



National Library
of Sweden

National guidelines for open science

Proposal open for public consultation 3 October-3 November
2023

PROPOSAL

Reading instructions

This proposal for national guidelines for open science will be open for consultation during October 2023, when it will be possible to submit feedback on the entire proposal or parts thereof.

The final guidelines may take a different form after the comments received have been taken into consideration.

The guidelines in this draft begin with a definition and contextualisation of open science, along with a background on the function of and need for national guidelines. (Section 1)

In the guidelines, there are **six areas within open science**, each described in its own section. Within each area there are **one or more strategic goals**. These vary in nature depending on the needs and conditions within the respective area. (Section 2)

Actors and their areas of responsibility for open science are described, as well as the existing needs for **support and guidance**. (Sections 3-4)

The document concludes with an account of how the guidelines have been developed, including the **starting points, establishment of a basis of support and communication** throughout the course of the assignment. (Section 5)

It is primarily the content of Sections 2-4 that should be taken into account when comments are submitted.

The main **target groups for the guidelines** are government agencies and organisations, in particular higher education institutions and research funders. However, many actors – both organisations and individuals - can contribute to the transition to open science; therefore feedback is welcomed from everyone.

Previously set targets within the areas of scholarly publications and research data will be retained, while other areas need more time to develop. The guidelines will require continuous updating and follow-up.

Visit kb.se/openvetenskap for more information and to submit comments on the proposal, or contact openvetenskap@kb.se with questions.

Table of Contents

National guidelines for open science	1
Reading instructions	2
1. National guidelines for open science - to promote and strengthen research	4
<i>1.1. Priority areas within open science</i>	5
<i>1.2. Timeline for the guidelines</i>	5
<i>1.3. The function and further development of the guidelines</i>	6
2. Areas within open science	7
<i>2.1. Open access to scholarly publications</i>	7
<i>2.2. Open access to research data</i>	9
<i>2.3. Open research methods</i>	10
<i>2.4. Open Educational Resources</i>	11
<i>2.5. Public engagement in science</i>	12
<i>2.6. Digital infrastructures supporting open science</i>	13
3. Actors and their areas of responsibility	15
<i>3.1. Researchers</i>	15
<i>3.2. Research-performing organisations</i>	15
<i>3.3. Research funders</i>	16
<i>3.4. Expert government agencies</i>	16
<i>3.5. Other agencies and actors</i>	16
4. Support and guidance	17
5. The development of national guidelines for open science	18
<i>5.1. Starting points</i>	18
<i>5.2. Grounding and communication</i>	20

1. National guidelines for open science - to promote and strengthen research

These guidelines are part of a movement towards open science and are intended to provide support and guidance for the actors who have overarching responsibility in the transition. The aim of open science is to enhance scientific quality while improving the interaction between research and the individuals and societal actors who are directly or indirectly affected by more accessible and transparent research. Open science lays the foundation for future research through open, transparent and reproducible research methods, providing everyone with the opportunity to access scientific information. Open science strengthens the entire research system as well as the surrounding society. It promotes knowledge growth, innovation and competitiveness.

There is a broad international effort underway to achieve equitable access to scientific results and research processes and to thereby accelerate the implementation of the UN Sustainable Development Goals (SDGs). Open science – understood as a set of principles and approaches – is an essential component of the efforts to reach the SDGs. The development and implementation of national guidelines is a way for Sweden to align itself with these global efforts.

Based on UNESCO's Recommendation on Open Science, open science is defined in these guidelines as follows:

Open science aims to make scientific knowledge open access, available, and reusable for everyone.

Through openness and transparency in all parts of the research process, scientific quality and trust in research are strengthened. This enables increased scientific collaboration, and the exchange of knowledge benefits both science and society.

Open science encompasses all scientific disciplines and ways of conducting research, from basic research to applied research.

