

Striving for Open Science compliance in Sweden: Achieved goals and remaining challenges

Sabina Anderberg^{1*} (ORCID: [0000-0002-3344-8130](https://orcid.org/0000-0002-3344-8130)), **Hans O. Karlsson**³ (ORCID: [0000-0002-5366-4949](https://orcid.org/0000-0002-5366-4949)), **Elin Kronander**⁴ (ORCID: [0000-0003-0280-6318](https://orcid.org/0000-0003-0280-6318)), **Ineke Luijten**² (ORCID: [0000-0001-5768-275X](https://orcid.org/0000-0001-5768-275X)), **Merlijn de Smit**¹ (ORCID: [0000-0001-9778-1656](https://orcid.org/0000-0001-9778-1656)), **Eva Stensköld**⁵ (ORCID: [0000-0001-9961-9118](https://orcid.org/0000-0001-9961-9118)), **Jessica M. Lindvall**^{2*} (ORCID: [0000-0002-5042-8481](https://orcid.org/0000-0002-5042-8481))

¹ Stockholm University Library, Stockholm University

² SciLifeLab Training Hub, Department of Biochemistry and Biophysics, Stockholm University

³ Division of Scientific Computing, Department of Information Technology, Uppsala University

⁴ National Bioinformatics Infrastructure Sweden (NBIS), SciLifeLab, Department of Cell and Molecular Biology, Uppsala University

⁵ Swedish National Data Service (SND), University of Gothenburg

*Corresponding authors: sabina.anderberg@su.se, jessica.lindvall@scilifelab.se

Nordic Perspectives on Open Science 2026, <https://doi.org/10.7557/11.8391>

© The authors. Licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/).

Abstract

Sweden has pursued Open Science as a strategic priority since the 2016 Research and Innovation Bill, which set 2026 targets for open access to publicly funded outputs and “as open as possible, as closed as necessary” research data. Using data from SUHF’s annual *Roadmap for Open Science* surveys (2023–2025), supplemented by national studies from the National Library of Sweden, the Swedish Research Council, and Vetenskap & Allmänhet, this article evaluates higher education institution’s (HEIs) Open Science implementation across the six priority areas of the *National Guidelines for Open Science*, with an additional focus on research assessment reform.

Progress is strongest in open access to publications, with most HEIs having initiated or completed actions to publish openly, although hybrid publishing and high costs persist. Research data policies and data management plans are widespread, but FAIR-aligned data sharing remains limited. Support for open research methods is expanding, yet integration into doctoral and undergraduate education is still weak. Open educational resources and public engagement are the least developed areas, with limited reported structured activity, although initiatives are emerging. E-infrastructures for Open Science remain uneven and insufficiently developed, with weak coordination at both national and international levels. Engagement with research assessment reform is increasing, yet substantive changes to assessment practices are still limited. The findings point to persistent gaps between policy and practice, driven by fragmented governance, uneven support and training, and weak incentives. Proposed actions for full Open Science implementation include establishing a shared national vision, building coordinated

infrastructures, securing long-term investment, developing skills across the research lifecycle, and aligning incentives and assessment.

The coming decade will need to move beyond commitments and declarations, translating them into sustained, measurable practice to maintain Sweden's international competitiveness in Open Science.

Keywords

Open Science, Open Access, FAIR Data, Research Data Management, Open Methods, Open Educational Resources, Public Engagement, Research Assessment, Scholarly Communication, Research Infrastructures, Higher Education Institutions, Sweden, SUHF Roadmap, Policy Implementation

Introduction

Sweden's commitment to Open Science has gradually evolved over the past decade in line with European and global frameworks. Following the European Commission's 2012 recommendation on access to and preservation of scientific information (European Commission 2012), the Swedish government tasked the Swedish Research Council (SRC) with developing national guidelines for open access to publications and research data. In 2015, the SRC published a proposal outlining a ten-year vision for open access (Swedish Research Council 2015). The SRC's ambitions were formalized in the 2016 Research Bill (Prop. 2016/17:50) (Regeringskansliet 2016), which set the target that all publicly funded research should be published with immediate open access from 2021, and that research data should be made accessible "as open as possible, as closed as necessary" by 2026. These goals were reinforced in the 2020 and 2024 Research Bills (Regeringskansliet 2020, 2024), and to operationalize them the Swedish government tasked the National Library of Sweden (NLS) with developing the *National Guidelines for Open Science*, which were published in 2024 (NLS 2024) and align with the UNESCO *Recommendation on Open Science* (UNESCO 2021).

Despite the clarity and ambition of this policy framework, the implementation of Open Science in Swedish academia has been slower and more uneven than anticipated. Sweden did not meet the 2021 target for immediate open access to publicly funded research publications and is unlikely to reach the 2026 target for open research data. This gap between policy objectives and practical implementation raises questions about how national Open Science ambitions are translated into concrete actions across the Swedish Open Science landscape. In this respect, Sweden represents a particularly instructive case, given its early, clear Open Science policy targets combined with a decentralised higher education system.

To address the discrepancy between policy objectives and practical implementation of Open Science in Sweden, we build on the work of Anderberg (2022), which introduced the initial version of the Association of Swedish Higher Education Institutions' (SUHF) *Roadmap for Open Science for higher education institutions* (HEIs), consisting of ten recommendations intended to guide institutional implementation of Open Science (SUHF 2021; rev. 2025). In this analysis, we examine HEIs' progress in implementing these

principles during 2023–2025 and identify remaining challenges across key Open Science domains, including open access publishing, research data sharing, open educational resources, public engagement in science, and open methodology. By systematically analysing HEI-level implementation over time, this study provides the first comprehensive assessment of how Sweden’s national Open Science ambitions are being operationalised in practice across the full Open Science landscape, beyond a sole focus on publications or research data. Our analysis highlights both areas of substantial progress and persistent barriers that continue to hinder full alignment between national Open Science policy and academic practice in Sweden.

Background: The Swedish Open Science landscape

To better understand how Sweden’s national Open Science ambitions are being operationalised in practice across the research system, it is necessary to first outline the institutional landscape in which these ambitions are implemented. This section provides an overview of the key actors, policy instruments, and coordination mechanisms that shape Open Science governance in Sweden and that form the context for the HEI-level analysis presented in this study.

Governance and division of responsibilities

Open Science governance in Sweden is characterised by a distributed model in which responsibilities are shared across government, national agencies, research infrastructures, HEIs, and individual researchers, as illustrated in Fig 1.

The government defines the overarching policy direction through Research Bills (Regeringskansliet 2016, 2020, 2024), which articulate national Open Science objectives and priorities. These policy ambitions are translated into annual appropriation directives that assign specific tasks and reporting requirements to government agencies and universities. In parallel, *the Higher Education Act* (Regeringskansliet 1992) embeds principles closely aligned with Open Science (e.g. scientific credibility, sustainable development, equality, and lifelong learning) within the broader mission of universities, thereby providing a legal foundation for Open Science-related activities within HEIs.

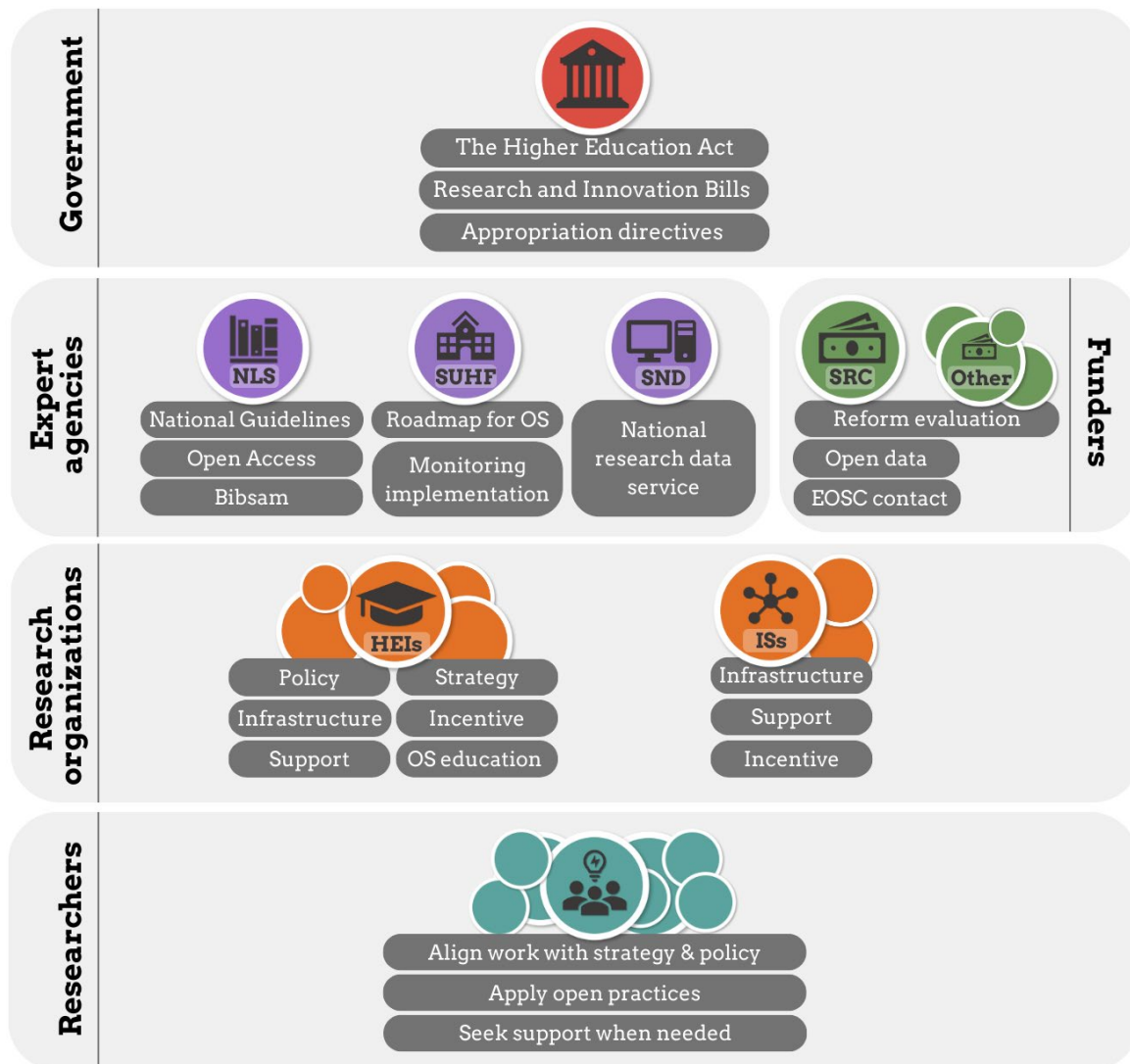


Figure 1. The Swedish Open Science landscape, illustrating major actors across different levels of the research system and their primary areas of responsibility, from national policy and coordination to institutional implementation and researcher-level practice. NLS = National Library of Sweden, SUHF = Association of Swedish Higher Education Institutions, OS = Open Science, SND = Swedish National Data Service, SRC = The Swedish Research Council, EOSC = European Open Science Cloud, HEIs = Higher Education Institutions, ISs = infrastructures.

At the national expert agency level, responsibility for Open Science coordination is divided primarily between the NLS and the SRC. Through government appropriation directives, the NLS coordinates national efforts related to open access to scholarly publications, while the SRC is responsible for open research data and represents Sweden within the European Open Science Cloud Association (EOSC-A). Both agencies support implementation by developing guidance, coordinating monitoring activities, and enabling shared infrastructures. Key examples include the SRC's funding of the Swedish National Data Service (SND), which supports researchers across disciplines in making research data accessible, and the NLS's coordination of the Bibsam Consortium, through which licence and publishing agreements are negotiated on behalf of Swedish HEIs.

Within the Swedish HEI landscape, SUHF acts as a coordinating and supportive expert agency for all Swedish HEIs. Although SUHF does not hold formal regulatory authority, it plays an important role in facilitating collaboration, knowledge exchange, and collective approaches to Open Science implementation across the sector.

