University of Lausanne

Open Science strategy and action plan

2023-2025

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Document status

First version 2019-2021 validated by the Rectorate at its meeting on December 17, 2019.

Update 2023-2025 approved by the Rectorate at its meeting of December 5, 2023

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Open Science strategy: summary

Aware that the production, management, dissemination and accessibility of research results (publications, data, algorithms, source codes, software, processes, etc.) - as well as the civic and participatory aspect of research - are the guarantee of honest, reliable and high-quality research, the Rectorate of the University of Lausanne (UNIL) has adopted an Open Science strategy and related action plan, and encourages its community to pay particular attention to it.

Open Science as transformation

The Open Science (OS) movement questions the research environment and the way researchers advance and share scientific knowledge. "[Based] on the fundamental principles of academic freedom, research integrity and scientific excellence, [Open Science...] integrates into the scientific enterprise practices of reproducibility, transparency, sharing and collaboration, resulting from an increased and reasoned openness of scientific content, tools and processes." (UNESCO, 2021)[1]

The four pillars of the strategy

To meet the challenges of disseminating "living knowledge", UNIL is committed to promoting Open Science and an open research culture through four key pillars: free access to scientific publications (Open Access - OA); open research data (Open Research Data - ORD); the development of participatory and citizen science (Citizen Science - CS); and the sharing of algorithms, source codes and software created by its community (Open Source Software - OSS).

Open Access - OA

UNIL focuses on several key areas of Open Access, including training the community in new methods of scientific publication, developing technical infrastructures for Open Access publishing, supporting all avenues of Open Access, and recognizing efforts to increase visibility and access to scientific results when evaluating researchers.

Open Research Data - ORD

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[1] UNESCO Recommendations on Open Science - 2021

When it comes to Open Research Data, UNIL adopts a vision of openness that is "as open as possible, as closed as necessary"[2] , strengthens support staff, develops infrastructures and best practices for managing and opening up research data in line with the FAIR[3] and CARE[4] principles, and intensifies communication, training and support for researchers, adopting an inclusive approach to meet the needs of its community.

Citizen Science - CZ

With regard to Citizen Science, UNIL promotes participatory research models, strengthens collaboration and networks of citizen initiatives, provides socio-technical infrastructures to support open and participatory research, protects the status of citizen co-researchers and encourages funding adapted to participatory science projects.

Open Source Software - OSS

In terms of opening up and sharing algorithms, source codes and software, UNIL promotes understanding of open licenses, supports the development of free software and hardware, facilitates the production of reference methodologies and best practices, and encourages the reproducibility and reuse of algorithms, source codes and free software.

5-point action plan

To implement this strategy, UNIL has drawn up an action plan focusing on five priority areas: governance, organization, infrastructure and tools, training and consulting, and awareness-raising and communication.

With its strategy, UNIL intends to develop openness by design by providing the necessary guidelines to foster and establish best practices, while supporting the research community's by desire initiatives in open science.

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[2] European Union Research Executive Agency, n.d. [Accessed online in October 2023]

[3] Wilkinson, M., Dumontier, M., Aalbersberg, I. *et al.* The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data* **3**, 160018 (2016). https://doi.org/10.1038/sdata.2016.18

[4] Carroll, S, Garba, I, Figueroa-Rodríguez, O, Holbrook, J, Lovett, R, Materechera, S, Parsons, M, Raseroka, K, Rodriguez-Lonebear, D, Rowe, R, Sara, R, Walker, J, Anderson, J and Hudson, M. 2020. The CARE Principles for Indigenous Data Governance. Data Science Journal, 19: XX, pp. 1-12. https://doi.org/10.5334/dsj-2020-042
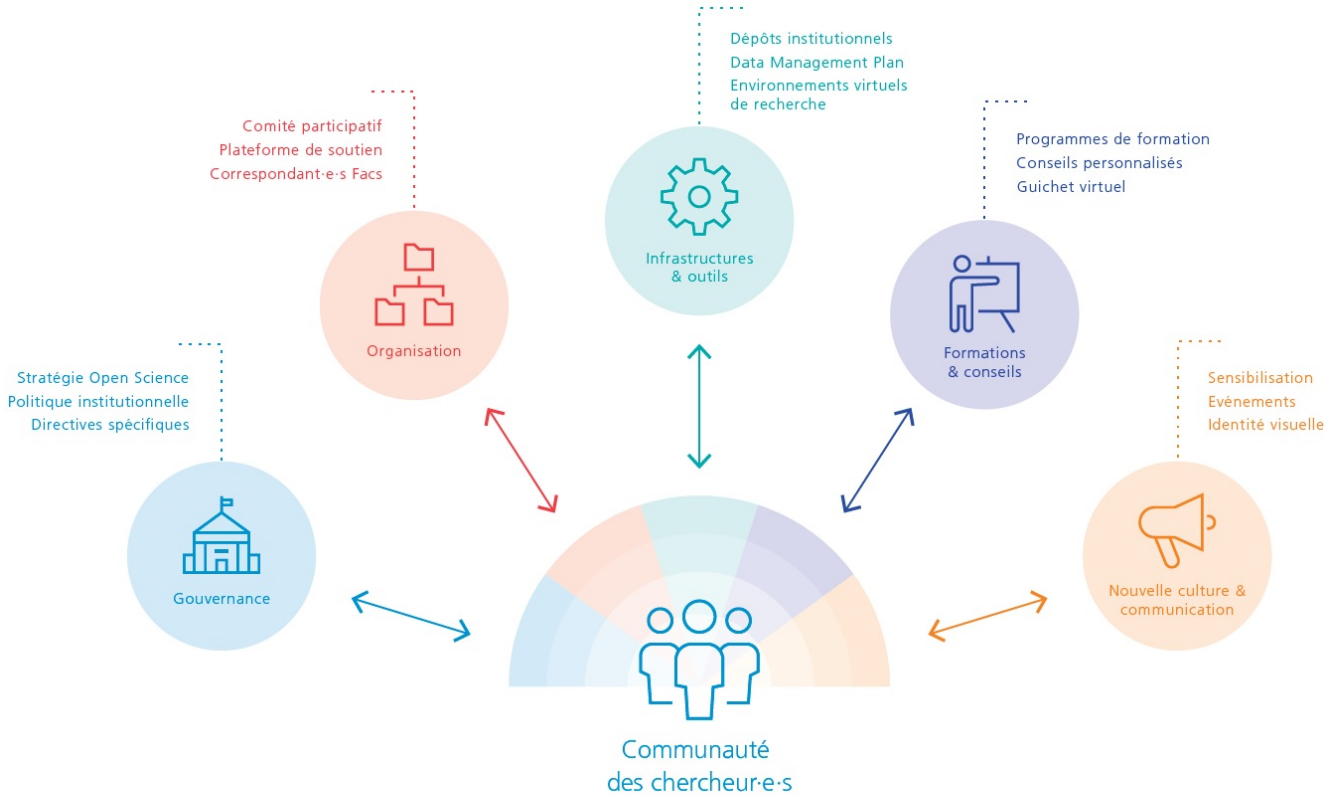
Stratégie Open Science de l'UNIL – Plan d'actions 2023-2025