The idea that science should be open to scrutiny and possible to build on is in itself an inherent part of scientific norms. Digitisation affects the entire scientific process and enables new ways of creating and disseminating scientific knowledge. This presents both opportunities and challenges. An intra-scientific discussion about the quality and integrity of research – including how findings and results should be reviewed and reproduced – has highlighted the need for open access to methods and results. There is also a strong need to foster a more open dialogue between the research community and other societal actors, particularly to collaboratively address societal challenges.

Science and the world of research are sometimes viewed as a whole, but they in fact consist of a multitude of quite different research areas and subject disciplines. These can differ not only in terms of the objects of study, theories and methods, but also in terms of everyday practices and values regarding what is considered normal and desirable for carrying out good research. Such differences exist not only between different fields of research, but also between (and sometimes within) disciplines within these broad subject areas.

However, common to all types of research is the idea that knowledge is built through dialogue, criticism and discussion, where established truths can be nuanced and sometimes discarded as new ideas and models are developed and gain support. This represents science's quality assurance process and is the way that inaccuracies and ambiguities in research are continually addressed.

Open science is ultimately an approach, but it involves more concretely changing practices at various stages of the scientific process to make them more open, both among researchers and in relation to society at large.

1.1. Priority areas within open science

Open access to scholarly publications and research data has been in focus for just over 20 years, and the work with the transition has progressed relatively far in Sweden. Open science, seen from a holistic perspective, also includes other components. In order to provide a clearer direction and goals for open science in Sweden and to create a common understanding of the importance of an open science system, six areas in which it is essential to promote development have been identified.

The guidelines cover the following six areas:

- Open access to scholarly publications
- Open access to research data
- Open research methods
- Open Educational Resources
- Public engagement in science
- Digital infrastructures supporting open science

These areas should be understood as a whole, and they are not ranked by importance. The goals formulated within each area are also not presented in order of priority, and efforts to achieve them should proceed concurrently within the established time frame.

1.2. Timeline for the guidelines

The transition towards open science is a process that is both challenging and time consuming. It is also an effort in which Sweden is not alone. Both the UNESCO Recommendation on Open Science and the EU open science policy have served as important starting points for these guidelines.

The national direction for open science is formulated in the research policy bill from 2020 (Prop. 2020/21:60). The target set forth there stipulates that results from research financed with public funds must be published with immediate open access starting in 2021, and the transition for research data must be fully implemented by 2026 at the latest.

The previously formulated goals are important to adhere to. Much work has been done by researchers, higher education institutions, funders and other actors. However, particularly when it comes to open access publications, the efforts are coordinated with both commercial and public entities in an international context, making the transition work complex. These guidelines provide the basis for increased efforts to achieve these goals.

As the guidelines address several aspects of open science that were not covered by the previously set goals, the assessment is that the vision of a transition to an open science system in a broader sense is more comprehensive and thus also longer term. To fully implement the transition, it is therefore considered necessary to formulate an overarching goal for the entire transition in addition to the goals to be achieved by 2026. The aim should be for this overarching goal to be achieved by 2030, to allow for the necessary changes to take effect. With 2030 as the time horizon, open science is also clearly linked with the development towards the UN's Sustainable Development Goals.

1.3. The function and further development of the guidelines

The purpose of these guidelines is to provide direction for the ongoing transition towards open science, specifying the key actors' responsibilities and proposing how the guidelines can be implemented and monitored over time. Each actor is responsible for formulating how these guidelines can and should be implemented within their respective organisations.

The national guidelines serve as a link between international efforts and recommendations, such as those from UNESCO and the EU, and the work of research-performing and research-funding organisations. The roadmap for open science, along with its associated implementation guidance, developed by the Association of Swedish Higher Education Institutions (*Sveriges universitets- och högskoleförbund*, SUHF), clarifies the responsibilities of higher education institutions and the measures needed to expedite progress. While the national guidelines focus specifically on the direction of open science in Sweden, SUHF's roadmap and guidance, as well as guidelines and governing documents from entities such as the National Library of Sweden (*Kungliga biblioteket*, KB), Agency for Digital Government (*Myndigheten för digital förvaltningar*, Digg) and the Swedish Research Council (*Vetenskapsrådet*, VR) and other funders are more focused on how open science should be implemented at higher education institutions and by researchers. It is in these latter resources that organisations and individuals can find practical support in their work to achieve open science.