Public research funders further reinforce Open Science objectives by aligning funding conditions with national policy and European frameworks such as Horizon Europe. The SRC thus plays a dual role as both a strategic funder of national infrastructures, including SND, and as a funder of individual research projects, where it has the opportunity to embed open Science requirements. Other major public funders, such as Forte and Formas, can similarly contribute by integrating Open Science considerations into their funding instruments.

Responsibility for translating national Open Science ambitions into practice ultimately lies with HEIs and research-performing national infrastructures, such as SciLifeLab and MAX IV. These organisations are expected to develop local policies, support functions, and infrastructures for Open Science, and to integrate Open Science into research management, education, and evaluation processes. They also contribute to national coordination through reporting, dialogue, and participation in joint initiatives led by NLS and SRC.

Finally, individual researchers are central actors in the Open Science system. While operating within institutional and policy frameworks, researchers make the day-to-day decisions that determine how Open Science is enacted in practice, from data management and publishing to methods and public engagement. Their incentives, constraints, and disciplinary contexts therefore play a decisive role in shaping the extent to which national Open Science ambitions are realised.

Coordination instruments and monitoring mechanisms

The roles and responsibilities of the actors described above are operationalised through a range of national policy instruments and coordination mechanisms that provide guidance and monitoring across the research system. The following section examines the central instruments through which Sweden's Open Science ambitions are coordinated and monitored.

The National Guidelines for Open Science

A key national coordination instrument is the *National Guidelines for Open Science*, published by the NLS in 2024. The guidelines operationalise Sweden's national and international Open Science commitments by defining six priority areas: open access to scholarly publications, open access to research data, open research methods, open educational resources (OERs), public engagement in science, and infrastructures supporting Open Science. In addition to articulating goals and priorities within each area, the guidelines clarify actors and their areas of responsibility across the research system and serve as a common reference framework for institutional implementation, coordination, and national monitoring.

The Roadmap for Open Science with action proposals for implementation

Complementing the national guidelines, SUHF first published the *Roadmap for Open Science with Action Proposals for Implementation* in 2021, with an updated version released in 2025. The roadmap translates national and international policy frameworks into ten concrete areas of action for HEIs, including open access, Findable Accessible Interoperable and Reusable (FAIR) data, OERs, research assessment reform, and public engagement. Designed as both a strategic and operational tool, it provides institutions with suggested actions and timelines for implementation. To support Roadmap implementation, SUHF and SND developed *Orienteringskartan* ("the Orientation map"), a mapping tool and collection of good practice examples designed to support institutions in implementing the guidelines (SND 2025).

Annual monitoring of implementation of The Roadmap for Open Science

To monitor HEI implementation of the roadmap, SUHF has conducted an annual survey since 2018 (SUHF 2018–2025). Initially, the survey focused primarily on research data management (2018–2022), but it was expanded in 2023 to cover the full scope of the roadmap's action areas. The expanded survey is aligned with the roadmap's recommendations, with questionnaire items corresponding to specific proposed actions. Each action is linked to a target year for expected completion, with 2026 as the final target year in line with the government's vision for the Open Science transition. The resulting data are based on self-reporting by HEIs.

Annual monitoring of Open Access publishing

As part of its national coordination mandate, the NLS has conducted annual monitoring of open access to scholarly publications since 2019. Since 2022, these reports have been issued under the title *Samordning av arbete för öppen tillgång till vetenskapliga publikationer* (Coordination of Work on Open Access to Scholarly Publications) (e.g. NLS 2024-2, 2025). The monitoring is based on bibliographic data of Swedish scholarly publications from Swepub, combined with information on open access status from Unpaywall. The reports compile annual statistics on the volume and costs of scholarly publishing in Sweden, as well as the share of openly accessible scientific articles produced by Swedish research-performing organisations.

Annual monitoring of open access to research data

In line with its mandate to coordinate, monitor, and promote collaboration on open access to research data, the SRC has published annual, publicly available monitoring reports since 2020. Since 2023, these reports have been issued under the title *Öppen tillgång till forskningsdata – en kartläggning, analys och bedömning* (Open Access to Research Data – Mapping, Analysis, and Assessment) (e.g. SRC 2024, 2025). The monitoring is primarily based on annual surveys directed at organisations responsible for funding, performing, or supporting research, complemented in some years by structured dialogue meetings with selected HEIs. The reports provide indicator-based evidence on organisational readiness for open research data, covering policies and workflows, staffing and infrastructure, capacity-building activities, levels of FAIR-aligned

data sharing, and the integration of open data practices into institutional incentive and reward systems.

Monitoring across other Open Science domains

In addition to the recurring national monitoring of open access to publications and research data, several targeted, one-off studies have been conducted to map and analyse other dimensions of Open Science in Sweden. These efforts address areas where systematic, longitudinal monitoring has not yet been established.

In 2023, the NLS published *Öppna lärresurser: en kartläggning och analys* (Open Educational Resources: A Survey and Analysis), commissioned by the Swedish government. The report examines the status of OER adoption, institutional support structures, and key challenges within Swedish HEIs. Its empirical basis consists primarily of surveys distributed to programme directors at HEIs and to HEI libraries, complemented by interviews. Since its publication, no subsequent, dedicated follow-up has been conducted to systematically assess progress in OER adoption across Swedish HEIs.

In parallel with the mandate on surveying the use of OERs, the Swedish government commissioned the NLS to survey and analyse public engagement in science, with particular attention to citizen science as a form of co-creation between research and society. This work resulted in the report *Public engagement in science: survey and analysis* (NLS 2023-2), which draws on a questionnaire developed by Vetenskap & Allmänhet (VA, a non-profit expert organization for dialogue, communication and collaboration around research), and distributed to Swedish university libraries. VA also published a separate report: *Medborgarforskning i Sverige: en kunskapsöversikt* (Citizen Science in Sweden: A State-of-the-Art Review) in 2022, which is included as an appendix to the NLS report. Also here, no dedicated follow-up has since been conducted.

Background summary

From this section, we conclude that Sweden has developed an extensive framework to support the implementation of Open Science. Nevertheless, the country did not meet the 2021 target for open access to publications and is unlikely to reach the 2026 target for open access to research data. While existing monitoring mechanisms provide valuable insights into the implementation of individual Open Science components (e.g. open access or research data management), they do not offer a comprehensive, Open Science-wide perspective that captures interactions across policy areas or reveals structural and organisational challenges at the institutional level. As a result, it remains difficult to identify where, how, and why gaps persist between national policy ambitions and institutional practice. Addressing these gaps requires closer analysis of how national objectives are interpreted, prioritised, and enacted within HEIs. Drawing on the SUHF Roadmap surveys (see *Annual monitoring of implementation of the Roadmap for Open Science*) – the only source of longitudinal, HEI-level data covering the full Open Science landscape – the following section outlines the methods and analysis used to assess institutional progress and remaining challenges in Open Science implementation during 2023–2025.

Methods and analysis

Survey design

This analysis is based on data from the 2023–2025 SUHF surveys, which track HEIs' implementation of the *Roadmap for Open Science with Action Proposals for Implementation* (SUHF 2021; rev. 2025). For each action proposal outlined in the Roadmap, institutions report their progress using four response categories: *Not started*, *Started*, *Completed*, or *Don't know*. Respondents are also invited to provide additional context or examples through free-text comments.

Respondents

The survey targets all 38 SUHF member HEIs, each providing a single, institution-level response, typically coordinated by staff responsible for research governance, Open Science, or digital infrastructure. Participation rate was 31 HEIs in 2023, 33 in 2024, and 34 in 2025, with 26 institutions responding consistently across all three years. In total, 35 HEIs are represented in the analysis. Response variation partly reflects turnover among designated respondents: in just over half of the HEIs, the same individual completed the survey each year, whereas in nearly 40% responses were submitted by different staff members (Fig. 2).

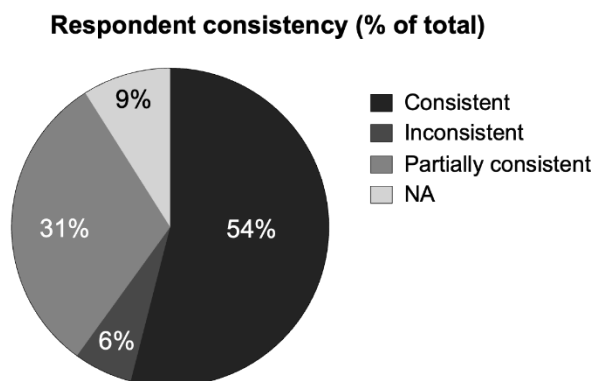


Figure 2. Percentage of institutions by respondent consistency across three consecutive survey years (2023–2025). *Consistent*: the same respondent(s) answered the survey each years; *Inconsistent*: different respondent(s) answered the survey each year; *Partially consistent*: the same respondent(s) answered the survey in at least two, but not all three, years; *NA*: respondent information not available.

In addition, respondents occupied diverse roles within their institutions, which may have shaped their perceptions depending on their position and access to information on governance, services, and support systems (Fig. 3). Such variability may affect both consistency over time within HEIs and comparability across institutions.

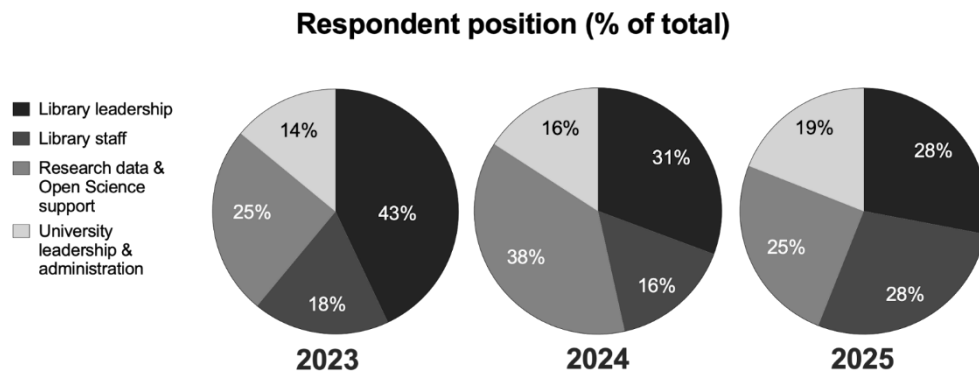


Figure 3. Percentage of survey respondents by role per survey year (2023–2025). Categories are: Library leadership (e.g. 'bibliotekschef', 'avdelningschef bibliotek', 'sektionschef bibliotek'), Library staff (e.g. 'bibliotekarie', 'utredare universitetsbiblioteket'), Research data & Open Science support (e.g. 'forskningsdata samordnare', 'projektledare för öppen vetenskap', 'expertgrupp FAIR forskningsdata', 'forskningsrådgivare'), and University leadership & administration (e.g. 'vice rektor för forskning', 'professor', 'senior rådgivare').

Data Collection and processing

The 2023–2025 surveys were distributed electronically by SUHF as part of their annual monitoring. Institutional responses were returned to SUHF, compiled, and made available for analysis in Excel with accompanying variable documentation.

After obtaining the 2023–2025 survey responses, we matched them by institution and variable, and ordered them alphabetically by HEI. Three HEIs were excluded because they participated in only one year, limiting comparability. To account for minor revisions, we cross-checked 2025 survey questions with earlier versions, and constructed a harmonized dataset across the three years.

Analysis

For each item, institutional responses were aggregated annually. Missing values were coded as NA and excluded. Proportions for each response category (*Not started*, *Started*, *Completed*, *Don't know*) were calculated, and percentage distributions were visualized to show longitudinal trends (2023–2025) for individual action proposals. Analyses and figures were produced in Excel. All raw data, calculations, and analyses are openly accessible on Zenodo (Luijten & Anderberg 2025).

Current progress in Open Science implementation

To examine how Swedish HEIs are translating national Open Science ambitions into practice, we analyse responses from the 2023–2025 SUHF Roadmap for Open Science surveys (see *Methods and Analysis*). Progress is mapped across the six priority areas defined in the National Guidelines for Open Science (see *Coordination instruments and monitoring mechanisms*) (NLS 2024) and an additional priority area: research assessment reform, and then compared, where relevant, with findings from other national monitoring reports (NLS 2023, 2023-2, 2025, SRC 2025, Vetenskap & Allmänhet 2023). This

approach allows us to identify both areas of advancement and persistent challenges, and to highlight patterns in institutional implementation across the three-year period.