5 axes prioritaires pour soutenir la communauté des chercheur·e·s de l'UNIL

Introduction: UNIL and research today

In its 2017-2021 plan of intent[5] , UNIL's Rectorate stated:

> *"The management of the University of Lausanne intends to adopt a very clear policy of promoting openness, both for publications (Open Access) and for research data (Open Data). This policy of openness must be carried out in collaboration with privileged editorial partners, UNIL researchers, (...) as well as with national partners (...), the political world, financial backers, the research community or the Consortium of Swiss University Libraries."*

The Rectorate's plan of intent for the years 2021-2026[6] reaffirms this commitment and announces that UNIL intends to:

> *"Acting for an open science that respects the diversity of research practices"*.

For UNIL's Rectorate, "*we need to help researchers live confidently through this transition by strengthening the University's resources to meet their data management needs*". UNIL's Rectorate intends to "*affirm UNIL more clearly as a leading institution in terms of action and reflection on the implications of the digital and open science revolutions for research and society*". It also intends to "*act to support a national policy on the production and management of research data in Switzerland that is coherent, respects the diversity of scientific practices and meets the challenges of sustainability*".

UNIL's *Open Science* strategy takes account of existing strategies, both institutional - UNIL's digital strategy[7] - and cantonal - Vaud's digital strategy[8] , the State Council's legislative program[9] and UNIL's strategic plan[10] .

For several years now, *Open Science* has been transforming the research environment and the way in which public research institutions and researchers advance and share science. At a time when data production is becoming

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[5] University of Lausanne Intention Plan 2017 - 2021

[6] University of Lausanne Management Intention Plan 2021 - 2026

[7] UNIL digital strategy and implementation plan - 2019 (to be revised in 2023)

[8] Digital strategy for the canton of Vaud - 2019

[9] 2017 - 2022 legislative program of the Vaud Cantonal Government

[10] Strategic Plan 2017-2022 of the University of Lausanne (UNIL) and Strategic Plan 2022-2027 of the University of Lausanne (UNIL)

increasingly massive (*Big Data*), when *fake news* and other "alternative facts" abound, and when science is being called into question by a number of individuals, *Open Science* offers an opportunity for a "fairer" science, one that is accessible, verifiable, reproducible and closer to citizens.

UNIL's *Open Science* strategy will not be the subject of a management report, but will be supplemented by a document for internal use to monitor the achievement of its objectives. It will be reviewed every two years. The action plan will be reviewed annually.

Open Science - science that's open and freely accessible

From an initial attempt to define...

In 2016, the *Amsterdam Call for Action on Open Science*[11] , a manifesto resulting from the reflections of numerous experts convened by the Dutch Presidency of the European Union (EU), defined *Open Science* as follows:

> *"Open science is about the way researchers work, collaborate, interact, share resources and disseminate results. A systemic change towards open science is driven by new technologies and data, the increasing demand in society to address the societal challenges of our times and the readiness of citizens to participate in research.*"

Towards a universal definition

In November 2021, the first international framework on open science was adopted by 193 countries under the aegis of UNESCO[12] . Until then, there was no universally accepted definition of open science, and standards existed only at national, regional or institutional levels. By approving this recommendation, these 193 countries agreed to conform to common standards for *Open Science*.

> *"Open science is understood as an inclusive concept that encompasses various movements and practices aimed at making scientific knowledge multilingual, freely accessible to all and reusable by all, strengthening scientific collaboration and information sharing for the benefit of science and society, as well as opening up the processes of creating, evaluating and disseminating scientific knowledge to societal actors beyond the traditional scientific community."*

This definition is complemented by a list of core values - quality and integrity; collective interest; equity and justice; diversity and inclusion - and guiding principles - transparency, control, criticism and reproducibility; equal opportunity; responsibility, respect and accountability; collaboration, participation and inclusion; flexibility; and sustainability.

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[11] Amsterdam call for action on Open Science - European Union (2016)

[12] UNESCO Recommendations on Open Science - 2021

UNESCO also calls on Member States to invest in open science infrastructures and to develop a framework describing the skills and competencies required for those wishing to participate.

Openness to guarantee accessible, high-quality scientific knowledge

The notion of openness in open science (sometimes referred to as "free" science) refers to "the absence of barriers to accessing information and the results of scientific work" (EUA, 2022)[13] . In particular, open access has the potential to improve the quality of science by making it more transparent, collaborative, inclusive, integrative and reproducible. Furthermore, open science can be understood as an end in itself: a system ensuring that the knowledge and insights produced by researchers are considered public goods available for the benefit of members of society as a whole, in order to improve the well-being of human beings across the planet (European Commission, 2019)[14] . Finally, open science supports social responses to the political, social and environmental challenges facing our societies (UEA, 2022)[15] .

The many dimensions of *Open Science*

In its 2020-2024 Research and Innovation Strategy[16] , the European Commission defined eight ambitions for open science[17] : *Open Data, European Open Science Cloud (EOSC), New generation metrics, Mutual learning exercise on open science - altmetrics and rewards, Future of scholarly communication, Rewards, Research integrity & reproducibility of scientific results, Education and skills, Citizen science*. The League of European Research Universities (LERU) has put forward over 40 courses of action for all these priorities, with a view to putting them into practice and supporting the cultural change required for their acceptance[18] .

