

D 2.1 Open science policies and resource provisioning in the Nordic and Baltic countries (first report)

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Abstract:

The EOSC-Nordic project's D2.1 deliverable provides a first assessment of the status of Open Science policies and provisioning of infrastructure resources in the Nordic and Baltic countries, and makes a comparison between the situation in the participating countries.



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Executive summary

As of 2016, the European Commission organises its Open Science policy according to eight ambitions, one of which is to create a federated ecosystem of research data infrastructures allowing researchers, communities, citizens and scientists to share and process publicly funded research results and data across borders and scientific domains.¹ The European Open Science Cloud (EOSC) is foreseen to provide this federated ecosystem. To achieve this aim, efforts through a number of projects are made to understand the state of play, maturity, timelines, conformity and divergence respectively with common EU guidelines for Open Science. In order to support the European Commission in the work related to mapping the state of play regarding Open Science, the EOSC-Nordic project has performed desktop studies examining Open Science policies across the Nordics and Baltics.

The EOSC-Hub project aims to form a single contact point for European researchers and innovators to facilitate discovery, access, use and reuse a broad spectrum of resources for advanced data-driven research.² Different national regulations govern the use of aforementioned horizontal IT-resources for data-driven research. The horizontal IT-services services chosen for the desktop studies in this report were limited to nationally available basic horizontal IT-infrastructure, compute and storage, funded by national funders. It is essential to understand the different national processes governing the access to resources, and to facilitate the potential development of common approaches to access policies and resource provisioning. Understanding access and resource provisioning principles is essential to facilitate the vision of EOSC-Hub.

The studies within this report describe the state of play regarding Open Science and resource provisioning and access policies addressing similarities and differences across the Nordics and the Baltics.

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https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_factsheet-open-science_2019.pdf

² <https://www.eosc-hub.eu/about-us>

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1. Introduction

The aim of this deliverable is to provide a first assessment of the status of Open Science policies and provisioning of infrastructure resources in the Nordic and Baltic countries.

To note is that this deliverable is produced at a time when the EOSC Executive Board Working Groups (EOSC WG) are in the process of producing the EOSC guidelines. As such this first report will not offer a roadmap on how the Nordic and Baltic countries can align with EOSC, as no guidelines are available at the time of this report.

Within the frame of the EOSC-Nordic Work Package 2, participants from the organizations SNIC, CSC, UEF, FMI, SIGMA2, UT/ETAIS, DeIC, UICE, RTU, and NORDUnet, have during September 2019 - February 2020 performed desktop studies of Open Science policies as well as resource provisioning and access policies in the Nordic and the Baltic countries.

As desktop studies and previous inventories performed by OpenAIRE³ and Nordforsk⁴ detail the Open Science policies in the Nordic and the Baltic countries, this report provides an update of the previous inventories. Furthermore, it complements previous inventories with desktop studies of the status of Open Science within higher education institutions (HEI) and funders in the Nordic and the Baltic countries.

1.01 Key findings

Within the Nordic and Baltic region, the maturity in regard to implementation of Open Science ranges from countries having laws in place governing the implementation of Open Science to countries being in the early stages of adopting national strategies and plans for the implementation of Open Science. The desktop studies made in order to produce this report show that in countries, where a national Open Science policy has yet to be established, some Higher Education Institutes (HEIs) and funders have established open access policies and to a lesser extent open data policies.

In regard to resource provisioning and access policies a finding is that horizontal IT-services are not available in all countries in the Nordic and Baltic countries. Mostly the access to horizontal IT-resources is solely for academic use, however, one country is offering horizontal IT-resources for commercial usage also. Regarding resource provisioning policies, the desktop studies performed show that principles throughout the Nordics and Baltics differ, ranging from access requiring technical and scientific review to access being granted on demand.

1.1 Comparative assessment of Open Science and resource provisioning policies in the Nordics and the Baltics

This section provides an assessment of Open Science and resource provisioning and access policies within the Nordics and Baltics focusing on similarities and differences.

³ <https://www.openaire.eu/>

⁴ https://www.nordforsk.org/en/publications/publications_container/state-o-open-science-in-the-nordic-countries/view

1.2 Open Science

Regarding Open Science, the desktop studies show that within the Nordics and Baltics progress regarding implementation of Open Science ranges from some countries having policies in place to some countries being in early stages of adopting national timelines and policies for implementation of Open Science. Denmark, Finland, Estonia, and Sweden have published guidelines. Iceland, Latvia, Lithuania, and Norway are at different stages of formulating national policies and strategies. As such, the transition towards Open Science is ongoing in some countries while some countries are formulating strategies regarding the transition towards Open Science.

Regarding the actors involved in the implementation of Open Science, ministries are involved in formulating policies in Denmark, Estonia, Finland, Latvia, and Norway. In Sweden, Iceland and Estonia, the respective research councils are involved in formulation of policies and roadmaps related to Open Science. National libraries are involved in the implementation of Open Science Policies in Estonia, Sweden and Iceland. Scientific societies are involved in Estonia and Finland.

The desktop studies also show that in some countries where a national Open Science policy has yet to be established HEIs and funders have established open access policies, and, to a lesser extent, open data policies.

While the Nordic and the Baltic countries are in different stages on defining strategies and implementation of Open Science, all countries exhibit, as shown via the report above, awareness of the importance of implementation of Open Science. As such, the Nordics and the Baltics are on the way to fulfil the European Commission’s ambition to create a federated ecosystem of research data infrastructures, namely EOSC, allowing researchers, communities, citizens and scientists to share and process publicly funded research results and data across borders and scientific domains.

Similarities and differences are summarized in the table below.

Table 1: Comparison of Open Science implementation in the Nordic and Baltic countries

Country	National policy/strategies published	HEI policies	Funder policies in open science	Actors /roles involved in open science
Denmark	Strategy adopted and published in 2018	National policy adopted into Institutional policies	Public funders have adopted Open data policies	Universities, DeiC, Ministry of Higher Education, National Library, National Archive.
Estonia	Recommendations for national policy published in 2016, policy is in making.	Majority of HEI have some kind of open science recommendations/instructions,	All research funders have instructions in some form for open science	Science Foundation, UT Library, Estonian Ministry of Education and Research, Estonian Research Council

		no official policies		
Finland	The Declaration for Open Science and Research published in 2019	All universities have set policies regarding open science	All research funders have instructions in some form for open science	The Federation of Finnish Learned Societies, National library
Iceland	Policy document in development. To be completed in 2020	Open access policies adopted by several universities	Public fund has an open access policy	Ministries, HEIs, National Library
Latvia	Policy document and implementation roadmap under development. To be completed in 2020-2021	Open access policies adopted by several universities	Legislation instructs to support implementation of Open Science principles	Ministry of Education and Science, HEI, Latvian National Library
Norway	National strategy for access and sharing of research data, published in 2017	Majority of HEIs have established open science policies	Majority of funders have established open science policies	Educational and Research Ministry, Research Council of Norway
Sweden	Roadmap and investigations for specific issues published in 2015	Majority of HEIs have established open access policies	Majority of funders have established open access policies	Research council, national library

1.3 Access policies and resource provisioning principles

In regard to resource provisioning and access policies, a notable finding is that horizontal IT-services are not available in all countries in the Nordics and the Baltics. The desktop studies show that access policies over all, with some exceptions, are similar throughout the Baltics and the Nordics. They range from countries offering access to horizontal IT-resources solely for academic use within national HEIs, to some countries offering horizontal IT-resources for commercial usage as well.

The desktop studies show that access to the horizontal IT-services are limited to academic usage for researchers at national HEIs in Denmark, Finland, Iceland, Latvia, Norway, and Sweden. In addition to academic usage, commercial usage is allowed in Estonia.

Regarding the resource provisioning policies, the desktop studies show that principles differ throughout the Nordics and the Baltics, ranging from technical and scientific review to automated on demand access. Resource provisioning entails scientific and technical review in Denmark, Latvia, Norway, and Sweden. Technical review is utilized in Finland and Iceland.

In regard to steering documents and strategies governing access policies and resource provisioning, the principles differ across the Nordic and the Baltic countries. The desktop studies show both similarities in access policies, and differences in resource provisioning policies. The aforementioned policies, unlike Open Science policies, are governed by national funders and stakeholders and differ due to differing requirements and demands by the funders. This report helps to facilitate the understanding of the regulations governing usage of resources and the different national processes governing access to resources. As such it helps to increase the understanding of the ability of the Nordic and the Baltic countries to contribute to the EOSC vision of forming a single contact point for the European researchers and innovators to facilitate discovery, access, use and reuse of a broad spectrum of resources for advanced data-driven research. The report facilitates the potential development of common approaches to access policies and resource provisioning.

Similarities and differences are summarized in the table below.

Table 2: Comparison of access and resource policies in the Nordic and the Baltic countries

Country	Users	Access and resource provisioning principles	Governance and steering documents	National strategies for e-infrastructures
Denmark	Academic users	Scientific/Technical review/Sandbox (Note - under development)	Currently no national HPC resources offered. Resource provisioning part of current strategy implementation	National Digital Infrastructure strategy adopted
Estonia	Academic users /commercial users	Technical review	Consortium agreement, EU state aid law.	Roadmap
Finland	Academic users	Scientific/Technical review	Finnish Limited Liability Companies Act (624/2006) and the State Shareholdings and Ownership Steering Act (1368/2007)	A strategy for national research infrastructures in Finland for the years 2020-2030
Iceland	Academic users	No review	NRENs articles of association	Roadmap to be published during 2020

Latvia	Academic users	Scientific/Technical review	NREN LAT and the Data Centre is governed by the Ministry of Education and Science	Coordinated by the Ministry of Education and Science
Norway	Academic users	Scientific/Technical review	Agreement between funder and consortium	Strategic responsibility lies with Sigma2
Sweden	Academic users	Scientific/Technical review	Grant agreement, consortium agreement	An outlook for national roadmap for e-infrastructures for research

1.4 Roadmap for future work

This deliverable, and document, is a living document which during the course of the EOSC-Nordic project will undergo two revisions, an updated report due month 18 (2/2021), and a final report due month 36 (02/2022).

In addition, the EOSC-Nordic project, via Work Package 2, will engage stakeholders to inform about similarities, differences as well as potential for common approaches between the participating countries through a series of workshops throughout the lifespan of the project.

The first workshop to engage project stakeholders was held on February 6th, 2020, and raised a lot of interest among policy makers. In total, 60 participants attended the workshop, and also streaming possibility was offered for remote participants. At the workshop, similarities and differences between the participating countries in regard to both Open Science as well as resource provisioning and access policies was discussed. The stakeholders included representatives from research councils, ministries, and representatives from EU-funded projects, such as OpenAIRE which co-organised the workshop. The next workshop will take place at the time of the second report about Open Science, access policies, and resource provisioning principles.

The results of the desktop studies will also be communicated to stakeholders via information items spread via EOSC-Nordic Work Package 6. The information items may also contribute to reaching a wider span of stakeholders.

1.5 Open Science, resource provisioning and access policies in the Nordic and the Baltic countries

The following section gives a detailed view about the results of the desktop studies giving an overview of Open Science, as well as resource provisioning and access policies in the Nordics and the Baltics.

1.6 Open Science in the Nordics and the Baltics

For the complimentary desktop studies each national representative carried out desktop studies examining information about, and policies for, Open Science policies, open access policies, data policies, and open data policies available via HEIs', funders', e-infrastructures' and for some countries, relevant research institutes', websites for each of the countries participating in the Work Package.