Area 1: Open Access to scholarly publications

Open access (OA) to scholarly publications is a central priority in the *National Guidelines for Open Science* (NLS 2024). Key national objectives include immediate OA for all publicly funded publications, the use of open licenses in line with FAIR principles, and transparent management of publishing costs.

Between 2023 and 2025 Swedish HEIs show measurable progress in implementing OA policies and practices (Fig. 4).

Completion rates for recommendations related to academic publishing

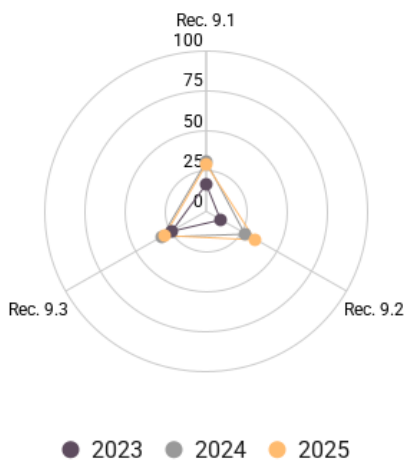


Figure 4. Percentages of HEIs over 2023–2025 who reported ‘Completed’ for three recommendations related to academic publishing from the National Roadmap for Open Science. Recommendations: 9.1 Actively support a transition to a publishing landscape where subscription-based and hybrid publishing agreements are gradually phased out. 9.2 Provide clear guidance on licensing research results and information so that researchers can publish without relying on publishers’ paid services for data accessibility. 9.3 Promote awareness of academic ownership of scientific communication, ensuring that researchers and their institutions retain copyright instead of transferring it away.

In 2025, nearly 30% of HEIs report completing three *Roadmap* recommendations related to academic publishing: transitioning away from subscription-based and hybrid agreements (Rec. 9.1), providing guidance on licensing of research results (Rec. 9.2), and promoting awareness of academic ownership (Rec. 9.3). This represents a notable increase from 2023, when completion rates were 17%, 10%, and 24%, respectively, indicating that HEIs are actively engaging with these measures. A further, detailed overview of reported progress across all recommendations is provided in the Appendix. Here we see that an additional substantial share of HEIs report that work on these recommendations is underway, with 62%, 44%, and 59% of HEIs having initiated Recs 9.1, 9.2, and 9.3.

This self-reported progress in implementing practical measures to realize Sweden's OA ambitions is encouraging, and partially reflected in national publication trends. In 2025, the NLS reported that 76% of the roughly 40,000 Swedish peer-reviewed articles were published with immediate OA, broadly corresponding to the proportion of HEIs that report either initiation or completion of Rec. 9.1 (90%). However, the distribution of OA models across published articles does not yet fully align with policy ambitions: green OA accounted for 5%, hybrid OA 53%, and fully OA journals (gold and diamond) 42%, indicating a continued persistent reliance on hybrid OA models. This is also mirrored in HEI publishing expenditures, which NLS reports to have totalled approximately 806 million SEK in 2024 (up nearly 1% from 2023) and have consistently represented around 1.5% of research and doctoral education revenues over the past four years, despite the transformative agreements negotiated through the Bibsam Consortium and the 2023 SUHF call to phase out read-and-publish agreements with hybrid journals by 2026 (a call that has since been adopted by the Bibsam Consortium Steering Committee) (Bibsam Consortium 2023).

Thus, while HEIs are making measurable progress in implementing OA measures, significant gaps remain. The persistence of hybrid publishing and the lack of reduction in overall expenditures illustrate the ongoing challenges in translating national OA policy into practice, highlighting areas where further institutional and sector-level efforts are needed.

Against this background of improving but uneven implementation, additional gaps become visible in parts of the OA landscape that extend beyond journal-based publishing. In particular, *Roadmap* Recs 9.4 (develop strategic policies for open publishing of longer formats such as books) and 9.5 (promote open publishing platforms with peer review and FAIR compliance) are at an early stage of implementation. Added to the SUHF survey in 2025, these recommendations show very low reported completion rates: 15% for Rec. 9.4 and just 3% for Rec. 9.5 (see Appendix). Additionally, 53% and 44% of HEIs, respectively, report not yet having initiated work on these recommendations. This institutional picture is reflected in national publication trends: according to the 2025 NLS data, just over 25% of monographs and anthologies were published with immediate OA in 2024. Although this represents an increase of around 10 percentage points since 2015, longer publication formats continue to lag behind journal articles in OA adoption, with potential implications for disciplinary equity, particularly in the humanities where books and monographs remain central to scholarly communication.

Overall, our analysis indicates that while Swedish HEIs increasingly report progress in implementing OA measures, the persistence of hybrid publishing, stable publishing expenditure levels and weak uptake of OA for books suggest that Sweden's OA transition remains partial and uneven, falling short of the transformative shift envisioned in national Open Science policy.

Area 2: Open access to research data

Making publicly funded research data FAIR transforms it into a national resource that drives innovation, accountability, and evidence-based decision-making. In Sweden, government directives require that by 2026, all such data be made available “as open as possible, as closed as necessary”. Practical priorities outlined in the *National Guidelines* (NLS 2024) include making research data accessible in line with FAIR principles, ensuring the use of data management plans (DMPs), and providing researchers with adequate support for and education on data sharing and open licenses.

SUHF survey data indicate tangible progress in operationalisation of research data management at Swedish HEIs. By 2025, 35% of HEIs report having implemented the use of DMPs for research projects (Rec. 4.1, Fig. 5), an increase of 15 percentage points since 2023. At the same time, the share of institutions reporting that work on this recommendation has not yet begun has fallen sharply, from 17% in 2023 to just 3% in 2025 (Appendix). Taken together, these trends suggest routinisation of concrete data management practices.

Completion rates for recommendations related to data management and FAIR

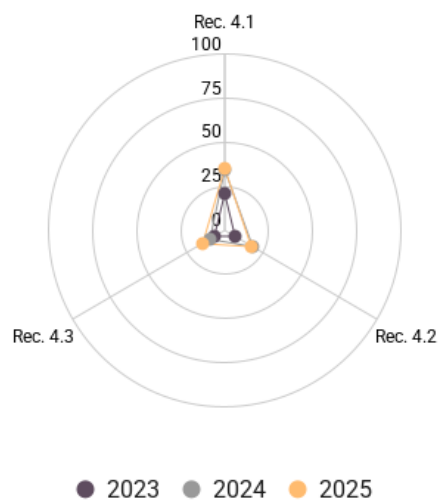


Figure 5. Percentages of HEIs over 2023–2025 who reported ‘Completed’ for three recommendations related to data management and FAIR from the National Roadmap for Open Science. Recommendations: 4.1 Implement data management plans for research projects. These plans should include information on methods for data collection, storage, information security, sharing, accessibility, and archiving, as well as continuous monitoring and quality assurance of the implementation throughout the entire lifecycle of the research data. 4.2 Deepen researchers’ understanding of the FAIR principles and enhance their knowledge of how these can be applied to improve research quality, adherence to good research practices, and regulatory compliance. This can be achieved through targeted training sessions, workshops, and practical guides that clearly demonstrate the connection between the FAIR principles over time and high-quality research. 4.3 Establish forums for knowledge exchange, idea development, and discussions on open science within research activities. Actively support and encourage researcher-driven initiatives aimed at promoting and integrating open science into research practices.

This development is reinforced by national monitoring conducted by the SRC. In its 2025 report (see *Annual monitoring of open access to research data*), the SRC shows that a

majority of HEIs have progressed beyond merely adopting strategic intentions to actively implementing them. While two thirds of responding HEIs report having fully or partly established a strategic direction for open research data, an even larger share (86%) report having translated these commitments into practice through the allocation of staff, time, and technical resources. Together, the SUHF and SRC findings indicate a maturing phase of implementation, in which policy commitments are increasingly being supported by operational measures at institutional level.

Despite the clear shift from policy formulation towards practical implementation described above, it remains uncertain to what extent these measures translate into increased data sharing in practice. SRC monitoring (Vetenskapsrådet 2025) shows that when HEIs are asked to estimate how much research data has been assessed as possible for OA, and additionally how much of that data has then been made openly available in line with FAIR principles, progress is limited. In 2025, only one HEI (2.6%) reports partial implementation, with none fully meeting the requirement. Many HEIs note that it is *'not possible to make an estimate of assessments of the possibilities for openness at present'*. Although efforts are underway to develop indicators and improve reporting, the heterogeneity of data publication channels and the uneven availability of metadata continue to hinder systematic tracking of data sharing outcomes. As a result, a gap persists between the growing institutionalisation of data management practices and the ability to demonstrate measurable increases in open and FAIR data sharing at national level.

Building on this uncertainty around actual data sharing outcomes, SUHF survey data indicate that the gap between policy ambitions, DMP adoption, and realised data sharing is likely linked to limitations in researcher support, competence development, and institutional capacity. Efforts to strengthen researchers' understanding of FAIR principles and their practical application (Rec. 4.2) remain at an early stage and show signs of stagnation: in 2025, only 18% of HEIs report full implementation, compared with 19% in 2024 (Fig. 5), while the share reporting having initiated activities declined from 72% to 65% (Appendix). Similarly, institutional forums for knowledge exchange and Open Science (Rec. 4.3) are still weakly embedded, with just 15% of HEIs reporting completion in 2025 (up from 9% in 2024) and nearly one third (32%) reporting that work has not yet begun, a proportion that has remained largely unchanged over time (Appendix). This interpretation is reinforced by SRC's 2025 monitoring, which shows that only 29% of HEIs report fully meeting requirements for organising capacity-building activities related to DMPs, FAIR data handling, open access to research data, and the promotion of data reuse, while a further 42% report only partial fulfilment.

Further challenges are evident in the area of open research software and source code. The most recently introduced SUHF *Roadmap* recommendation (Rec. 4.4), added to the survey for the first time in 2025, addresses the need to ensure that research software and source code are made as openly accessible as possible under recognised open licenses, while respecting legitimate restrictions. Reported implementation is minimal: only 3% of HEIs indicate completion in 2025 (Appendix).

Taken together, the findings indicate that Swedish HEIs have made substantial progress in institutionalising research data management through policies and the implementation of DMPs. However, this operational maturity has not yet translated into

measurable increases in open and FAIR data sharing, revealing the need for better monitoring and outcome indicators. Equally important is the need for stronger institutional education and support for researchers to share and FAIRify not only research data but also related outputs such as research software and source code.

Area 3: Open research methods

Promoting openness in study design, workflows, and software strengthens research reliability and reproducibility, and is expected to reduce unnecessary duplication of effort. The *National Guidelines* (NLS 2024) highlight sharing protocols, workflows, software, and source code under FAIR-aligned open licenses, developing field-specific standards, and providing institutional support to researchers as priorities for implementing open research methods.

The SUHF *Roadmap* lacks a dedicated section on open research methods, and no national monitoring currently tracks the extent to which research methods are openly published by Swedish HEIs. However, related *Roadmap* recommendations offer insight into the support and training that researchers receive for implementing open methods.

When it comes to providing support and efficient services that assist researchers in applying open research methods (Rec 2.1) growth has been substantial. Completion rates increased from 38% in 2023 to 56% in 2025 (Fig. 6), while an additional 38% of HEIs reported having initiated work in 2025, indicating near-universal engagement (Appendix).

Training and education show a more mixed picture. At the doctoral level, progress is visible: the share of HEIs reporting full integration of open-methods skills into doctoral training (Rec. 2.2) increased by 19 percentage points since 2023, reaching 26% in 2025 (Fig. 6). At undergraduate and master's levels (Rec. 2.3), however, implementation remains minimal and largely unchanged, with completion rates rising only from 3% in 2023 to 6% in 2025 (Fig. 6) and a steady two thirds of HEIs reporting that work has not yet begun (Appendix).