The benefits of *Open Science*

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[13] The EUA Open Science Agenda 2025 - European University Association (2022)

[14] European Commission, Directorate-General for Research and Innovation, (2019). Future of scholarly publishing and scholarly communication: report of the Expert Group to the European Commission, Publications Office. https://data.europa.eu/doi/10.2777/836532

[15] UEA (2022). Op. cit.

[16] European Commission. Research and innovation strategy 2020-2024 - European Commission (2020)

[17] https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science_en#ref-8-ambitions-of-the-eus-open-science-policy

[18] Implementing Open Science. Challenges and Opportunities for research-intensive universities in LERU - LERU (2020)

The expected benefits of opening up science are scientific, societal, ethical and economic, and revolve around the following issues in particular:

Transparency and integrity: open science means research with integrity, accountability, transparency, reproducibility[19] , validity and quality; the visibility of researchers and universities is increased as open data and publications are more widely downloaded, read and shared.

Impact and new discoveries: thanks to its greater visibility, open science has a greater impact; the circulation of knowledge is also amplified, encouraging innovation and the development of new knowledge.

Democratization of knowledge: access to knowledge is a universal right; open science reduces the gaps between states, institutions and citizens; it defends free access to knowledge and opposes any discrimination based on financial criteria.

Public funding = public good: most of the research carried out at UNIL is financed by public funds, and therefore by the citizens of the Canton of Vaud. The data, publications and research results thus obtained are a public good[20] which must therefore be freely accessible to society as a whole.

Open Science is also a means of strengthening the trust and bond between citizens and the science they fund, while improving its visibility and reproducibility. Realizing the potential of Open Science depends essentially on the values that constitute science (objectivity, impartiality, integrity, ethical and deontological principles, etc.).

Binding national and international rules

On a global scale, *Open Research Data* (ORD) has become a requirement of a significant number of governments and public funding bodies. The latter require both the drafting of *Data* Management Plans (DMP), and the open access, sharing and archiving of data associated with scientific publications. On the other hand, many scientific publishers have *Open Data Policies* requiring access to data,

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[19] Morton, L. (2022). 5 Open Science practices that improve reproducibility & support trust in science. The Official PLOS Blog. [Accessed online October 2023].

[20] UNIL's charter stipulates that knowledge is considered a public good.

metadata, code, software, materials, methods and protocols associated with articles published in their journals.

In Switzerland, the Swiss National Science Foundation (SNSF) has been committed to open science since 2006[21] . Since 2008, it has supported open access to scientific publications; in 2018, it set itself the target of making 100% of the publications resulting from its support available in *Open Access* by 2020; from the beginning of 2023, it will require scientific articles to be published with immediate open access (Plan S principles)[22] . Since 2017, swissuniversität has been supporting the principle of open access to research data, requiring projects funded by swissuniversität to draw up a PMD and to make data collected during research work available by depositing it in SNSF-compliant repositories[23] . For its part, *swissuniversities is* aiming for 100% open access for all university publications by 2024[24] . In November 2021, it also published its national *Open Research Data* strategy - the aim of which is to "define the main goals and principles for the Swiss ORD landscape" - as well as a related action plan for the period 2022-2028[25] .

A strong institutional commitment

Since November 2015, UNIL has been a signatory of the *LERU Statement on Open Access to Research Publications[26]* , which aims to promote open publications, archiving and making scientific data available. In 2018, UNIL also signed the Berlin Declaration[27] on open access to knowledge in the exact sciences, life sciences, humanities and social sciences.

Aware of the importance that research evaluation and research culture have in the engagement of researchers and the success of Open Science, UNIL signed the San Francisco Declaration on Research Evaluation (DORA) in 2018 as well as the agreement on research evaluation reform launched by the European initiative "*Coalition for Advancing Research Assessment*" (CoARA)[28] in 2022. To date, discussions on the evolution of research assessment continue to be the subject of

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[21] Open science - Swiss National Science Foundation (2017)

[22] cOAlition S (2018). Plan S. [Accessed online October 2023]

[23] See RS art. 47 and RE art. 11.8.

[24] Swiss Open Access Strategy - Swissuniversities (2018)

[25] strategy National Open research Data action - Swissuniversities (2021)

[26] LERU statement on Open Access to Research Publications - LERU (2012)

[27] [Text consulted online in October 2023].

[28] The Agreement on Reforming Research Assessment - 2022

several initiatives at European level[29] and in Switzerland, to which UNIL intends to make an active contribution.

Open Science priorities for UNIL

In 2019, with a view to focusing on the challenges of disseminating living knowledge, UNIL's *Open Science* approach focused on two pillars of open science: the opening up of scientific publications (***Open Access***) and the opening up of research data (***Open Research Data***).

Following the example of UNESCO's 2021 recommendation on open science, UNIL also intends to promote the opening up of science creation processes to society's stakeholders, beyond the traditional scientific community (***Citizen Science*** or participatory science). This co-creation of science involves strengthening citizen participation, giving access to the practices and tools that are part of the research life cycle, and making the scientific process more inclusive and accessible. The production of living scientific knowledge thus relies on new forms of collaboration and work, such as participatory production, scientific volunteering and participatory funding.

Opening up scientific knowledge also means sharing, without hindrance, the algorithms, source codes and software produced as part of scientific research (***Open Source Software*** or science based on the *open source* movement). UNIL intends to provide its researchers with the support and infrastructure they need to publish these materials and make them freely accessible, modifiable and reusable under licenses that are as open as possible, while respecting the rights of their creators and the institution.

Finally, the cross-cutting theme of **research evaluation reform**, by broadening the criteria for success, encourages researchers to become more involved and adopt new practices. By emphasizing quality, societal and environmental impact, and collaboration, it promotes open science and encourages greater diversity in research methods and topics. This approach strengthens confidence in results, facilitates the dissemination of knowledge and stimulates innovation, thus contributing to the overall success of the open research approach. UNIL therefore intends to initiate a review of the criteria for successful research and the evaluation of researchers.

