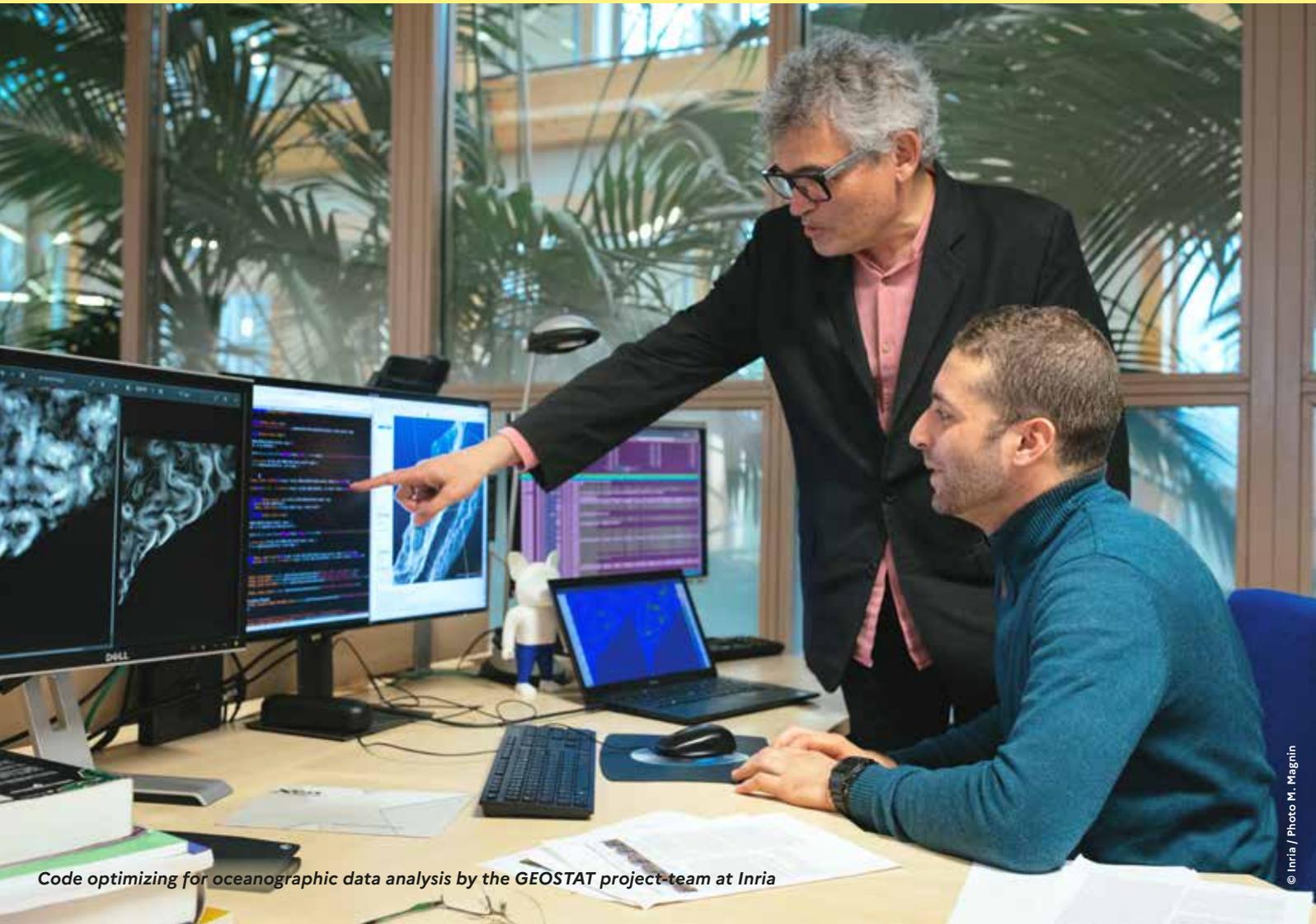
Software plays a key role in scientific research, and it can be a tool, a result, and a research object. Making software source code available, with the option of modifying, reusing and disseminating them, is a major requirement to ensure the reproductibility of scientific findings and to support the creation and sharing of knowledge, in keeping with the open science ethos.