The desktop studies show that in some countries where a national Open Science policy has yet to be established HEIs and funders have established open access policies, and, to a lesser extent, open data policies of their own.

1.6.1 Open Science in Sweden

In Sweden, a roadmap towards Open Science and investigations for specific issues have been done on national level, and implementation of Open Science is to be done by 2025.

Open Science policies in place in Sweden

In 2015, the Swedish Research Council presented a proposal for national guidelines for open access to scientific information, as a result of the assignment from the Swedish Government. The proposal included suggestions regarding allocation of responsibilities, the need for additional investigations, as well as suggestions for structure and mandate for national coordination. The proposal envisioned a national timeline for a transition towards open access to research results, including artistic works and research data forming the basis for scientific publications, to be completed within ten years.⁵

The Swedish Research Bill 2016/17:50⁶ envisions that all scientific publications resulting from publicly funded research should be made available immediately after being published. Research data underlying scientific publications is envisioned to be made available at the same time as associated publications.⁷ The Government followed up the proposals in the report in its 2016 research policy bill (2016/17:50), which assigned specific national coordination responsibility for open access to data (to the Swedish Research Council) and to publications (to the National Library of Sweden).

In 2018, the government assigned the National Library of Sweden with the task to report on the following topics:

- Expenditure on scholarly publishing – Swedish Universities and University Colleges
- Scholarly publications and the FAIR Principles
- Total Cost of Publications in Sweden

⁵<https://www.vr.se/english/analysis/reports/our-reports/2015-03-02-proposal-for-national-guidelines-for-open-access-to-scientific-information.html>

⁶ <https://www.regeringen.se/4adad0/contentassets/72faaf7629a845af9b30fde1ef6b5067/kunskap-i-samverkan--for-samhallets-utmaningar-och-starkt-konkurrenskraft-prop.-20161750.pdf>

⁷https://www.nordforsk.org/en/publications/publications_container/state-o-open-science-in-the-nordic-countries/view

In 2019, the National Library of Sweden published sixteen recommendations for national solutions to facilitate the national goals regarding Open Science. The recommendations were based on five investigations on the following topics:

- The current merit and resource allocation system versus incentives for open access
- Funding for a transition from a system based on subscriptions to open access publishing
- Open access to scholarly monographs
- Financial and technical support for converting peer-reviewed and scholarly journals from toll access to open access
- Monitoring of compliance with open access policies and mandates

The reports and recommendations above were created together with a report detailing the transition to an open access system was sent to the government in March 2019.⁸ As of 2020 all publicly funded scientific publications should be available via Open Access.⁹ Funders and HEIs cooperate regarding Open Access for monographs via the *Kriterium* portal¹⁰.

A transition to open access to research results is envisioned to be gradual, until 2025, in order to ensure that it is done in a responsible way.¹¹ In the budget for 2020 the Swedish government reaffirmed support for Open Science by emphasizing Open Science as a tool for scientific quality.¹²

Open Science actors and their roles in Sweden

The National Library of Sweden has been given tasks in order to facilitate the transition towards Open Science. For example, in 2017, the ministry of Education tasked the Swedish Research Council and National Library of Sweden to produce criteria to assess whether research data respectively publications produced via public funding are compliant with the FAIR principles or not. As of 2017, the National Library of Sweden is also tasked with the coordination of the national transition towards open science regarding scientific publication in consultation with the Swedish Research Council as stated in the appropriation directions for the National Library of Sweden.¹³ In December 2019, the government assigned the National Library to establish a national digital platform for scientific publications resulting from Swedish HEIs.

The Swedish Research Council is tasked with the coordination of efforts towards open research data. In 2017, the Swedish Research Council received an assignment from the Government to produce criteria for assessing how research data that have wholly or partly been produced using public funds fulfil the FAIR principles.

⁸<https://www.kb.se/samverkan-och-utveckling/oppnen-tillgang-och-bibsamkonsortiet/open-access-and-bibsam-consortium/open-access.html>

⁹<https://www.regeringen.se/pressmeddelanden/2019/12/oppnen-digital-plattform-for-svenska-vetenskapliga-tidskrifter/>

¹⁰ <https://www.kriterium.se/site/en-about/>

¹¹<https://www.regeringen.se/4adad0/contentassets/72faaf7629a845af9b30fde1ef6b5067/kunskap-i-samverkan-for-samhallets-utmaningar-och-starkt-konkurrenskraft-prop.-20161750.pdf>

¹²<https://www.kb.se/samverkan-och-utveckling/nytt-fran-kb/nyheter-samverkan-och-utveckling/2019-09-18-oppnen-vetenskap-och-fairprinciperna-lyfts-i-regeringens-budgetproposition-for-2020.html>

¹³ <https://www.kb.se/samverkan-och-utveckling/oppnen-tillgang-och-bibsamkonsortiet/oppnen-tillgang.html>

Target groups and data collection

This section details the level of adoption and implementation of open science policies by HEIs and funders in Sweden. HEIs which were chosen based on an inventory available via the Swedish Department of Education¹⁴. Regarding funders a target group consisting of 15 funders was chosen based on information regarding major funders available via the OpenAIRE¹⁵ and the Swedish Department of Education.¹⁶

Higher Education Institutions (HEIs)

Among the studied HEIs none had, at the time of the report, established open science policies or guidelines. A minority provided information about Open Science via documentation or information on their websites. A majority had, at the time of the report, established Open Access policies or guidelines and provided information via documentation or information on their websites. Among the studied HEIs a minority had, at the time of the report, established data policies or open data policies. A minority provided information via documentation or information on their websites.

Research funders

Among the studied funders none had, at the time of the report, established open science policies. A minority provided information via documentation or information on respective websites.

A minority had, at the time of the report, established open access policies. A majority provided information via documentation or information on respective websites.

Among the studied funders two had, at the time of the report, established open data policies, and provided information via documentation or information on the respective websites.

Conclusion

The findings are consistent with inventories stating that a majority of HEIs have adopted open access policies, and that a minority have adopted open data policies. Regarding funders the desktop study shows that a minority of studied funders have established open access policies. In conclusion this desktop study, regarding both HEIs and funders, confirms the results of earlier studies performed for both HEIs and funders regarding Open Science, such as studies by OpenAire¹⁷.

1.6.2 Open Science in Finland

In Finland, the research community has jointly created a Declaration for Open Science and Research for 2020–2025, which awaits all organisations of the research community to sign it in February 2020. All universities have set Open Science policies and all research funders have instructions in some form for Open Science. Key actor in Open Science is the Finnish research community organised through The Federation of Finnish Learned Societies.

¹⁴<https://www.uka.se/fakta-om-hogskolan/universitet-och-hogskolor/var-finns-universiteten-och-hogskolorna-.html>

¹⁵ <https://www.openaire.eu/item/sweden>

¹⁶<https://www.regeringen.se/regeringens-politik/hogskola-och-forskning/finansiering-av-forskning-i-sverige/>

¹⁷ Ibid

Open Science policies in place in Finland

Open Science and Research Initiative¹⁸ of the Ministry of Education and Culture (2014–2017) launched the Roadmap of Open Science and Research as a plan for the strategic level of Finnish open science and research. The roadmap was meant as a guideline for Finnish researchers, research groups, research organizations, decision-makers, funders and citizens to promote the conditions, use and practical application of open science and research.

In the summer 2017, UNIFI, the Finnish universities' council of rectors, set up a working group to consider solutions for research data management, to examine the challenges of publication and open science culture at different stages of the research lifecycle and Finnish scholarly community. In the spring 2018 UNIFI published Open science and data - action programme for the Finnish scholarly community¹⁹ where the main objective was "Finland is an Open Science trendsetter". In Finland, Open Science is part of the daily life of science at all levels. This was the basis for national coordination.

In 2019, the Finnish research community (organised through The Federation of Finnish Learned Societies) has jointly created a Declaration for Open Science and Research for 2020–2025²⁰. The declaration was approved by the National Open Science and Research Steering Group 10th of December, 2019. It outlines a vision where Open Science and research are seamlessly integrated in researchers' everyday work. The joint mission of the declaration is to promote openness as a fundamental value of science, to strengthen the relevance of research in society and to increase the mobility and impact of research.

The next step for the research community is to express its commitment to the declaration. All the organisations of the research community in Finland will be invited to sign the joint Declaration for Open Science and Research in February 2020.

In addition to the above-mentioned Declaration, the Ministry of Education and Culture recently published the Atlas of open Science and Research in Finland²¹, an evaluation of openness for academia, research institutes, funding agencies, Finnish academic and cultural institutes abroad and learned societies. The goal of the evaluation was to assess the progress towards an open culture for the organization that have been analysed in the previous years. By examining key indicators chosen to provide the level of openness, the Atlas was able to supply insights on the progress towards openness, but also to discuss obstacles to overcome and development needs to be considered in order to increase the competence of the institutions to stimulate openness.

Open Science actors and their roles in Finland

The Federation of Finnish Learned Societies²² is supporting the coordination of Open Science activities with funding from the Ministry of Education and Culture²³. The coordination is based on a strong collaboration between all members of the research community.

¹⁸ <https://www.eoscsecretariat.eu/eosc-liason-platform/post/fairsfair-landscape-analysis-outputs>
<http://doi.org/10.5281/zenodo.3558173>

¹⁹ https://www.unifi.fi/wp-content/uploads/2019/04/UNIFI_Open_Science_and_Data_Action_Programme.pdf

²⁰ <https://openscience.fi/en/policies/declaration-open-science-and-research-2020-2025>

²¹ <http://julkaisut.valtioneuvosto.fi/handle/10024/161990>

²² <https://tsv.fi/en>

²³ <https://avointiede.fi/en/coordination>

A panel of experts for each of the four areas of open science (Open Data, Open Access, Open Education and Culture of Open Scholarship) convenes bi-annually to identify essential tasks to advance open science and form working groups to resolve issues and challenges. Membership in expert panels and working groups is open to anyone within the Finnish research community.

Open Science National Steering Group convenes over national guidelines and policies for open science. The Steering Group is formed by members representing research organizations, libraries, and funders. The Steering group collaborates closely with the Ministry of Education and Culture, but works independently²⁴.

Finnish National Board on Research Integrity TENK²⁵ is a body of specialists appointed by the Ministry of Education and Culture, which addresses ethical questions relating to research and to the advancement of research ethics in Finland (Decree 1347 of 15 November 1991²⁶). TENK focuses on promoting the responsible conduct of research, as well as formulating and publicising common guidelines in co-operation with the research organisations. All the universities in Finland, almost all publicly funded research institutions, the Academy of Finland, Business Finland and the Prime Minister's Office are committed to following TENK's preventative ethical instructions *Responsible conduct of research and procedures for handling allegations of misconduct in Finland (RCR²⁷)*.

The National Library of Finland²⁸ is the oldest and largest scholarly library in Finland. It is responsible for the collection, description, preservation and accessibility of Finland's printed national heritage and the unique collections under its care. Openness is a strategic goal²⁹ of the National Library of Finland and it especially promotes open access to the cultural heritage. It provides open publication archive platform services and promotes open access, for example, by negotiating with publishers. In addition, it develops open services, promotes open science, integrates its open services into national and international infrastructures and services and influences the development of legislation by extensively supporting open access to resources and services. The National Library of Finland is responsible for the digital preservation of national online material.