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[29] For example: Appel de Paris sur l'évaluation de la recherche - Paris Open Science European Conference - OSEC (2022) European Commission, Directorate-General for Research and Innovation, *Towards a reform of the research assessment system: scoping report*, Publications Office, 2021, https://data.europa.eu/doi/10.2777/707440

A responsibility shared by many players

For UNIL management, open science is a responsibility shared between researchers - the main players in this transformation; UNIL management - who set the objectives and provide the means to implement this transition; UNIL faculties - who are committed to recognizing and promoting the necessary skills; administrative and technical staff - located within faculties or central services, supporting researchers. Beyond the UNIL community, open science is also the responsibility of funders (public and private), scientific publishers and political authorities, who are responsible for the regulatory and legal framework within which Swiss research evolves.

Open Access - scientific publications in free access

The colors of *Open Access*: 360-degree support

Open Access is a worldwide movement, launched by the *Budapest Open Access Initiative* in 2002[30] , aimed at making research results available to all through the development of the Internet. *Open Access* aims to provide free access to scientific output in a number of ways[31] : the Platinum *or Diamond road* - provides for immediate *Open Access* publication with no reading or publication fees; the *Gold road* - provides for work to be freely accessible at the time of publication in a *pure Gold Open Access* journal, in return for payment (*Article Processing Charges - APC*); the *Green road* is the path of self-archiving or deposit by the author in an open archive. The aim is to deposit, often at a later date, a version of the scientific publication in an institutional, regional, national or disciplinary repository. Access is free of charge. Lastly, the *Hybrid road* provides for the immediate *Open Access* publication of individual articles, subject to payment of a publication fee, in journals that publish both *Open Access* and restricted-access articles.

An institutional approach that guarantees academic freedom

The results of a survey conducted in 2017[32] show a good predisposition of the UNIL academic community towards *Open Access*, highlighting a desire to democratize knowledge and a concern for budget savings.

Given the richness and variety of UNIL's disciplinary fields, a one-size-fits-all approach to *Open Access* that favors one route over another is not appropriate. In order to guarantee its researchers their academic freedom, UNIL wants to develop a mixed and pragmatic approach where all paths coexist and complement each other. In this way, researchers can choose the publication method best suited to their research and make their publication freely accessible.

This approach is reflected in the OA 360 strategy, deployed in 2021, which ensures support for UNIL researchers in all *Open Access* paths[33] .

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[30] Budapest Open Access Initiative - 2002

[31] The paths of Open Access. Micaela Crespo-Quesada (2021), University of Lausanne.

[32] Open Access at UNIL: report of the institutional survey 2017

[33] https://news.unil.ch/display/1635103565174

Open Access challenges and issues for UNIL

This mixed strategy has necessitated the development of Serval (SERVeur Académique Lausannois), the institutional repository of UNIL and CHUV. In 2019, Serval was optimized to become a tool geared to the needs of researchers and current *Open Access* publication issues: internationalization of Lausanne research, raising the profile of scientific work, citations of UNIL researchers, exhaustive list of UNIL-funded publications, etc.

As part of the Department's digital initiative (TransNum project), and in particular its research axis, Serval will form the first pillar of a new research information system (*Institutional Research Information System - IRIS*) designed to ensure continuity of service, an integrated and contextualized view of UNIL's research, and increased visibility of shared *Open Access* elements.

As for the publication of monographs, there is still a long way to go. UNIL intends to develop its policy in partnership with the research community and stakeholders, including publishers, who have long been partners in the promotion of scientific research.

Solutions acceptable to all parties will still have to be found, taking into account the requirements of financial backers, the national strategy, the needs of researchers and the institutional challenges of a public university, which has a duty to shine beyond cantonal and national borders through the quality of its research and teaching.

UNIL therefore gives priority to its involvement and support in :

- supporting its researchers and communicating the opportunities offered by *Open Access*;
- training its community in new, complementary modes of scientific publication (bibliodiversity);
- the development of technical infrastructures and the provision of tools for publishing *Open Access* journals;
- support for all avenues of *Open Access*;
- taking into account, in the context of researcher evaluations, efforts to raise the profile of scientific results (deposit on the Serval institutional server) and provide access to them;
- subscribing to and using an *Open Researcher and Contributor ID* (ORCID) for scientific activities.

This approach should enable us to meet the challenges of *Open Access* and scientific communication at the beginning of the 21st century.

Open Research Data - transparent, reasoned data management

A broader definition of research data

In 2007, the Organisation for Economic Co-operation and Development (OECD) defined research data as :

> *"factual records [...] used as primary sources for scientific research and [which] are generally recognized by the scientific community as necessary to validate research results."* [34]

In 2021, the OECD updated its definition to add the following to the above:

> *"Other digital objects relevant to [publicly funded] research: metadata, algorithms, workflows, models and software (including code) resulting from [partially or fully publicly funded] research and which are used in a research and development context."*[35]

This broader definition is the one used by UNIL in its reflections and work on research data management and openness. UNIL's research data strategy is defined within a binding international and national framework. It is also based on the needs and expectations of its community, as identified in surveys carried out in 2015[36] and 2021[37] .

Data management in accordance with the FAIR and CARE Principles

Research data management is "that part of the research process concerned with the organization and handling of research data, including data management planning, [structured] storage, description, curation, preservation and provision of complementary metadata, algorithms, code, software and workflows, as well as compliance with domestic, national and international privacy legislation" (OECD, 2021)[38] .

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[34] OECD principles and guidelines for access to publicly funded research data - 2007

[35] Recommendation of the Council concerning Access to Research Data from Public Funding - OECD (2021)

[36] Jambé C. Research data management at the University of Lausanne: transdisciplinary issues (2015)

[37] Currently being published.

[38] Ibid.

This management of research data, at every stage of its life cycle[39] - planning; collection; processing and analysis; publication and sharing; preservation; reuse - as well as throughout the research process - before, during and after a research project - is not only necessary to be able to open and share research data, but is also part of the "good research practices" guaranteeing scientific integrity[40] .

UNIL encourages and supports good research data management practices, i.e. transparent and open data management that complies with current legislation (personal data protection, copyright, intellectual property, etc.); follows scientific regulations on ethics, deontology and scientific integrity; is based on sustainable and interoperable European infrastructures (e.g. the European Open Science Cloud - EOSC).); in line with scientific regulations on ethics, deontology and scientific integrity; based on sustainable, interoperable European infrastructures (e.g. the *European Open Science Cloud - EOSC*)[41] ; or based on international norms and standards such as the FAIR principles[42] - Easy to Find, Accessible, Interoperable and Reusable - and the CARE Principles[43] - *Collective* Benefit, *Authority to Control*, *Responsibility*, and Ethics.