In order to implement the national policy on data, algorithms and source code as requested by the Prime Minister, we aim to ensure that the source code and software produced through French public research are developed, sustainably maintained, preserved and treasured. As such, the remit of Chief Data Officer in the Ministry of Higher Education, Research and Innovation has been expanded to include algorithms and source code from research.

The opening of software source code is a major challenge for the reproductibility of scientific results

Scientific software stacks are hugely complex and sometimes combine hundreds of programs representing millions, even tens of millions of lines of code. Efforts to develop these stacks should be pooled at the scale of the international scientific community in the widest sense: academics, industry and citizens. This impetus has today become a key lever in research and innovation. Also, priority will be given to the dissemination of software productions as open source software – published under a license recognised by the Free Software Foundation and Open Source Initiative, in compliance with the legal constraints.

Distribution of software products under open source licence will be preferred

France will support the development and preservation of source code – inseparable from the support of humanity's technical and scientific knowledge – and it will, from this position, continue its support for the Software Heritage universal archive. So as to create an ecosystem that connects code, data and publications, the collaboration between the national open archive HAL, the national research data platform Recherche Data Gouv, the scientific publishing sector and Software Heritage will be strengthened.

In order to increase the visibility of software and recognise its contribution to research, a catalogue of these productions will be built and made widely accessible. An open source research software prize will be created to showcase and award teams who carry out exemplary work in this field.

To facilitate the coordination of the open source software communities at a national and international level, a Source Code and Software College will be created within the Committee for Open Science. Links will also be forged between the Open Software Task Force at the French Interministerial Directorate for Digital Technology, and the European Open Science Cloud (EOSC), the Research Data Alliance (RDA), the Research Software Alliance and FORCE 11.

Measures

7

Recognize and support the dissemination under an open source license of software produced by publicly funded research programmes

8

Highlight the production of source code from higher education, research and innovation

9

Define and promote an **open source software policy**

Define and promote an open source software policy

→ Produce a **National Charter for Open Source Software** coming from higher education, research and innovation.

→ Develop the link between data and software through **a network of Chief Data Officers** in the various universities and research performing organizations.

→ Produce **recommendations for funding bodies** to best support software development.

→ Improve the skills of commercialization services for the **economic models associated** with producing open source software.

→ Support **Software Heritage** and recommend it for the archiving and referencing of source code.

Recognise source code as a contribution to research

→ Create an **open source research software prize** which rewards teams and projects for exemplary work in this domain.

→ **Provide greater recognition** for software production in the career of researchers, research support staff and in the assessment of research organisations.

→ **Monitor over time** the production of code and software by French research teams so as to identify and assess their dynamics, openness and impacts through the Open Science Barometer.

→ Build a **catalogue** of software resulting from research, using a standardised metadata model that is shared by all the stakeholders in higher education, research and innovation.

Coordinate the communities that use source code and open source software

→ Create a **College of Experts for source code and software** within the Committee for Open Science.

→ Establish a long-lasting link between the Committee for Open Science and the Open Software Task Force at the French Interministerial Directorate for Digital Technology.

→ Establish a link with **national and international stakeholders**, particularly the Software Working Group at the EOSC, the FAIR for Research Software Working Group at the RDA, FORCE11 and the Research Software Alliance – ReSA.

## Build an ecosystem that connects code, data and publications

→ In the context of public funding for journals and conferences, recommend adopting a **policy of open source software associated with the articles**, developing articles about the software and experimenting with approaches that link articles, data and code.

→ Develop proper coordination between **software forges**, **open publication archives**, **data repositories** and the **scientific publishing** sector.

→ Propose standardising the **Software Heritage Identifier (SWHID)**, which will complement the DOIs for software.

