

# An Open Science Roadmap for Swedish Higher Education Institutions

*By Sabina Anderberg*

## **Abstract**

In the spring of 2021, a *National Open Science Roadmap* for Swedish Higher Education Institutions (HEI) was adopted by The Association of Swedish HEIs. The roadmap's eight principles aim to guide the HEIs' development of local structures and processes, speed up their concrete actions and encourage their collaboration in the shift to Open Science. The recommendations are concentrated on specific measures for open access to research data and research publications at HEIs. The primary target group for the roadmap is university management at Swedish HEIs. In the spring of 2022 the roadmap is to be supplemented by an action plan for Open Science.

## **Author Biography**

Sabina Anderberg works as a Business Developer in Open Science, specifically in research data management services, at Stockholm University. She is involved in a number of national working groups, for example, the Research Data Working Group at The Association of Swedish HEIs, the Swedish National Data Service (SND) DAU council and the National European Open Science Cloud (EOSC) Reference Group to mention some. Finally, Sabina is one of the co-chairs in task force group "Upskilling countries to engage in EOSC" that is part of the EOSC Advisory Group Research Careers and Curricula<sup>1</sup>.

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<sup>1</sup> [Upskilling countries to engage in EOSC](#)

## Keywords

Open Science, Roadmap, Universities, Open Scholarship, Open Research, Open Access, Open Data

## Adjusting to Open Science

Open Science represents a culture change and a paradigm shift in the way stakeholders in research, education, and knowledge exchange communities create, store, share, publish and preserve the output of their work and results. Open Science entails a movement to make scientific research and its dissemination accessible to as many people as possible. The question is no longer whether Open Science is going to happen, but rather how everyone can contribute and benefit from the transition. Practicing Open Science principles aims to reduce duplication in collecting, creating, transferring, and re-using scientific material. In order for this to be feasible, it is necessary that several actors coordinate and work towards the same goal.

For years, stakeholders have been talking about benefits and challenges of Open Science. Many might have seen the shift as something that will happen in the future, many years ahead. But the future starts today and we need to take concrete action to create solutions for the change to really happen tomorrow. In the near future, Open Science will hopefully be named just science – open, when possible, will be the default. The implementation of this transition is by no means straightforward. Challenges lie ahead for Swedish HEIs, and other stakeholders, to fully embrace Open Science principles, policies, and practices. There needs to be a *major* cultural, technical and organizational change in these institutions if the transition is to be successfully implemented. It is important that Open Science questions are dealt with at leadership level at the HEIs. It is a matter for the whole of the HEI, not just for the stakeholders providing the services and support. HEIs need to step up and provide the researchers with adequate services and support to correctly handle, store, publish and preserve their research results, so that publicly funded research will be as findable, accessible, interoperable and re-usable (FAIR<sup>2</sup>) as possible through a secure digital infrastructure.

## National goals and coordination

The Swedish government's goal stated in the Research Bill 2016/17:50<sup>3</sup> was that all scientific publications that are the result of publicly funded research should

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<sup>2</sup> [The FAIR Data Principles](#) [2022-04-29]

<sup>3</sup> [Research Bill 2016/17:50](#) (in Swedish) p.107 [2022-04-29]

be available immediately upon publication and that research data should also become openly available at the same time as the accompanying publication. For scientific publications it was stated that the transformation could start immediately while further investigations of the forms for open access to research data were required. The vision, then, was that a transition to open access to research results including scientific publications, works of art and research data should be fully implemented within ten years, by 2026<sup>4</sup>. After 2016 the Swedish government identified a need to update the national orientation for Open Science and add a more specific timeline. This meant a clarification in the Research Bill 2020/21:60 that from 2021 research funded by public funds, should be immediately openly available. In the case of research data, the transformation should be completed no later than 2026 and research data must then be made available as openly as possible and only as limited as necessary.<sup>5</sup>

In 2017 the Swedish Government tasked The Swedish Research Council (SRC) with an assignment to act as a national coordinating body for Sweden’s work on introducing open access to research data. At the same time the Government tasked the National Library of Sweden (NLS) with coordinating the work of introducing principles to promote open access to scientific publications. The process of coordination of the national work on open access to research data has been slow and not yet fully inclusive and transparent. The e-infrastructure landscape today is still very fragmented, poorly coordinated and in several different organizational forms – there is a tendency for each authority to work in its own way instead of finding new ways of working together. Currently, there is a lack of clear vision and common national strategy for the Swedish digital e-infrastructures for research and their role in the digital transition. It will be necessary to agree on a way forward for the benefit of all.