To meet all these requirements, UNIL provides institutional support for this research data management - both in terms of research support staff and infrastructure - taking into account "the time needed for scientific work, while respecting the diversity of methods and personalities "[44] .

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[39] UK Data Service, University of Essex, University of Manchester and Jisc (2012-2023). Research Data Lifecycle. [Accessed en online October 2023]

[40] ALLEA (2023) The European Code of Conduct for Research Integrity - Revised Edition 2023. Berlin. DOI 10.26356/ECOC

[41] https://eosc-portal.eu

[42] Wilkinson et al (2016). Op. cit.

[43] Carroll, S, et al. (2020). The CARE Principles for Indigenous Data Governance. Data Science Journal, 19: XX, pp. 1-12. https://doi.org/10.5334/dsj-2020-042

[44] Plan d'intentions de l'UNIL. Op. cit.

A reasoned opening of research data

UNIL advocates data openness "as open as possible, *as closed as necessary*"[45] . This openness - combined with conditions for future reuse - includes sharing negative results and those that do not conform to expected results.

Following UNESCO's recommendations, UNIL considers that "access restrictions must be proportionate and justified. They can only be justified on grounds of protection of human rights, national security, confidentiality, the right to privacy and respect for human study subjects, legal procedure and public order, protection of intellectual property rights and personal information, sacred and secret indigenous knowledge, as well as rare, threatened or endangered species."[46]

Challenges and issues of *Open Research Data* for UNIL

The product of scholarly work, research data is a public good whose management - in the short, medium and long term - raises numerous issues: scientific, ethical, deontological, legal, technical, economic, societal and environmental. These issues and their complexity call for a large number of skills and expertise that need to be reinforced, both quantitatively and qualitatively, since research data management is, in many respects, indispensable and crucial: it ensures compliance with the legal and regulatory framework, as well as with the requirements of scientific funders and publishers; it guarantees the authenticity, integrity, reliability and usability of data; it facilitates reproducibility, sharing and reuse; finally, it makes research work and results more visible, and contributes to research quality.

To meet these many challenges, UNIL is focusing its efforts and strong support on the following areas:

- raising awareness and communicating this culture of openness based on the principle of "as open as possible, *as closed as necessary*";
- Accompanying, supporting and training researchers in research data management and openness in line with the FAIR and CARE Principles;
- strengthening and upgrading the support staff for research data management and openness - *Data Stewards*, research engineers - supervised by the Division calcul et soutien à la recherche (DCSR) and the Service UNIRIS.
- developing infrastructures for managing research data throughout its life cycle;

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[45] European Union Research Executive Agency. Op. cit.

[46] UNESCO (2021). Op. cit.

- the establishment of participative governance and an inclusive organization able to respond effectively to the needs of its community and disciplinary specificities.

Constantly guided by the values and guiding principles defined in UNESCO's recommendations on open science, UNIL's interventions in research data management and openness contribute to "fostering equitable access to scientific information [...] to respond to global emergencies and increase the resilience of societies" (UNESCO, 2021)[47] .

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[47] UNESCO (2021). Op. cit.

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Citizen Science - a participatory approach
open to society

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Citizen Science at the service of science and society

Open data and access to scientific articles are necessary, but insufficient to ensure the transition to open science. Knowledge production must also be opened up to enable more active participation by society's stakeholders. To enhance the social relevance and impact of science, we need to invent new ways of constructing it that enable us to produce knowledge while at the same time having a concrete impact on the way we live and think.[48] UNIL thus recognizes citizen or participatory science as an important pillar of *Open Science* that needs to be strengthened.

Several terms are now being proposed, with variations on the degree of citizen involvement or the aims of inclusive research methods: action research, collaborative research, participatory research, citizen research.[49] The production of living scientific knowledge thus relies on innovative forms of collaboration in which citizens are brought into various roles, such as data collection (*crowdsourcing*), contribution to data interpretation (distributed intelligence), co-definition of research problems (participatory science) or participation in all phases of a research project.[50]

These various sub-fields support a *Citizen Science* dynamic that is expanding rapidly on an international scale. At *a minimum,* citizen science or research refers to two complementary movements. Firstly, it may involve citizen mobilization on technoscientific subjects, with the aim of influencing research agendas or legislative frameworks (leading examples: GMOs, nanotechnology). Secondly, it can also mean including citizens with no scientific training in research, and involving them in all or part of the scientific process: in the construction of the research question, the definition of the methodological protocol, data collection, data analysis and the valorization of results. Citizen participation in research is possible in all scientific fields[51] .

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[48] University of Lausanne Management Intention Plan 2021 - 2026

[49] Eitzel, M.V., et. al., 2017. Citizen Science Terminology Matters: Exploring Key Terms. Citizen Science: Theory and Practice, 2(1), p.1

[50] Haklay, M. 2015. Citizen science and policy: A European perspective. Washington D.C.: The Woodrow Wilson Center/Commons Lab.

[51] Roucayrol Anne-Marie, "Les sciences Participatives," La Pensée, 2018/4 (No. 396), pp. 58-70. https://doi.org/10.3917/lp.396.0058.

Citizen science thus offers the means to strengthen the implementation of open, holistic and participatory processes for the production of scientific and citizen knowledge[52] . The aim is to broaden collaboration between scientists and societal players beyond the scientific community, by developing a listening ear for social demand so as to integrate it into research agendas.

A participatory and inclusive institutional approach

Through its activities over the last 20 years (creation of the Interface sciences-société in 2002), UNIL is recognized in the international community as one of the pioneering universities in terms of opening up research to society. It is a member of several international networks and consortia, such as the Alliance Science Société (ALLIS), the EUniverCITIES network and the REseau International UNIversités-Société (REIUNIS).

UNIL's strategy for strengthening citizen science and inclusive research includes the creation of a Maison des savoirs vivants[53] (MSV), to be set up by the end of 2023. The MSV is a platform designed to meet this need on an institutional scale, by creating the right conditions for the coordinated development of innovative research partnerships involving UNIL members. With this approach, UNIL intends to support and encourage the involvement of UNIL lecturers, researchers, students and departments in social impact research activities, while facilitating the cross-fertilization of disciplinary approaches and the development and sharing of collaborative and innovative experiences and methods.