ENCOURAGE CROSSOVERS BETWEEN OPEN SCIENCE AND ARTIFICIAL INTELLIGENCE

— To predict and assess changes in biodiversity caused by climate change and/or human activities, support the ANR's "**Artificial intelligence research in the field of biodiversity**" challenge by supplying all participating research projects with shared data sets.

— Feed or develop **machine learning bases for the automated translation** of scientific texts.

— Support the creation of a **reference centre for digital pathology** to stimulate **innovations in artificial intelligence** in the field of pathology as part of an organised challenge.

Graph structures study
by the TYREX project-team at Inria
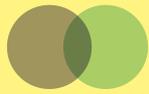
Transforming practices to make open science the default principle

Research team at the laboratory of mechanics and civil engineering (CNRS, University of Montpellier)

Open science should become the default principle for researchers and it should constitute a criteria of excellence in research, as is now the case in the Horizon Europe programme. For this, the higher education and research ecosystem must be transformed to align the incentives, strengthen capacity and increase recognition of the efforts made.

Transformation of the assessment system is required in order to foster long-term open science practices

To ensure these practices persist over time, the assessment system for researchers, laboratories, universities and research performing organizations must be changed so that it becomes coherent with the principles of open science. In line with the *San Francisco Declaration on Research Assessment* (DORA) and the *Leiden Manifesto for Research Metrics*, this involves reducing the importance of the quantitative aspect to the benefit of a more qualitative approach, taking into account – beyond what publications do – the plurality of research findings, making reasoned use of indicators and rewarding cooperation and openness over competitiveness and secrecy. As part of the French Presidency of the European Union, France intends to hold a European event to promote open science at the *Académie des sciences* (Paris). It will also encourage the creation of a coalition of European researchers who commit to implementing operational, reciprocal and legible transformations in their assessment practices.

To transform daily practices, the concept of open science should be present throughout the research training programmes, from bachelor's degree level to senior researchers, with an emphasis on the strategic stage of the doctorate. The management and opening up of research data requires new skills and leads to the emergence of new professions which are important to develop, recognise and value.

Aligning the assessment and training policies will make it possible to reduce the contradictory demands to which researchers have been subject, so that the benefits of open science are fully understood. With this objective in mind, researchers' access to public data and private data of general interest will be made easier, through the creation of a mediator for data of general interest. Adopting open licenses for data, publications and source code will help to free up the circulation of scientific findings, and the generalisation of the ORCID identifier for researchers will consolidate their digital identity and increase the visibility of their work.

To meet the ambitious objectives of this new plan, open science policies should be strengthened and amplified. The National Fund for Open Science will be continued and its field of action expanded. We propose that funding from the PIA is used to intensify and diversity its actions. A firm commitment from universities and research performing organizations to formalise and implement open science policies will enable their widespread territorial deployment. In parallel, France will increase its presence in the international bodies for open science, particularly the EOSC, to support the construction of an effective, regulated, transparent and resilient ecosystem, which serves to help the scientific community and society as a whole.

Finally, open science policies must be better monitored and their impacts measured through a consolidation of the Open Science Barometer and an expansion of its scope to include new aspects. These policies will be informed by contributions from research, through the creation of an Open Science Lab dedicated to developing "research on research", and through the launch of a dedicated call for proposals by the French National Research Agency.

Measures

10

Develop and value open science skills throughout the educational and career pathways of students and research staff

11

Value open science and the diversity of scientific productions in the assessment of researchers, of projects and of universities and research performing organizations

12

Triple the budget for open science through the National Fund for Open Science and the Investments for the Future Programme

Recognise open science in assessments

→ In the context of the French Presidency of the European Union, organise **European Open Science Days** at the Académie des Sciences in Paris. These will propose creating an international coalition focussed on **taking open science into account in the assessment** of researchers, projects and research institutions. They will also emphasize open access with no publication fees and the importance of source code in open science.

→ Include the open science principles and best practices in the **Hcéres reference** files and strengthen cooperation between the Hcéres and the Committee for Open Science.