The investigation *Organisation, styrning och finansiering av forskningsinfrastruktur*<sup>6</sup> was launched on behalf of the Government in May 2020. The directives included a broad review of the Swedish national research infrastructure, aiming to ensure that Sweden can maintain high-quality research infrastructure and meet both current and future societal challenges. The report, presented in August 2021, proposed various ways to develop and strengthen the Swedish research infrastructure on a national level, for example by establishing a new authority with responsibility for digital infrastructure. The report points to the benefits of centralization in these issues.<sup>7</sup> It will be interesting to see the

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<sup>4</sup> [Research Bill 2016/17:50](#) (in Swedish) p.107 [2022-04-29]

<sup>5</sup> [Research Bill 2020/21:60](#) (in Swedish) p.101 [2022-04-29]

<sup>6</sup> [Organisation, styrning och finansiering av forskningsinfrastruktur](#) [2022-04-29]

<sup>7</sup> [Stärkt fokus på framtidens forskningsinfrastruktur](#) SOU 2021:65 p.220 [2022-04-29]

impact of the report and how it will be realized in practice, hopefully within the near future.

## Responsibilities of the universities

Sweden is by tradition a de-centralized country: public-sector HEIs have considerable autonomy within a system of management by objectives and it has, more or less, been up to each HEI to create its own vision, strategies, organization, and infrastructure. Overall responsibility for higher education and research rests with the Swedish Parliament and the Government. These bodies decide on the regulations that apply to the higher education sector, primarily the Higher Education Act and the Higher Education Ordinance. They also allocate resources to the HEIs. Within the framework of this legislation, HEIs take most decisions themselves. These decisions cover such areas as organization; internal allocation of resources; educational offerings; educational content and design; how many students are admitted and what research they conduct. An agreement for collaboration among HEIs (authorities) is voluntary, they cannot be forced to collaborate.

De-centralization creates opportunities for each HEI to adjust its organization and local infrastructure according to its needs, but it also creates challenges when it comes to national collaboration and development – regardless of the fact that all Swedish HEIs have reasonably similar needs for conducting higher education on scientific grounds and building strong research environments. Many Swedish HEIs have become administrative authorities and have an organizational form that does not suit the nature and the needs and demands of a modern HEI organisation. The HEIs must be managed much more resource-efficiently, like any large organization, and make wise use – and also report it – of the large financial resources that society makes available to them. For the researcher, the geographical university affiliation should facilitate and not impede the individual researcher's ability and opportunities to conduct research and make it available in accordance with the principles of Open Science.

Research libraries have long experience in promoting the transition to Open Science, and they continue to be of great importance in providing support and services in the work of HEIs, but Open Science is not a question for the research libraries alone. It is a matter for the whole HEI sector and its researchers. Harmonization of principles for open access to publications and research data proposed by research funders and HEIs are key. HEIs and research funders also have a responsibility to design and implement clear incentives that promote Open Science.

In their Open Science efforts, the HEIs are guided by the work and outcome from the National Library and the Swedish Research Council. However, their work will

not solve the HEIs’ responsibilities or problems to fulfill and meet the recommendations from society, funders, and political demands. Only the HEIs themselves can set up the strategic and operational guidelines and recommendations for how researchers can and must embrace Open Science in their everyday researcher life. The HEIs’ regulation letters for 2021 state very clearly that HEIs shall continue to develop their work with Open Science, in order to achieve the national direction towards an Open Science system. Their work also includes contributing to the Swedish Research Council and the National Library’s respective assignments on coordination of work for open access to research results.<sup>8</sup> Here the Swedish Association for HEIs can play an important role to support and coordinate the HEIs.

One example of HEI collaboration is the Swedish National Data Service (SND). It is run by a consortium consisting of nine universities<sup>9</sup>. The SND network consists of in total 35 Swedish HEIs and public research institutes. This is one initiative of national collaboration to create possibilities for researchers to describe, share, and reuse research data. They provide Swedish HEIs and other research organisations with support in their efforts to establish and maintain local functions for research data support. The organisations in the SND Network have access to support such as advice, training materials, and tools for research data management, and opportunities for knowledge exchange. SND collaborates with many organisations that strive for improved access to research data on a national and international level. The national collaborations are mainly in connection to the SND Network, where SND is the node. The network is important for the work with research data management support at the universities for the support services, but has not yet been sufficient for the strategic work on these issues at the HEI management level. In my view one of the reasons for this is that much of the participation and engagement in the network comes from the libraries and the operative support functions within the HEIs. There is a need for more strategic participation from the HEIs management level and active involvement of researchers, who are the main producers and users of research data.