Integrating the *Citizen Science* dimension into *Open Science* roadmaps means not only promoting the openness of scientific methods to citizens, but also enhancing the value of non-academic modes of scientific expression.

Citizen Science challenges and issues for UNIL

To meet the challenges of a more open, participatory and inclusive science, UNIL focuses its interventions and support in the areas of :

- the provision of socio-technical infrastructures to enable and strengthen open and participatory research;
- enhancing the status (legal and social) of citizen co-researchers;

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[52] Global Citizen Science perspectives on Open Science Written input by the CSGP Citizen Science & Open Science Community of Practice to the UNESCO Recommendation on Open Science, 2020.

[53] The Maison des savoirs vivants was officially renamed *Interface, Fonds de soutien à la recherche partenariale* by UNIL management in January 2024.

- Strengthening opportunities for collaboration and networking between citizens' initiatives;
- making researchers and science more accessible to the general public;
- support for the production of knowledge that does not necessarily claim universal values, but can produce local or national results with strong social impacts;
- the development of interfaces to capture social demand for research and encourage the social relevance of research;
- defining best practices and evaluation criteria for inclusive research methods;
- the strengthening and development of new financial and fundraising resources adapted to projects involving participatory science;
- the promotion of participatory research practices in the evaluation of researchers' careers.

Open Source Software - free sharing of algorithms, source code and software

Openness that encourages best practices and reasoned availability

Computer code has become indispensable in all areas of scientific research.

> *"Software is a hybrid object within research, of which it is at once a driver (as a tool), a result (as evidence of the existence of a solution) and an object of study (as an artifact)" (Committee for Open Science, 2019)*[54] .

However, the access, use and distribution of software have become increasingly complex. Due to its increasing prevalence in research, its access and distribution are as varied as research itself can be. It can be freely accessed or distributed through open access forges and repositories using *open source* licenses. Just as they can be subject to strict use under complex proprietary licenses, or form an integral part of equipment developed in the course of research.

Free and *open source* software can provide a partial response to the challenges of digital sovereignty. They can also help foster the widespread adoption of best practices and increase the exchange of user contributions. Their openness and sharing is important for making research reproducible and verifiable. To a certain extent, this approach helps to reduce research costs, while providing flexible solutions adapted to infinite scientific needs.

Open Source Software (OSS) is based on methodologies and principles that are at the heart of *Open Science*: free access to algorithms, source codes and software, as well as to related documentation; facilitating the reproducibility of projects by making experiments available via the underlying source codes; capitalization on work carried out; citation of the producer/developer; possibility of reuse and improvement.

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[54] Opening up science: an opportunity paper on the commercialization of research-based software - 2019

An institutional approach to processes and methods

UNIL intends to develop processes, methods and infrastructures enabling it to make algorithms, source codes and/or software produced as part of the research activities carried out by its community available to the scientific community and the general public under open licenses. Nevertheless, *open source* licenses do not allow any restrictions on the use of the software, even if this use is malicious, and it is therefore essential that the software is made available in such a way as not to threaten the institution, research or development of the software created in this way.

Support for open algorithms, open source and open source software extends from the process of creating the software or code, through to its distribution, perpetuation and enhancement, not forgetting recognition of the work carried out by those who contribute to these activities.

Challenges and stakes of opening up and sharing free software and source code *at* UNIL

One of UNIL's major challenges is to identify the software produced by its community, inventory it and promote it (commercially or otherwise) through the appropriate channels. This identification of marketable software is the mission of the Technology Transfer Office - PACTT[55] , but requires the involvement of in-house expertise - in particular the Computing and Research Support Division (DCSR) and the UNIRIS Service - and relays within the University's faculties, as well as technological tools to manage this information.

Valorization is also a major challenge in connection with *Open Source Software*. *Open source* licenses are numerous, and not all software developed at UNIL lends itself to this type of license. UNIL will therefore need to define strategies for commercializing this "new" scientific production that minimize the risk of malicious reuse. The aim is to provide UNIL researchers with national and international visibility, as well as long-term, sustainable reuse, while guaranteeing appropriate valorization and the preservation of UNIL's own values.

In response to these multiple challenges, UNIL focuses its interventions and support on the following areas:

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[55] UNIL and CHUV Technology transfer office : https://www.pactt.ch/documents/disclosure-form-idf-or-swdf/w.pactt.ch/documents/disclosure-form-idf-or-swdf/

- supporting the development of free and open software and hardware in the various scientific communities;
- helping to produce and disseminate reference methodologies and best practices relating to the production and governance of technological projects carried out by UNIL researchers and staff;
- Reproducibility, capitalization and reuse of free software and source code in a reasoned manner;
- the implementation of a clear software valorization strategy (as open as possible and as closed as necessary) and the recognition of creators.

UNIL therefore intends to encourage its community to make software and code developed as part of research projects freely and openly available. This must be done in a reasoned way, giving priority to free re-use licenses, and in collaboration with the departments involved (PACTT), in order to guarantee institutional, copyright and intellectual property rights.

Open science action plan 2023-2025

As a result of its reflections, surveys of its researchers and teachers, and the involvement of stakeholders in its faculties and departments, UNIL has defined a 5-priority action plan:

1. **Governance**: to develop an *Open Science* policy, strategy, processes and guidelines to support UNIL's vision.

2. **organization**: to put in place administrative and support structures that guarantee a participatory and inclusive approach for researchers.

3. **infrastructures** and tools: to provide the technical means to manage, store, secure, share and archive scientific information.

4. **training** and consultancy: to support, accompany and empower researchers in the management of their projects

5. a **new culture** and communication: to raise community and public awareness of the challenges and opportunities of OS.

Each of these 5 areas is broken down into specific objectives, concrete measures to be taken and expected deliverables.

Area 1 - Governance

In brief: the establishment of an institutional framework supported by UNIL's management; the development of an institutional *Open Science* strategy and guidelines; the definition of processes and the development of procedures for OA and ORD.