Target groups and data collection

This section details the level of adoption and implementation of Open Science policies by higher education institutions, funding agencies, e-infrastructures and relevant research institutes in Finland. 13 Universities³⁰ that operate in Finland under the Ministry of Education and Culture have been surveyed. Finland has two types of higher education institutions: Universities and Universities of Applied Sciences (UAS). Universities of applied sciences offer professionally oriented higher education while universities focus on scientific research and education based on it. Because the degree of research in the UASs is relatively modest, the focus of this survey has been on the universities whose main task is to engage in scientific research. In regard to research funders, the target group contains three main research funders; Academy of Finland, Business Finland and Kone Foundation. 12 Finnish governmental research institutes have been surveyed.

²⁴ <https://openscience.fi/>

²⁵ <https://www.tenk.fi/en>

²⁶ <https://www.tenk.fi/sites/tenk.fi/files/decree.pdf>

²⁷ https://www.tenk.fi/sites/tenk.fi/files/HTK_ohje_2012.pdf

²⁸ <https://www.kansalliskirjasto.fi/en>

²⁹ <https://www.kansalliskirjasto.fi/en/open-science-as-co-operation>

³⁰ <https://minedu.fi/en/universities>

Universities

All Finnish universities have set policies and principles advocating and defining their position on Open Science, especially related to open scientific publications, research methods, open source and the availability and reusability of research data.

- 12/13 universities have, at minimum, a general statement regarding their commitment to promote Open Science and responsible conduct of research based on the instructions of the Finnish Advisory Board on research integrity TENK.
- 6/13 universities have complete Open Science policy and others have separated policies for different focus.
- According to Atlas of Open Science and Research in Finland 2019³¹, 9/13 universities and more than 60 % of the UASs mention openness of research results in the strategy level.

The universities' policies are focused mostly on Open Research Data and Open Access.

- All Universities have a data policy in place together with implementation plans, recommendations and practical guides for research data management.
- 10/13 universities require open licensing of research data.
- According to Atlas of Open Science and Research in Finland 2019, about 80 % of the HEIs have principles for the use of open access channels for publishing.

Research funders

The commitment of research funders to the promotion of Open Science can be seen in practice in the way they define policies and principles that promote transparency. According to Fair Policy Landscape analysis by FairsFair³², the policies of funding bodies are the key driver for many of the stakeholders developing policies – both at the national and institutional level.

According to the survey, all research funders have encouraged openness to some extent in their research funding. For example, open access publishing is a requirement in Business Finland -funded research projects³³ carried out by public research organisations. Academy of Finland requires that Academy-funded projects³⁴ see to that the scientific publications in which the project's results are published are open-access, and that the projects' data are made widely available.

According to Atlas of Open Science and Research in Finland 2019³⁵, all research funders have instructions in some form for Open Science and research practices for funding applicants. Two funders require open access publishing and one recommends it. For research data, one funder requires, and two recommend

³¹ <http://julkaisut.valtioneuvosto.fi/handle/10024/161990>

³² <https://www.fairsfair.eu/fairsfair-landscape-analysis-competence-centres-outputs>

³³ https://www.businessfinland.fi/globalassets/finnish-customers/01-funding/04-research-organization/business_finland_requires_open_science_020218.pdf?_t_id=1B2M2Y8AsgTpgAmY7PhCf%3d%3d&_t_q=open+science+policy&_t_tags=language%3aen%2csiteid%3a53b34a16-7ce7-4ab0-8c7e-f06c83547e28&_t_ip=193.166.223.5&_t_hit.id=Finpro_Web_Features_MediaData_GenericMediaData/_23768d55-29b4-47d5-acec-658480f7fd5d&_t_hit.pos=2

³⁴ <https://www.aka.fi/en/funding/apply-for-funding/az-index-of-application-guidelines/open-science/>

³⁵ <https://julkaisut.valtioneuvosto.fi/handle/10024/161990>

openness. All research funders explain broadly the process of their funding calls and the review criteria used, but only one of them has openness or re-use of research as a review criterion in the funding calls.

Research institutes

The research institutes own strategies show that in most of them (10/12) the concept of Open Science is non-existent. Only two institutes clearly promote Open Science and good research practices related to it, covering open access to publications and open data. However, not all aspects related to Open Science are included.

In terms of open access to publications, almost half (5/12) deliver open access to organizational publications (reports, newsletters, series, PhD thesis etc), but only one advocates that all the scientific articles and conference papers produced by the institute should be published according to open access principles. Only the copyright rules and agreements with publishers and collaboration parties may cause exception to this basic rule. $\frac{2}{3}$ recommend Creative Commons By 4.0 to be used by external users.

On the other hand, open data policies are relatively common among research institutes. A majority (8/12) have in place data policies promoting opening the research data obtained from publicly funded projects, ensuring compliance with all applicable laws and regulations, but only 2 mention that data management and openness to be in line with the FAIR principles³⁶.

Conclusion

Although the organizations surveyed have been able to significantly improve their performance in terms of openness in the past years, there are considerable differences in the level of open operational culture between and within target groups. Finnish universities reached the highest ranking through understanding of what open science means and accelerating their implementation efforts to establish and develop their capabilities to support openness. Research institutes could use their collaboration skills and benefit from the expertise of Finnish universities. Implementation plans and principles of openness could be easily adapted, while working together to overcome common obstacles/barriers.

According to Atlas of Open Science and Research in Finland 2019³⁷ Research institutes consider that conflicting incentives, insufficient funding and resources are the biggest barriers for promoting Open Science, while the universities recognize as significant impediments uncertainties in fulfilling legal demands, conflicting incentives and disproportionate standards for researchers to fulfil. The merit system cannot be forgotten, which has also been mentioned according to report.

1.6.3 Open Science in Norway

Since 2017, there is a national strategy for access and sharing of research data in Norway. Universities do not have a unified strategy on Open Science and open data, and strategies are defined on an institutional basis. Research Council as research funder has put in place concrete measures that stimulate an increased degree of openness. Some key actors in Open Science are Research Institutes, Research Council, and the Norwegian Directorate for ICT and Joint Services in Higher Education & Research (UNIT).

³⁶ <http://julkaisut.valtioneuvosto.fi/handle/10024/161990>

³⁷ <http://julkaisut.valtioneuvosto.fi/handle/10024/161990>

Open Science policies in place in Norway

The Open Science concept has been discussed in Norway at different levels in the last two decades, among data holder institutions as well as ICT providers. During the first decade of the millennium, IT infrastructure for research was offered to Norwegian researchers only at the local level, as services for single universities. There were neither national nor institutional policies with regard to data produced by universities and research institutions, and most of the strategies related to data sharing, data storing and preservation were done locally, by single researchers or departments. Hundreds of repositories have been established to host domain specific data sets, resulting in a very fragmented research data landscape.

A significant portion of this landscape is covered by the Norwegian center for Research Data (NSD), hosting one of the largest archives for social data in the country, the Norwegian Institute for Public Health (NIPH), data custodian for a variety of health data registries, and Statistic Norway, for statistical data.

In the early 2010, the Research Council of Norway started exploring the concept of Open Science by mapping and promoting solutions for archiving data and managing data. Data Management plans were made mandatory in some of the funding programs already from 2018.

In December 2017, the Ministry of Research and Education published the new *National Strategy on access to and sharing of research data*³⁸. The strategy aims at establishing the basic principles for the management and curation of publicly funded research data, and therefore building the foundation for facilitating the reuse of data for advancement of knowledge and for the benefit of the society in its whole.

The strategy stems from three basic principles, namely (i) Research data must be as open as possible, as closed as necessary; (ii) Research data should be managed and curated to take full advantage of their potential; (iii) Decisions concerning archiving and management of -research data must be taken within the research community. Change in the underlying culture, increased competence, data management plans, better technical infrastructure, improved national coordination among subject fields and sustainable funding models are the identified requirements in the process of establishing the above-mentioned principles as a national practice.

The strategy also highlights the need to facilitate the reuse of data from Statistics Norway in research and identify concrete measures to facilitate the processes of accessing and consuming statistical data. Similarly, the link of public registries data and Statistics Norway data with the health data is envisioned in connection with the Health Data Program. The program started in 2017 under the Directorate of e-Health to improve the utilization of Norwegian health data from health registries, population-based surveys and research biobanks.

Open Science actors and their roles in Norway

Research Institutes are assigned to build the knowledge and define policies and procedures for data management (including the adoption of the Data Management Plans as an integral part of the project management)

³⁸<https://www.regjeringen.no/en/dokumenter/national-strategy-on-access-to-and-sharing-of-research-data/id2582412/?ch=1>

Research Council is assigned to enforce the adoption of data management and promote the access to and re-use of research data at national and international level, as well as suggest a sound plan for the sustainability of data services and archives.

Norwegian Directorate for ICT and Joint Services in Higher Education & Research (UNIT) was established in 2018 and is elected as coordinator of several of the processes and as provider of central services for the management of research data.

Target groups and data collection

This section details the level of adoption and implementation of open science policies by higher education institutions and research funding agencies in Norway.

Universities

Higher education institutes in Norway consist of universities and university colleges spread all over the geographical region. At the time of the writing, there is not a unified strategy with regard to open science and open data, and strategies are locally defined.

From information provided by desktop analysis, two of the four oldest universities, namely the University of Oslo UIO³⁹ and the Norwegian University of Science and Technology NTNU⁴⁰ have published policies on Open Science and guidelines based on open access to data, including restrictions and exceptions due to sensitivity and business confidentiality. The University of Bergen has, at the time of the writing, an ongoing activity to define the Open Science policy for the institution. The UiT Arctic University of Norway has a policy for Open Access⁴¹ and a policy for Research Data Management⁴², covering two essential parts of Open Science. Policies for Open Access can also be found in Colleges, such as the Oslo Metropolitan School⁴³.

Research funders

Since 2000, the Research Council has demanded that research data must be archived in a sound manner for at least ten years. A policy has been drawn up for the provision of research data (2014, 2017) which, in accordance with national principles, states that data should be as "open as possible, as closed as necessary", with certain exceptions. Furthermore, the Research Council expects the FAIR to be the driving principle for the research data practice. For projects that have applied for and received funding from 2018 onwards, the project manager must consider the need for a data management plan.

In 2017, the Research Council, together with several other research funders, signed a "Joint Statement" from the WHO toward activities to ensure that all funded clinical studies are required to provide a report on their results. The Research Council sets requirements for registration of the studies in a separate

³⁹<https://www.uio.no/english/for-employees/support/research/research-data-management/policies-and-guidelines/index.html>

⁴⁰https://innsida.ntnu.no/c/wiki/get_page_attachment?p_l_id=22780&nodeId=24646&title=NTNU+Open+Data&fileName=NTNU%20Open%20Data_Policy.pdf

⁴¹https://en.uit.no/Content/626289/cache=20191704103344/Principles%20for%20open%20access%20at%20UiT_2019.pdf

⁴²https://intranett.uit.no/Content/532111/Principles%20and%20guidelines%20for%20research%20management%20at%20UiT_010917.pdf

⁴³ <https://ansatt.oslomet.no/en/open-access-policy>

database for clinical studies when allocating funds from specific programs. In May 2018, the Research Council signed The San Francisco Declaration on Research Assessment (DORA).

The most recent version of the open research policy published by the Research Council of Norway is from December 2019 and covers the horizon 2020–2025.⁴⁴ The policy assigns the Research Council a key role in the implementation of the national strategy through concrete measures that will stimulate an increased degree of openness. Some of the proposed measures include: offering training and competence building; testing open research and innovation in projects; fostering access and reuse of research results; promoting data infrastructure for handling and making available research data; enforcing merit and evaluation of researchers and research; promoting socially responsible research and innovation.