## The National Roadmap for Open Science

Within the Association of Swedish HEIs<sup>10</sup> it has been discussed which issues in Open Science should be prioritized in particular, as well as how the association can support the members in these matters and contribute to support and incentivize open knowledge practices in scholarly research. The association can only issue *recommendations* to its members, it is up to each HEI to accept and

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<sup>8</sup> [Research Bill 2020/21:60](#) (in Swedish) p. 102 [2022-04-29]

<sup>9</sup> [The SND Consortium](#) [2022-04-29]

<sup>10</sup> [The Association of Swedish Higher Education Institutions](#) [2022-04-29]

implement them. The areas that are central and prioritized at the moment in order to promote the transparency of science, are open access to research data and research publications, although Open Science also includes open education, open source, open peer-review and citizen science.

In the transition to an Open Science system, the association's Working Group on Research Data has the task of monitoring national and international developments in the management of research data. On behalf of the association's Open Science Coordination Group, the working group shall propose concrete strategies and measures in dialogue with relevant stakeholders. Another aim is to promote coordination of national strategic work to develop research support services for research data management at the Swedish HEIs. The working group compiled the roadmap in the autumn of 2020. In March 2021, *The National Open Science Roadmap*<sup>11</sup> was adopted by the association and also presented to all the principals of the Swedish HEIs.

### Aims of the roadmap

The aim of the roadmap is to inspire HEIs and other stakeholders to coordinate on issues of a common nature, encourage extended collaboration, and jointly create overall conditions for researchers at the Swedish HEIs to have similar opportunities in the transition to an Open Science system regardless of university affiliation. The set of eight principles in the roadmap aims to speed up the development at each HEI and encourage concrete actions instead of getting lost in all the issues and challenges ahead. At some stages, it is better to focus on what can be actually done now rather than giving attention to issues that cannot be solved yet. The expectation is that it will inspire and help to reduce barriers to cooperation in a national perspective. The roadmap will be continuously updated as new issues emerge within Open Science and followed up to adjust to development and the speed of implementation. The recommendations are limited to measures that the HEIs need to take in order to promote open access to research publications and research data. The primary target group for the roadmap is the HEI managements.

### The set of eight principles and responsibilities of the HEIs

1. Create research and educational environments that support, encourage, inform, and educate about Open Science in practice, by adopting, implementing, and anchoring local governing documents or frameworks
2. Provide relevant research and training support services concerning Open Science, that in a resource-efficient way can meet the researchers' needs for

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<sup>11</sup> Here, the concept of Open Science includes research on a scientific and artistic basis

support throughout the whole research process, i.e., before, during, and after a research project

3. Strive to make research data and research results, insofar as it is possible, compatible with the FAIR principles
4. Offer researchers priceworthy, adequate and safe infrastructure services and solutions which comply with current regulations (especially the Freedom of the Press Act<sup>12</sup>, the Public Access to Information and the Secrecy Act<sup>13</sup>, the Archives Act, and the GDPR) and the FAIR principles – to handle, store, make available and preserve research data and research results, and where preserving and selected disposal are included as an integral part of the research process and the work for Open Science.
5. Actively collaborate with other universities, infrastructures, and funders to find resource and cost-effective, common national solutions concerning governing documents, frameworks, and infrastructural services
6. Promote, participate in and collaborate with international actors and initiatives, for example within the European Open Science Cloud (EOSC) and The San Francisco Declaration on Research Assessment (DORA)
7. Develop an incentive structure that promotes and values Open Science examples in merit assessment and performance-based resource allocation
8. Strive for a model ensuring that copyright for publication and reuse of research results is not exclusively transferred to commercial scientific publishers.

### Action plan for Open Science based on the roadmap

The Association of Swedish HEIs is a member of the European Open Science Cloud Association (EOSC-A) through Stockholm University. EOSC will enable researchers across disciplines and countries to share research data<sup>14</sup>. At present, a handful of Swedish HEIs are individual members of EOSC-A. Within the Association there is an EOSC reference group with delegates from the member universities. The aim of the reference group is to facilitate and strive for more national coordination and collaboration in issues related to EOSC membership.

