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Swiss National Open Research Data Strategy

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Abbreviations

CARE	Collective Benefit, Authority to control, Responsibility and Ethics
DelOS	Open Science Delegation
DORA	Declaration on Research Assessment
EOSC	European Open Science Cloud
EPFL	Swiss Federal Institute of Technology Lausanne
ETHZ	Swiss Federal Institute of Technology Zurich
FAIR	Findability, Accessibility, Interoperability, and Reusability
GDPR	General Data Protection Regulation
ORD	Open Research Data
OSPP-REC	Open Science Policy Platform Recommendations
RDM	Research Data Management
SERI	State Secretariat for Education, Research and Innovation
SNSF	Swiss National Science Foundation
UNESCO	United Nations Educational, Scientific and Cultural Organization

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1 Introduction

1.1 Mandate

The Swiss National Open Research Data (ORD) Strategy was initiated on the basis of the ORD Agreement between the State Secretariat for Education, Research and Innovation (SERI), swissuniversities, the Swiss National Science Foundation (SNSF), the Swiss Federal Institute of Technology Zurich (ETHZ) and the Swiss Federal Institute of Technology Lausanne (EPFL). The new ORD Strategy complements the existing Swiss National Strategy on Open Access and is to be detailed in the ORD Action Plan.[1]

In the ORD Agreement, swissuniversities and the newly established Open Science Delegation (DelOS) are assigned overall responsibility for drafting the ORD Strategy and Action Plan, for ensuring compliance with the existing Open Access Strategy and Action Plan, and for including all relevant stakeholders in the process. DelOS has established a project group to draw up the ORD Strategy and Action Plan as well as an accompanying analysis report. The purpose of the ORD Strategy is to define overarching objectives and principles for the Swiss ORD landscape. These objectives are to be supplemented by clear terms and conditions regarding organisation, governance, and financing. The ORD Action Plan corresponds to an implementation plan.

1.2 Scope of the Open Research Data Strategy

The Swiss National ORD Strategy provides a framework for the development of practices built around sharing research data in Switzerland, and for governing the services and infrastructures that support researchers and enable ORD practices. The Strategy addresses research data from publicly funded research in Switzerland, with research data being understood in a broad sense. The Strategy is concerned with data in the form of digital objects that are required for the reuse of data and reproduction of research results. It also encourages researchers and research communities to adopt ORD practices and aims to foster the use of and facilitate the development of these practices. The default mode of sharing data in the Strategy is openness; exemptions due to overriding legal, ethical, commercial, and security reasons are possible (c.f. 3.3).

2 Vision and context of the Open Research Data Strategy

By facilitating access to and reuse of research data, ORD promotes better, more effective, and more impactful research for the benefit of society as a whole. Through the principles of open access and reusability of research data, ORD practices support transparent and reproducible research findings. Moreover, ORD fosters collaboration by promoting exchange among researchers across disciplines, legal systems and national borders, thus enabling creativity and innovation to thrive.

1 ORD Agreement between SERI, swissuniversities, ETH Council, ETH Zurich, EPFL and SNSF for the elaboration of the Swiss National ORD Strategy and of the corresponding Action Plan, January 2020. https://www.swissuniversities.ch/fileadmin/swissuniversities/Dokumente/Hochschulpolitik/ORD/Vereinbarung_Open_Research_Data-sign.pdf

The Swiss scientific community is committed to adopting international best practices regarding ORD, especially the FAIR principles of Findability, Accessibility, Interoperability, and Reusability. The key stakeholders at Swiss higher education, research and innovation institutions acknowledge the resulting costs that may arise after a research project has been concluded – in particular the long-term maintenance, curation, and community support costs – and they are committed to supporting researchers in developing the necessary skills, services, and infrastructures.

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The Swiss National ORD Strategy is situated in the context of international open science initiatives. Open science represents a paradigm shift in current academic systems and practices: it seeks to promote high-quality research through the principle of openness, and to strengthen the impact of scholarship by improving the management and use of information generated through research. Although the open science movement is diverse, it operates on the shared assumption of openness, which, in its broadest interpretation, includes access to, dissemination of, and reuse of publications, data, materials, and methods.[2]

The Swiss National ORD Strategy is therefore in line with other national policies and international recommendations and initiatives related to open science that aim to include research communities into various policy contexts.
These policies include:

- The Declaration on Research Assessment (DORA)[3]
- The Leiden Manifesto[4]
- The European Code of Conduct for Research Integrity[5]
- The Amsterdam Call for Action on Open Science[6]
- European Open Science Cloud (EOSC)[7]
- FAIR principles[8]
- Open Science Policy Platform Recommendations (OSPP-REC)[9]
- Plan S Initiative[10]
- The upcoming United Nations Educational, Scientific and Cultural Organization (UNESCO) Recommendations on Open Science[11]
- Collective Benefit, Authority to control, Responsibility and Ethics (CARE) Principles for Indigenous Data Governance[12]

2 Levin, N,., Leonelli, S,., Weckowska, D,., Castle, D,. & Dupré John, J. (2016)). How Do Scientists Define Openness? Exploring the Relationship between Open Science Policies and Research Practice. In: *Bulletin of Science, Technology & Society, 36* (2), 128-141. https://doi.org/10.1177/0270467616668760

3 More information on the DORA: https://sfdora.org/

4 Hicks, D., Wouters, P., Waltman, L., de Rijke, S. & Rafols, I. (2015). Bibliometrics: The Leiden Manifesto for research metrics. *Nature*, *520*, 429-431. https://doi.org/10.1038/520429a

5 All European Academies. (2017). *The European Code of Conduct for Research Integrity*. https://www.allea.org/wp-content/uploads/2017/05/ALLEA-European-Code-of-Conduct-for-Research-Integrity-2017.pdf

6 Government of the Netherlands, Ministry of Education, Culture and Science. (2016). *Amsterdam Call for Action on Open Science*. https://www.government.nl/documents/reports/2016/04/04/amsterdam-call-for-action-on-open-science

7 More information on the EOSC: https://www.eoscsecretariat.eu/node

8 More information on the FAIR principles: https://www.go-fair.org/fair-principles/

9 European Commission. Directorate-General for Research and Innovation. (2018). *Open Science Policy Platform Recommendations*. https://op.europa.eu/en/publication-detail/-/publication/5b05b687-907e-11e8-8bc1-01aa75ed71a1

10 More information on the Plan S Initiative: https://www.coalition-s.org/

11 More information on the UNESCO Recommendations on Open Science: https://en.unesco.org/science-sustainable-future/open-science/recommendation

12 More information on the CARE principles: https://www.gida-global.org/care

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3 Guiding principles for the Open Research Data Strategy

3.1 FAIR principles

The FAIR principles[13] serve as guidelines to improve findability, accessibility, interoperability, and reuse of digital assets. Findability is the first step in enabling the reuse of data and is why data and metadata should be easy to discover. Once data are located, it is important to know how they can be accessed. Because data usually need to be integrated with other data, data and the infrastructures used to store them must be interoperable. Lastly, all these steps are necessary to enhance and promote reuse of data. The FAIR principles are a way to ensure good data management and to optimise the use of data, including data sharing. The FAIR principles support the long-term maintenance of valuable digital assets, allowing them to be found and reused for downstream investigations. On the path to achieving this goal, it may become necessary to consider and adopt further principles.

3.2 Good research practice includes openness

When implementing ORD, it is essential to observe best practices such as research protocols, guidelines, and replication protocols. By default, research data should always be published with the appropriate metadata, in accordance with general and discipline-specific ORD standards. To ensure this is the case, the necessary standards, tools, and services are made available to researchers during the entire data life cycle (planning, acquisition, annotation, processing, sharing, and preservation). Tools and services rely, wherever possible, on open and non-proprietary formats and protocols.

Openness is both a prerequisite and a means of supporting high-quality research, as it promotes transparency, enhances effectiveness of the research process, and allows for better reproducibility[14] of results. Reproducibility implies that different research groups are able to produce the same results using the same methodology and data or – given the difference in disciplines – it means that the traceability and intersubjective comprehensibility of research results is ensured. Adherence to FAIR principles is a key step towards improving overall reproducibility of research. In addition, it is important that the actions necessary to ensure good research practices are taken before, during, and after research is conducted.

3.3 As open as possible, as protected as necessary

ORD principles stipulate that research results must be accessible. Therefore, and in line with international declarations such as the 2020 Sorbonne Declaration,[15] the creators or rights holders of research findings must grant users the right of access, including the right to copy, use, distribute, transmit, and present findings with the aim of conducting and distributing follow-up research. The authorship and ownership rights of the data creators must be respected, and, in keeping with good scientific practice, are to be cited accordingly. This also applies to the citation practices of publications.