→ **Reduce the influence of the journal impact factor**, starting with the removal of all references to this indicator and to H-index in the texts of calls for projects and in the application forms.

→ Encourage the journals' editorial committees and scientific publishers **to request that the data and code associated with the texts submitted be provided**, to take these into account in the assessment procedures and to make public their policies concerning the data and code linked to the publications.

→ Promote the use of **narrative CVs** to reduce the importance of quantitative assessments to the benefit of qualitative ones, and experiment with an "**openness profile**" on ORCID.

Develop and recognise the skills and professions of open science

→ Consider **data literacy** as a set of key skills and **develop the range of initial and continuing education degree programmes** in data science and engineering by building on existing initiatives.

→ Encourage the development of teaching units or training pathways in open science at **bachelor's and master's level** and strengthen open science training for doctoral students, by defining a frame of **reference for open science training** for doctoral schools, by creating an **open science thesis prize**, and by offering thematic booklets from the *Passport for Open Science*.

→ Increase awareness-raising and training programmes in open science for **senior researchers**.

→ Support the **evolution in skills and career pathways for research staff**, with a notable emphasis on valuing skills and professions linked to managing data lifecycles and developing source code.

→ In the **competency framework for researchers, research engineers and technicians**, introduce a subset of competencies linked to open science.

Encourage stakeholders in higher education and research to adopt an open science policy

→ Encourage universities, research organisations, prestigious universities and engineering schools to adopt an **open science plan**, which is made public and is closely supervised.

→ Encourage these stakeholders, and the national research infrastructures, IDEX, I-SITE, European universities and projects funded by the PIA **to request open-source publications, data and source code** and to offer support to researchers in these fields.

→ **Encourage the universities and research performing organizations who have signed DORA** to actively inform their assessment committees and support them in the effective implementation of the principles adopted.

SUPPORT THE DEVELOPMENT OF OPEN SCIENCE IN THE FIELD OF CLIMATE, EARTH SYSTEMS AND BIODIVERSITY STUDIES, IN LINE WITH THE CLIMATE LAW

— Make use of the recommendations of the "observation of natural environments and systems" task force that are validated, to strengthen research services, such as long-term data integration services and resulting models.

— To accelerate and strengthen climate and earth system studies, boost the development of a **framework for data preservation and description practices** in these fields, and generalise their referencing in the research infrastructures of the national road map or in Recherche Data Gouv.

— Support **data set harmonisation and interoperability** to build large reference

Observation of plant behavior at the European Ecotron in Montpellier

© Hubert RAGUET/CNRS Photothèque

data sets for each field. This involves encouraging dialogue between the scientific domains to facilitate integrated ecosystem approaches. For example, this can be useful when studying interactions between the ocean and the atmosphere, or the continental surface and the atmosphere.

→ **Recommend the use of open licenses for research productions** – the (French) public license, one of the (international) Creative Commons licenses or the specific open licenses for software – to promote the reuse of publications, data and source code and to protect their provenance.

→ Create a working group for **participative research** within the Committee for Open Science.

→ Encourage all stakeholders in higher education and research to get involved in shared work on **open educational resources** to make them more visible and easier to share and encourage their reuse.

Simplify researchers' lives through open science

→ In line with the national policy on data, algorithms and source code as requested by the prime minister, **accelerate researchers' access to public data** and create a mediator **to facilitate access to data of public interest owned by private parties**. In particular, this will help to increase the contribution researchers make to designing and assessing public policies.

→ Encourage researchers to adopt the **ORCID identifier** to consolidate their digital identity and increase the visibility of their work, and propose adding data from ORCID to

MAKE USE OF THE RESEARCH INFRASTRUCTURES WHICH HAVE SIGNED UP WITH THE NATIONAL ROAD MAP TO TRANSFORM PRACTICES AND GENERALISE OPEN SCIENCE

— Invite infrastructures to **include in their access conditions** the principles of open access publication and of opening by default of data and source code.