For the HEIs to be part of EOSC ecosystem, they need to have their framework, organisation, and infrastructures in place and ready to use. In discussions about the Swedish HEIs’ participation in the EOSC ecosystem it became clear that the Open Science roadmap needed to be complemented by a timeframe, more specific

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<sup>12</sup> [The Freedom of the Press Act \(1949:105\)](#) [2022-04-29]

<sup>13</sup> [Public access to information and secrecy](#) [2022-04-29]

<sup>14</sup> [What the European Open Science Cloud is](#) [2022-04-29]

measures and suggestions for how it would be implemented, so that the transition to an Open Science system could be fulfilled in 2026, but also as a preparation for contexts such as EOSC and the aims of the EU's Open Science Policy<sup>15</sup>.

The association has therefore produced an action plan for Open Science with suggestions based on the eight recommendations to further support the HEIs to take action. There are follow-up proposals for concrete measures, mainly timed by the end of 2023 or 2025 at the latest. The latter is the year when a first version of the EOSC ecosystem is expected to be available and the year before Sweden should have fully implemented an open science system. The action plan for Open Science was adopted by the association's board in mid-February and presented to all the principals of the Swedish HEIs in mid-March 2022. The HEIs had the opportunity to submit comments on the action plan before the end of March. The final version of the action plan will be presented shortly.

The development of EOSC environment is relevant to Sweden's work on open access to research data in many ways. For many Swedish HEIs EOSC is still something that is remote in both form and function. Some still believe that corresponding solutions in each field of science are more urgent and appropriate than a common federated virtual environment with services for storage, management, analysis, and re-use of research data. Regardless of the development in each field of science, HEIs, both the smaller and the bigger ones, need to be able to provide their share of basic infrastructure that can interact in a larger national and international context. Today all necessary functions and services are still not in place yet. The local infrastructure includes a number of parts that are generally the same for all HEIs, regardless of size and focus, and in several aspects, these needs can and should be coordinated nationally for the common good.

Through the Swedish association of HEIs, the HEIs are members of The European University Association (EUA). There are also other networks of HEIs such as The League of European Research Universities (LERU), CESAER and others where individual HEIs are included. Within both the EUA and the other networks, the issue of the transition to an Open Science system is being pursued. The Swedish HEIs as members of the association will, in line with the *EUA Agenda for Open Science 2025*<sup>16</sup>, be part of a scholarly ecosystem characterised by:

- Academic ownership of scholarly communication and publishing
- A just scholarly publishing ecosystem (i.e. transparent, diverse, economically affordable and sustainable, technically interoperable, and steered by the research community)

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<sup>15</sup> [The EU's open science policy](#) [2022-04-29]

<sup>16</sup> [The EUA Open Science Agenda 2025](#) p.6 [2022-04-29]

- FAIR research data as the norm in producing and sharing scientific knowledge
- New professional profiles for dataintensive careers
- An active engagement in EOSC
- A responsible, transparent, and sustainable research assessment system
- Open Science as an integral part of research assessment practices
- Assessment approaches balancing qualitative and quantitative metrics

## Status at the HEIs

Since 2018, the Working Group on Research Data has sent a questionnaire to all HEI members. The aim of the questionnaire survey is to compile a quick and simple overview of the Swedish HEIs’ progress in their efforts to develop local infrastructure to specifically support research data management. The questionnaire was comprised of general questions relating to research data policy, a template for a Data Management Plan (DMP), local infrastructure for research data management, storage solutions for data, and what the key current issues in research data management are. Some questions about EOSC were added in 2021.