Objectives	Measures	Deliverables
1.1 Establish a participatory institutional framework for the SO, clarifying roles and responsibilities	Submit to the UNIL community a draft OS strategy combining OA and ORD Integrate OS and its various issues into existing internal guidelines and faculty regulations	✓ Open Science institutional strategy ✓ OA Directive ☐ ORD and OSS directives ✓ Existing documents updated to include OS issues ☐ Data retention and disposal policy
1.2. Actively participate in national or international projects related to the SO	Supporting the SWISSUBase project (*swissuniversities* P5) SCOSS (Support for DOAJ, SHERPA/RoMEO, PKP, ...	✓ Co-financing, with UNIZH, of the FORS project to create a data repository (SWISSUBase)

	ORCID Consortium Steering Committee and Steer Co ORD ?	✓ UNIL's participation in the p-5 OKM (Open Knowledge Maps) project
1.3. Assert UNIL's position in OS and its support for open and responsible research on a national and international level.	Sign international declarations and treaties related to OS Participate in association or academic bodies related to the SO Support participation in and organization of OS-related events	✓ Agreement on the reform of research assessment (CoARA) signed ✓ Signing of the "*Action plan for Diamond Open Access*" [56] ☐ Signature of the Appel de Jussieu ✓ UNIL position paper on the national *Open Research Data* strategy action plan (swissuniversities) ✓ UNIL's participation in the Strategic Committee and the Coordination Committee of the National Open Research Data Strategy (swissuniversities) ✓ UNIL position paper on the action plan of the National *Open Access* Strategy (swissuniversities) ✓ Signing of international declarations on SO, OA and ORD ([Berlin](), [DORA]()) ✓ UNIL co-presidency of AKOA[57] ✓ National Open Access Conference 2018
1.4. Review the researcher evaluation system	Integrate the criterion of visibility and sharing of publications, research data, algorithms, source code and open software into the evaluation process.	☐ Take stock of research evaluation practices at UNIL ☐ Launch the first initiatives to reform research evaluation criteria ☐ New research evaluation guideline based on DORA principles[58]
1.5. Assess UNIL's *Open* Science compliance with national and international requirements	Track costs and *Open Access* publication and data deposit rates	☐ Financial monitoring system ✓ OA publication rate monitoring report (all

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[56] https://www.scienceeurope.org/our-resources/action-plan-for-diamond-open-access/

[57] Open Access Working Group appointed by Swiss Library Network for Education and Research (SLiNER)

[58] https://sfdora.org

		variants) - UNIL OA Barometer[59]

Area 2 - Organization

In short: identification of in-house expertise; creation of *Open Science* support services and a virtual one-stop shop; support, coordination and recognition of OS expertise within faculties.

Objectives	Measures	Deliverables
2.1. Develop a participatory culture for OS issues at UNIL	Draw on internal expertise (management, central services, faculties) and external expertise (partners) Develop a participative organization for OS reflections and results	☐ Participative and representative committee of OS researchers ☐ Introduce OS issues into relevant UNIL charters
2.2. Provide support for researchers on OS issues	Identify the specific needs of researchers in different disciplinary fields Developing an interface/platform (virtual counter)	✓ HEG Master's thesis on the organization of support for researchers ✓ Support services integrating OS issues ☐ A virtual hotline for researchers' questions ☐ Participation in the development of support initiatives for *Citizen Science* issues
2.3 Consolidating the network of internal OS referees in the Faculties	Acknowledge the OS skills of respondents in current job specifications. Lead a knowledge-sharing network. Develop data management support by *Data Stewards* and Research Engineers (DCSR)	✓ Research consultants, *data stewards*, research engineers and correspondents recognized as key contacts in SO matters ✓ Regular meetings with OS sponsors ☐ Maintain UNIL's network of faculty *data stewards* and research engineers. ☐ Develop and lead communities of practice around the OS pillars (AO - ORD - CZ - OSS)

3 - Infrastructure and resources

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[59] https://www.unil.ch/openscience/home/menuinst/open-access/open-access-a-lunil/barometre-open-access-unil.html

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In a nutshell: the creation of online DMPs; an infrastructure and tools for storing, collaborating, sharing, depositing, long-term preservation and promoting scientific publications and research data.

Objectives	Measures	Deliverables
3.1 Provide IT tools adapted to each stage of the research life cycle	Develop existing solutions in line with norms and standards (FAIR principles, OAIS standards, etc.). Identify collaborative tool needs by discipline Participate in the SWISSUbase project as a privileged partner (see 1.2)	✓ Evolution of the institutional repository for scientific publications (Serval) ✓ Integration of ORCID into Serval ☐ Research Information System (IRIS) ☐ Repository for research data related to publications (cf. 1.2) ☐ Virtual research environments / active data management tools / electronic laboratory notebooks ☐ Creation of a data storage decision support tool ☐ Open code management repository (software forge)
3.2 Facilitating the drafting and follow-up of DMPs	Develop an online tool dedicated to the DMP, adapted to any future solutions proposed on a national scale.	✓ UNIL online tool for creating and monitoring DMPs ✓ Generic DMP model ☐ Development of DMP production/management tools
3.3. Develop interactive tools to support researchers	Centralize and facilitate access to relevant information on *Open Access* and *Open Research Data* Supporting alternative scientific publishing initiatives	✓ Short video tutorials on using Serval and ORCID ✓ *Open Access* guides, FAQs and resources on the Open Science UNIL website. ✓ Open Access Personal Assistant (PAPAGO)
3.4. Provide technical and/or financial resources to facilitate *Open Science* processes	Development of platforms/financial flows/processes to facilitate adherence to *Open Science*	✓ UNIL *Gold Open Access* Fund[60] ✓ Shared *Open Access* diamond publishing platform for journals

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[60] https://www.unil.ch/openscience/home/menuinst/open-access/open-access-a-lunil/soutien-360/voie-doree/gold-open-access-fund-unil.html

| | | published in-house at UNIL (SOAP2)[61] |
| | | ☐ Provision of legal resources for *Open Science*-compatible dissemination (software licenses for research, OSS recommendations) |

4 - Training and consulting

In short: general training courses and tailor-made workshops; an advice and support platform for researchers.