Data creators have the right to reasonable first use and processing of their data within the scope of ongoing research projects and related publications, under consideration of the various time frames in different disciplines. Valid access restrictions according to good disciplinary practices regarding data may apply, but are limited to justified legal and/or ethical constraints or security reasons and must not be extended to metadata. No negative consequences will be imposed on researchers who do not share data for justified reasons.

Switzerland is a leader in innovation, and because collaborative research with the private sector is greatly valued by higher education institutions in Switzerland, it is important that the national ORD Strategy enables companies to collaborate with research institutions.

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

14 Trustworthiness and reliability of research results are crucial in all fields of academia; the Swiss National ORD Strategy understands the concept of 'reproducibility' as comparable to 'intersubjective comprehensibility'.

15 Sorbonne Declaration on research data rights. Association of American Universities, African Research Universities Alliance, Coordination of French Research-Intensive Universities, German U15, League of European Research Universities, Research University 11, Russell Group, The Group of Eight & U15 Group of Canadian Research Universities. January 27, 2020. https://www.leru.org/files/Sorbonne-declaration.pdf

There is therefore a need to develop guidelines on whether, when, and how commercially sensitive data are to be made openly accessible.

3.4 Recognition of the value of data

The value of data is manifested in different dimensions: the acquisition or production process, the data as a product or an asset, the access and use of the data, and the long-term maintenance and curation of the data. While these dimensions bring different challenges, they are all considered as relevant aspects of the research process and are to be valorised as such. It is also important that the action of providing data to the research community be recognised properly, notably in the academic record of the data producer.

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3.5 Respecting disciplinary diversity

Research is conducted in heterogeneous environments that have their own cultures and contexts. The research objects and research materials considered to be data differ from discipline to discipline, and not all disciplines work with digital objects. Moreover, academic fields and research communities have diverse conventions, standards of methodology, and values as well as distinct approaches to conducting research, generating data, and evaluating research; in addition, researchers in some disciplines tend to work individually and others collaboratively. This means the digitisation of research practices differs accordingly, and many disciplines may currently not have established standards or infrastructures for data management.

It is therefore essential that researchers have the freedom to implement procedures related to ORD as is appropriate for the relevant academic community; there must be no 'one size fits all' approach. It is also important to encourage discipline-specific measures and methods, as they support the creation of practices, standards, and infrastructures within communities. Although discipline-specific demands and solutions must be respected, a balance must nevertheless be found to allow for cross-disciplinary reuse. Thus, standards are ideally based on internationally shared best practices across disciplines.

3.6 Connection to national and international ecosystems

The interoperability of existing and emerging infrastructures and organisations, such as the European Open Science Cloud (EOSC), and compliance with relevant legal frameworks at the national and international level must be ensured and the need for the adequate volume and type of investment recognised. Existing and planned data infrastructures of national interest to support FAIR principles and metadata search tools are to be developed to allow federation across national and international repositories as well as across generic and domain-specific repositories.

3.7 A sustainable approach

The development of ORD and all components of the information systems introduced to realise them must take into account their ecological, societal, and economic impact, as set out in the 2030 Agenda for Sustainable Development[16] adopted by all United Nations Member States in 2015.

4 Objectives of the Open Research Data Strategy

The ORD Strategy defines four objectives, each of which must be approached and managed differently. The level of maturity in ORD practices varies greatly between research communities.[17] Communities with different levels of maturity therefore have individual needs in terms

16 United Nations General Assembly. 2015. *Resolution adopted by the General Assembly on 25 September 2015 -- Transforming our world: the 2030 Agenda for Sustainable Development*. A/RES/70/1. https://digitallibrary.un.org/record/3923923?ln=en

17 For example, some fields seek to extract petabytes of highly structured data per year, while others aim to consolidate smaller, yet highly heterogeneous datasets.

of support and are to be evaluated according to discrete criteria. The following objectives of the Strategy take these aspects into account.[18]
The first two objectives concern the development, establishment, and consolidation of ORD practices, infrastructures, and services. The third objective is to raise awareness for FAIR and ORD in the scientific community and to promote Research Data Management (RDM) education and ORD training. The fourth objective addresses incentives and rewards for researchers as well as the legal and ethical aspects arising from ORD and the international alignment.