Completion rates for recommendations related to open methodology

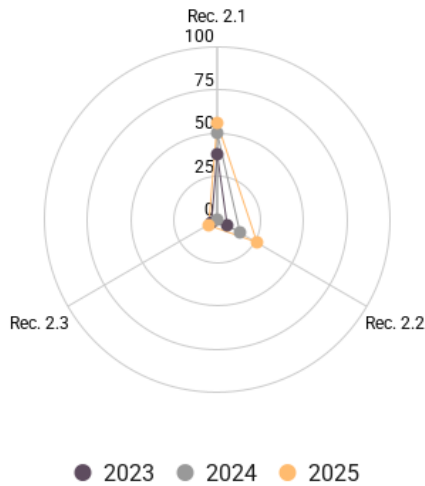


Figure 6. Percentages of HEIs over 2023–2025 who reported ‘Completed’ for three recommendations related to open methodology (2.1–2.3) from the National Roadmap for Open Science. Recommendations: 2.1 Implement operational support functions that assist researchers with secure management, storage, accessibility, and preservation of research data. The support should complement discipline-specific expertise and cover archives, libraries, publishing, accessibility, information security, legal matters, funding support, and be linked to e-infrastructure and IT functions and services. 2.2 Ensure the availability of training at the doctoral level and professional development for researchers, enabling them to acquire skills in open research methods and proper management of research data in accordance with current standards. 2.3 Ensure that undergraduate and graduate-level education includes secure open research practices as an integral part of scientific methodology.

Taken together, these findings suggest that Swedish HEIs are increasingly investing in institutional support structures for open research methods. While services that assist researchers in applying open methods have expanded substantially, education and training (particularly at undergraduate and master’s levels) remain underdeveloped. Moreover, in the absence of field-specific standards, clearer expectations for sharing, and systematic monitoring, it remains unclear to what extent protocols, workflows, software, and source code are actually being shared under FAIR-aligned open licenses.

Area 4: Open educational resources

OERs can enhance equitable access to education by lowering costs for students, fostering collaboration, and enabling reuse and adaptation to diverse learning needs. In Sweden, national priorities include developing institutional policies and guidance for OER production and use, sharing resources and metadata under FAIR-aligned open licenses, and coordinating efforts both within institutions and at the national level.

In the SUHF *Roadmap*, a dedicated recommendation for OERs was added in 2024. Overall, the recommendation stands out as having the highest share of “not started” responses of any *Roadmap* recommendation in 2025, indicating that OER remains a low-priority area for many institutions.

Already at the strategic level, reported completion is minimal: in 2025, only 3% of HEIs report having completed goals and strategies for OERs, up from 0% in 2024 (Rec. 3.1, Fig. 7). However, there are early signs of movement, with the share of HEIs initiating work increasing from 16% in 2024 to 29% in 2025 (Appendix), suggesting that OERs may be entering the institutional agenda. These findings align with the 2023 NLS survey on OER use in Sweden, which found that 78% of HEIs lack OER policy documents.

Completion rates for recommendations related to OERs

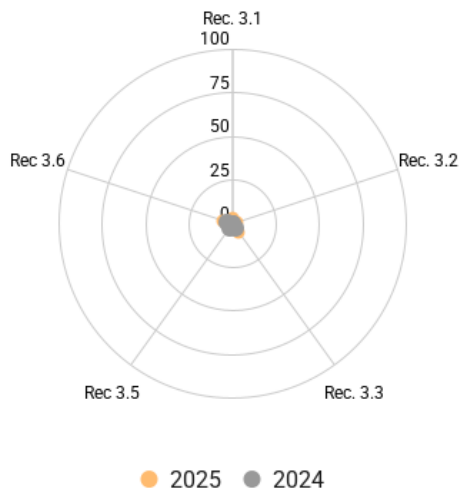


Figure 7. Percentages of HEIs over 2024–2025 who reported ‘Completed’ for five recommendations related to open educational resources (3.1–3.3, 3.5, 3.6) from the National Roadmap for Open Science. Recommendations: 3.1 Develop goals, strategies, and guidelines for open educational resources. 3.2 Implement an incentive structure that recognizes and rewards work with open educational resources, such as in merit assessments. 3.3 Begin offering support functions, services, and infrastructure that meet the needs of teachers and students for open educational resources in a resource-efficient manner. 3.5 Provide resources for the creation and sharing of open educational resources, for example, through service planning or project funding. 3.6 Actively collaborate with other institutions and stakeholders, both nationally and internationally, in the development and dissemination of open educational resources.

Because strategic attention and policy frameworks are still limited, it is difficult to assess how (or whether) these intentions translate into actual practice. No national follow-up exists to estimate how many educational resources developed in Sweden are made openly available and reused as OER. NLS’s 2023 survey indicates that local tracking at the institutional level is also sparse, with 51% of responding HEIs reporting that they do not systematically monitor OER use. Nonetheless, self-reported data do suggest some growth: the share of programs using OERs in at least half of their courses rose from 4% in 2019 to 11% in 2022 (NLS 2023), indicating that OER activity may be increasing even in the absence of strong policy frameworks or monitoring systems.

A key barrier to OER uptake in practice may be limited support available to educators and students. In 2025, only 6% of HEIs report fully providing support services and infrastructures for teachers and students (Rec. 3.3, Fig. 7), up from 3% the year before. Similarly, the provision of resources for OER creation and sharing (Rec. 3.5) remains minimal, with completion rates steady at just 3% in both 2024 and 2025 (Fig. 7). Close to half of HEIs have not started work on either recommendation (Appendix). When support

exists, it is often library-led: NLS data (2023) show 30% of HEIs report library assistance with OER dissemination and 37% rely on libraries for OER sharing.

Limited knowledge of copyright and licensing, particularly in relation to the Swedish “teachers’ exemption”, may also constrain uptake; only 3% of HEIs report having completed implementation of education on open licensing for teachers and students (Rec. 3.4, Appendix), consistent with NLS findings (2023) that copyright understanding remains a major barrier for OER uptake. Finally, the lack of recognition and reward for OER creation and reuse may further inhibit adoption: only 3% of HEIs report completion of this recommendation (Rec. 3.2, Fig. 7) in 2025, and over 70% have not yet begun implementation (Appendix).

Collaboration with other (inter)national institutions on the development and dissemination of educational resources (Rec. 3.6) also remains limited, with only 6% completion and 35% of HEIs not having started (Fig. 7 & Appendix). This aligns with NLS findings that peer-to-peer OER development remains rare, although it has increased from 10% of programs in 2019 to 27% in 2022.

Overall, our findings suggest that OER remains at an early stage of institutional implementation in Sweden, with weak strategic attention, limited monitoring, and persistent barriers to practical uptake. To move from policy to practice, HEIs will need more consistent support and infrastructure, and clearer recognition for OER creation and reuse, alongside improved national monitoring to track real progress.

Area 5: Public engagement in science

In Sweden, HEIs are legally required to pursue *den tredje uppgiften* (“the third mission”), which obliges them to engage with society beyond education and research. This mission can be realized through approaches such as citizen science, co-creation, and scientific crowdsourcing, where the public contributes to knowledge generation, research design, and dissemination. To strengthen such engagement, the *Guidelines* (NLS 2024) call on research-performing organizations to develop principles and methods for public involvement, provide researchers with methodological support and training, and coordinate with funders to promote collaboration and co-creation across disciplines.

Despite societal outreach being embedded in Swedish law, formal policy documents on public engagement appear to be sparse across HEIs. The SUHF survey does not include questions on whether institutions have policies for, or actively engage in, public engagement in science. However, the 2023 NLS survey on public engagement (NLS 2023-2) found that only two HEIs reported having formal policy documents on public engagement, suggesting that strategic commitment at the institutional level remains limited. At the same time, the same survey shows that the absence of formal policy does not necessarily preclude action: 52% of responding HEIs report that they actively pursue public engagement in science.

While formal policies provide one indication of institutional commitment, the extent to which HEIs support researchers in engaging with the public is another key factor in translating the third mission into practice. In the SUHF *Roadmap*, only one recommendation (added in 2025) explicitly addresses public engagement in science (Rec. 10.1). The recommendation aims to promote knowledge-enhancing initiatives that

ensure that principles and methods for public involvement in research are developed, well known, and established across relevant disciplines. In 2025, none of the responding HEIs report full completion of this recommendation, although 62% indicate that work has been initiated (Fig. 8). Findings from the 2023 NLS survey reinforce this picture of limited institutional support. Only 33% of responding HEIs report offering skill development opportunities to help researchers engage the public in their research, suggesting that while engagement activities do occur, structured support and capacity building remain uneven and underdeveloped.

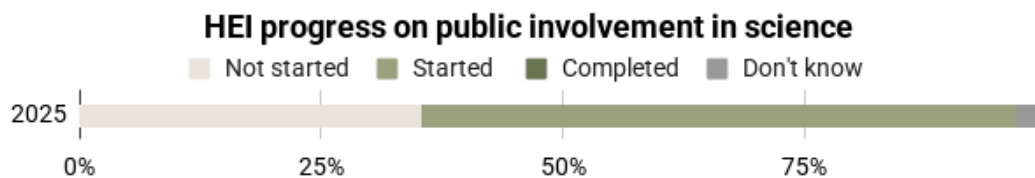


Figure 8. Proportion of HEIs in 2025 reporting the implementation status (Not started, Started, Completed, or Don't know) of one recommendation related to public involvement in science from the National Roadmap for Open Science. Recommendation: 10.1 Promote knowledge-enhancing initiatives to ensure that the principles and methods for involving the public in the research process are developed, well-known, and established across all research disciplines where relevant for data and fact collection

The SUHF Roadmap and survey data do not distinguish between different forms of public engagement, which limits the ability to assess progress in specific modes of involvement. One area where more detailed evidence is available is citizen science. The 2023 survey by Vetenskap & Allmänhet (see *Coordination instruments and monitoring mechanisms*) of 3,687 Swedish researchers shows that awareness remains limited: 56% of respondents reported that they had not heard of citizen science. Moreover, 61% of researchers reported no experience of participating in projects involving volunteer contributors, and among those with experience, public involvement was most often confined to data collection or dissemination of results rather than deeper forms of co-creation. This suggests that even where public engagement occurs, it often remains methodologically narrow and weakly integrated into research design and decision-making.

Taken together, these findings indicate that public engagement in science in Sweden is characterized by a gap between strong legal mandates and uneven institutional support. While engagement activities do take place, the lack of strategic frameworks, monitoring, and researcher training constrain more systematic and meaningful forms of public involvement.

Area 6: Infrastructures supporting open science

Infrastructures supporting Open Science, particularly (inter)national e-infrastructures, play a central role in enabling connectivity, computing capacity, and the management and sharing of data, software, and other research outputs. Swedish research relies heavily on a combination of national and international services, with SND, the Swedish University Computer Network (SUNET), and the National Academic Infrastructure for Supercomputing in Sweden (NAISS) forming the core national backbone. In addition, other national research infrastructures contribute through training, community-building

activities, and the implementation of FAIR data principles within their respective domains. The *Guidelines* (NLS 2024) emphasize coordinated funding of international Open Science infrastructures, support for non-profit OA publishing platforms, the development of infrastructures for sharing open research methods, and the adoption of common standards and technical solutions that link publications, data, and methods as priorities.

At the institutional level, progress in developing e-infrastructures that meet researchers' needs appears underway. The SUHF survey assesses whether HEIs provide secure, needs-adapted e-infrastructures for managing research data throughout the research lifecycle (Rec. 5.1). In 2025, 12% of HEIs report full completion of this recommendation (Fig. 9), an increase of six percentage points compared with 2024. 76% of HEIs report that work is initiated (Appendix), indicating that many institutions are in early or transitional phases of implementation rather than having established mature, fully operational solutions.

Progress is more limited when it comes to interconnectivity between research-supporting services, a priority highlighted in the *Guidelines*. No HEIs report completion of national interconnectivity between services such as e-archives, data management plan tools, and electronic lab notebooks (Rec. 5.2) in any of the three survey years (Fig. 9). In 2025, approximately three quarters of HEIs indicate that work on this recommendation has not yet begun (Appendix), suggesting that integration across services is not yet a strategic focus at most institutions.