Conclusion

Although open research has been a central theme of the research policy agenda for over ten years in Norway, there has been a lack of comprehensive approach to the field. This is likely due to the concept of open research being broad and used to describe different and sometimes contradictory objectives. However, the strategy document from the Educational and Research Ministry has put the foundation for a more unified roadmap. Clearly any process to support the open science roadmap requires and underpin a cultural change that appears to be possible only through the establishment of strong cooperation between different actors, namely among researchers and research environments, service providers and governmental and funding agencies. Concrete steps are currently in progress to promote such cooperation, through the establishment of UNIT and the launching of different initiatives, such as the design of a national PID and research registries.

1.6.4 Open Science in Denmark

The Danish Open Access Strategy (in regard to scientific publications) was published in 2018 and was formally endorsed by the Danish Minister of Science and Higher Education. Currently all universities have adopted Open Access policies that are mainly related to the adoption of the Danish Code of Conduct on Research integrity. The majority of the largest Danish public and private research funding bodies do not have a policy regarding open access to research data. The publicly funded research foundations have adopted a common OA policy based on the Danish Open Access Strategy. Only one of the private foundations in Denmark has done so.

Open Science policies in place in Denmark

The Danish Open Access Strategy (in regard to scientific publications) was published in 2018 and was formally endorsed by the Danish Minister of Science and Higher Education. An official strategy for Open Access (OA) to data has not yet been formulated. For various reasons Open Access to data is not as developed as Open Access to research publications. One of the reasons is that providing Open Access to data is more complicated – both in terms of technical solutions on data storage and access, organizational, cultural and legal issues and not least funding.

There have, however, for several years been a number of important initiatives that feed into a process, that will eventually lead to a formal adoption of such a strategy. Most importantly have been The Danish Code of Conduct for Research Integrity in 2014, The Danish National Strategy for Research Data Management for

⁴⁴ <https://www.forskningradet.no/siteassets/tall-og-statistikk-seksjonen/apen-forskning/forskningradets-policy-for-apen-forskning.pdf>

2015-2018, The Danish OA Strategy from 2018 and the Danish Strategy for National Cooperation on Digital Research Infrastructure from early 2019.

In 2014, the Ministry of Higher Education and Science - along with all Danish universities - adopted a Danish Code of Conduct for Research Integrity⁴⁵. The Code aims to ensure credibility, integrity and thereby quality in Danish research through common principles and standards for responsible conduct of research. The Code stresses the need to ensure scientific reproducibility and verification by other actors. Primary materials and data should be retained, stored and managed in a clear and accurate form that allows the result to be assessed, the procedures to be retracted and – when relevant and applicable – the research to be reproduced. Also institutions should allow access to the stored primary materials and data, except when this is in conflict with privacy matters or intellectual property rights. However, the code was not supported by any regulatory framework nor any guiding principles for data management and access policies across institutions.

Parallel to the formulation of the Danish Code of Conduct for Research Integrity, key stakeholders in the Danish e-infrastructure community initiated a National Strategy for Research Data Management 2015–2018. An expert group was charged with the task of formulating a national strategy for research data management, including formulating recommendations and proposals for actions towards Data Management and Open Access to Data across Danish scientific institutions and repository owners, and also covering the all-important topic of funding. The strategy contained a number of recommendations for implementing Open Data Policy to be presented to the universities' leadership and to the Danish Minister of Science.

The Danish Open Access Strategy was published in 2018 and was formally endorsed by the Danish Minister of Science and Higher Education. The strategy aims to secure Open Access for scientific articles and conference proceedings in journals and proceedings with an ISSN number. Denmark adopted a Green OA principle, with an ambition that by 2025 all peer-reviewed publications from Danish universities would be openly available - but at the same time accepting the principle of embargo of up to 12 months. The guiding principle has been to maintain a steady state in terms of research funding going into publishing (not increasing costs) and that scientists maintain complete authority as to their choice of publication channel.

In April 2019, Independent Research Fund Denmark, Innovation Fund Denmark and Danish National Research Foundation endorsed the National Open Access Strategy, by adopting an Open Access policy for public sector research funds and foundations. This policy requires grant holders to make the final, peer-reviewed scientific article accessible and must include all graphic and other materials prepared for the article. However, research data was specifically exempted.

Open Science actors and their roles in Denmark

Since Denmark does not have a formal Open Science policy, the following list is not an authoritative list of Open Science actors with a very clear role and mandate. This list comprises stakeholders who's role are currently involved in the discussions regarding Open Science.

Universities are currently building their knowledge base and define policies and procedures for data management at institutional level. Moreover, the universities have been charged with formulating a national Data Management policy across the different institutions through the Danish E-Infrastructure Collaboration framework.

⁴⁵ <https://ufm.dk/publikationer/2014/the-danish-code-of-conduct-for-research-integrity>

Public Research Councils have a limited role in Danish Open Science policy, compared to other countries. They have adopted an Open Access policy and promote data management and access to and re-use of research data at national level through grant allocation.

Danish Agency for Science and Higher Education. The agency is part of the Ministry of Higher Education and Science, and it was established 1 January 2017, and has responsibility for all tasks that require particular expertise within the areas of research and education – across all institutions. Moreover, the Danish Agency for Science and Higher Education contributes expert knowledge in the provision of ministerial services and policy development in cooperation with the Department - specifically also on Open Science policy issues.

The Danish National Archive and The Danish Royal Library. Both institutions, formally part of the Ministry of Culture, have roles in relation to Open Science. Specifically the Royal Library is charged with establishing licensing agreements with publishers. The Danish National Archive have a role in harvesting and making scientific datasets available - as well as a host of public registries and datasets. Particularly the role of the Danish National Archive in relation to long-term preservation forms part of the current policy development.

The Danish Ministry of Health in collaboration with research actors is actively working out an Open science policy for health data, within the legal framework and data security issues that revolves around personal health information. This work is particularly informed by the establishment of the Danish National Genome Centre.

The Danish Agency for Digitization under the Ministry of Finance has the primary responsibility for implementing the PSI directive. (Delete if not deemed relevant).

Target groups and data collection

This section details the level of adoption and implementation of open access policies by higher education institutions and research funding agencies and other public actors in Denmark.

Universities

Currently all the universities have adopted open access policies that are mainly related to the adoption of the Danish Code of Conduct on Research integrity. This in turn has been implemented through staff guidelines and policies specifying the requirement of staff to ensure that data and code generated from research is stored and can be extracted. Although some of the universities even mentioned open access to data and FAIR, the main purpose seems to be to ensure proper data management from staff, for verification purposes in the context of research integrity.

There is a marked focus on Open Access to data with the scientific communities and certainly more so than ever at university leadership. Some of the universities have already or are planning to put in place support services and tools that will help scientists with their data management tasks. The current focus is more on the supply side of Open Data - that is proper data management rather than the demand side – how to actually implement systems for effective reuse of scientific data.

There is a general consensus, that the individual universities should not develop their own Data management regime, but should rather seek to establish common standards and policies across all the institutions in Denmark, and also link this to the development of the European Open Science Cloud (EOSC) and the requirements towards Open Data in H2020 calls. However, the long process of developing a new strategy for national cooperation on digital research infrastructure has stalled a lot of the development in the last couple of years. Many university representatives have expressed a need for a true national Data management /Open Data strategy across the scientific institutions, but the process has not proceeded swiftly due to prolonged discussions on an agreement on the Danish e-Infrastructure Cooperation.

Research funders

Among funders, there is a mixed picture in terms of OA policies. Unlike most other Nordic countries Denmark has quite large private research foundations. None of the largest Danish public and private research funding bodies - the Independent Research Fund Denmark, the Innovation Fund Denmark, the DNRF, the Carlsberg Foundation, the Novo Nordisk Foundation – have a policy regarding open access to research data, with the Lundbeck Foundation as an exception.

The Lundbeck company and the Lundbeck Foundation have a clear policy on Open Access, disclosing clinical trial information and results summaries in public registries and shares clinical data generated by or sponsored by Lundbeck. Although all the private foundations generally seem to acknowledge the principle of Open Science, there is also a tradition of not adopting policies that are fundamentally driven by state actors.

The publicly funded research foundations have adopted a common OA policy based on the Danish Open Access Strategy. Only one of the private foundations in Denmark has done so. These foundations then require grant holders to make research results and articles publicly available. Data is specifically excluded from this requirement, and OA publication costs are not eligible for funding (and obviously neither is data management costs).

The Independent Research Fund Denmark has published a policy paper in 2017, which is highly critical of the current trend towards Open Access to data, highlighting some of the core issues: Which data are relevant to share? Who owns the data? Why would people voluntarily share their arduously collected and highly valuable raw material? And who should cover the expenses for maintaining large data repositories?

Other public actors

The Danish Regions, representing most of the operational parts of the Danish Health Care service provision system, have declared that they will work towards providing scientists with access to health data based on the FAIR principles. The same guiding principles have been suggested for the recently established Danish Genome Centre, which is a separate public institution within the Danish health care system. In general, there is a huge focus on providing better access to health data for scientific and clinical purposes in Denmark, based on the principles of FAIR. Obviously, being health data and thus potentially sensitive personal data, there is a host of issues regarding technical solutions, ethics, public legitimacy, data control and workflows that will need to be addressed.

Other public actors are also picking up the principles of OA, most notably the municipality sector and public authorities that host large administrative datasets. This process has been helped by the renewal of the PSI-directive and a general political focus on improving public access to digital objects generated within the public sector.

Conclusion

Over the course of the last 5-6 years Open Access has gradually moved closer to the centre of science policy. There has been a strong political commitment towards ensuring that scientific data generated with public money, should also be made available to the public more expedient and effectively.

Denmark moved quickly to establish a Code of Conduct on Research Integrity, which highlighted the responsibility of universities and researchers to store their data and code. The CoC itself offered very little in terms of support structure, infrastructure and precise guidelines on how to actually do proper data management, and in most cases institutions, communities and scientists were left to implement the CoC themselves.

Work began in 2015 to remedy this situation, putting together key stakeholders to formulate an overall national Data management strategy. Although this work moved things forward, there were a number of obstacles. First of all, there was an increasing concern amongst universities regarding the cost of Open Data, and the lack of financial commitment from the funder side. Whereas the public funders have adopted an OA policy, data had been specifically exempted, which was a very clear decision, that the science funders was not prepared to take financial responsibility for open data. The Danish Ministry of Science was also being increasingly aware that Open Data could potentially become a cost driver. This issue was highlighted in the early phases of the European discussion on EOSC and the FAIR principles, where there was a push towards free access to data for the end-users. Denmark has consistently argued that such models are unsustainable.

Adding to that was an increasingly vocal concern from the scientific community regarding what was being seen as interference in the scientific process, putting responsibilities and workloads on the scientific community with little perceived value, and possibly also concerns about the potentially disruptive properties of Open data amongst a highly competitive scientific community.

Whereas the development of Open Data has been in a state of limbo in the last couple of years, things can be expected to move forward again, with the adoption of the Danish Strategy for National Cooperation on Digital Research Infrastructures in 2019. The DeIC Organization has been formally charged with coming up with a National Data Management Strategy, including EOSC, the governance of DeIC has changed, ensuring direct links between decisions made in the DeIC Board and the University management. Also, the universities and the Ministry have agreed on a long term funding plan, increasing funding for digital infrastructure considerably.

1.6.5 Open Science in Iceland

An Open Science Policy is in preparation at the Ministry for Education, Science and Culture of Iceland and open access to public data has been increasing for a number of years.

