

Guide for
implementation
of
the National
Roadmap for Open
Science

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1. Background

Research – like much of society – is undergoing radical digitisation. This fundamentally provides new opportunities but also imposes new demands, not least in terms of presenting and sharing digital research results (publications, research data, software, etc.) and digital research resources. Research carried out with maximum openness and presented in digital fora helps to achieve higher research quality by providing greater opportunities for replication of results and enabling critical review of the research process. Openness also helps to bring about faster progress by facilitating the transfer of knowledge, both within research and to other parts of society.

In May 2016, governments in EU countries adopted Council conclusions stating that the Union should make the transition to a new system for Open Science. Partly as a consequence of this, the Government already stated in its research bill *Kunskap i samverkan för samhällets utmaningar och stärkt konkurrenskraft [Knowledge in collaboration for society's challenges and strengthened competitiveness]* (Government Bill 2016/17:50) that all scientific publications resulting from publicly funded research should be made openly accessible immediately upon publication. The research and innovation bill entitled *Forskning, frihet, framtid – kunskap och innovation för Sverige [Research, Freedom, Future – Knowledge and Innovation for Sweden]* (Government Bill 2020/2:16) states that “scientific publications resulting from publicly funded research shall be openly accessible immediately with effect from 2021. The transition for research data shall be fully implemented by 2026, which means that research data shall be made available as open as possible, as closed as necessary”.¹

In recent years, a number of powerful initiatives for an Open Science system have been implemented at European level. The strength of this development is reflected in the updated framework for the European Research Area (ERA)² which will be implemented. One priority area for the European Commission is the development of assessment and definition of merit of scientific contributions, with a view to supporting the transition to Open Science, and the Commission has recently launched its *Paris Call on Research Assessment* initiative which European stakeholders have been invited to join; from Sweden, the Swedish Research Council and others have joined.³

European developments have a specific impact on Swedish researchers, both when they participate in European collaborations and, perhaps even more importantly, when the Swedish science system is adapted to the European one. Most Swedish research takes place in an international context, and Swedish development towards Open Science needs to be fully integrated into international development so as to optimise opportunities for Swedish researchers. Higher education institutions (HEIs) and research funders have a *joint*

¹ <https://www.regeringen.se/4af915/contentassets/da8732af87a14b689658dadcfb2d3777/forskning-frihet-framtid--kunskap-och-innovation-for-sverige.pdf> s.101 Downloaded on 2 February 2022

² https://ec.europa.eu/info/research-and-innovation/strategy/strategy-2020-2024/our-digital-future/era_en Downloaded on 2 February 2022

³ <https://osec2022.eu/paris-call/> Downloaded on 15 February 2021, <https://www.eua.eu/resources/publications/999:open-science-in-university-approaches-to-academic-assessment.html> Downloaded on 15 February 2021

responsibility in this respect, which is also underlined in the bill *Forskning, frihet, framtid – kunskap och innovation för Sverige* [Research, Freedom, Future – Knowledge and Innovation for Sweden] (Government Bill 2020/2:16), which gives mandates in this regard to HEIs, the Swedish Research Council and the National Library of Sweden.⁴

UNESCO's new recommendation on Open Science states that scientific work worldwide should be made more readily accessible and inclusive by means of measures such as inviting the general public and other stakeholders to participate in the research process. The principle of Open Science plays a key role in efforts to achieve the UN Sustainable Development Goals. All 193 UNESCO member states have been involved in the development of the Recommendation, which contains specific proposals for the way forward. The Recommendation points to the need to adapt the work to the conditions and needs of each country. The member states also undertake to follow up efforts on the Recommendation. The Swedish National Commission for UNESCO⁵ coordinates the work in Sweden. The UNESCO Recommendation on Open Science provides an international framework for Open Science policy and practice that recognises disciplinary and regional differences in Open Science perspectives. This takes into account academic freedom, gender transformative approaches and the specific challenges faced by researchers and other Open Science stakeholders in different countries, particularly in developing countries, and is helping to reduce the digital, technological and knowledge gaps that exist between and within countries. UNESCO has launched a global consultation to collect good examples of Open Science practices.⁶

The Association of Swedish HEIs (Sveriges universitets- och högskoleförbund, SUHF) adopted the *Roadmap for Open Science* (REK 2021:1) at the meeting of the General Assembly held in March 2021.⁷ The roadmap aims to create enhanced opportunities for HEIs and other relevant stakeholders to coordinate on issues of common concern and encourage greater collaboration. It is important to jointly create conditions for researchers at Swedish HEIs, regardless of their affiliation to any particular higher education institution, to have similar opportunities for services and support in the transition to an Open Science system.