Similar constraints are evident at the international level. The integration of research support services into a coherent, secure digital infrastructure with sustainable governance and international connectivity (Rec. 5.3) remains very limited. In 2025, only 3% of HEIs report completion of this recommendation (Fig. 9), a level unchanged since 2024. Across all three survey years, around 40% of HEIs report that they have not initiated work (Appendix), indicating that international interoperability and coordination are largely treated as peripheral rather than core components of institutional infrastructure strategies.

Completion rates for recommendations related to Open Science infrastructures

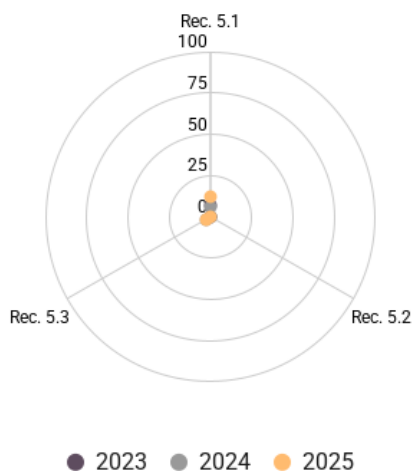


Figure 9. Percentages of HEIs over 2023–2025 who reported ‘Completed’ for 3 recommendations related to Open Science infrastructures, (5.1–5.3) from the National Roadmap for Open Science. Recommendations: 5.1 Ensure that the institution provides a secure e-infrastructure tailored to researchers’ needs, with workflows, support, and guidance for the proper and secure handling of research data. This includes storage, sharing, analysis resources, long-term preservation, and accessibility. The choice of service providers should be based on research needs, with decisions made at a strategic level. 5.2 Include and, where appropriate, interconnect or create interoperability between more research-supporting services within the institution’s IT architecture, such as links between e-archives, data management plans, and electronic laboratory notebooks. 5.3 Integrate research-supporting services and guidance into a cohesive, secure digital infrastructure with long-term funding and governance. Ensure that these services can connect to national and international digital infrastructures through coordination and collaboration.

The limited progress observed across the infrastructure-related recommendations above may be explained by a lack of dedicated institutional investment. Reported completion for Rec. 5.4, which was added to the survey in 2025 and focuses on HEIs’ contribution to the development and funding of infrastructures that support Open Science, is only 9% (Appendix).

Overall, the development of e-infrastructures supporting Open Science in Sweden remains uneven and slow, with limited maturity at the institutional level and relatively weak coordination both nationally and internationally.

Additional area 7: Research assessment reform

One important dimension of Open Science that is not addressed as an area in the *Guidelines*, and is largely absent from existing national monitoring frameworks (apart from the *SUHF Roadmap*), is research assessment reform. We therefore include research assessment reform as a seventh area of analysis, as – like the other areas discussed above – it represents a systemic change that must be implemented across the academic system to enable meaningful progress in Open Science. Reforming research assessment entails a shift away from narrow, metric-driven evaluations toward broader criteria that

recognise a wider range of research contributions, including open science practices, quality, and societal relevance.

Results from the SUHF survey show that reform of research assessment practices remains at an early stage across Swedish HEIs. For the core recommendation to revise merit assessment criteria in line with Open Science (Rec. 8.1a), no HEIs report full completion in any survey year (Fig. 10). Progress is nevertheless visible: the share of institutions that have initiated work increased from 28% in 2023 to 53% in 2025 (Appendix). Reform work is likely actualized through engagement with international reform initiatives. At the time of writing, 37 Swedish entities (HEIs, research infrastructures, funders, and non-profit organisations) have signed the *Agreement on reforming research assessment* by the Coalition for Advancing Research Assessment (CoARA) (Arentoft et al, 2022). Signatories commit to developing and implementing action plans for reform. Reflecting this, 29% of HEIs report having completed SUHF *Roadmap* Rec. 7.3 (signing CoARA and implementing internal measures in line with its principles, Appendix) in 2025, while a further 35% report that work is underway, presumably through the development and implementation of action plans (Appendix).

CoARA currently appears to be the primary vehicle for advancing research assessment reform in Sweden, as uptake of other international assessment initiatives remains limited. In 2025, only 6% of HEIs report having signed and implemented the San Francisco Declaration on Research Assessment (DORA 2012; Rec. 7.2, Appendix). The recent 2024 Barcelona Declaration on Open Research Information (Rec. 7.4) shows just 3% reporting completion (Appendix), but uptake may increase in the coming years.

Completion rates for recommendations related to research assessment reform

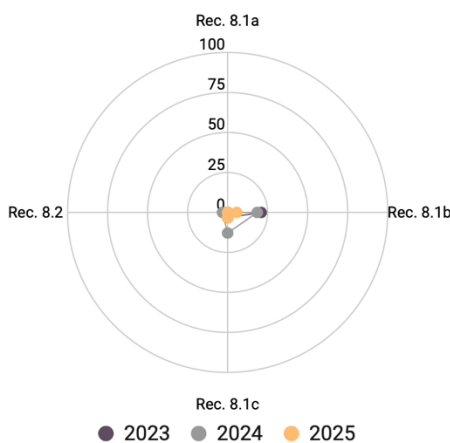


Figure 10. Percentages of HEIs over 2023-2025 who reported 'Completed' for 4 recommendations related to research assessment reform, (8.1a-c-8.2) from the National Roadmap for Open Science. Recommendations: 8.1a Revise merit assessment criteria in line with open science; 8.1b Develop research support services for quality control; 8.1c Provide support to experts in assessments to implement the institution's policies; 8.2 In dialogue with researchers and research funders, develop new assessment methods that respect disciplinary diversity and have effective follow-up

Moving beyond formal commitments to the practical implementation of assessment reform appears challenging. In 2025, completion rates for developing research support

services for quality assurance in assessment processes (Rec. 8.1b) and for providing support to assessment experts to implement institutional policies (Rec. 8.1c) remain very low, at 6% and 3% respectively (Fig. 10). Progress is even more limited when it comes to the development of new assessment methods that respect disciplinary diversity and enable effective follow-up (Rec. 8.2), for which no HEIs report completion in 2023 and 2025, and approximately half report that work has not yet begun.

Taken together, these findings indicate that while engagement with research assessment reform is increasing, primarily through participation in CoARA, substantive changes to assessment practices have yet to materialise. This lack of operational implementation risks constraining the broader uptake of Open Science practices that depend on aligned incentive and reward systems.

Discussion

In this analysis, we have examined how Sweden's national Open Science ambitions are being translated into institutional practice. Drawing on data from the 2023–2025 SUHF *Roadmap for Open Science* surveys, complemented by findings from other national monitoring efforts, our analysis mapped progress across the six priority areas defined in the *National Guidelines for Open Science* (NLS 2024), plus an additional priority area. Our analysis has several limitations. The primary data source is self-reported HEI responses, which may introduce optimism bias, inconsistent interpretation of response categories, and limited external validation. Complementary national reports from the NLS, SRC, and VA provide useful context but differ in scope, methodology, and timing, limiting precise cross-study comparisons. The SUHF survey and analysis also focuses on institutional implementation rather than individual researcher behaviour or disciplinary practices, making it difficult to assess whether policies translate into everyday academic workflows. Disciplinary diversity further complicates interpretation, as openness is enacted differently across fields. Despite these constraints, the analysis offers a valuable system-level overview of progress and challenges in Sweden's transition towards Open Science and offers useful insights into ongoing developments.

In summary, our analysis shows that, despite a clear and ambitious Open Science policy framework, practical implementation remains slow and uneven, due to a persistent gap between policy objectives and everyday research practice. Across all seven areas, progress is characterised by partial implementation and fragmentation. HEIs report substantial advances in policy development and compliance-oriented measures (most notably in OA and research data management) but these advances have not consistently translated into measurable outcomes, such as reduced reliance on hybrid publishing or increased sharing of FAIR research data. In several areas, including open research methods, OER, public engagement, and research infrastructures, limited monitoring, weak incentives, and insufficient training seem to constrain practical uptake.

Taken together, the findings suggest that the core challenge for Open Science in Sweden lies not in the absence of policy frameworks, but in the “last mile” of sustained and coordinated implementation. The following discussion therefore focuses on barriers that help explain the policy–practice gap, and on the actions required to move from

formal commitments toward more consistent and sustainable Open Science implementation.

Structural barriers to Open Science implementation in Sweden

Infrastructure and governance

A central factor contributing to the policy–practice gap is the fragmented governance and uneven development of Open Science infrastructures in Sweden. Although national guidelines and institutional strategies are in place, responsibility for implementation within HEIs is typically distributed across libraries, IT services, research offices, and faculties, with limited overarching coordination. In the absence of clear governance structures and long-term mandates, institutions tend to rely on ad hoc and project-based solutions that are difficult to scale and often fail to support researchers throughout the full research lifecycle.

This fragmented approach is reflected in the slow development of e-infrastructures and weak interoperability between core systems such as repositories, DMP tools, and electronic lab notebooks. These shortcomings have direct implications for researchers' access to secure, sustainable solutions for data storage and management. While national actors such as SUNET, SND, and NAISS play a critical role in providing infrastructure and services, their offerings do not consistently bridge institutional gaps or fully address lifecycle needs, thereby limiting Sweden's ability to align with international Open Science standards and initiatives.

Coordination between institutions and across national agencies is also minimal, meaning that cross-cutting issues frequently fall between institutional remits and remain unaddressed. When each agency monitors progress only within its own mandate, systematic follow-up of the *National Guidelines for Open Science* as a whole is lacking, making it difficult to identify shared bottlenecks or to address challenges that require coordinated action.

Support, skills and training

A second key barrier explaining the policy–practice gap is the limited and uneven provision of training, support, and competence-building for Open Science across Swedish HEIs. While many institutions report establishing services and support structures, these efforts often remain fragmented, under-resourced, or concentrated in specific disciplines or researcher levels. As a result, researchers may lack the practical skills and institutional guidance needed to translate policies into day-to-day practices.

Incentives and research assessment

A third major factor creating a barrier to translating Open Science policy into practice is the lack of recognition of open practices in research assessment and career progression. Although many HEIs have formally endorsed research reform declarations (mainly CoARA), these principles are not yet embedded in promotion criteria, evaluation practices, or reward systems across institutions. As a result, researchers and research

support staff have limited motivation to prioritise open practices, particularly in areas such as method sharing, OERs, and public engagement.

Actions for sustainable Open Science implementation in Sweden

Define a shared national vision and measurable objectives

To address the current fragmentation of responsibilities and to ensure consistent Open Science implementation in Sweden, all actors – government, agencies, funders, and HEIs – must commit to a shared and clearly defined national vision of Open Science that goes beyond aspirational statements. This vision should be grounded in measurable objectives and supported by systematic follow-up and monitoring, enabling progress to be tracked consistently across institutions and over time (e.g., monitoring FAIR data sharing, OER creation and reuse, method sharing and infrastructure maturity).

A key step in achieving this shared vision is to consolidate and harmonise existing policy documents. In doing so, it is essential to emphasise the core enablers of Open Science: OA to publications, open research data, and training and education. Securing these foundations is a prerequisite for advancing the broader Open Science agenda. All involved actors need to ensure that this shared vision and policy is treated as a central priority rather than a peripheral task.

To strengthen collective commitment and capacity, structured exchanges of experience should be facilitated between public officials engaged in Open Science at HEIs, research funders (public and private), and expert authorities. Such exchanges would also provide smaller organisations with limited resources greater capacity to engage effectively in Open Science.

Build robust and coordinated infrastructures

With a shared vision and policy framework established, Open Science implementation hinges on the availability of robust, coordinated, and sustainable research infrastructures that are aligned across the national system. The need for improved coordination and development of e-infrastructure for research in Sweden has been highlighted repeatedly over the last decade, and there is a pressing need for organisational reform to avoid further fragmentation and overlap. Both the SRC and HEIs have presented proposals for reform, and it is now imperative that HEIs, the SRC, and the Government assume shared responsibility to agree on the most suitable organisational model and begin implementation without delay. A coordinated national infrastructure organisation would significantly strengthen Sweden's capacity to deliver scalable, interoperable, and researcher-centred Open Science services. In some areas, concrete steps are already underway: a national working group has been established to advance coordination efforts related to OER, including the development of a national platform for sharing and finding OER, representing a promising example of emerging infrastructure.