Objectives	Measures	Deliverables
4.1. OS training for the UNIL community	Developing a training program for the UNIL community	✓ Workshops and hands-on training ✓ Online training modules for general OS, OA and ORD issues ☐ Creation of a CAS in *data stewardship* ☐ Development of a specific guide for data management in participatory research projects ☐ Creation of tools to help manage and open up data, in line with data protection requirements
4.2. Develop a personalized advisory service	Develop customized training and consultancy programs at the request of faculties for their doctoral students and within the framework of the *Graduate Campus* or other interested circles.	✓ Support offices in faculties ✓ Organization of DMP lunches in faculties ✓ Individual support ✓ Production of video tutorials dedicated to the operation of OS tools ✓ *Open Access* Personal Assistance (PAPAGO) ☐ Collaboration on the creation of a tool to help manage personal and sensitive data (based on PAPAGO)

Area 5 - New culture and communication

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[61] https://www.soap2.ch

In short: raising awareness of *Open Science* issues within the UNIL community; supporting a new, more open and accessible scientific culture; promoting *Open Science* and organizing events.

Objectives	Measures	Deliverables
5.1. Make the UNIL community aware of OS, OA and ORD issues	Develop awareness campaigns for different target audiences	✓ Promotional material, OS explanatory *flyer* ✓ Awareness-raising articles for in-house magazines (Uniscope and Allez savoir) ✓ Regularly updated website ☐ Creation of an OS UNIL prize highlighting the management, sharing and openness of science (publication and data).
5.2 Organizing scientific and cultural events dedicated to OS	Setting up a cycle of events on the themes of OA and ORD (study day / annual conference / *Open Science* exhibition) Organize exhibitions with broader themes (e.g. *data visualization*)	✓ UNIL-Wallonie International Conference on *Open Access* (2017) ✓ OA National Conference (2018) ✓ Policy presentation OA FNS (2019) ✓ ORD and OS Conference (2015, 2016, 2017) ✓ Webinar OA and copyright (2019) ✓ *Open Science week* at UNIL ✓ *Open Access* Tour: 360° support[62] ☐ Lausanne Open Science Days 2024 in partnership with
5.4. Communicate on the status of the OS dossier at UNIL	Create communication channels concerning the financial and adoption status of OS at UNIL. Adapting the message to different target audiences	☐ Communication strategy based on different target audiences ☐ Table of UNIL's annual costs for journal subscriptions and OA-related expenses (in collaboration with BCUL and faculties) ✓ Annual barometer of OA adoption at UNIL

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[62] https://www.unil.ch/openscience/home/menuguid/evenements/octobre-2021---semaine-open-access-2021.html

CARE *Data Principles*: developed by the *Global Indigenous Data Alliance* (GIDA) and complementary to the FAIR Principles, the CARE Principles for Indigenous Data Governance are people- and goal-oriented, reflecting the crucial role of data in advancing innovation and self-determination for indigenous peoples. CARE stands for *Collective Benefit*, *Authority to* Control, *Responsibility* and *Ethics*.

Citizen Science (CS): Citizen science is an interdisciplinary field of research characterized by the participation of in scientific activities (observations, data collection, analysis, planning of research topics, valorization of results, etc.). In this fast-growing field, citizens and researchers collaborate to produce new knowledge for science and society, with the aim of enhancing the social relevance and impact of science.

Source code: source code is the basic element of all software. It is the text written in computer languages. There are many different computer languages. Each corresponds to a specific need: C, Java, Python, R, Ocaml, Scilab, etc.

Research data lifecycle: the usual reference model defines six key stages in the life of data: creation or collection; organization and processing; analysis; accessibility or sharing; preservation; reuse.

Research data: "factual documents [...] used as primary sources for scientific research and commonly accepted by the scientific community as necessary to validate research results. [...] Other research-relevant digital objects from public funds: metadata, algorithms, workflows, models and software (including code) [...] that are used in a research and development context." (OECD, 2021)[63]

FAIR *Data Principles*: published in 2016, these guidelines apply to research (meta)data and aim to ensure that it can be FAIR: *Findable*, *Accessible*, *Interoperable* and *Reusable*.

Research data management (RDM): "that part of the research process concerned with the organization and handling of research data, including data management planning, structured storage, description, curation, preservation and provision of metadata and complementary algorithms, code, software and

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[63] OECD, 2021. Recommendation of the Council concerning Access to Research Data from Public Funding.

workflows, as well as compliance with domestic, national and international privacy legislation." (OECD, 2021)[64]

Software: software (or computer programs) is the description, in one or more computer languages, of a data-processing operation to be carried out by a computer. Software is said to be "free" when it is technically and legally permissible for others to use, study, modify and duplicate for distribution. Free software does not necessarily mean free and unprotected.

Open Access (OA): formalized by the Budapest Initiative in 2002, the *Open Access* movement is generally presented in two ways: the "green *road"* allows self-archiving of a version of articles (or books) on the author's website or an open institutional archive, often after a waiting period (embargo); the "gold *road"* is the publication of an article (or book) in an *Open Access* journal. These articles are immediately available to all. Publication fees (*Article/Book Processing Charge)* sometimes apply for the golden road, but the green road remains free for authors and readers. Between the two, there's the hybrid route. This is much criticized, as it involves paying the publisher to publish the article in *Open Access* in a journal that is also accessible by paid subscription (*double dipping*).

Open Research Data (ORD): research data that is open, freely accessible and can be reused by others. Also known as *Open* Access *to Research Data*, this movement advocates that the research data underlying scientific publications should be shared and made freely accessible.

Open Science (OS): Open Science is about how researchers work, collaborate, interact, share resources and disseminate the results of their work. *Open Science* is a movement that aims to make scientific research, data and their dissemination accessible to all. The paradigm shift towards more open science is driven in particular by the rise of new technologies, the expectations of funding bodies, society's growing demand for scientists to address societal challenges, and the desire of citizens to participate more actively in research.

Open Source Software (OSS)**:** Open Source Software is software whose license meets certain established criteria, allowing the software to be used as long as the conditions of the license are respected by the user. OSS licenses are generally validated by the *Open Source Initiative*. They are based, among other things, on free distribution and redistribution of the software, access to the source code, authorization to create derivative works, prohibition of discrimination against

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[64] op. cit.

persons or groups of persons, prohibition of discrimination as to field of research or use, and technological neutrality.