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4.1 Objective A: Support researchers and research communities in imagining and adopting ORD practices

The first objective of the ORD Strategy is to provide direct support to researchers and communities of researchers in implementing ORD, thus recognising the essential role of individual researchers who explore ORD practices. In their work, researchers develop projects to strengthen ORD practices both in terms of quality (e.g. transparency, reproducibility of results) and impact (e.g. research methods, reuse of data). The ORD Strategy understands community-driven projects as being transformative ideas, concepts, services, or infrastructures on the basis of which researchers construe and organize their work, thus changing how research is conducted. Projects promoting an ORD orientation in, for instance, a disciplinary field, require financial support to guarantee that the Swiss research community retains its status as a global leader.
Objective A relies on project-designated financial support to develop and adopt ORD practices, but not to provide long-term or permanent financing. Alternative funding models must be sought for projects that run permanently or over longer periods of time. With this in mind, the Strategy allows for a series of different pathways to secure long-term funding.[19] Access to these pathways is dependent on demonstrable and continued added value to users. The provision of a long-term financing pathway specifically for services of national importance is a key element of objective B.

4.2 Objective B: Development, promotion, and maintenance of financially sustainable basic infrastructures and services for all researchers

The first aspect of Objective B is to ensure a comprehensive and effective range of basic infrastructures and services that are made available to all researchers in Switzerland and that enable them to carry out their research efficiently. In addition, these infrastructures and services must be designed to support the work of researchers in the individual phases of the data life cycle and to ensure interoperability: it is therefore important that research organisations provide access to the necessary infrastructure and services and that they offer guidance to individual researchers and communities on best practices for data management, sharing, and storage for a particular discipline.
Long-term funding and management of basic infrastructure is crucial in this context. The Strategy does not prescribe a single policy, and a set of funding requirements for all researchers and all disciplines is neither feasible nor desirable. Nevertheless, to make the best use of the financial resources allocated, funding gaps and unnecessary duplication must be avoided by consolidating existing infrastructures and minimising duplicate infrastructures as well as services of similar scope at the national level. Because infrastructures ensure interoperability through open standards and protocols, it is important to maintain and support well-established infrastructures in the research community in order to encourage

18 The four objectives of the Swiss National ORD Strategy translate into four objectives in the Action Plan.
19 The Action Plan describes different pathways to financial sustainability. One pathway seeks financing via users who can use research funding (second- and third-party funds) for this purpose (e.g. voucher funding). Other pathways build on, for instance, a higher education institution taking on responsibility for long-term funding. A solution via long-term public funding for ORD projects (e.g. similar to publicly funded archives or libraries) must ensure the same goal of contributing to Switzerland's place at the forefront of research. Another pathway leads via non-profit or commercial non-profit ventures that assume responsibility for the development and maintenance of ORD-projects.

long-term viability as well as close integration with the national ecosystem via open standards.
In rare cases, a community-driven project will require additional funds to maintain a unique infrastructure or service; in such cases, an evolution from this unique infrastructure into a basic infrastructure is only possible for projects of high strategic importance. In addition, pure data repositories are to be gradually replaced by, or integrated with, infrastructures that provide standard interfaces between storage and active research infrastructures. It must be ensured that all service providers, including those offering unique services, are regularly evaluated and that they continue to actively align themselves with the needs of researchers. Furthermore, they must be embedded internationally and take into account the needs of the different disciplines they serve.

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The second aspect of objective B is to define, establish, and promote the role of data stewards at Swiss higher education and research institutions and to determine effective models to anchor these stewards. Data stewardship encompasses the management and monitoring of an organisation's data assets in order to provide users with access to high-quality data. As such, it represents the link between researchers and support units in the form of IT, libraries, and infrastructure providers at different levels. Data stewardship is discipline- or even community-specific and requires a certain skillset on the part of researchers and supporting professions, which is why RDM training is essential.

4.3 Objective C: Equipping researchers for ORD – skills development and exchange of best practices

In order to establish ORD in research practices, researchers must master the necessary skills. While researchers develop their own ORD practices and capacities, it is important that higher education institutions and research organisations support them by providing relevant services and training opportunities that cover a wide range of skills (e.g. technical skills on data management, RDM skills, and knowledge of legal requirements and principles of research integrity) and that address a broad audience (e.g. students, instructors, research leaders, administrators) while also accounting for discipline-specific requirements.
RDM skills form an integral part of scientific practice, as they bridge disciplinary practices and are linked to international principles and standards. In the interest of establishing and passing on best practices, it is crucial to strengthen knowledge exchange among research communities through the creation of networks between institutions and between data stewards or similar positions within higher education and research institutions (cf. 4.2). Intensifying collaboration and coordination among communities, institutions, and service providers as well as developing shared and complementary services that are tailored to a community's needs are necessary actions towards supporting skills development and knowledge exchange.