2. The European Open Science Cloud (EOSC)

Together, the European Commission and EU member states are making a long-term and very large-scale investment in the European Open Science Cloud (EOSC) as a key ERA tool in order to facilitate and support Open Science. The aim is to build a common, open and virtual environment for well-documented and, where possible, open research data and other digital research resources, such as software. EOSC will build on and bind together existing initiatives and digital research infrastructures in member states for storing, managing, sharing, analysing and using digital research resources focusing on research data. The plan is for the EOSC ecosystem to be launched and available to researchers by 2025. A European partnership between the EOSC Association (EOSC-A) and the European Commission has been established in order to support this work.

⁴ <https://www.regeringen.se/4af915/contentassets/da8732af87a14b689658dadcfb2d3777/forskning-frihet-framtid--kunskap-och-innovation-for-sverige.pdf> p. 102 Downloaded on 2 February 2022

⁵ <https://unesco.se/unescos-rekommendation-om-oppen-vetenskap/> Downloaded on 11 May 2022

⁶ <https://www.unesco.org/en/natural-sciences/open-science> Downloaded on 11 May 2022

⁷ <https://suhf.se/app/uploads/2021/03/REK-2021-1-F%25C3%25A4rdplan-f%25C3%25B6r-%25C3%25B6ppen-vetenskap-SUHF-Antagen-210310-REV-1.pdf&sa=D&source=docs&ust=1643797373823796&usg=AOvVaw15Pk4FT0dWlgikSkQaJx6P>

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SUHF is a member of EOSC-A through Stockholm University, its host organisation. Similarly, the HEI-owned digital infrastructures Swedish National Data Service (SND) and the current Swedish National Infrastructure for Computing (Snic) are members through the University of Gothenburg and Uppsala University, respectively. Chalmers University of Technology, Karolinska Institutet, Linnaeus University, Lund University, the Swedish University of Agricultural Sciences, Umeå University and the research council Formas, as well as the European Spallation Source (ESS) research infrastructure are also members. The Swedish Research Council is appointed by the Government to be a mandated organisation in Sweden.

3. FAIR science

What are known as the FAIR principles (Findable, Accessible, Interoperable, Reusable) are an underlying quality concept for digital research resources such as research data.⁸ These principles now serve as a guide for good data management and open access to research data.

The FAIR principles were already included in the European Council conclusions of June 2016, and member states are invited to follow them in their research programmes and with regard to research funding. FAIR means that research data must be searchable, that its availability must be well described and that research data must be reusable and possible to combine. The fact that data is FAIR can be regarded as the basis necessary for it to be made openly available, if such is desirable and possible in view of legal requirements.

4. Assignment – guide for the roadmap

SUHF's *National Roadmap for Open Science* (REK 2021:1)⁹ contains eight comprehensive recommendations for actions that need to be implemented and skills that need to be in place at HEIs in order to achieve an open and FAIR science system. In its continued work, SUHF has identified a need to propose further specific initiatives in the work to develop and implement Open Science at Swedish HEIs. SUHF's coordination group for Open Science has set up a special working group to devise recommendations for such initiatives. This group's assignment is to work on the basis of the roadmap's recommendations to identify the initiatives required to enable Swedish HEIs to become part of the EOSC scientific ecosystem and to define a schedule to help them achieve the Government's specified goals for the transition. This working group includes members from SUHF's National Working Group on Research Data and the EOSC-A reference group.

This guide has been circulated to some HEIs for comment and was discussed at the SUHF General Assembly in March 2022. All HEIs were invited to comment on the guide. The Swedish Research Council and the National Library of Sweden have also been given the opportunity to comment on the document.