In light of the guidelines' focus on the transition process as well as the ongoing, partially unpredictable changes that will occur in our environment in the coming years, it is deemed necessary to keep the guidelines updated. Such updates should occur every three years,

starting from 2026, and they should be based on an evaluation of the results and effects of the guidelines. To gain a comprehensive understanding of the progress towards open science in Sweden, the guidelines should be regularly followed up. This should be seen as an integral part of the work. The follow-up should focus on both achieved results in the transition to open science and the extent to which the guidelines have produced the intended effect. This comprehensive follow-up should be carried out in collaboration among relevant stakeholders. Presently, the national work on open access to scholarly publications and research data is monitored by KB and VR, while other government agencies and organisations assess and track their own policies and strategies. Knowledge and experience gained from these efforts, as well as successful examples from other countries, should be used in shaping the design of the monitoring of both open science as a whole and of its various components.

Several actors are already tasked with coordinating and promoting open science. However, the collective effort needs to be coordinated so that all actors clearly understand their roles and can at the same time have an overview of the situation and overall progress. Such coordination can involve both the exchange of knowledge and experience among the actors as well as collaboration on monitoring and updating.

2. Areas within open science

2.1. Open access to scholarly publications

Open access to scholarly publications means that everyone has the right to read, download, copy, reuse, transform and distribute the work in digital form. The publication should have an open license that specifies how the work may be reused. Scholarly publications include, among other works, articles in scholarly journals, books, book chapters, conference papers and reports.

Sweden had previously set the goal that by 2021 at the latest, all publicly funded research must be published with immediate open access. In 2022, around 70 per cent of scholarly articles were published with open access. The majority of these are open access thanks to the transformative agreements (read and publish agreements) signed within the Bibsam Consortium. However, a significant portion of scholarly articles are still published behind paywalls, which indicates that other paths to open access should also be promoted. For example, researchers can deposit a copy of their article in a repository, a practice known as parallel publishing. In these cases, the economic copyright to the work has usually been transferred to the publisher, which means that the researcher cannot unconditionally distribute the work. This in turn typically results in a delay in parallel publishing, sometimes of as long as 24 months after the original publication date.

When it comes to other forms of publication, such as books, the open access percentage is lower. Open access to books is not typically included in read and publish agreements, and the cost of making a book open access, which is often substantial, must be covered by the researcher's project funds or through special research grants. As a rule, research-performing and -funding organisations have exceptions from requirements for open access for books, due to different conditions and traditions regarding book publishing.

In May 2023, the EU member states adopted Council conclusions with the aim of accelerating the transition to open science to improve the quality, efficiency and impact of research by promoting transparency, access, diversity, reusability, reproducibility and reliability of research results. The conclusions highlight, among other things, that immediate and unrestricted open access to scholarly publications with an open licence should be the norm and should follow the FAIR principles (Findable, Accessible, Interoperable, Reusable). Costs associated with scholarly publications should not be borne by either authors or readers. It is also emphasised that consideration should be given to the fact that publishing practices vary across disciplines and that open access to books, in particular, should be supported.

Furthermore, it is noted that the costs of academic publishing are at risk of becoming unsustainable for public organisations, and the importance of supporting the development of non-profit models and initiatives driven by public research organisations is highlighted.

Copyright measures that promote open science are also emphasised, among which is the review of copyright conditions for research that is part of the political agenda for the European Research Area 2022–2024. Legislation at the national level that ensures the right of authors to make their research publications immediately open access regardless of any agreements with publishers, known as secondary publication rights, is welcomed.

Rationale for open access to scientific publications

Open access to scholarly publications contributes to improving the quality, efficiency and impact of research. Making scholarly publications immediately open access provides better opportunities for the rapid adoption of scholarly knowledge and allows for results to be scrutinised, discussed and supplemented.