— Invite infrastructures to formalise their open science policies by **making a strategic document public**, and to effectively implement the FAIR principles and data management plans by and for their users.

— Provide each infrastructure with a **persistent digital identifier** (funder ID) that the researchers will be asked to mention in their publications, code and data produced through this infrastructure.

— Encourage infrastructures within a **policy of recruiting professionals responsible for processing, quality checking, describing and preserving data**.

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Aerial view of the Pic du Midi Observatory

— Get infrastructures involved in assembling and hosting large reference data sets and **guidelines for practices by discipline and theme** for preserving, describing and referencing research data.

— Implement the **winning projects of the call for expressions of interest in Structuring Equipment for Research by the PIA** which strengthen the development of infrastructures, platforms and services for thematic data.

the research information systems to limit the number of repeated submissions.

→ **Enrich ScanR**, a search engine for research and innovation which brings together data from laboratories, research project authors, public funds and businesses.

Participate in the European and international open science landscape

→ **Ensure that sovereign solutions** are adopted to allow higher education and research stakeholders to keep control over their open science services for publications, data, source code, videos and open educational resources, etc.

→ Participate in the **governance of standards** for metadata and persistent digital identifiers for research objects and stakeholders (Crossref, DataCite, ORCID, ROR, etc.) and in the governance of open science services (Directory of Open Access Journals, Directory of Open Access Books, OPERAS, etc.).

→ Encourage the creation of an open ecosystem for citations as an alternative to proprietary environments by supporting the **Initiative for Open Citations** and the **OpenAlex** project run by OurResearch.

→ Create a post of **national open science coordinator** and a network of national open science coordinators, the **Council of national open science coordination** (CoNOSC).

→ Continue to structure the French community in its **contribution to the EOSC**: promote the EOSC membership to French research organisations, moderate the community of French EOSC stakeholders, organise an annual EOSC-France event.

→ Actively encourage French open science services to sign up to the **EOSC catalogue of services**.

→ Include commitments to support open science in the **Open Government Partnership** (OGP).

Develop the Open Science Barometer as a tool for monitoring, observing and measuring the impact of open science

→ Expand and sustain the Open Science Barometer by introducing new indicators that cover more than just publications:

- To monitor declarations of health studies, particularly **clinical trials**;

- To monitor the **opening up of data and source code**;

- To monitor **data sharing statements**;

- To monitor the **uses society makes of open science**;

- To monitor the universities and research performing organizations' **open science policies**, ideally at the European level;

- To monitor **accessibility** for disabled people to French scientific publication platforms;

- To monitor **publication fees** for articles and books.

Develop research on research in order to advance open science

→ Create an **Open Science Lab** to develop research on research, with the aim of informing and guiding open science policies and encouraging their enactment in the different disciplines. The Open Science Lab could be part of an *Open Science Observatory* to be created at international level.

→ Propose that the ANR launch an annual call for projects involving **research on research with an open science perspective**.

Report

First French Plan for Open Science

On 4 July 2018, Frédérique Vidal, the Minister for Higher Education, Research and Innovation, launched the French Plan for Open Science. Three years after this plan was introduced, the report testifies to the success of the mobilisation and to a committed transformation. A budget of 15.8 million euros has been allocated.

Theme one: Generalising open access to publications

→ **The National Fund for Open Science** was created.

→ **The HAL national open archive** received some exceptional funding and introduced sustainable economic and governance models.

→ **The French National Research Agency requests** that all scientific articles from the projects it funds are published in **open access journals**.

→ **Two calls for proposals in "open scientific publishing and editing"** were launched, worth nearly 5 million euros.

→ The **Open Science Barometer** was created in 2018.

Theme two: Structuring and opening up research data

→ **The French National Research Agency launched a flash call for proposals** worth 2.5 million euros to accelerate development in response to the issues of data management.

→ **The French National Research Agency requests** that the research projects it funds draw up **data management plans (DMP).**

→ The role of **ministerial Chief Data Officer** was created at the Ministry of Higher Education, Research and Innovation and a network of Chief Data Officers is currently being set up in the universities and research performing organizations.