Regarding government mandates in Open Science (for example, NLS's role in coordinating OA work and SRC's role in open research data), coordination between expert agencies must be strengthened and clarified. National research infrastructures

and other specialised agencies where substantial technical, organisational, and community-building capacity is already being developed should be systematically engaged in these national coordination efforts.

Secure sustained investment and capacity

Beyond vision and coordinated infrastructure, sustained Open Science implementation requires long-term financial and human resource commitments. HEIs must therefore make explicit, long-term prioritisation decisions. University leadership has a central responsibility to allocate dedicated resources for Open Science and to embed these activities into core operations, rather than treating them as time-limited or project-based initiatives. Crucially, researchers must be given sufficient time and support to integrate Open Science practices into their everyday academic work, which requires adjustments to workload models and career structures.

Research funders play an equally critical role in enabling this transition. Funding mechanisms should clearly allow researchers to allocate resources for Open Science activities and should cover the full research lifecycle, including data stewardship, publication, and long-term accessibility of research outputs. To ensure effective use of public research funding and high-quality data management, the SRC should require researchers to publish research data through institutional, national, or international infrastructures where possible, and to make FAIR metadata publicly available when data sharing is restricted.

Finally, sustained investment must be coupled with expectations for good practice. Integrating infrastructure use and Open Science requirements already at the project planning stage, and systematically following up in final reports against FAIR standards, DOI use, and OA requirements, would strengthen data quality, traceability, and reusability, and help translate financial commitments into lasting structural change.

Develop skills and training across the research lifecycle

Open Science is realised in everyday research practice. Even where governance, infrastructure, and funding are in place, successful implementation depends on researchers having the awareness and skills needed to apply open practices in their work. Effective implementation of Open Science therefore requires systematic education and training at all stages of the research career. Training must go beyond basic awareness and include practical competencies in areas such as research data management, open research methods, public engagement, and FAIR implementation. These skills should be embedded across undergraduate, master's, doctoral, and postdoctoral education, as well as in continuous professional development for established researchers and research support staff.

OERs offer a strategic opportunity to strengthen training across disciplines. Unlike many research outputs, educational and lifelong learning resources share common features across fields, making OER development and reuse more readily scalable. At the same time, OERs can function as concrete and visible examples of the benefits of openness, helping to demonstrate its value in teaching, learning, and scholarly communication.

To ensure effective uptake, education and training must be paired with active implementation support and continuous guidance, for example through communities of practice or dedicated support roles. Without practical tools and sustained institutional backing, even well-designed training initiatives risk remaining disconnected from daily research practice.

Align incentives and assessment

Aligning incentives and research assessment is arguably the most critical condition for successful Open Science implementation, as researchers operate under severe time constraints and are unlikely to prioritise practices that are not recognised or rewarded. Incentives must therefore shift the culture of academia so that openness is not treated as an additional task, but as a core dimension of scholarly excellence.

University leadership has a central responsibility to move beyond formal endorsement of reform declarations (e.g. CoARA) and to embed Open Science principles into recruitment, promotion, and assessment criteria. This includes recognising and rewarding a broad range of open practices, such as data and software sharing, reproducible methods, open peer review, the development of OERs, and public engagement. For lasting impact, these principles must be applied consistently across all career stages and institutional roles.

Research funders also play a decisive role in shaping incentives. Funding calls and grant evaluation processes must explicitly value Open Science practices and require clear plans for openness, including data management, FAIR principles, and open dissemination of outputs. By integrating Open Science into assessment criteria and funding conditions, funders can align researchers' incentives with national policy goals and accelerate adoption across the system.

Concluding perspective

A successful transition to an Open Science system will require more than policy documents, strategies, and formal commitments; it will require genuine culture change. Open Science must become embedded in everyday academic practice, rather than remaining a compliance exercise or a set of aspirations. This transformation depends on visible leadership and sustained institutional effort, supported by broad academic dialogue and collaboration across the entire system. Bottom-up initiatives must be actively encouraged and reinforced by clear incentives, consistent training, and shared responsibility at all levels. Acknowledging and applying the core principles of the *Roadmap*, while thoughtfully adapting them to institutional contexts, remain essential steps toward building a sustainable, interoperable, and genuinely Open Science ecosystem in Sweden.

If decisive action is not taken, Sweden risks falling behind internationally and failing to deliver on the transparency and societal benefits promised by Open Science. However, Sweden can still position itself as a global leader in open, collaborative research. After a decade of policy initiatives and roadmaps, the critical question is whether the coming decade will finally move beyond commitments to sustained, measurable practice.

CRedit contribution statement

Conceptualization: Sabina Anderberg, Jessica M. Lindvall

Data curation: Sabina Anderberg, Ineke Luijten

Formal analysis: Ineke Luijten

Methodology: Sabina Anderberg, Ineke Luijten

Visualization: Ineke Luijten

Writing – original draft: Sabina Anderberg, Ineke Luijten, Jessica M. Lindvall

Writing – review and editing: Sabina Anderberg, Ineke Luijten, Hans O. Karlsson, Elin Kronander, Merlijn de Smit, Eva Stensköld, Jessica M. Lindvall

References

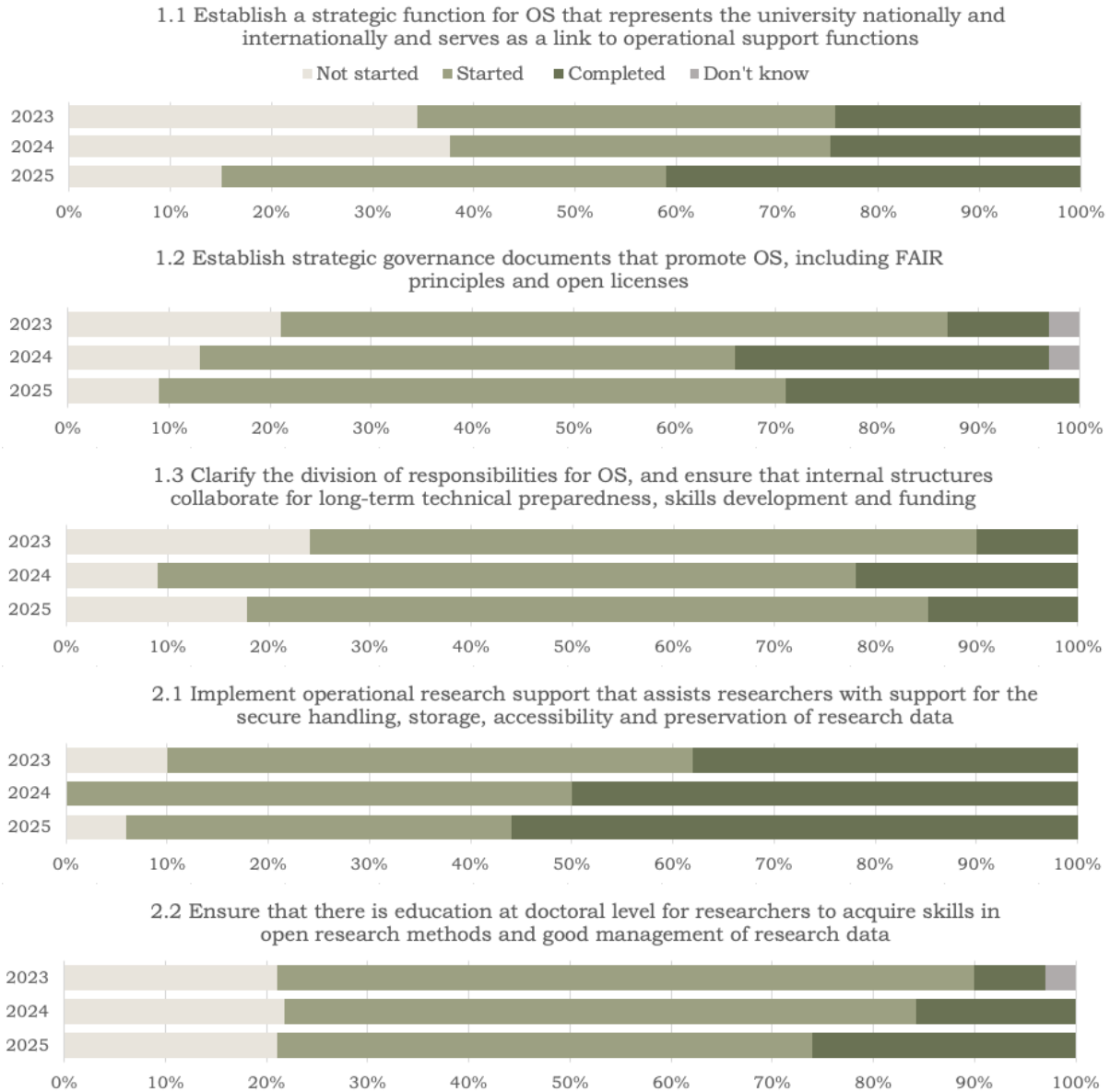
- Anderberg, S. (2022). "An Open Science Roadmap for Swedish Higher Education Institutions", Nordic Perspectives on Open Science, 7. <https://doi.org/10.7557/11.6253>
- Arentoft, M., Berghmans, S., Borrell-Damian, L., Bottaro, S., Faure, J.-E., Gaillard, V., Glinos, K., Albacete, J. L., Morais, R., Morris, J., Schiltz, M., & Stroobants, K. (2022). Agreement on Reforming Research Assessment. Zenodo. <https://doi.org/10.5281/zenodo.13480728>
- Barcelona Declaration on Open Research Information, Kramer, B., Neylon, C., & Waltman, L. (2024). Barcelona Declaration on Open Research Information (1.0). Zenodo. <https://doi.org/10.5281/zenodo.10958522>
- BIBSAM Consortium (2023). *Charting Sweden's path beyond transformative agreements – Analysis and proposals for strategic direction*.
- European Commission. (2012). *Commission Recommendation of 17 July 2012 on access to and preservation of scientific information* (2012/417/EU). *Official Journal of the European Union*, L 194, 39–42.
- Luijten, I., & Anderberg, S. (2025). Analysis of SUHF National Roadmap for Open Science Annual Survey 2023–2025 [Dataset]. <https://doi.org/10.5281/zenodo.17234124>
- National Library of Sweden (NLS) (2023). *Open Educational Resources: survey and analysis*. Dnr KB 2023-1069. ISBN: 978-91-7000-479-7
- National Library of Sweden (NLS) (2023-2). *Public engagement in science: survey and analysis*. Dnr KB 2023-1228. ISBN: 978-91-7000-480-3.
- National Library of Sweden (NLS) (2024). *National guidelines for Open Science*. Dnr KB 2024-42. ISBN: 978-91-7000-492-6
- National Library of Sweden (NLS) (2024-2). *Samordning av arbete för öppen tillgång till vetenskapliga publikationer*. Dnr KB 2024-790; ISBN 978-91-7000-490-2
- National Library of Sweden (NLS) (2025). *Samordning av arbete för öppen tillgång till vetenskapliga publikationer*. Dnr KB 2025-395; ISBN 978-91-7000-505-3
- Regeringskansliet (1992). *Högskolelag*, 1992:1434. Stockholm: Utbildningsdepartementet
- Regeringskansliet (2016). *Kunskap i samverkan - för samhällets utmaningar och stärkt konkurrenskraft*, Prop. 2016/17:50. Stockholm: Utbildningsdepartementet
- Regeringskansliet (2020). *Forskning, frihet, framtid - kunskap och innovation för Sverige*, Prop. 2020/21:60. Stockholm: Utbildningsdepartementet
- Regeringskansliet (2024). *Forskning och innovation för framtid, nyfikenhet och nytta*, Prop. 2024/25:60. Stockholm: Utbildningsdepartementet
- San Francisco Declaration on Research Assessment. (2012). *The San Francisco Declaration on Research Assessment (DORA)*. <https://sfedora.org>
- SND (2025). *Orienteringskartan. Verktyg för att planera och utvärdera arbete med öppen vetenskap*. <https://doi.org/10.5281/zenodo.14678994>
- SUHF (2018). *Hantering av forskningsdata - status vid de svenska lärosätena*. Dnr 0005-17.