5. General goals

All researchers at Swedish HEIs need the right support and conditions to conduct research of the highest quality and with the greatest possible transparency and openness, regardless of

⁸<https://www.nature.com/articles/sdata201618&sa=D&source=docs&ust=1643797373818489&usg=AOvVaw2mRLKkdPdCvi7vb71ET5O1> Downloaded on 2 February 2021 <https://www.go-fair.org/fair-principles/&sa=D&source=docs&ust=1643797373815841&usg=AOvVaw3sgJxOsXMzkwb44EDuqN0I> Downloaded on 2 February 2022

⁹ <https://suhf.se/app/uploads/2021/03/REK-2021-1-F%C3%A4rdplan-f%C3%B6r-%C3%B6ppen-vetenskap-SUHF-Antagen-210310-REV-1.pdf> Downloaded on 2 February 2022

the HEI at which they work. All HEIs have a responsibility to help ensure that their researchers have access to relevant support and demand-based services which can help them be part of an emerging Open Science ecosystem. The guide is intended to encourage and promote national coordination and enhanced cooperation between HEIs and other relevant stakeholders, but also to allow for adaptation by HEIs to meet specific needs.

In the longer term, a future Open Science system can be expected to include all aspects normally associated with Open Science; that is to say, open and immediate presentation of all parts of the scientific process via digital channels. This involves open access to scientific publications, open research data, open software and tools, open learning resources, public participation in the research process and open documentation of the research process. However, in line with the Government's research bills and the SUHF roadmap, the guide focuses mainly on aspects of scientific publications and research data. Openness for software has started to be discussed within EOSC-A, and in some cases this is also included.

The Swedish HEIs are members of the European University Association (EUA) through SUHF. There are other networks of HEIs too, such as the League of European Research Universities (LERU), CESAER and others, which include individual HEIs and are driving the issue of the transition to an Open Science system. When making the transition to an Open Science system by 2026 in line with the *EUA Agenda for Open Science 2025*¹⁰, Sweden's HEIs should form part of a scientific ecosystem characterised by:

- Academic ownership of scientific communication and publishing.
- A fair ecosystem for scientific publishing (i.e. transparent, diverse, affordable and sustainable, technically interoperable and driven by the scientific community).
- FAIR research data as the norm for producing and sharing scientific know-how.
- New professional profiles for data-intensive careers.
- Active involvement in the EOSC.
- A responsible, transparent and sustainable research evaluation system.
- Open Science as an integral part of research evaluation methods.
- Evaluation methods that balance qualitative and quantitative metrics.

6. The eight recommendations of the roadmap and their associated actions

The eight recommendations from SUHF's *National Roadmap for Open Science* are listed below, along with associated proposals for specific actions for HEIs that can be followed up. These are mainly scheduled for the end of 2023 or 2025 at the latest. The latter is the year in which a first version of the EOSC ecosystem is expected to be available, and the year before Sweden – according to the Government's target scenario – will have fully implemented an Open Science system.

The HEI holds overall responsibility for ensuring that the proposed measures can be implemented. Here, the HEIs will probably need to draw on a range of internal competences and resources, including the HEI-owned national infrastructures such as SND, SNIC, SciLifeLab, MAX IV, ICOS and others. These are already being used by Swedish researchers and are already working – within their respective fields of responsibility – on implementing parts of the actions

¹⁰ <https://www.eua.eu/resources/publications/1003:the-eua-open-science-agenda-2025.html>

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described below. It is also clear that many of the actions rely on the involvement of researchers and research communities and take strong ownership for their implementation. HEIs need to actively and promptly support their researchers so that they have the opportunity to conduct their research with the highest possible quality and impact in the Open Science system that is now taking shape. The roadmap and guide will help HEIs to jointly create conditions for researchers to have similar opportunities for services and support in the transition to an Open Science system, which will also promote mobility and cooperation between HEIs in Sweden.

Recommendation 1

To create research and education environments that support, encourage, inform and educate about Open Science as a practice by adopting, implementing and supporting local steering documents or frameworks.