Open science policies in Iceland

The Icelandic government does not have a national policy on Open Access at this point, but a requirement to allow open access to publications of research supported by public funds has been present in the Act on

public support for research (3/2003)⁴⁶ since 2012. The requirement only applies to peer reviewed journal articles.

In its Policy and action plan 2017-2019⁴⁷, the Science and Technology Policy Council lists open access to research publications and research data as a key element of a planned national research strategy; the Council has the development of a policy on open access to data as one of ten action points for the period. In accordance with the Action, a working committee was formed and given the task of making a proposal on policy for open access to research data and publications in Iceland. The working group presented its recommendations for a national open access policy for publications; work on a policy for open data has not been completed but will hopefully be finished in the year 2020.

In line with the Science and Technology Policy Council's action plan, the Ministry of Education, Science and Culture formed a working committee for the preparation of a national roadmap on research infrastructure in Iceland which will be published shortly. One of the main emphases of the RI roadmap will be the handling, storage and access to research data.

Outside HEI's, various Icelandic government agencies and institutions have data policies published on their websites.

All seven Icelandic Universities share an open access repository for peer reviewed publications, maintained by the National Library. The repository, opinvisindi.is, is OpenAIRE compliant.

Open science actors and their roles in Iceland

As a National Policy on Open Science is not yet in place, actors and roles have not been defined. The current work on a national policy on Open Science is led by Iceland's Ministry of Science, Education and Culture and the Science and Technology Policy Council's in cooperation with representatives from the Icelandic Research Centre, Universities and research organisations plus The National and University libraries. The Science and Technology Policy Council's roadmap which will be implemented from 2020 onwards. Universities and other research organisations are at varying stages of preparing open science policies and practices.

Universities

Three of Iceland's Universities have policies on open access to research publications available on their websites, but open data policies have not yet been implemented by Icelandic HEI's.

The University of Iceland, a public university and by far Iceland's largest HEI, has a policy on open access⁴⁸ to publications which was adopted by the University Council in 2014 and came into force in 2015. The University of Iceland's Strategy for 2016-21⁴⁹ calls for an improvement of research infrastructure and the formulation of a policy on storage and access to research data. The University's Science Committee is currently preparing for work on an open science policy which will include open research data. Some data

⁴⁶ <https://www.government.is/media/menntamalaraduneyti-media/media/law-and-regulations/Act-on-public-support-for-research-No.-3-2003.pdf>

⁴⁷ <https://www.government.is/lisalib/getfile.aspx?itemid=58e09fff-ac4b-11e8-942a-005056bc4d74>

⁴⁸ https://english.hi.is/university/open_access_policy

⁴⁹ https://english.hi.is/university/strategy_of_the_university_of_iceland_2016_2021

collections are already available in open access through the university's web, and a FAIR data repository - DATICE⁵⁰ - is under construction.

In 2013, Bifrost University, a small HEI in a rural area, became the first of Iceland's HEI's to adopt an OA policy. According to the policy⁵¹, which was revised in 2019, Bifrost staff shall seek to make their research articles openly available, either through OA journals or by depositing a copy in an OA repository. Staff also grant the university the right to publish copies in opinvisindi.is, a repository shared by all Icelandic Universities and maintained by the National Library. The OA policy adopted by Reykjavik University 2014 similarly encourages staff to publish their work in OA journals and make works available in repositories⁵². The policies do not apply to research data.

Funders

The two main funds covered by the Act on public support for research (3/2003)⁵³ and administered by Rannís, The Icelandic Centre for Research⁵⁴ are the Icelandic Research Fund⁵⁵ and the Infrastructure Fund⁵⁶.

The IRF is an open competitive research fund that awards funding to research projects according to the Icelandic Science and Technology Policy Council's general priorities.

The Infrastructure Fund⁵⁷ supports research infrastructure by co-financing purchase, build-up, operation and access to equipment and any other research infrastructures that are important for scientific progress. The Infrastructure Fund will co-finance research infrastructure selected for funding in line with the priorities of the national roadmap mentioned previously.

Rannís' open access policy⁵⁸ encourages researchers to publish their works in open access journals or deposit a copy in an open repository. Embargos of up to 12 months are accepted. The policy does not mention research data. The IRF's Applicant Handbook for 2020, however, mentions adherence to open access policy in relation to the publication of results and data.

Others e.g. agencies

While a number of Icelandic public research institutes hold data collections that are to a varying degree available online, specific access or data policies are mostly absent. In some cases, access to data is mentioned in general institutional policies or strategies, often in connection with the need for improved infrastructure to allow preservation and access.

⁵⁰ <https://fel.hi.is/datice>

⁵¹ <https://www.bifrost.is/english/about-bifrost/policies-and-regulations/open-access-policy/>

⁵² <https://en.ru.is/media/hr/skjol/RU-OA-Policy---Approved-by-RU-Executive-Committee-November-13-2014.pdf>

⁵³ <https://www.government.is/media/menntamalaraduneyti-media/media/law-and-regulations/Act-on-public-support-for-research-No.-3-2003.pdf>

⁵⁴ <https://en.rannis.is/>

⁵⁵ <https://en.rannis.is/funding/research/icelandic-research-fund/>

⁵⁶ <https://en.rannis.is/funding/research/infrastructure-fund/>

⁵⁷ <https://en.rannis.is/media/innvidasjodur/Infrastructure-Fund-rules-and-guidelines-2019.pdf>

⁵⁸ <https://en.rannis.is/activities/open-access/>

Public authorities and agencies are encouraged to make data openly available on a centrally run web⁵⁹. Presently, ten out of twelve public bodies listed as using the web use it to publish datasets or link to datasets on their own websites. The bodies include Registers Iceland, The Financial Management Authority, The Árni Magnússon Institute for Icelandic Studies, the National Land Survey of Iceland, The Icelandic Institute of Natural History and the city of Reykjavík. Information on licences is not always presented.

The National and University Library of Iceland is the main legal deposit library of the country and preserves copies of works published or issued in Iceland. The library has a policy on open access and open science⁶⁰ (in Icelandic only) and serves a centre for digital preservation of various collections. The National Library maintains an open repository, www.opinvisindi.is⁶¹, for peer reviewed publications, set up at the request of the University of Iceland and shared by all Iceland's universities. University librarians have been and continue to be leading in the cause of open access in Iceland.

Conclusion

There are clear signs of a growing awareness in Iceland on the importance of open access to research data as well as publications, in addition to open data collected by various government agencies. An Open Science Policy is in preparation at the Ministry for Education, Science and Culture and open access to public data has been increasing for a number of years.

Iceland's first national roadmap on research infrastructure will be published shortly where the handling, storage and access to research data are among the RI roadmap's main emphases.

1.6.6 Open Science in Estonia

Estonia has an Open Science Policy Framework in development in the Ministry of Education and Research.

Open Science policies in Estonia

The Estonian official position with respect to Open Science (OS) has been clearly defined by the government decision concerning the availability and preservation of research information. This decision states, among other issues, that research publications should be openly accessible. In case of publicly funded research, OA must be included into the funding conditions. Additionally, this decision highlights Estonia's commitment to the harmonisation of OA policies at the European Union (EU) level and contributes to the efforts to explain the possibilities of OA to both the researchers and the public. Estonia also supports the broadening of free access to research data along with consideration of large-scale investments.

In the beginning of 2016, the Open Science Expert Group of the Estonian Research Council published the principles and recommendations for developing the national policy "Open Science in Estonia"⁶², paying

⁵⁹ www.opingogn.is

⁶⁰ https://landsbokasafn.is/uploads/stefnur/Lbs-Hbs_Stefna%20um%20opinn%20a%C3%B0gang%202016%20-%20isl%20-%20loka.pdf

⁶¹ <http://www.opinvisindi.is/>

⁶² <http://www.etag.ee/wp-content/uploads/2017/03/Open-Science-in-Estonia-Principles-and-Recommendations-final.pdf>

attention to research data as well. The document defines Estonia's strategic objective 2020: The academic community is familiar with and accepts the principles of open science and open data. Research data collected with the support of public funding are freely accessible and re-usable to all, if not restricted by legal requirements. Research data are preserved in open repositories which meet certain standards and are made available at the earliest opportunity.

The prime target of Open Science is to enable the society, entrepreneurs and scientists free access to the research results and there-by improve transparency and efficiency of research. Open science is the horizontal value and practice across Estonia's science structure, which is taken into account in science communication, research results evaluation, funding decisions, shaping careers in science and granting access to scientific information alike. The standards include:

- all research papers supported by public money to be freely accessible
- the research data acquired on public funds support to be open access
- scientists, entrepreneurs as well as wider public to be well informed on the essence of the open science, appreciate and implement it in their daily activities
- the necessary infrastructure to ensure implementation of these principles being developed
- the principles of open science are evaluated and valued in the process of assignment of research funds and promoting careers

Publications:

- A. All publications reflecting research supported from public funds should be made freely accessible no later than within 12 months from the date of publication in at least one of the following resources: open database of the publisher, institutional repositories, publishing platform or in an OpenAIRE type repository, preferably supported by a Creative Commons Attribution (CC BY) licence.
- B. All tax-payer funds supported journals published in Estonia must grant immediate public access to the fresh releases in accordance with open access principles and public licencing (e.g. CC BY) and guarantee long-term archiving, as well as open access to the archived materials.
- C. While supporting open access publication, it is important to make sure that implementation of the open science principles does not hamper Estonian science community access to the subscription-based science publications and resources.

Research data:

- A. The data collected for public funds supported research should be made available according to the FAIR Data Principles (**F**indable, **A**ccessible, **I**nteroperable, **R**eusable)
- B. Alongside with publications, it is also advisable to adhere to the open licencing principles for the release of research data, enabling access with the save, copy, forward and reuse functionality.

- C. The data being subject to intellectual property or GDPR (**General Data Protection Regulation**) or national security may comprise an exception of the above-mentioned rules. (Estonia as a member of LERU has signed the Sorbonne Declaration on research data rights⁶³).

Communication and skills:

- A. Dissemination to make Estonian science community to recognize and acknowledge Open Science as an integral part of the research process is equally important. Enterprises and organizations should be informed of their Open Access right to the research publications as well as raw data.
- B. Knowledge building among Estonian scientists in this context puts an emphasis on being aware of the available selection of publication choices, as well as improvement of their data management skills.
- C. The University of Tartu Library offers training (in Estonian and English) on RDM⁶⁴ for researchers who have to include a Data Management Plan (DMP) in their funding applications submitted either to the Estonian Research Council or the European Commission (under Horizon 2020).

Infrastructure:

- A. Research institutions own an infrastructure to support their research goals, as well as public dissemination of the data, the results and the derived publications.
- B. Research institutions have the opportunity to develop and use institutional repositories, but the critical support structures for data governance and excellence in expertise aggregate into the Open Science Competence Centre.
- C. Re3data⁶⁵ database lists six data repositories for Estonia. There is no national level repository in Estonia. The only cross-disciplinary data repository in Estonia is the University of Tartu's data repository (DataDOI) whereas all the other repositories are disciplinary. Research data is usually deposited in international data repositories, like Zenodo.

Research evaluation:

- A. Both governmental and institutional evaluation of research is based on the DORA (San Francisco Declaration on Research Assessment⁶⁶) principles: with the focus on rather the content and avoiding the use of publication based indicators (e.g. Journal Impact Factor). The criteria are clear cut and versatile research-target-orientated (incl. data).
- B. Clear definition of qualifiers and quality criteria for the open data repositories is an ultimate prerequisite for integration of the elements of open science into the research evaluation procedure.