- SUHF (2019). [Forskningsdatahantering - inventering 2019](#). Dnr 0005-17
- SUHF (2020). [Forskningsdatahantering - inventering 2020](#). Dnr 0005-17
- SUHF (2021). [Forskningsdatahantering - inventering 2021](#). Dnr SU-850-0005-17
- SUHF (2021; rev. 2025). [Roadmap for Open Science with Action Proposals for Implementation](#). REC 2021:1. Dnr SU-850-005-17.
- SUHF (2022). [Forskningsdatahantering - inventering 2022](#). Dnr SU-850-0005-17
- SUHF (2023). [Sammanställning enkät 2023](#). Presentation
- SUHF (2024). [Sammanställning enkät 2024](#). Presentation
- SUHF (2025). [Sammanställning av SUHF enkät 2025](#). Presentation
- Swedish Research Council (Vetenskapsrådet). (2015) [Proposal for national guidelines for open access to scientific information](#) (Dnr 1.1.2-2015-8). Stockholm: Swedish Research Council. ISBN 977-91-7307-263-2.
- Swedish Research Council (Vetenskapsrådet) (2024). [Öppen tillgång till forskningsdata 2024 - en kartläggning, analys och bedömning](#). Dnr 5.2-2024-06211; ISBN 978-91-89845-18-3
- Swedish Research Council (Vetenskapsrådet) (2025). [Öppen tillgång till forskningsdata 2025 - en kartläggning, analys och bedömning](#). Dnr 2025-06741; ISBN 978-91-89845-35-0
- UNESCO. (2021). *Recommendation on Open Science* (SC-PCB SPP/2021/OS/UROS). <https://doi.org/10.54677/MNMH8546>
- Vetenskap & Allmänhet (VA) (2023). [Medborgarforskning – en kunskapsöversikt](#). VA-rapport 2023:1. ISSN: 1653-6843. ISBN: 978-91-89039-19-3.

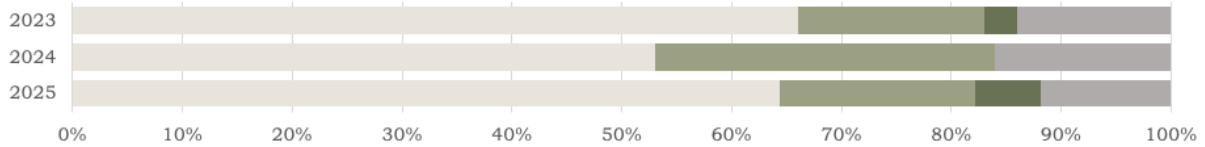
Appendix: Full analysis of reported progress across the SUHF Roadmap for Open Science

Stacked bar graphs showing the proportion of HEIs reporting the implementation status (Not started, Started, Completed, or Don't know) for each recommendation in the National Roadmap. Recommendation titles may be shortened; full titles are available in SUHF (2021; rev. 2025).

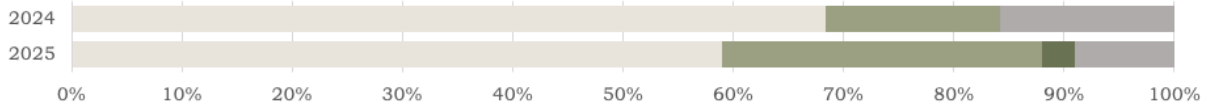
Abbreviations: OS = Open Science; HEIs = Higher Education Institutions; FAIR = Findable, Accessible, Interoperable, Reusable; OERs = Open Educational Resources; EOSC = European Open Science Cloud; EOSC-A = EOSC Association; SND = Swedish National Data Service; DORA = San Francisco Declaration on Research Assessment; CoARA = Coalition for Advancing Research Assessment



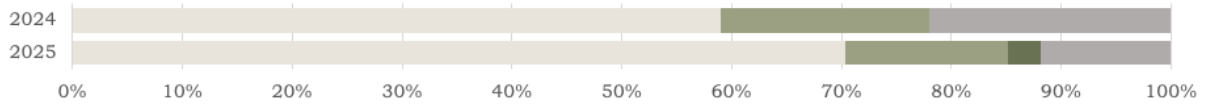
2.3 Ensure that undergraduate and graduate education includes safe open research practices as an integral part of scientific methodology



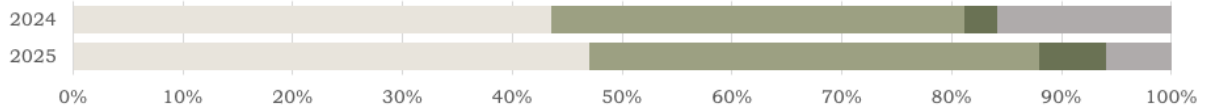
3.1 Develop goals, strategies and guidelines for OERs



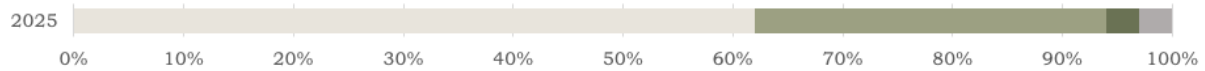
3.2 Implement an incentive structure that values and rewards work with OERs, for example in merit assessments



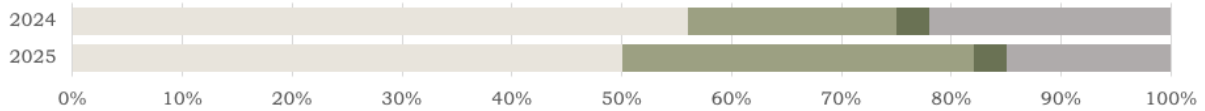
3.3 Begin work on offering support functions, services and infrastructure that meet teachers' and students' needs for OERs



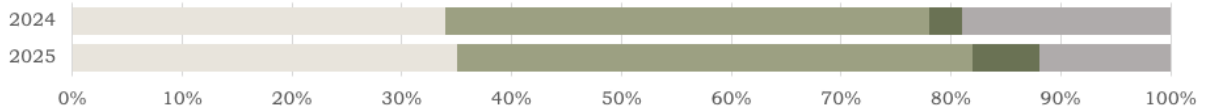
3.4 Educate and inform about how open licenses can strengthen teachers' and students' ability to protect and control the copyright of their educational resources



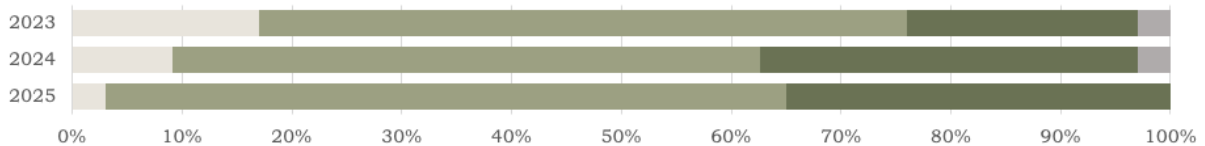
3.5 Provide resources for the creation and sharing of OERs, for example through service planning or project funds



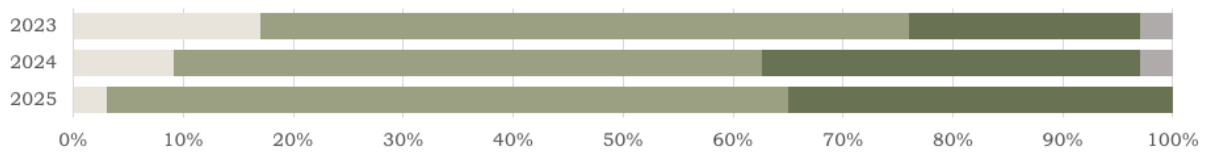
3.6 Actively collaborate with other HEIs and stakeholders, both nationally and internationally, in the work of developing and disseminating OERs



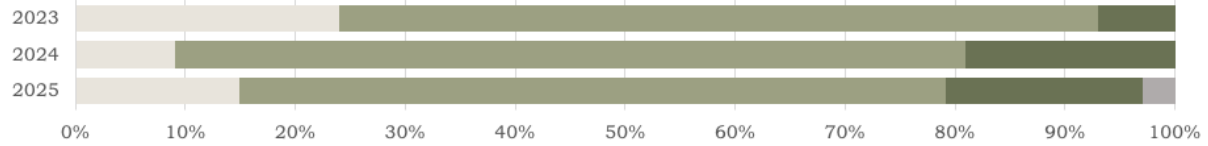
4.1 Implement data management plans for research projects



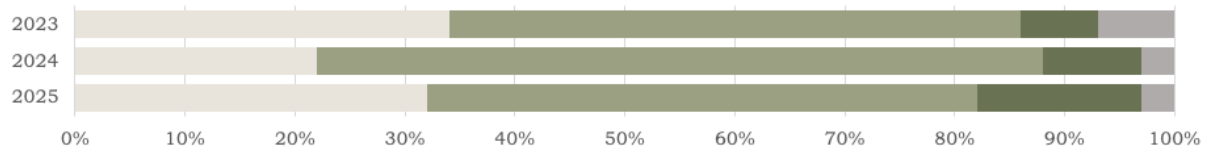
4.1 Implement data management plans for research projects



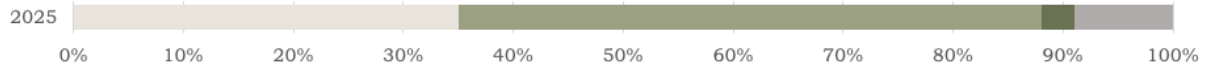
4.2 Deepen researchers' understanding of the FAIR principles and increase their knowledge of how they can be applied



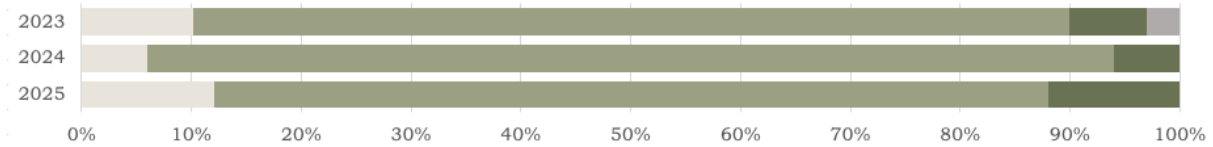
4.3 Establish forums for knowledge exchange, idea development and discussions about OS within research activities



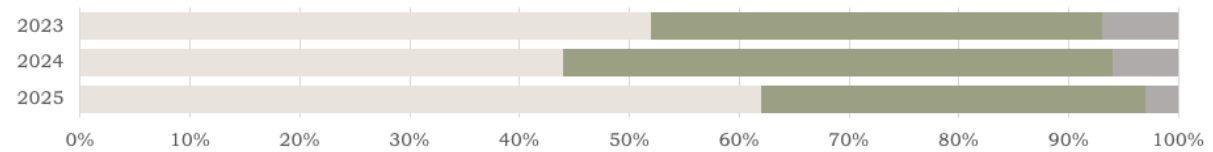
4.4 Research data and source code produced in research are made openly available as openly as possible and as restricted as necessary



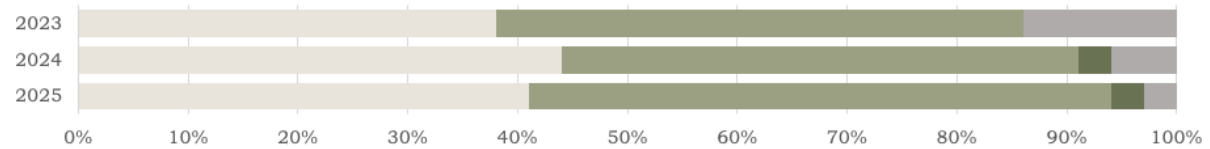
5.1 Ensure that the HEI offers a needs-adapted secure e-infrastructure with work processes, support and advice for good and secure management of research data



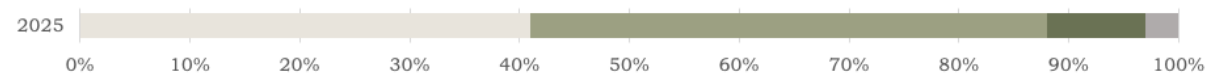
5.2 Include and, where appropriate, interconnect or create interoperability between more research-supporting services in the university's IT architecture



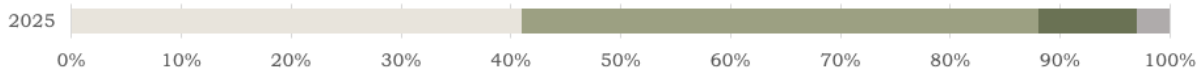
5.3 Integrate research support services and consultancy into a coherent, secure digital infrastructure with long-term funding and governance.