The purpose of the yearly survey is to get an idea of the current situation at the HEIs, and indications of how the Swedish Association of HEIs, and other relevant stakeholders, can jointly support the HEIs. Recent examples of this support are recommendations on *Data Management Plan* (2018) and *Research Data Framework* (2019) and, most recently, the eight principles in the *National Roadmap for Open Science* (2021) and in 2022 the action plan for Open Science.<sup>17</sup> It may be concluded from the replies to the questionnaire, that Swedish HEIs have considerable work ahead of them in developing university-wide research support services and infrastructure for managing, storing, accessing, and preserving research data. The answers show that awareness of issues about managing research data exists, but the structures for fully implementing the work in the HEIs still seem unclear. Developing research support services of this type, which require several different skills in the course of the research process cycle, and which affect various stakeholders both within and outside the HEI, calls for active and strong involvement in the matter from staff performing the HEIs’ executive functions. In addition, the need to upskill and educate staff with different functions within HEIs is of importance and sadly often a forgotten or down-prioritized effort. Education and development of relevant Open Science skills will be a very important issue to deal with – at staff level, at student level and at researcher level. The HEIs have a tendency to “forget” their research infrastructures. These infrastructures are often quite independent in their

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<sup>17</sup> [Recommendations to the members of the Association of Swedish HEIs](#)[2022-04-29]

structure and staffed with skilled persons and resources that the HEI should learn more from and involve much more.

Implementing these efforts both in the management organisation and in dialogue with the researchers and the core operation calls for coordination, cooperation, and new working methods and task forces throughout HEIs' activities. Inevitably, some of the most important parameters in the operational development of research support services for data management will be researcher participation, funding issues, resource allocation, skills development, and organizational structures, in addition to regulatory and legal aspects.

In the questionnaire answers, there seems to be an overall tendency for respondents to base answers on their individual professions and operational areas, rather than on the university's strategies. In general, very little is said about the overarching work required at the HEIs and the need for strong management support to be able to drive these issues throughout the whole HEI and develop adequate support that includes skills from several areas. This suggests that there are many in HEI management that have yet to embark on working actively on these issues. Also lacking is a clear connection and interactivity with how well the work is supported by researchers and how their needs should be taken into account in the development of research support services. A new questionnaire will be distributed during the spring of 2022.

## Summary

The development of open access to research publications and research data must merge together because good research data management is part of good research. At present, these areas are often separated workflows at many HEIs mainly because research data services are not yet as refined and well established as the process and support for research publications. On the national level, the processes are also still separated by giving two different authorities individual assignments. The Swedish Research Council has an assignment to act as a national coordinating body for Sweden's work on introducing open access to research data and the National Library of Sweden has the assignment to coordinate the work of introducing principles to promote open access to scientific publications. Even though they are supposed to cooperate in these issues they work rather differently with their assignments and are not currently fully coordinated. Much more could be done to coordinate the work better and more resource-efficiently in Sweden. Managing research publications and research data as separate workflow processes entails a risk in the long run both within the HEIs and on a national level. This separation should not persist in the long term: instead, these processes and the national and local structures to support them must work in more unison.

Implementing the roadmap and the action plan calls for collaboration, and coordination. The goal for the HEIs must be to have functional local basic infrastructures for an open scientific system in operation in 2026. These infrastructures need to be built in a way that makes them interoperable with other services within the scientific ecosystem. There are two key measures that need to be taken – collaboration is one and reallocation of resources within the HEI administration the other. Open Science is a hybrid activity involving many different stakeholder groups. The HEIs are one of the biggest and most important stakeholders to contribute and lead the way to successful change in the paradigm shift to Open Science. The global scholarly landscape is changing and so must the HEIs, their workflows, services, priorities and strategies. The HEIs face new costs in building local research support infrastructures for managing and preserving research data and research information. It will be impossible to cover these costs without changing the internal structures and administration within the HEIs and also defining what research shall be stored, preserved and where and for how long.

The culture in Sweden of working with issues within the local HEI rather than in a broad national context requires change, and the change is needed now. The HEIs also need to be more aware of and take advantage of the skills and expertise their own research infrastructures have access to. It is necessary to collaborate on the basis of joint, overarching frameworks in those areas where this is possible and create resource-efficient research support services and Open Science policies that do not differ too greatly from one HEI to another. Realizing the transformation successfully requires leadership, vision, strategy, and adequate resources, as well as an overarching policy or statement on the commitment of the HEI to Open Science approaches, and the implementation of targeted measures to spread Open Science knowledge and skills throughout the organisation. Policies and actions must be clearly described and communicated. New development and better services can also serve to support, develop and change researcher behaviour, leading to agreed changes of practice for each individual in line with the framework for Open Science. Whilst changing the organisations it is also very important that researchers are much more actively involved and engaged in the implementation and development of the system structures. Acknowledging and adopting the eight roadmap principles and the suggestions in the action plan will be important steps forward for Open Science success at the Swedish HEIs.

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