Open access to publications means that everyone who can benefit from or who has an interest in research results has the opportunity to access and benefit from them, regardless of financial resources or organisational affiliation. This includes researchers at universities and university colleges or other research-performing organisations, professionals in the public sector such as schools and healthcare, as well as the business sector, the media and the general public.

Goals within the area

- That research results in the form of scholarly publications that have been wholly or partially publicly funded are published with immediate open access. Publication should occur under an open license to promote dissemination and reuse.
- That costs associated with open access publishing not burden either readers or authors.
- That costs associated with open access publishing are reasonable and transparent, and that non-profit infrastructures for open access publishing are particularly supported.
- That measures promoting authors retaining the economic copyright to their works are implemented.

2.2. Open access to research data

Research data are data (information in digital format) produced within the framework of research activities. Open access to research data means that research data are published freely accessible online. Not all research data can be open access, or they may be accessible only to a certain extent, such as when the data contain personal information. The assessment of openness should be based on applicable legislation and the principle "as open as possible, as closed as necessary". This principle means that access to research data should not be restricted where there is no reason to do so, and that usage restrictions should not be imposed when not necessary.

In cases where research data cannot be made open access in their entirety, efforts should be made to provide open access to descriptive metadata.

To ensure that open research data can be reused, built upon and the results reproduced, they should be made available according to the FAIR principles. This means that research data must be Findable, Accessible, Interoperable, and Reusable.

For strategic and practical support, there is guidance available from VR and Digg. These resources explain the legal requirements placed on state-governed universities and university colleges regarding making research data and associated metadata accessible.

Rationale for open access to research data

Open access research data can be more easily found, reviewed, shared, cited and reused. This contributes to improving the quality of research by allowing more researchers to validate and build on previous findings.

Data produced within or funded by the public sector are a strategic national resource for the development of society, industry and the public sector. The use and reuse of data can provide benefits such as transparency, innovation, efficiency and support for decision-making and research.

Goals within the area

- That by 2026 at the latest, research data generated within publicly funded research are made accessible according to the principle "as open as possible, as closed as necessary."
- That data and metadata are made accessible in accordance with the FAIR principles and with support of existing guidance from VR and Digg.
- That strategic directions and supporting and technical measures for open access to research data are established at all relevant levels and in working practices, processes, and routines.
- That cost-effective management of open access is ensured. First and foremost, costs associated with making data open access according to FAIR principles should be clearly identified.
- That research-performing organisations, including research infrastructures, provide researchers with adequate support, awareness-raising efforts, and reliable, expedient, and interoperable technical solutions that enable open access to research data according to FAIR principles.

2.3. Open research methods

Open research methods encompass the entire workflow required to progress from observation to results and conclusions. This includes open protocols and workflows, open software and source code as well as open computational models. It also includes the publication of detailed metadata and documentation to facilitate peer review and ensure transparency regarding how the research results have been achieved.

Rationale for open research methods

Open research methods enhance the quality of research through increased reproducibility. This means the ability to reproduce or duplicate results using the same data or materials and

methodology as in the original research. Open research methods have the potential for adaptation or reuse in other contexts and within different disciplines.

Making research methods open access averts researchers spending time and funding on developing approaches that already exist. New procedures and methods also become more quickly available for others to use.

Goals within the area

- That, to ensure transparency in processes of data collection and analysis, protocols, methods, and source code are made open access, unless there are specific reasons not to do so.
- That procedures for open research methods are always documented and made available at a sufficiently detailed and comprehensive level to enable a thorough review of how results have been derived and how the chosen method may affect results and conclusions.

2.4. Open Educational Resources

Open Educational Resources (OER) include learning and teaching materials that are copyright-free or published under an open license and that others can access, reuse, repurpose, adapt and redistribute at no cost. These primarily consist of digital resources such as courses, videos, books and articles.

The perception of what constitutes OER may need to evolve from them being viewed as finished products, such as a complete textbook, to understanding that an educational resource can also consist of standalone components that can be assembled into a new whole to serve a specific purpose. Herein lies the strength of openness, as new resources can be created from freely circulating materials, as long as rights and obligations, such as citation and licensing terms, are met.