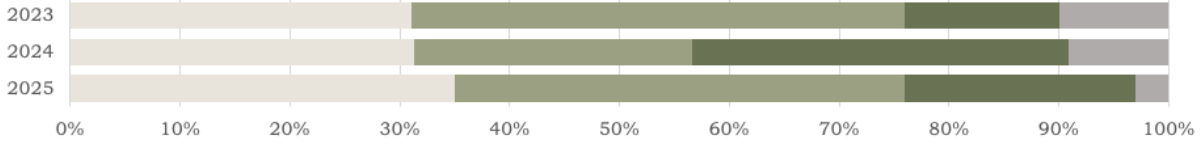
5.4 Contribute to the development and financing of infrastructures that support OS



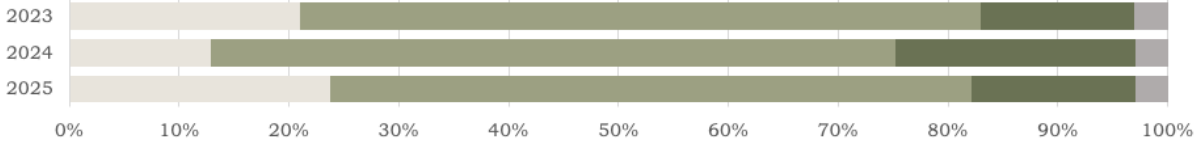
5.4 Contribute to the development and financing of infrastructures that support OS



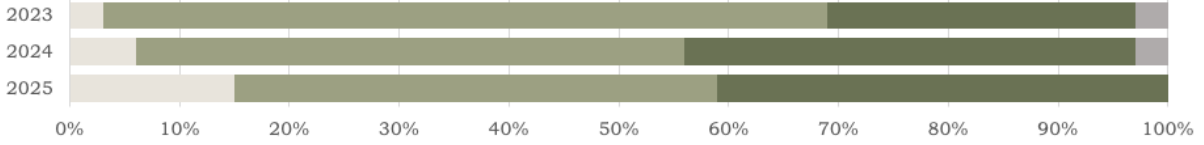
6.1a Develop and actively pursue cooperation between HEIs and other actors to ensure good access to resource-efficient and effectively utilized e-infrastructure



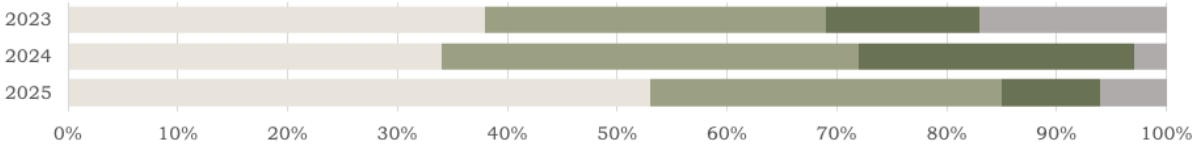
6.1b Deepen collaboration between HEIs on policy development, creating and sharing OERs, and developing and implementing joint education and technical solutions



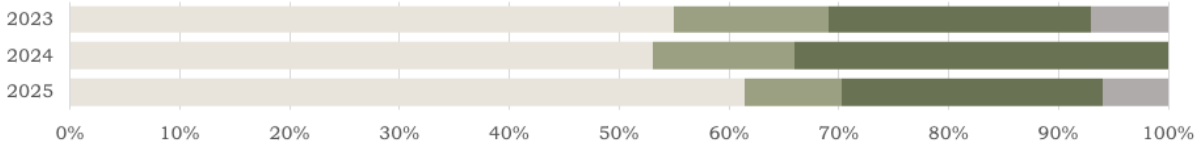
7.1a Actively follow international developments in OS and digital infrastructure, especially within EOSC



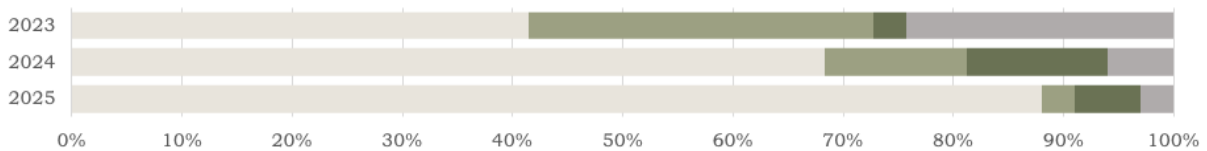
7.1b Strategically assess participation in international projects both individually and through national consortia such as SND and other national infrastructures



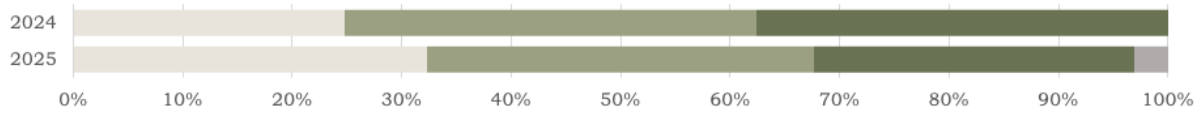
7.1c Join the member organization EOSC-A to influence and contribute to developments within Europe



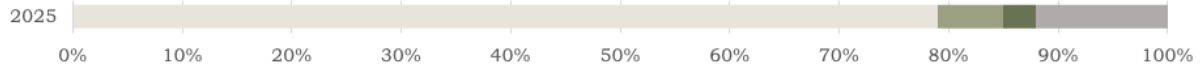
7.2 Sign DORA and implement internal measures in line with its principles



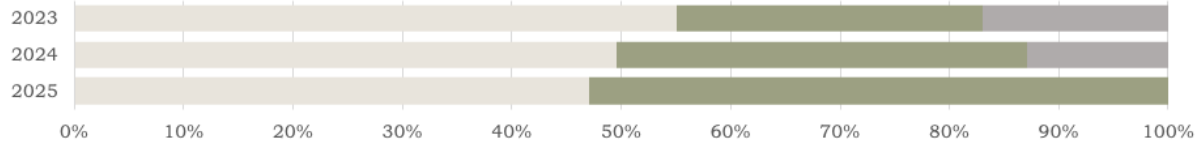
7.3 Sign CoARA and implement internal measures in line with its principles



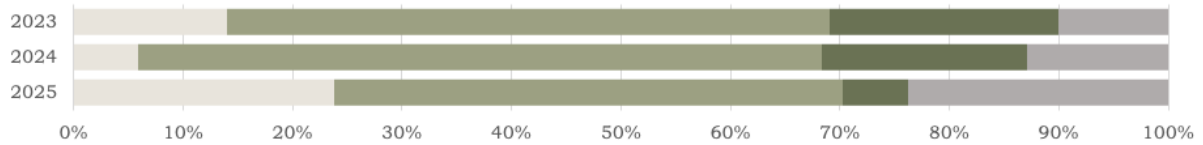
7.4 Sign The Barcelona Declaration and implement internal measures in line with its principles



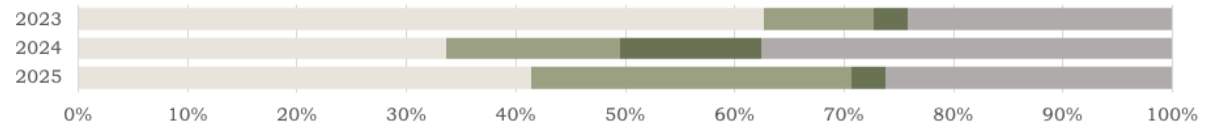
8.1a Revise merit assessment criteria in line with OS



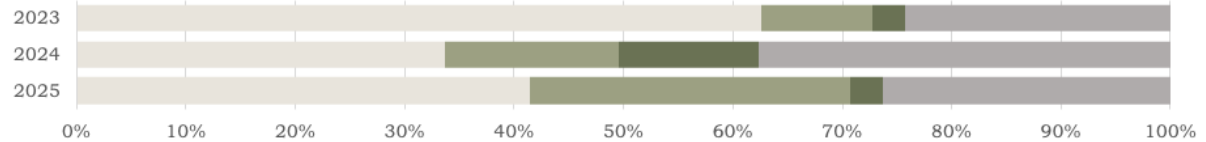
8.1b Develop research support services for quality control



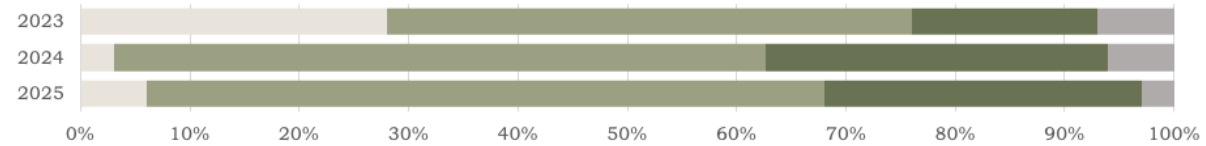
8.1c Provide support to experts in assessments to implement the institution's policies



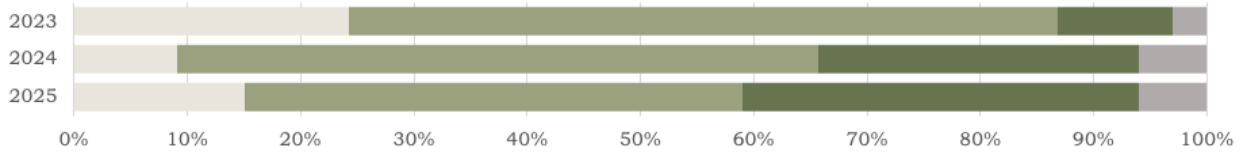
8.2 In dialogue with researchers and research funders, develop new assessment methods that respect disciplinary diversity and have effective follow-up



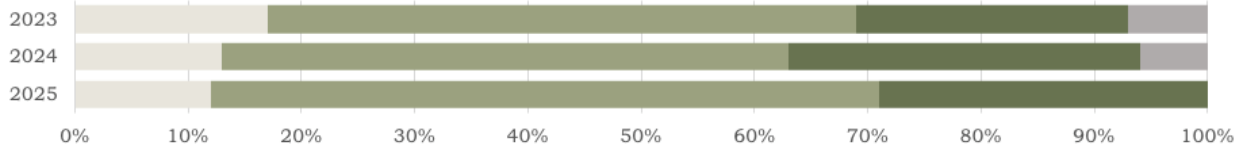
9.1 Actively support a transition to a publishing landscape where subscription and hybrid publishing agreements are gradually phased out



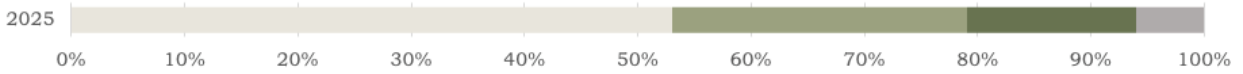
9.2 Provide clear guidance on licensing of research results, so that researchers can publish without using publishers' paid services for making data available



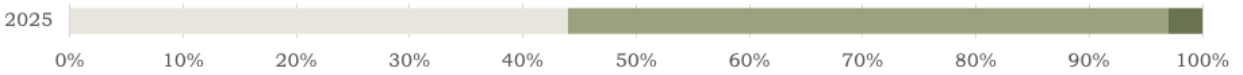
9.3 Promote knowledge about academic ownership of scholarly communication, so that researchers and their institutions retain copyright instead of contracting it out



9.4 Develop the strategic steering documents for open scientific publishing to also include and particularly highlight publication types in longer formats such as books



9.5 Promote the development of open publishing platforms with peer review and FAIR principles, where publication costs are not burdened by authors or readers



10.1 Promote knowledge-raising efforts so that principles and methods for how the public can be involved in the research process are developed, known and established