→ The **Recherche Data Gouv** project was formalised.

→ The National Fund for Open Science provided support for the **Research Data Alliance** and a French section was created.

Theme three: Adopting a sustainable approach at European and international level

→ The **Passport for Open Science** for PhD students and other practical guides were published.

→ France contributes to **structuring and governing the EOSC**.

→ The National Fund for Open Science supported the **international open science infrastructures** (DOAB, PKP, OpenCitations, Software Heritage).

→ **Twenty research performing organisations adopted an open science policy**, and the Conference of University Presidents created a network of open science advisors in the universities.

To find out more, read the full report of the First French Plan for Open Science 2018-2021.

Announcement of the First French Plan for Open Science by Frédérique Vidal at Lille

OUVRIR LA SCIENCE !
ouvrirlascience.fr website launch

Mandatory open access for publications from research projects financed by the French National Research Agency (ANR)

ANR
Flash call for proposals on open science and research data by the ANR

Creation of the Open Science Committee

July 2018

December 2018

January 2019

March 2019

April 2019

First edition of the Open Science National Days

First edition of the Open Science Barometer:
41% of French publications are open access

Support given to the Research Data Alliance and to Software Heritage

Software Heritage   RDA

September 2019

Second edition of the Open Science Barometer:
49% of French publications are open access

First call for proposals of the National Fund for Open Science (FNSO) on open acces scientific publishing

December 2019

HAL
Adoption of a new funding and governing model for the national open archive (HAL)

July 2020

January 2020

FNSO gives support to 3 fundamental international Open Science projects by:
OpenCitations
Directory of open access books
Public Knowledge Project

recherche.data.gouv.fr
Formalization of the **Recherche Data Gouv** project, a national plateform for research data

July 2020

Publication of the *Passport for Open Science, a practical guide for PHD students*

November 2020

January 2021

March 2021

22 projects won the first FNSO call for proposals
2,6 M€

Creation of the "Chief Data Officer" position at the Ministry of Higher Education, Research and Innovation

Third edition of the Open Science Barometer:
56% of French publications are open access

Second call for proposals of the National Fund for Open Science on open access scientific publishing

Second French Plan for Open Science

July 2021

APPENDICES

Lexicon

Algorithm: set of processes or rules to resolve a type of problem. In computing, algorithms are then transposed into source code, ultimately leading to executable software.

Bibliodiversity: in the publishing world, this corresponds to a diversity of publishing bodies, as opposed to publishing concentration. The concept also covers a diversity of editorial formats (journals, books, encyclopedias, etc.) and languages.

Chief Data Officer: this officer works closely with the governance of the universities and research performing organizations to coordinate stakeholder actions in inventorying, governing, producing, circulating and using the data, algorithms and source code produced by research. Not to be confused with the Delegate for data protection, nor (in the information technology field) with the database administrator.

Data paper: as opposed to a traditional scientific article that uses, analyses and interprets scientific data, a data paper gives a detailed description of one or more sets of data so as to facilitate their understanding and potential reuse.

Diamond model: 75% of open access journals do not ask authors to pay publication fees. In this open access publication model, the publication costs are covered beforehand by the State, a university, a consortium of public establishments or a non-profit organisation.

FAIR principles: the notion of FAIR data describes methods of constructing, preserving, presenting and publishing data in a way that ensures the data are Findable, Accessible, Interoperable and Reusable.

"Hybrid" journals: these journals are circulated by subscription while asking their authors to pay publication fees (also called APCs) so that their article can be published as open access. This payment of additional fees to subscription-only journals introduces double-dipping.

Open data and shared data: open data are accessible to all. Shared data are accessible under authorisation to identified individuals or groups.

Open science skills: Skills relative to the publication system, data structuring, legal rights, new digital uses and best practices for open science.

Persistent Identifier (PID): identifier attributed to a person or object that is unambiguous and persists over time.