Rationale for Open Educational Resources

OER can be used in many learning contexts. There are opportunities and application areas in adult education and clubs and associations as well as continuing education. However, a crucial context is that of formal education, including preschool, primary and secondary school, but especially higher education. Openly available course books have great potential for students at universities and university colleges to access assigned literature. OER can also play an important role in lifelong learning and promote equal access to educational materials.

OER can be used and reused beyond the context in which they are created. By virtue of being openly accessible on the internet, these resources can be used by people in all the above-

named contexts. However, all forms of educational resources need to take into account the context and the user's level of knowledge, which requires reflection and a learner-centred approach.

Goals within the area

- That open access to educational resources and learning objects is part of an open science system.
- That universities and university colleges promote the development and use of OER so as to contribute to the dissemination of research-based knowledge and lifelong learning.

2.5. Public engagement in science

An important aspect of open science is to bring the scientific process closer to society and its citizens. As a result of the digitisation of society and research, opportunities have improved for the public and non-academic actors to participate in research activities. Bringing the scientific process closer to the community and its residents is a cornerstone of both UNESCO's and the EU's policies and initiatives in open science.

Within research overall there are several approaches and forms for involvement, dialogue and collaboration. They go by names such as citizen science, scientific crowdsourcing, user participation, citizen dialogue or co-creation. They are all characterised by researchers and the public collaborating to, among other things, generate new knowledge, develop new research topics or highlight an urgent societal issue.

In citizen science, individuals who are not trained researchers actively participate in the research process, for example by collecting data in the form of observations. Participation can take place at various stages of research projects (e.g. data collection or analysis). The general public is not the subject of the research (e.g. as informants or research study subjects), and the research is typically led by a trained researcher.

There are challenges in engaging and reaching out to a broader public. Citizen science needs to be organised and conducted in an inclusive manner, with an awareness of equal opportunities for participation.

Rationale for public engagement in science

A strong motivation is the way public participation contributes to the quality of research and the manner in which new knowledge and/or understanding is created. It would not be feasible to carry out some research in a sufficiently efficient manner without deeper involvement of participants from the public, such as for data collection on a larger scale.

Another motivation is the effects that arise from the interaction between research-performing organisations, their researchers, and various actors in society - including individual citizens. Research conducted in close and active collaboration with the public and various organisations increases the chances that the research addresses problems that the concerned actors consider relevant and urgent research areas and questions. Through this form of participation, better opportunities are also created for new knowledge to be implemented in operations or in society. This interaction can also contribute to increasing understanding of scientific processes.

Goal within the area

- That principles and methods for involving the public in the research process become known, established, and developed in all research disciplines where public involvement is relevant for the quality and development of research.

2.6. Digital infrastructures supporting open science

Digital infrastructures that support open science can encompass various types of systems, services and protocols used in research. They enable scientific results to be collected, stored, managed and made accessible. They also play a key role in building an effective research and innovation environment that includes processes for open science. Openly accessible services contribute to increased accessibility and use of research results as well as to collaboration among users within or outside the scientific discipline.

By contributing to the development of standards and principles for descriptive metadata about research, digital infrastructures supporting open science facilitate the reuse of, for example, research data, publications and research methods. They also expedite the monitoring and evaluation of open science, thereby contributing to its advancement.

The operation and development of digital infrastructures supporting open science takes place at individual organisations or through collaboration between organisations, both nationally

and internationally. They are typically funded through a combination of membership fees and/or grants and are operated by public research organisations or as non-profit initiatives.

Within the EU, the development of the European Open Science Cloud (EOSC) is ongoing. The ambition is to connect and build upon existing solutions and infrastructures within the EU countries. In Sweden, VR is tasked with coordinating and promoting Swedish involvement in EOSC.

Rationale for digital infrastructures supporting open science

Digital infrastructures that support open science practices are central to an open science system. They provide the foundation for making scientific results openly accessible to other researchers, businesses and the public. Through education and skills development, they standardise principles and practices for openness. It is of great importance that these infrastructures are developed to meet the needs of research, based on principles of openness.