⁶³ <https://www.leru.org/files/Sorbonne-declaration.pdf>

⁶⁴ https://sisu.ut.ee/rdm_course1/avaleht

⁶⁵ [https://www.re3data.org/search?query=&countries\[\]=EST](https://www.re3data.org/search?query=&countries[]=EST)

⁶⁶ <https://sfdora.org/>

Open Science actors and their roles in Estonia

The **Ministry of Education and Research** is responsible for the shaping of the Open Science policy i.e. integrating it into the legislative guidelines for science.

Estonian Research Council is in charge of coordination of the implementation of the set goals, including arrangement of the Open Science Expert Group sessions. The latter is tasked to elaborate proposals for developing the principles of national open science policy and to advise Estonian Research Council as well as the Ministry of Education and Research and other related parties on open science issues (both strategic and practical), like: collecting scientific information, open access publishing, infrastructure pertaining open science and its data etc.

Open Science Expert Group is also in charge of making proposals on more specific aspects of the implementation of open science principles by forming purpose-oriented workgroups to tackle them.

Estonian Research Council's Open Science Expert Group is comprised of representatives of the Ministry of Education and Research, the Estonian Research Council, scientific libraries, institutions for research and development and Academy of Science.

In 2015, Estonian Research Council established the Open Science Expert Group⁶⁷ which has compiled the general principles and policy recommendations document for open science in Estonia⁶⁸. This document is a systematic approach in the field of open science, where the principles of open science are introduced, the main open science policy options and further activities are indicated. The purpose of the document is to create a common framework and understanding how to handle open science issues in Estonia and to encourage the development of national strategy and institutional policies in open science.

In 2017, two surveys about open science issues were carried out by the University of Tartu and Tallinn University in cooperation with Estonian Academy of Sciences. The aim of both surveys is to support Estonian policymakers in the field of open science at national and EU levels. The survey carried out by the University of Tartu was focused on general issues of open science, open access publishing, open data and socio-economic impact assessment of open science. The survey carried out by Tallinn University and Estonian Academy of Sciences involves the factual material to enable the interpretation and describe the meaning, possibility and potential of the trends of Open Science in the context of the developmental needs of the Estonian sciences and the State. Both surveys include practical recommendations for the adoption of open science policy in Estonia.

In February, 2020, Estonian Research Council signed the agreement for Estonia to join the Nordic e-Infrastructure Collaboration NeIC, which gives Estonian research infrastructures the possibility to maintain and enhance their competitiveness and do more international cooperation.

Universities

Estonian universities have no adapted Open Access or Open Science policies at the moment; however, universities are participants in various projects that promote Open Science advancement. Most of the Estonian universities, such as the University of Tartu, Tallinn University of Technology, Tallinn University

⁶⁷ <https://www.etag.ee/en/activities/horizontal-topics/open-science/open-science-expert-group/>

⁶⁸ <http://www.etag.ee/wp-content/uploads/2017/03/Open-Science-in-Estonia-Principles-and-Recommendations-final.pdf>

and the Estonian University of Life Sciences, introduced requirements to deposit university's theses and dissertations in their institutional repositories and make it publicly available via the green OA route.

The University of Tartu Library has been actively promoting Open Access and Open Science since 2009. University of Tartu has been a member of the OpenAIRE project since 2009, it's library being OpenAIRE NOAD in Estonia. Starting from 2019, the University of Tartu is also the National Node of Research Data Alliance. The University of Tartu Library offers training (in Estonian and English) on RDM for researchers who have to include a Data Management Plan (DMP) in their funding applications submitted either to the Estonian Research Council or the European Commission (under Horizon 2020).

In 2017, the Centre for Ethics and the University of Tartu in cooperation with a working group appointed by the Estonian Research Council published the Code of Conduct for Research Integrity⁶⁹. The Code states the researcher avoids publishing a publication if there are any doubts about the reliability of the publication or the publisher or the quality of peer reviewing. If all the conditions are satisfying, the researcher is recommended to publish in an OA journal. Furthermore, it specifies that the researcher is responsible for ensuring that research results are made available to the broad public and, if necessary, cooperating with parties outside the research community to popularise research.

Funders

The Ministry of Education and Research in Estonia implements national research policy, organises the financing and evaluation of the activities of R&D institutions and coordinates international research cooperation at the national level. The Ministry is also responsible for the planning, coordination, execution and monitoring of research policy related to the activities of universities and research institutes. Prepared by the Ministry of Education and Research prepared the Estonian Research and Development and Innovation Strategy 2014-2020 Knowledge-based Estonia (R&D&I strategy)⁷⁰. On the 21 January, 2014, Estonian Parliament (Riigikogu) approved this strategy. One of the points in the strategy (2.11.) states that it is important to encourage Open Access (OA) to publicly financed research results and research data. Support extensions to databases in research institutions and research libraries, and ensure access to the most important research databases.

In general, the Estonian Research Council as well as universities give researchers freedom to publish their research publications in any chosen journal; however, the Estonian Research Council requires researchers with personal research grants to publish their publications via green OA route. According to the Conditions of and Procedure for Personal Research Funding Applications for Postdoctoral Grants⁷¹ the full texts of the articles that have been published as a result of the funded project and also contain a reference to the grant have to be made freely available by the host institution via the Estonian Research Information System (ETIS), unless limited by publishing restrictions, copyright, or IP laws. Also, the Article Processing Charges (APCs) fees are eligible for funding in personal research grants. Starting from 2017, the Estonian Research Council added a requirement for RDM as a requirement of personal research grants. The Conditions of and Procedure for Personal Research Funding Applications for Postdoctoral Grants in 2018 includes a requirement to provide an explanation on how the data of the project will be managed.

⁶⁹ https://www.eetika.ee/sites/default/files/www_ut/hea_teadustava_eng_trukis.pdf

⁷⁰ https://www.hm.ee/sites/default/files/estonian_rdi_strategy_2014-2020.pdf

⁷¹ <https://www.etag.ee/wp-content/uploads/2019/03/ENG-PUTJD-taotlemise-juhend-2019.pdf>

Conclusion

Although, open science and research data have been topics of the research policy agenda for almost ten years in Estonia, there has been a lack of comprehensive approach to the field. The Ministry of Education and Research in Estonia has started to develop a roadmap for an open science policy framework which is expected to result in official policy in a couple of years. It is expected that in a few years, this policy can result in the establishment of Estonian Open Science Competence Center which is a central support system for open science implementation in Estonia. Estonian Research Council has started to require research data management plans from all personal grant applications. In addition, Estonian universities have started to offer various services to support open science, like e-infrastructure, data management training etc; however, it is clear that Estonia needs change of culture and reward system in order to make rapid progress in implementation of open science roadmap.

1.6.7 Open Science in Latvia

Latvia has not implemented a national open science policy yet, but several actions and initiatives to implement principles of open science are taking place in Latvia.

Open science policies in Latvia

Latvia joined OpenAIRE project in 2009 and eInfraNet project in 2010 - both related to Openness⁷² issues. National Open Access Contact point⁷³ and the National Open Access Desk has been created by the University of Latvia being a member of OpenAIRE consortium.

The Ministry of Education and Science released the "Latvian European Research Area Roadmap 2016-2020⁷⁴", listing the promotion of open access as a top priority.

Open science actors and their roles in Latvia

The Ministry of Education and Science is initiating and coordinating development of open science policy and roadmap in Latvia.

Universities and other HEI, as well as research institutions are involved and open access policies are being already implemented by some of them.

Latvian National Library and the National Open Access Contact point are playing a very active role in promoting open science and open access by organizing different events.

Universities

Open science and open access policies in HEI are at an early stage in Latvia. There are 6 universities in Latvia and three of them are slightly ahead in development. Activities in this field are very much supported by being

⁷² <https://www.oerknowledgecloud.org/archive/e-InfraNet-Open-as-the-Default-Modus-Operandi-for-Research-and-Higher-Education.pdf>

⁷³ <https://www.napd.lu.lv/>

⁷⁴ http://www.izm.gov.lv/images/starptautiska_sad/Eiropas_Pētniecības_telpa/Latvian_ERA_Roadmap_2016_-2020.pdf

involved in international projects, as for example, OpenAIRE. From 2010 the University of Latvia⁷⁵ and from 2017 the Riga Technical University⁷⁶ adopted institutional policies of open access. It is recommended that researchers provide open access to their publications and other research outputs in their data repositories. Riga Stradiņš University⁷⁷ also has their data repository Dspace⁷⁸.

Funders

There are two main funders related to higher education and research in the country- the Ministry of Education and Science⁷⁹ (IZM) and State Education Development Agency⁸⁰ (VIAA). IZM released the "Latvian European Research Area Roadmap 2016-2020"⁸¹, listing the promotion of open access as a top priority. This document states that only 17% of the research articles and data are provided with open access and define several aims to be reached in the field of open access:

- provide funding for publishing research articles and data in open access journals or repositories;
- amend the legislation by defining what kind of research publications and data must be provided with open access and must be archived in the institutional open-access repository;
- develop a concept for establishment of the national repository for open-access research publications and data in Latvia;
- organize informative seminars.

According to the Law on National Research Information System from 2017 the Ministry of Education and Science is promoting implementation of open science principles. Cabinet Regulation No.560 from 2018 on "Procedures for the Implementation of State Research Programme Projects" demand "...dissemination of research results without exclusivity and discrimination, including through the use of teaching, free access databases, open publications or open source software".

The Ministry of Education and Science of Latvia is participating in the ERAC Standing Working Group on Open Science and Innovation (ERAC SWG OSI).

The Ministry has initiated a project to perform information review on open science and landscape analysis on the situation in Latvia with mapping of data repositories. The aim of the project is to develop open science policy and implementation Roadmap. Latvian National Library⁸² is leading this project.

⁷⁵ <https://www.lu.lv/eng/>

⁷⁶ <https://www.rtu.lv/en/science/open-access-initiative/rtu-position-regarding-oa-free-access-issue>

⁷⁷ <https://www.rsu.lv/en>

⁷⁸ <https://www.rsu.lv/en/dspace>

⁷⁹ <https://www.izm.gov.lv/en/>

⁸⁰ <http://viaa.gov.lv/eng/>

⁸¹ http://www.izm.gov.lv/images/starptautiska_sad/Eiropas_Pētniecības_telpa/Latvian_ERA_Roadmap_2016_-2020.pdf

⁸² <https://www.lnb.lv/en>

Other public actors

Latvian National Library is very active in promoting open access and creating open data repositories as well as cooperating with IZM and universities. Good example is Digital Humanities⁸³ repository containing digitised and digitally created texts for use in computerised analysis for research and study purposes.

Research institutions also have their research data repositories in specific research fields mainly connected to ESFRI project vertical data infrastructures.

Open data initiatives are very popular in Latvia in recent years. Latvian Open Technology Association⁸⁴ LATA is uniting organisations and individuals, including public, municipal authorities, educational and scientific institutions to promote openness of technologies, interoperability, reusability and open standards.

Conclusion

There are promising trends in raising awareness on open science and open data in Latvia in recent years. The Ministry of Education and Science is focused on the development of open science policy and Roadmap involving potential users in the process. There is already a good example on how Latvia achieved fast development in creating and implementing Open Data policy in public domain⁸⁵ since 2016 (open data portal⁸⁶, Latvian Open Technology Association⁸⁷ (LATA) organizing conferences, hackathons etc.).