Publication bias: tendency to only publish positive results, or to publish less negative or inconclusive results. Due to this fact, the meta-analyses, which synthesize all studies on the subject, cannot provide a complete overview of the research carried out. *For example:* In Europe today, 50% of clinical trials for cancer publish no results at all. Many different strategies have been put in place to compensate for this publication bias: journals publishing negative results, publication of results in Clinicaltrials.gov, submitting articles based on their methodology before obtaining the results (known as registered reports).

Publication fees: some (25%) open access journals ask authors to pay publication fees, also known as APCs (article processing charges), to fund the editorial work. However, other funding models do exist.

Publications: scientific communications resulting from the work of researchers. These publications are subject to peer review.

Public interest data: data possessed by legal persons governed by private law that could serve for descriptions, elucidations or actions for the public interest, or presenting an interest for public research.

Research data: factual records (figures, texts, images, sound, videos, etc.) used as primary sources for research and which are generally accepted by the scientific community as being necessary to validate the research findings.

Software programme: an executable computer program.

Source code: a set of statements or instructions comprising a computer programme in a programming language. Source code are generally presented in the form of a set of text files that can be read by a user and are executable by a machine. Source code is the representation of a software programme that enables the user to make modifications.

Abbreviations and organisations

ANR – *Agence nationale de la recherche* / French National Research Agency

Crossref – a Digital Object Identifier (DOI) Registration Agency for scientific publications

DataCite – a Digital Object Identifier (DOI) Registration Agency for research data

DORA – San Francisco Declaration on Research Assessment

EOSC – European Open Science Cloud

HAL – French national open archive managed by the *Centre pour la communication scientifique directe* (Centre for Direct Scientific Communication - CCSD), a mixed service unit

Hcéres – *Haut conseil de l'évaluation de la recherche et de l'enseignement supérieur* / High Council for Research and Higher Education Assessment

IDEX – *Initiative d'excellence* / Benchmarks of Excellence, research universities with global influence

I-SITES – *Initiative Science, Innovation, Territoires, Economie* / Science, Innovation, Territories and Economy Initiative, universities that use their thematic scientific attributes to develop a partnership strategy with the business world

ORCID – Open Researcher and Contributor ID, a persistent digital identifier for researchers

OGP – Open Government Partnership, organisation uniting 78 countries and hundreds of civil society organisations for transparency in policy-making

PIA – *Programme d'investissements d'avenir* (French Investments for the Future Programme)

RDA – Research data alliance. Research Data. Sharing without barriers

ROR – Research Organization Registry, unique identifiers for research organizations

APPENDICES

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APPENDICES

Further resources

Ouvrirlascience: reference website produced by the Open Science Committee. https://www.ouvrirlascience.fr/

Lettres de la science ouverte (open science letters) (monthly): to keep up to date with the news in open science. https://www.ouvrirlascience.fr/category/lettres/

Passport for Open Science - A Practical Guide for PhD Students https://www.ouvrirlascience.fr/passport-for-open-science-a-practical-guide-for-phd-students/

Belles histoires de la science ouverte (*Success stories from open science*): tangible accounts of success stories in the field of open science. https://www.ouvrirlascience.fr/category/histoires/

Je publie, quels sont mes droits ?: a guide for researchers. https://www.ouvrirlascience.fr/je-publie-quels-sont-mes-droits/

DoRANum: Digital Learning for Research Data, a platform to start understanding research data. https://doranum.fr/

DOAJ – Directory of open access journals: directory of reference open access journals across the world that work through peer reviews. https://doaj.org/

DOAB – Directory of open access books: directory of reference open access books across the world that work through peer review. https://www.doabooks.org/

DMP OPIDoR: provides support by producing and putting into practice data and software management plans. https://dmp.opidor.fr/

Working groups of the Open Science Committee: the Open Science Committee facilitates working groups to ensure concrete progress is made in precise subjects. https://www.ouvrirlascience.fr/category/groupes/