Efficient and suitable development and long-term management of digital infrastructures and research data, as well as the digital services they handle and encompass, are essential for realising and promoting open science and open innovation. Sweden's involvement in EOSC is relevant for national efforts related to guidelines, recommendations and principles for open access to research data, as well as for grounding and coordinating activities at the national level concerning, for example, interoperability, standards and best practices.

Stronger interaction and collaboration among research infrastructures, users and suppliers from industry and academia creates opportunities for synergies between public and commercial activities. Infrastructures and open science support innovation and contribute to increasing the transfer of knowledge from publicly funded research to industry.

Goals within the area

- That digital infrastructures supporting open science are given the necessary resources to be maintained and developed to meet the needs of research.
- That coordination takes place between national data and research infrastructures and international initiatives, such as the European Open Science Cloud (EOSC).
- That policies and agreements ensure that the management and preservation of research data are carried out appropriately, and that the accessibility and reuse of research data are promoted.

3. Actors and their areas of responsibility

The research and innovation system is complex in terms of both content and organisation, encompassing various areas of science and research, as well as public and private research-performing organisations and research funders of different types and sizes. These guidelines are designed for publicly funded research but can, of course, also provide guidance in other contexts.

3.1. Researchers

It is central to the work with open science that research is conducted by researchers, individually and in groups, and that responsibility for research processes and results lies primarily with those conducting the research. A transition to open science needs to occur within everyday research practices involving research data and scholarly publications as well as throughout the research process. *How* a transition to a more open science is to be achieved will vary among different scientific disciplines, research areas and operations. It is a necessary consequence of academic freedom that the responsibility for designing and carrying out processes and activities to achieve a more open science needs to lie where the research is conducted.

Researchers have a responsibility to continuously work towards open science in their daily practices by developing work methods or implementing policies themselves, as well as using and seeking support and guidance when needed.

3.2. Research-performing organisations

The fact that much of the concrete responsibility for the transition to open science lies with researchers does not mean that they are alone in this task. All researchers exist within contexts and organisations – research groups, institutions, faculties and higher education institutions, as well as research institutes, companies, civil society organisations and government agencies engaged in research.

All of these organisations that perform research activities have a responsibility as employers and actors within the research and innovation system to promote open science. This entails concrete support in the form of knowledge and expertise, as well as various types of technical tools, libraries with their varied services, platforms and digital storage, as well as the design and implementation of norms and rules, information and education, among other things.

In cases where open science requires personnel and/or financial resources, the organisations carrying out the research need to take responsibility for necessary prioritisations. How this is done also needs to be managed within the framework of each organisation, in dialogue with the researchers.

Research-performing organisations also need to develop incentive structures that promote and value open science, for example in merit assessment and evaluation of research. This

work needs to align with international and national initiatives aimed at reforming how research is assessed.

Research-performing organisations, where higher education institutions play a prominent role, are responsible for developing and implementing policies and incentives for open science, as well as providing resources, support and guidance to enable this work.

3.3. Research funders

Funding of research is done in several ways, but public research funders play a crucial role as public funding comes with conditions, where different aspects of open science can be stipulated. The requirements for open access to scholarly publications is one such example. Research funders also have a designated responsibility to contribute to the transition to open science. This includes work on norms and rules related to research grants and efforts related to funding of, for example, publication channels or open science infrastructures.

Research funders need to collaborate with higher education institutions and other central stakeholders regarding both norms and regulations as well as payment streams and funding of open science.

3.4. Expert government agencies

Given the multitude of actors and organisations with significant roles to play in the transition to open science, there is a clear need for coordination and coordinated leadership of the work. So far, **VR** and **KB** have shared this responsibility, and **SUHF** has played an important role in coordinating work with open science within the higher education sector. **Digg** is tasked with promoting the accessibility and reuse of data from the public sector. Continued clear mandates and coordination responsibilities are crucial for the successful transition towards an open research and innovation system.