4.4 Objective D: Building up systemic und supportive conditions for institutions and research communities

Objective D addresses three major issues: incentives to promote ORD at higher education institutions and in research communities, legal and ethical aspects of ORD, and alignment with international standards and policies.
First, to implement ORD, the ways in which researchers are rewarded for adopting and adhering to ORD practices must be changed, a goal that requires a multipronged approach. Because ORD skills are of academic value, adequate development of data literacy in curricula at all levels of higher education is a necessary part of the process. Research assessment and career evaluation systems must be aligned with the principles of open science. Moreover, different elements of practicing ORD must be incentivised and rewarded, and criteria in evaluation and assessment procedures adapted accordingly, including criteria for hiring academic staff or for the allocation of research funding.
Second, production, access, and use of data present numerous legal, ethical, and societal challenges. Switzerland has complex legal frameworks at both the cantonal and federal

level, and is subject to other regulations, such as the European General Data Protection Regulation (GDPR). These legal bases influence and regulate many of the processes involving data, from acquisition to reuse, and they delegate different levels of accountability to individual stakeholders, including citizens, companies, and organisations. Moreover, new application ordinances that apply differently for different types of data are used at various stages of research. Because the legal status of various data types and the associated constraints must be fully understood within a research community, it is important that researchers have access to support and resources enabling them to gain the necessary expertise.
Third, policies and measures to implement ORD practices at the national level must be aligned with international standards and actions that are relevant to the Swiss research community. The Swiss National ORD Strategy facilitates and coordinates the alignment of all Swiss ORD initiatives – for instance, those from the ETH domain, the SNSF, and other institutions – and also endeavours to be in alignment with international actions. The Swiss community is encouraged to contribute to international initiatives and to take a leading position in the development and implementation of innovative technical solutions for putting FAIR principles into action. The inter-connectedness of the Swiss research landscape and its representation in European and global initiatives are essential factors in ensuring that Swiss higher education and research institutions retain their leadership position. ORD policies at the national level must not create barriers to international collaboration. Instead, it is important that communities are supported in building new, useful resources for the international research community, particularly in areas that have been identified as strengths. In order to safeguard these interests and empower communities to contribute to and participate in international activities, such initiatives are to be regularly monitored and their value for the Swiss landscape assessed. Furthermore, existing gaps are to be identified and adequate measures adopted to fill these gaps.

5 Governance of the Open Research Data Strategy

It is crucial that the future ORD landscape be set up and developed according to the needs of researchers and in adherence with the political framework conditions. Efficient and effective governance is therefore required to ensure that good decisions are made at the right time and at the right level. As such, it is essential that all actors involved in and affected by the Swiss National ORD Strategy be included in the right place in each constellation. Among these actors are researchers, the SNSF, the Swiss Academies of Arts and Sciences, higher education and research institutions and swissuniversities, and the SERI.
To form an effective governance system, it is important to differentiate between an overarching strategic level and operational levels, which must nonetheless also be strategy oriented.[20] An ORD Strategy Council bears responsibility for overall strategic management. The ORD Strategy Council is charged with developing a common vision for the future ORD landscape in Switzerland and for ensuring both coherence and interoperability of all infrastructures and services while also underpinning the interfaces with other research areas. The ORD Strategy Council also assumes responsibility for initiating and promoting the development and communication of positions and policies across Switzerland in international debates, while guaranteeing that the institutions remain autonomous.
The ORD Strategy Council is constituted in such a way that the key actors responsible for steering the development of the Swiss ORD landscape have balanced representation. Members of the ORD Strategy Council are senior officeholders in their respective institutions. Their status and expertise enable them to generate a common understanding of how to coordinate and act together while also permitting them to make reliable and binding statements on behalf of their institutions or to represent a robust position for a group of institutions. To assess the landscape, to negotiate and consolidate, and to prepare its decisions, the ORD Strategy Council can issue commissions to third parties.

20 The governance system and structures of the Swiss National ORD Strategy are described in further detail in the Action Plan.

To facilitate the deliberations and decisions of the ORD Strategy Council, two permanent ORD Sounding Boards are planned. The first ORD Sounding Board consists of researchers, thus accommodating and acknowledging the needs and experiences of experts in the field; further inclusion and participation of the research community may take various forms. The second ORD Sounding Board is responsible for grouping service providers involved in operational implementation of ORD services. The researchers and specialists on the ORD Sounding Boards are not members of the ORD Strategy Council, but instead provide their expertise for the further development of the ORD landscape.

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