The HEI should consider:

- 1) Establishing a formal strategic function within HEI management by the end of 2022 at the latest, focusing on issues relating to open and FAIR science. This function should be capable of representing the institution in the field both nationally and internationally, for example on issues related to EOOSC-A, and provide a coordinating link between the institution's management and the corresponding operational support function(s) (see Recommendation 2, point 1).
- 2) Developing/revising and establishing strategic orientation decisions and steering documents by 2023 that promote Open Science in an international and European context (FAIR and open access to all digital scientific objects, such as publications, data, software and materials, as well as open licences such as CC licences).
- 3) Ensuring by 2023 that the distribution of responsibilities for the field of open and FAIR science within the higher education institution is clarified, including relationships and links with other stakeholders both nationally and internationally, and that there are internal organisational structures that work together to ensure technical readiness, competence, capacity building and financial flows in the long term.

Recommendation 2

To provide relevant research and education support services relating to Open Science that can meet researchers' needs for support throughout the research process, i.e. before, during and after a research project, in a resource-efficient manner.

The HEI should consider:

- 1) Ensuring by 2023 that there is a coherent, appropriate, visible and professional operational advisory and support function for researchers on issues relating to the management, storage, publication and retention of research data. The support function should complement domain-specific competences and should at least be able to assist in the fields of archives, libraries, publishing, law and funding support. The support function should also be closely linked to the e-infrastructure and IT services described in Recommendation 4. This function could be extended to support researchers with regard to other digital resources as well, such as software.
- 2) Ensuring by 2025 that there is appropriate third cycle training and skills development for researchers making it possible for researchers to acquire the necessary skills in open

research practices and good research data management according to new standards and research practices so that this is established and included in basic research implementation by 2026.

- 3) Ensuring by 2025 that appropriate first and second cycle education is in place to teach open research practices as an integral part of scientific method education.

Recommendation 3

To aim to ensure that research data and research results are compliant with the FAIR principles as far as possible.

The HEI should consider:

- 1) Ensuring that data management plans are used before the end of 2022 by way of practice to ensure that FAIR is implemented in research projects right from the outset, and that these can be followed up later.
- 2) Enhancing understanding of what FAIR means for research data and other research resources by 2023, as well as raising awareness among researchers of what FAIR involves, linked to quality and good research practice.
- 3) Ensuring the existence of fora within research activities for in-depth discussion on Open Science in 2022 and beyond, and supporting researcher-driven Open Science initiatives.

Recommendation 4

To provide researchers with affordable, adequate and secure infrastructural services – compliant with the applicable regulatory framework (in particular the Freedom of the Press Act, the Public Access to Information and Secrecy Act, the Archives Act and the GDPR) and the FAIR principles – for the management, storage, publication and retention of research data and research results, archiving and deletion forming an integral part of the research process and open access/Open access work.

The HEI should consider:

- 1) Ensuring by 2023 that the HEI has a comprehensive and demand-based set of e-infrastructure services, work processes and workflows, and advice on good research data management. This includes services for storing and sharing data during ongoing research activities, linking to relevant resources for data analysis, services and workflows for long-term retention, and services that provide opportunities for data sharing and publication. Informed decisions on the choice of service providers should be made at a high strategic level, based on a review of research needs and the applicable regulatory framework.
- 2) Ensuring by 2025 at the latest that additional services relevant to the HEI's research are included in the IT enterprise architecture, such as the link between e-archives, data management plans, the Electronic Laboratory Notebook (ELN) and other relevant digital support systems included in the offering to researchers.
- 3) Ensuring by 2025 that the services and advice linked with them are integrated into a coherent digital infrastructure with long-term funding and control from research activities, and that the services can be integrated into relevant national and international digital infrastructures through coordination or collaboration.

Recommendation 5

To actively collaborate with other SHEIs, infrastructures and funders to find resource-efficient and cost-effective joint national solutions regarding steering documents, frameworks and infrastructural services.

The HEI should consider:

- 1) In 2022-2023:
 - a) Developing and actively pursuing enhanced joint coordinated cooperation both amongst themselves and with other stakeholders, with a view to ensuring good access for Sweden to efficiently used and resource-efficient e-infrastructure from a national standpoint, as well as part of the ecosystem being built within the EOSC.
 - b) Extending collaboration between SHEIs in areas such as policy work, training materials, developing and implementing joint training courses, technical solutions and the like.