1.7 Resource provisioning and access policies in the Nordic and Baltic countries

Within the frame of EOSC-Nordic work package 2 participants from SNIC, CSC, UEF, FMI, SIGMA2, UT/ETAIS, DeIC, UICE, RTU and NORDUnet have during September 2019 - February 2020 carried out desktop studies regarding resource provisioning and access policies for horizontal IT-services services. The limitation for the desktop studies was nationally available basic infrastructure such as trust and identity, compute and storage, funded by national funds.

The horizontal IT-services services chosen for the desktop studies were limited to nationally available basic horizontal IT-infrastructure, compute and storage, funded by national funders. Additionally, the participants have assisted Work package 3 in listing policies in order to match the requirements of the aforementioned work package for upcoming deliverables.

The desktop studies also build on previous inventories⁸⁸ performed by the e-Infrastructure Reflection Group regarding resource provisioning and access policies, this in order to add to existing knowledge.

⁸³ <http://www.digitalhumanities.lv/home/>

⁸⁴ <https://www.lata.org.lv/?lang=en>

⁸⁵ <https://www.europeandataportal.eu/en/dashboard#2019>

⁸⁶ <https://data.gov.lv/eng>

⁸⁷ <https://www.lata.org.lv/?lang=en>

⁸⁸ <http://e-irg.eu/documents/10920/238968/NationalNodesGettingorganisedhowfararewe.pdf>

A notable finding is that horizontal IT-services are not available in all countries in the Nordics and the Baltics. The desktop studies show that access policies over all, with some exceptions, are similar throughout the Baltics and the Nordics. They range from countries offering access to horizontal IT-resources solely for academic use within national HEIs, to some countries offering horizontal IT-resources for commercial usage as well.

1.7.1 Resource provisioning and access policies in Sweden

This section details access policies and resource provisioning principles for horizontal IT-services, compute and storage, in Sweden. Resources are provided by several actors at the national level: SND, SNIC, SUNET and RUT⁸⁹. Generally available compute-services for research, and storage for active data, are provided mainly by SNIC.

Steering documents

Both SNIC and SND are governed by the Swedish Research Council general grant agreement, specific grant agreements for the e-infrastructures, and consortium agreements for respective organizations. SUNET and RUT is governed by the Swedish Research Council, which has a special commission from the Swedish Government to host and operate SUNET.⁹⁰

Financing

Resource provisioning and access policies for the horizontal IT services provided by SNIC is coupled to the financing of SNIC.

SNIC and SND is financed by 50% by the Swedish Research Council and by 50% by consortium consisting of HEI: s. The base funding from the Swedish Research Council to SUNET comes as a directive from the Government with a specified budget. RUT is financed by the Swedish Research Council.⁹¹

Users

Access for SNIC horizontal e-Infrastructure services provided by SNIC, SND, SUNET and RUT is free for end-users at the point of access. SNIC and SND services are limited to employees of Swedish HEI: s. SUNET services also include cultural institutions. RUT services also include government authorities, hospitals etc.⁹²

For SNIC the user bases are defined by the specific grant agreements, as such governs the mandate regarding access by defining the scope of the user base that has access to the horizontal IT-services.

Access

Resource provisioning for horizontal IT services, compute and storage provided by SNIC specifically, is defined the SNIC consortium agreement, which governs the allocation principles and access mechanisms for SNIC services. These are further defined in agreements between the SNIC-office and parties within the SNIC consortium providing the hardware and personnel. The SNIC-consortium agreement details access policies used within SNIC, tasking SNIC to uphold the steering documents governing allocation procedures.

⁸⁹ https://www.vr.se/download/18.50a36236168b14238b1dbb/1552381575539/Outlook-national-roadmap-e-infrastructures-for-research_VR_2019.pdf

⁹⁰ Ibid

⁹¹ Ibid

⁹² Ibid

SNIC utilizes technical review for some types of allocations, and for some types of allocations both technical and scientific review. Technical review mainly involves review of feasibility and efficiency. Scientific review mainly involves review of usage, the ability of the research group, project plan, and output.

1.7.2 Resource provisioning and access policies in Finland

The below section details access policies and resource provisioning principles for horizontal IT-services, compute and storage, in Finland.

Steering documents

Finland's Strategy and Roadmap for Research Infrastructures 2014–2020, includes Finland's research infrastructure strategy and an updated roadmap for 2014–2020. The research infrastructure ecosystem is governed by this strategy. Such an ecosystem includes major national research infrastructures, Finnish actors' partnerships within European infrastructure

projects (ESFRI), memberships of other international infrastructures and research organisations' strategically significant infrastructures. The roadmap for research infrastructures (Finland's Strategy and Roadmap for Research Infrastructures 2014–2020⁹³ will be updated every five years).

In January 2020, the Academy of Finland published a strategy for national research infrastructures in Finland was updated for the years 2020-2030⁹⁴. The objective of the strategy is to promote the quality, competitiveness and renewal of research, to strengthen the broad-based impact of research environments and to increase national and international cooperation. The strategy was drawn up by the Finnish Research Infrastructure Committee and adopted by the Board of the Academy.

CSC – IT Center for Science Ltd⁹⁵ (CSC) acts as a partner in several ESFRI projects and has an important role in horizontal e-infrastructures that integrate scientific disciplines and organisations across Europe. (Finland's Strategy and Roadmap for Research Infrastructures 2014–2020⁹⁶)

CSC is a non-profit state enterprise with special tasks. As part of the national research system, it develops, integrates and provides high-quality information technology services. CSC is owned by the Finnish state (70% shareholding) and higher education institutions (30% shareholding)⁹⁷.

The primary norms pertaining to a state-owned company entrusted with the performance of special tasks are based on the Finnish Limited Liability Companies Act (624/2006) and the State Shareholdings and Ownership Steering Act (1368/2007)⁹⁸.

⁹³ <https://www.aka.fi/en/research-and-science-policy/research-infrastructures/finlands-roadmap-for-research-infrastructures/>

⁹⁴ <https://www.aka.fi/en/about-us/media/press-releases/2020/academy-of-finland-publishes-strategy-for-national-research-infrastructures-in-finland-20202030/>

⁹⁵ <https://www.csc.fi/en/home>

⁹⁶ <https://www.aka.fi/en/research-and-science-policy/research-infrastructures/finlands-roadmap-for-research-infrastructures/>

⁹⁷ <https://www.csc.fi/en/csc>

⁹⁸ <https://www.csc.fi/en/administration>

Users

The primary customers of CSC are the Ministry of Education and Culture and organizations in the field, higher education institutions (universities and universities of applied sciences), research institutes and public administration. CSC provides services to its owners for no profit⁹⁹.

Financing

The department for Higher Education and Science Policy and General Upper Secondary Education of the Ministry of Education and Culture procures service packages to serve educational, scientific, cultural and administrative needs¹⁰⁰.

Access

The right to use CSC's services is based on user's affiliation to a Finnish higher education institution (Universities, Universities of Applied Sciences), or a state research institute¹⁰¹. For using CSC services, you usually need a project and user accounts for every user¹⁰².

Academic use

Academic and educational use for higher education institutions and state research institutes is funded by the Ministry of Education and Culture. Research focus should be academic research of which results are published as thesis (pro graduate, licentiate and doctoral thesis) or articles in scientific publications.¹⁰³

1.7.3 Resource provisioning and access policies in Norway

The below section details access policies and resource provisioning principles for horizontal IT-services, compute and storage, in Norway.

Steering documents

Sigma2 offers IT services for research in Norway. Sigma2 was established as a non-profit company in December 2014, based on an agreement between the Research Council of Norway and the consortium formed by the four oldest universities in Norway. UNINETT Sigma2 AS (Sigma2) has a strategic responsibility for and manages the national e-infrastructure for large-scale data and computational science in Norway. Sigma2 is mandated to provide services for high-performance computing and data storage to individuals and groups involved in research and education at all Norwegian universities and colleges, and other publicly funded organisations and projects.

Users

Sigma2 infrastructure consists of compute and storage resources connected with data services to cover the whole research project life cycle. The users are mainly researchers from public institutions such as Universities and Universities Colleges, but also research institutes and small and medium-sized enterprises (SMEs). Principle Investigators owning the projects beneficiary of the IT resources should be Norwegian

⁹⁹ <https://www.csc.fi/en/csc>

¹⁰⁰ <https://research.csc.fi/free-of-charge-use-cases>

¹⁰¹ <https://research.csc.fi/free-of-charge-use-cases>

¹⁰² <https://research.csc.fi/accounts-and-projects>

¹⁰³ <https://research.csc.fi/accounts-and-projects>

while no restrictions are connected to the nationality of the users accessing the resources. Compute resources are free of charge for small projects publicly funded, while a contribution model is required for large projects or projects needing special resources. Storage resources are free of charge up to a certain amount beyond which a contribution model is required, according to the same principles adopted for the compute resources. The archive and the Data Management Tool services are free of charge and support FAIR principles by-design.

Financing

Sigma2 basis funding is to the large part provided by the Research Council of Norway (RCN) together with Sigma2s support consortium. Furthermore, Sigma2 applies for additional funding for the procurement of the infrastructure to the INFRA program provided every second year by the RCN. Last, Sigma2 income also includes funding from the contribution model connected with the provisioning of the infrastructure and the support from the participation to European Projects in the framework of the H2020/INFRAEOSC or the EuroHPC.

Access

Access to the resources is done through peer reviewed allocation process run every 6 months. The resources are granted on the basis of scientific merit. The evaluation of the proposal is done by a resource allocation scientific committee, supported by the assessment of the technical feasibility of the project done by a technical working group. For the projects that required dedicated/special resources on a pay-per-use model, the access is granted on demand, without evaluation from the Resource Allocation Committee.

1.7.4 Resource provisioning and access policies in Denmark

The below section details access policies and resource provisioning principles for horizontal IT-services, compute and storage, in Denmark.

Steering documents

National service provision in Denmark is for the most part managed by the Danish e-Infrastructure Cooperation, which is the main e-infrastructure provider and cooperation entity set up as a unit based on an agreement between the Danish Ministry of Science and Higher Education and the Danish universities.

The original agreement ran from 2012-2016, but has been extended for the last couple of years until a new strategy can be implemented from 2020 forward. In order to bridge the transition, all the universities have agreed to provide access to resources locally on a pay-per-use principle.

Users

The grant conditions for usage of HPC-resources are identical in all cases - the co-funding covers some of the acquisition costs for a system, provided that all danish scientific users could get access regardless of affiliation, provided that the costs for the access was covered.

Financing

When DeIC was established the organization received a grant of 7 Meuro from the government's Research Infrastructure Fund. A large proportion of that money was used as cofund to provide national access to HPC. Through a process of competitive calls for proposals three national systems have been established.

A major part of the new Strategy on National Cooperation on Digital Research Infrastructure, is to establish a new service platform for HPC provisioning.

The basic principle that was accepted by the Ministry and the universities was that there should be a common model for open access to national HPC, in which end-users should have the same conditions for access regardless of affiliation and free of charge. Access to HPC must also include access to services.

In order for that to take place, there is a funding model between the involved universities, ensuring coordination, scalability and regular update of HPC systems. Cost of ownership should be addressed, including balancing the costs and effectiveness of building HPC in Denmark, compared to procuring resources outside Denmark, particularly addressing the Danish involvement in EUROHPC. The Danish Ministry of Science and Higher Education and the 8 Danish Universities have made a common pledge to increase funding for national e-infrastructure over the next three years. A large part of this increase will be dedicated to HPC.