Expert agencies with coordination responsibilities should continue to work on monitoring the national efforts related to open access to scholarly publications and research data. A broader monitoring of the transition to open science needs to be developed, along with regular updates and revisions of the national guidelines for open science. This may also involve and include other agencies, especially research-performing organisations, primarily universities and university colleges.

3.5. Other agencies and actors

Other agencies and actors operating within or closely related to the research and innovation system need to actively monitor developments and ensure that their work contributes to the transition to open science. This includes agencies with special research-related missions, such as those with archival responsibilities and those working with digitisation of material, which in turn can be used in research.

Other organisations that represent civil society or special interests have an important role to play in creating a common understanding of open science, for example by drawing attention to open science in different contexts or by disseminating research publications and other research information to the public.

4. Support and guidance

Research-performing and research-funding organisations should develop and/or update **open science policies and guidelines** relevant to their areas of operation. Such overarching and general documents become normative for the organisation but should also be formulated in a way that aligns with the governance documents of other organisations. They can advantageously be developed and grounded in collaboration among organisations in the same sector. To ensure that policies and guidelines are rooted in consensus and also effectively implemented, it is crucial to create organisational conditions for coordinating efforts for open science within the organisation. The national guidelines should be the starting point for local governing documents on open science, particularly concerning the overall objectives for the various areas within open science.

Similarly, more concrete and timely **strategies and action plans** for specific initiatives relevant to the organisation can be developed. These should outline concrete goals to be achieved as well as actions to implement. An example of a strategy developed, rooted and decided upon through broad collaboration is *SUHF's National Roadmap for Open Science*. The roadmap and accompanying guidance clarify the responsibilities of Swedish higher education institutions and the measures needed to expedite the work on open access to research data and research results.

The establishment of open science entails that **investments and reallocation of resources** need to be made for research-performing and research-funding organisations. A shift towards open science, as formulated in these guidelines, requires long-term investments in the establishment and maintenance of infrastructure, of support functions, in competence development and for specific work efforts.

Targeted investments in all areas of open science are desirable. This will establish and support existing national solutions and infrastructures as well as subject-specific and interdisciplinary solutions that promote open research methods. Specific financial investments should be made to enable digital infrastructure that supports open science to adapt to and support increased open accessibility of research data and open research methods.

Research-performing organisations should **offer their researchers support and guidance on legal issues** that may arise when open research practices intersect with laws and their interpretation. Organisations should also coordinate their knowledge and assessments regarding the intersection of open science and law to ensure that researchers and others receive equal support. In particular, this involves copyright issues and questions related to personal privacy and data protection when research data is to be made openly available.

As an increasing number of researchers and organisations adopt open research methods, the need increases for **concrete guidance** on how individual researchers, groups and associations should adopt established open science best practices throughout the entire research process. Research-performing organisations should ensure that there is guidance in the form of documents, support functions and opportunities to establish and disseminate knowledge about concrete actions, such as data management plans. The need for local, subject-specific or national guidance should be explored.

There is also a need for **training in open science** for researchers at all levels and for students and relevant professional support staff. The training can be both a formal part of studies, for example doctoral studies, and an informal part of the work of higher education institutions.

5. The development of national guidelines for open science

In June 2022 the government tasked KB with developing national guidelines for open science (U2022/02287). The government assignment includes, from a holistic perspective on open science, identifying common goals and priorities, mapping the distribution of roles and areas of responsibility, and defining the need for support and guidance. According to the assignment, KB should gather knowledge and data from VR as well as knowledge and experiences from universities and university colleges and other relevant agencies and organisations.

5.1. Starting points

In November 2021, UNESCO's General Conference adopted a Recommendation on Open Science, which has since been ratified by all member countries. In UNESCO's Recommendation, open science is broadly defined and encompasses open scientific knowledge, open science infrastructure, open participation from societal actors and open dialogue with other knowledge systems. The aim is to contribute to an international shift towards a more open science system that contributes to sustainable societal development and takes into account varying conditions. One recommendation is to develop national policies.