Recommendation 6

To promote, participate and collaborate with international stakeholders and initiatives such as the European Open Science Cloud (EOSC) Association and the San Francisco Declaration on Research Assessment (DORA).

The HEI should consider:

- 1) In 2022-2023:
 - a) Remaining abreast of international developments in Open Science and digital infrastructure, including within the EOSC.
 - b) Strategically evaluating participation in international projects in the field, such as EOSC projects funded by the European Commission, either individually or through relevant national consortia such as SND and other HEI-owned national infrastructures.
 - c) Strategically evaluating joining the membership organisation EOSC-A with a view to influencing and contributing to development in Europe. Collaboration between Swedish HEIs and national cooperation provides a strong common voice.
- 2) Strategically evaluating signing the *DORA Declaration*¹¹ and following up with internal work in line with the principles, as well as evaluating endorsement of the *Hong Kong Principles*¹² and the *Leiden Manifesto*¹³, for example.

Recommendation 7

To develop an incentive structure that promotes and assesses Open Science, such as in performance assessment and performance-based allocation of funds.

The HEI should consider:

- 1) In 2022:
 - a) Participating in the European Commission's work on the development of research assessment.

¹¹ <https://sfdora.org/> Downloaded on 4 May 2022

¹² <https://wcrif.org/guidance/hong-kong-principles> Downloaded on 4 May 2022

¹³ <http://www.leidenmanifesto.org/> Downloaded on 4 May 2022

- b) Participating in international and national development in the field together with funders and other stakeholders, taking a position on policy development and assisting with the same.
- 2) In 2024:
- a) Working on the basis of ongoing work nationally and internationally to revise the criteria for performance assessment that conflict with Open Science objectives.
 - b) Ensuring that quality control of research is developed through researcher support services, for example, that can assist researchers in ensuring that recommendations for the publication of various research results are met, for instance.
 - c) Ensuring in the case of assessments that experts are supported with implementing the intentions codified in the HEI's policies.
- 3) In 2026:
- a) Ensuring that new methods and criteria are developed with respect for the diversity prevailing between different fields, in close dialogue with researchers and research funders in the fields concerned, and with appropriate follow-up.

Recommendation 8

To work to ensure that copyright for the publication and re-use of research results is not transferred exclusively to commercial scientific publishers.

The HEI should consider:

- 1) In 2022 and beyond:
 - a) Actively supporting a change in the publishing landscape where subscription and hybrid publishing agreements are phased out.
 - b) Providing information on how the licensing of research results and research information should be handled, and how researchers should license their material so that they do not need to manage and publish research data via publishers' paid services in order to make research data available.

Providing information on academic ownership of scientific communication and publishing so that authors and their institutions retain copyright instead of excluding themselves via contract.

7. Conclusion

HEIs have everything to gain by further improving and extending cooperation amongst themselves in order to coordinate initiatives in the various fields required. In most aspects, there are similar challenges and needs at both individual level and organisational level. Using resource allocation in a common national and – by extension – international context means making optimum use of publicly allocated resources.

Research often takes place in national and international collaborations, and it is not uncommon for leading researchers to move frequently between different higher education institutions during their careers. Research will become both simpler and more efficient if steering documents and research support are based on principles and standards that are jointly established and implemented by sHEIs, research infrastructures and research collaborations as far as possible.

The National Roadmap for Open Science and the accompanying *Roadmap Implementation Guide* will need to be updated on an ongoing basis going forward as circumstances change. In the long term, they will also need to cover other elements of Open Science. The guide is intended to provide assistance and overall support to management teams at sHEIs. Every HEI has its own criteria as regards internal organisational structures, so the fact that there is no instruction manual or template that suits all HEIs needs to be taken into account, along with the fact that the actual management and local action plan may differ in different places. However, all HEIs need to ensure that appropriate services, support and frameworks for an Open Science system are in place. Of course, the funders, and not least the Swedish Research Council, have an important part to play here as they can accelerate the transition by defining requirements and/or conditions in their calls for proposals. Finally, the importance of *collaboration* between HEIs and other stakeholders, finding common solutions and sharing resources where appropriate and possible, is once again emphasised.