The funding model will be such that the HPC systems installed, will be 50% funded from the Ministry and 50% from the universities, distributed such that each university pays a share and gets access to HPC cycles according to the size of each individual university's turnover.

For the 50% that the Ministry pays, an application system and peer review system will be set up, to ensure proper prioritization of requests for resources. The benefit of this (on paper) is that each university pays, and manages their own part of the resources according to needs. Also, the hosts have a sustainable cost recovery model, not facing the economic risk of having too few customers.

In principle this costing and distribution system is much like the system being implemented in EUROHPC and is basically the funding model chosen for the Danish engagement in the LUMI consortium.

Access

None of the Danish systems were based on free user access, but different funding models were chosen for each system:

- The Cultural Heritage Cluster is based on institutional membership, based on the full cost of ownership over the lifespan of the system.
- Computerome is based on pay-per-usage, prices being calculated on total cost of ownership for the system, minus the costs covered by the DeIC grant, and direct costs of services.
- ABACUS 2- the largest HPC system in Denmark, was installed by SDU as a general-purpose machine. It is also based on pay-per-usage but also offered institutions to front funding for their scientists providing them with access to the system based on the share an institution would cover.

Requests for access to HPC facilities for private/commercial users are allocated depending on the available resources and within the limits of the service. Prices are higher, since costs covered through the state grant only apply to scientific users. All academic users, independently of their host institution (including scientists from the host institution) pay the same price.

1.7.5 Resource provisioning and access policies in Iceland

The below section details access policies and resource provisioning principles for horizontal IT-services in Iceland.

The University of Iceland and the University of Reykjavík jointly run **IHPC**¹⁰⁴, the Icelandic High Performance Computing Centre. The IHPC is supported by the Icelandic Research Centre's Infrastructure Fund.

The Icelandic University Research Network, RHnet, aims to enhance the level of communication within the Icelandic university and research community, as well as serving as a gateway to international networks. RHnet also provides transit to the Icelandic network of secondary schools and distance education centers (FSnet). FSnet is run by the Ministry of Education under contract with a commercial service provider. Rhnet handles relations with NORDUnet.

Steering documents

RHnet - Icelandic University Research Network (RHnet) is a limited company. Its board of five is elected annually. As majority shareholder, the University of Iceland has three members on the board. Rhnet have articles of association¹⁰⁵.

Users

Use of IHPC¹⁰⁶ is limited to academic researchers at Icelandic research institutions and collaborators of Icelandic research groups. Applicants must have a tenured position at an academic institution or be employed by a research institution in Iceland. Students must be sponsored by their professors. A user applies electronically for access.

Financing

Rhnet is financed by its shareholders; IHPC is financed by the Infrastructure fund and participating institutions.

Access

Academic researchers both inside and outside Iceland, who collaborate with a Icelandic research group, can apply for access to IHPC via email.

1.7.6 Resource provisioning and access policies in Estonia

The below section details access policies and resource provisioning principles for horizontal IT-services, compute and storage, in Estonia.

Steering documents

The Estonian Research Infrastructures Roadmap¹⁰⁷ is a long-term planning instrument with a perspective of 10–20 years, which contains a list of new nationally important research infrastructure units or of those in need of modernization. Objects listed in the roadmap might be physical or network structures as well as involvement in the international research infrastructure organisations. The main objective of this roadmap

¹⁰⁴ <http://ihpc.is/>

¹⁰⁵ <https://www.rhnet.is/samt.html>

¹⁰⁶ <http://ihpc.is/garpur/>

¹⁰⁷ https://www.etag.ee/wp-content/uploads/2019/06/ETAg_Research_Infrastructure_Roadmap_2019.pdf

is to support establishment of new large-scale research infrastructures, define their significance on national level and create a basis for the funding decisions in this regard.

- I. There are certain infrastructure elements dedicated to guarantee the competence and services required for open science on a national level. These infrastructure units give the technical backing for the competitiveness of Estonian science and ease of sharing the research results with cooperation partners as well as broad public. The following should be enlisted:
 - A. Estonian Research Information System (ETIS¹⁰⁸) performing also as a metadata database with the research publication archival and open access granting functionality.
 - B. Estonian Scientific Computing Infrastructure (ETAIS¹⁰⁹) belongs to the Estonian roadmap of research infrastructures providing computing and storage resources for Estonian scientific community. ETAIS works on integration of High-Performance Computing services both in Estonia and beyond - including upcoming supercomputer LUMI, which will be built in Finland as a joint effort of several countries under EuroHPC umbrella.
 - C. On the initiative of the research infrastructure roadmaps, the University of Tartu joined the DataCite in 2014 and acquired the right to assign unique DOI identifiers to research data. The University of Tartu is the DataCite member and Allocation Agent for DataCite DOIs in Estonia. In early 2015, Estonian universities formed the DataCite Estonia Consortium¹¹⁰ with the aim to improve the accessibility of Estonian research data.
- II. The second category are subject or discipline based and institutional repositories also supporting the goals of open access and open science.
 - A. On site repositories maintained by universities, libraries or research institutes of the Academy of Science.
 - B. Data repositories with integrated processing pipelines (e.g Natural history archives and information network - NATARC¹¹¹ , Center of Estonian Language Resources – CELR¹¹², the Estonian E-varamu¹¹³ portal - an integrated e-environment created for digitized resources of the Estonian memory institutions: libraries, archives and museums, etc.)

Users

The cost and access policies vary. The use of research network is free for academic customers. The access is limited to academic users. The main access criteria are that it has to be a scientific or development work, though industrial users are very much welcome. Access to foreign users is granted, providing this is useful for international cooperation.

Financing

The operations of NREN are financed by the Ministry of Education and Science. The computing infrastructure is acquired mainly using structural funds, operation costs are covered by universities and

¹⁰⁸ <https://www.etis.ee/Portal/News/Index/?IsLandingPage=true&lang=ENG>

¹⁰⁹ <https://etais.ee/about/>

¹¹⁰ <http://datacite.ut.ee/>

¹¹¹ <https://natarc.ut.ee/en/index.php>

¹¹² <https://keeleressursid.ee/en/>

¹¹³ <https://www.e-varamu.ee/content/about/>

commercial customers. The government also financed the participation in LUMI supercomputer and EuroHPC Competence Center. Most development is financed from international projects. Industry users are very welcome. There is currently no credible strategy for replacing hardware, earnings from selling Estonian share of LUMI resources to users will be used to support local Infrastructure.

The roadmap is an input to the investment decisions regarding research infrastructures.¹¹⁴ The inclusion in the roadmap does not automatically guarantee funding, but usually results in a grant that helps to cover ca 10% of cost related to cooperation and interoperability.

Access

No peer-review, all access to resources from a single portal/ marketplace and is handled mostly automatically.

1.7.7 Resource provisioning and access policies in Latvia

The below section details access policies and resource provisioning principles for horizontal IT-services in Latvia.

Steering documents

There is no horizontal e-Infrastructure development strategy and resource provisioning for Latvia defined, documented and approved. Partly this issue has been touched during work on ESFRI Roadmap for Latvia. Overall governance of research related development in the country is the responsibility of the Ministry of Education and Science¹¹⁵ (IZM) and State Education Development Agency¹¹⁶ (VIAA).

The Department of Information Technology of IZM is responsible for maintaining functionality and the governance of the Latvian NREN (LAT) according to agreement with VIAA. IZM is also representing Latvia in GÉANT¹¹⁷. By the Order of the Cabinet of Ministers No.160 from 26.03.2015 "Membership of Latvia in GEANT network" responsibility to provide connection of Latvian academic network LAT to GEANT has been delegated to SigmaNet¹¹⁸ being under LU MII (eng. IMCS UL) - the Academic Network Laboratory of the Institute of Mathematics and Computer Science of the University of Latvia (LU).

The responsibility for provisioning the national level computing (HPC) and data services has not been allocated to any organization in Latvia. Academic and research organizations are mostly organizing these services by themselves, but LU MII and the Riga Technical University (RTU HPC centre) are also offering their services to other institutions.

¹¹⁴ <https://www.etag.ee/en/funding/infrastructure-funding/estonian-research-infrastructures-roadmap/> .

¹¹⁵ <https://www.izm.gov.lv/en/>

¹¹⁶ <http://viaa.gov.lv/eng/>

¹¹⁷ <https://www.geant.org/>

¹¹⁸ <https://www.sigmanet.lv/>

Users

NREN LAT covers Latvia and connects 20 academic institutions with the Data Centre located in Riga, RTU campus. IZM is responsible for the LAT connectivity (agreement with Lattelecom¹¹⁹ providing fibre links and technical service), but academic institutions are responsible for their campus networks. In the Data Centre facility academic and research institutions can place their computing and/or data storage equipment and this process is coordinated by IZM.

Research institutions involved in ESFRI projects (BBMRI-ERIC, CLARIN, ESS-ERIC, JIV-ERIC, EU-OPENSREEN etc.) use LAT network, their own compute/data equipment, as well as other services available on mutual agreements.

Financing

IZM provides funding for academic network LAT and some database services from the state budget. Access to LAT for academic and research users is free of charge, but local network infrastructures of academic institutions, as well as computing/data equipment and services, are in responsibility of their owners and are financed from available resources (government dotation, user contribution, EU project funding etc.).

Access

Access to LAT is open for academic and research organizations for educational and research (non-commercial) purposes. Each computing service provider has its own access policy and application site for new users. Infrastructure is open mainly for academic users, but for users from industry just for research purposes. There are regulations not allowing usage of LAT for other than academic organizations (ex. schools) and for providing commercial services.

¹¹⁹ <https://en.wikipedia.org/wiki/Lattelecom>

List of abbreviations

APC	Article Processing Charges
CSC	IT Center for Science
CoC	Code of Conduct on Research Integrity,
DNRF	Danish National Research Foundation
DMP	Data Management Plan
DeiC	Danish e-Infrastructure Cooperation
DORA	The San Francisco Declaration on Research Assessment
ETAIS	Estonian Scientific Computing Infrastructure
ETIS	Estonian Research Information System
EOSC	European Open Science Cloud
ESFRI	The European Strategy Forum on Research Infrastructures
EU	European Union (EU)
EUROHPC	The European High-Performance Computing Joint Undertaking
ERAC	Standing Working Group on Open Science and Innovation (ERAC SWG OSI).
FAIR	Findable, Accessible, Interoperable, Reusable
FMI	Finnish Meteorological institute
GDPR	General Data Protection Regulation
HEI:s	Higher education institutions
IZM	Latvian Ministry of Education and Science
IHPC	Icelandic High Performance Computing Centre
LATA	Latvian Open Technology Association
LUMI	Large Unified Modern Infrastructure
LU	University of Latvia
NTNU	the Norwegian University of Science and Technology
NSD	Norwegian center for Research Data
NIPH	the Norwegian Institute for Public Health
OA	Open Access
RHnet	Icelandic University Research Network
RCN	Research Council of Norway

RTU	Riga Technical University
RUT	register-based research
SDU	University of Southern Denmark
SMEs	Small and medium-sized enterprises
SNIC	Swedish National infrastructure for computing
SND	Swedish National Dataservice
SUNET	Swedish university Network
TENK	Finnish National Board on Research Integrity
UEF	University of Eastern Finland
UT	University of Tartu
UICE	University of Iceland
UAS	Universities of Applied Sciences
UNIT	Norwegian Directorate for ICT and Joint Services in Higher Education & Research
UIO	University of Oslo
UNIF	the Finnish universities' council of rectors,
VIAA	Latvian State Education Development Agency

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