In its open science policy, the EU highlights eight priority areas: open data, the European Open Science Cloud (EOSC), a new generation of metrics, the future of scholarly communication, research career evaluation systems, research integrity and the reproducibility of scientific results, education and skills, and citizen science.

The EU's Council of Ministers has on several occasions adopted Council conclusions related to open science, and in particular open access to research data and scholarly publications. Most recently, in May 2023, Council conclusions for the development of scholarly publishing were adopted. Previously, open science has been addressed in various contexts, including the Council conclusions from June 2022 on research assessment and open science, as well as in December 2020 and May 2021 on the development of the European Research Area.

In the 2016 research policy bill (*Collaborating for knowledge – for society's challenges and strengthened competitiveness*, prop. 2016/17:50 p. 107) the government set the goal of the transition to open access to research results, including scholarly publications, research data and artistic works, being fully implemented by 2026. In the case of scholarly publications, the transition would begin immediately, while open research data and artistic works were deemed to require more time. It was also emphasised that it is a shared responsibility for all actors in the research system, such as universities and research funders, to work to ensure that the goal is met.

In the subsequent research policy bill from 2020 (*Research, freedom, future - knowledge and innovation for Sweden*, prop. 2020/21:60), the government saw the need to update and clarify the national direction for open science. The goal set forth calls for results from research financed with public funds to be published with immediate open access starting in 2021, while the transition for research data must be fully implemented by 2026 at the latest.

In March 2021, SUHF adopted a national roadmap for open science. It was revised in 2022 and reapproved by the SUHF board in June 2022, along with guidance for its implementation. The roadmap states that Sweden's higher education institutions, in line with the European University Association (EUA) Open Science Agenda 2025, must be part of the open science ecosystem by 2026 at the latest, and it concludes with eight recommendations.

The development of open science is taking place globally, and coordination with what is happening in other countries is necessary and obvious. As part of the development process, national guidelines, policies and action plans, primarily from other EU countries, have therefore been studied to gain insights and learn from their processes and content. The aim has been for the Swedish national guidelines to harmonise with those of other countries, while taking into consideration our specific conditions, thus creating the best opportunities for Swedish research and researchers to compete successfully internationally. Policies, guidelines, and other governance documents for open science or various areas within it that have been developed at Swedish universities and university colleges were also surveyed.

For the area of open science related to research data, the results and processes from VR's coordination assignment for open access to research data have been of particular importance. VR has published recommendations as well as strategic and guidance documents on, among other things, principles for open access to research data, guidelines for the implementation of FAIR research data and data management plans, as well as indicators for monitoring progress. VR's assignment in the area of research infrastructures is also important for the national guidelines for open science.

For open access to scholarly publications, results and processes from KB's assignment to coordinate the work for open access to scholarly publications have been similarly used. The five investigations presented in 2019 address the merit and resource allocation system, financing the transition to an open access scholarly publishing system, open access to books, financial and technical support for Swedish open access scholarly journals, and monitoring requirements for open access to publications and recommendations for Creative Commons

licenses. Furthermore, KB has highlighted the importance of the FAIR principles for open access to scholarly publications, and each year has charted the development of open access to Swedish scholarly publications and reported the total expenses for scholarly publishing for universities and university colleges. KB is monitoring and participating in the work with implementation of EU legislation in the field of copyright, which has an impact on both the use of research data and the conditions for open access publishing.

5.2. Grounding and communication

For the implementation of the assignment, a working group was established at KB with borrowed expertise from VR and Forte.

During fall 2022, KB appointed a reference group for the assignment, comprising representatives from agencies and organisations responsible for and interested in open science, as well as researchers with specialist knowledge in various areas of open science. The aim has been to gather knowledge and experience, receive guidance for ongoing work, ground proposals and create engagement with the guidelines. The reference group held four meetings between December 2022 and September 2023.

During the project's implementation, engaging with and building a basis of support has also taken place with other groups. Representatives from the working group have participated in meetings with VR's reference group for research data and EOSC, SUHF's working group for OER, DIVA forum, as well as several university libraries to inform about and gather experiences relevant to the national guidelines.