D2.8: Open Science policies and resource provisioning in the Nordic and Baltic countries (final report)

Author(s)	Emma-Lisa Hansson - SNIC, Linas Bukauskas - VU, Sara Garavelli - CSC, Birna Gunnarsdóttir - UICE, Per-Olov Hammargren - SNIC, Tomi Rosti - UEF, Anca Hienola - FMI, Maria Francesca Iozzi - SIGMA2, Dorthe Anna Mette Morthorst-Jensen - DeIC, Eske Christiansen- DeiC, Päivi Rauste - CSC, Ilmars Slaidins - RTU, Terje Vellemaa - EITAS
Status	Final
Version	1.0
Date	25 April 2022

Document identifier:	
Deliverable lead	SNIC
Related work package	WP 2, WP 4
Author(s)	Emma-Lisa Hansson - SNIC, Linas Bukauskas - VU, Sara Garavelli - CSC, Birna Gunnarsdóttir - UICE, Per-Olov Hammargren - SNIC, Tomi Rosti - UEF, Anca Hienola - FMI, Maria Francesca Iozzi - SIGMA2, Dorthe Anna Mette Morthorst-Jensen - DeIC, Päivi Rauste - CSC, Ilmars Slaidins - RTU, Terje Vellemaa - ETAIS
Contributor(s)	
Due date	2022-02-28
Actual submission date	202203XX
Reviewed by	Josefine Nordling (CSC) Lars Fisher (NORDUnet)
Approved by	
Dissemination level	
Website	https://www.eosc-nordic.eu/
Call	H2020-INFRAEOSC-2018-3
Project Number	857652
Start date of Project	01/09/2019
Duration	36 months

License	Creative Commons CC-BY 4.0
Keywords	Open science, Open Access, Open methods, Cross-border, policy, LUMI, HPC, EOSC, resource provisioning, FAIR

Table of contents

Abstract

D2.8 Open Science (OS) policies and resource provisioning in the Nordic and Baltic countries (final report):

This deliverable, the final report in an instalment of three on OS policies and resource provisioning, provides an updated assessment since the last deliverable, *D2.5 OS policies and resource provisioning in the Nordic and Baltic countries - second report* (Hammargren, Arvola, Rauste 2021). It reports on the fragmented status of OS policies, the different choices for provisioning infrastructure resources and services in the participating countries, and the progress to establish an EOSC perspective within their national policies.

Executive summary

This deliverable, formulated in dialogue with the EOSC Steering Board, is based partially on the EOSC Steering Board survey, which for this deliverable has been developed further into a proposed EOSC framework of OS elements. The elements proved helpful when mapping policies to see how far the Nordic and Baltic countries have come in their policymaking.

All Nordic and Baltic countries have made progress on making new policies, where the scope is national rather than cross-border. Depending on the organisational and political authorities in the countries, different actors are involved in policymaking. The OS landscape is fragmented and oblique. Regarding resource provisioning, this deliverable shows different approaches among the Nordic and Baltic countries concerning EuroHPC. For some countries, EuroHPC appears to be the primary provider of resources, while most countries rely mainly on national resources, with EuroHPC as a complementary provider. Until recently, resources have been nationally allocated, the novelty being a change to supranational co-allocation of resources via the JU part of EuroHPC, e.g. LUMI.

1. Purpose and scope of the document

This deliverable aims to provide a final assessment of the status of OS policies and provisioning of infrastructure resources in the Nordic and Baltic countries, as well as an assessment of how EOSC is included within national policies. The focus of the deliverable was shaped based on the requirements set out in the EOSC Nordic project plan and to support the EOSC Partnership, namely to support the compilation of the survey of the EOSC Steering Board on national contributions to EOSC[1].

In EOSC, a large number of stakeholders work together to create the European web of research data and services. This requires a significant investment of money, resources, and work from all partners involved. The EOSC Association, the European Commission, the EU member states, and associated countries each are to provide their share to make the EOSC a success story. To do so, the three parties of the EOSC partnership have agreed to build up a monitoring system, which will eventually measure the

[1] https://www.eosc.eu/news/launch-first-eosc-steering-board-survey-national-contributions-eosc

progress toward Open Science as the new normal. As a first step, the EU member states and associated countries have worked with the European Commission to start the EOSC monitoring by performing an annual survey on the national contributions to EOSC. This includes the development of policies in the different countries that support EOSC-relevant activities, and resulting from this or already in place, significant investment into the EOSC.

The deliverable provides an inventory of open science documents such as policies and guidelines in the Nordic and Baltic countries. In addition, the deliverable aims at creating understanding and awareness of how EOSC is addressed in the context of OS national policies in the Nordic and Baltic countries, about the implementation of OS at the national levels. The deliverable should clarify the difference between intentions on a supra-national level, EOSC, and the inclusion of the aforementioned aims on the national level.

Regarding resource provisioning, this deliverable focuses on understanding how EuroHPC enables cross-border resource sharing, with a focus on how the LUMI consortium enhances the national HPC landscapes via the addition of supra-national resources at a single site (*About LUMI - LUMI*, n.d.). Commonalities and differences are highlighted regarding the way the addition of supra-national resources affects national provisioning. D2.8 builds upon two previous EOSC Nordic deliverables that are described in the following paragraph.

1.2 Previous deliverables

The first report on this subject produced by EOSC Nordic was deliverable D2.1, OS *policies and resource provisioning in the Nordic and Baltic countries -first report*[2] (Per-Olov Hammargren; Maijastiina Arvola; Päivi Rauste, 2020) and was published in February 2020. The main conclusion of D2.1 was that the maturity of OS implementations in the Nordic and Baltic countries ranges from countries having laws in place governing the implementation of OS, to countries being in the early stages of adopting national strategies and plans for implementing OS. The desktop studies showed that in countries, where a national OS policy has yet to be established, some Higher Education Institutes and funders have established open-access policies, and to a lesser extent open data policies.

Another finding related to resource provisioning and access policies was that horizontal IT services are not available in all Nordic and Baltic countries. For the most part, access to horizontal IT resources is solely provided for academic use, however, one country is offering horizontal IT resources for commercial use. The desktop studies performed on resource provisioning policies showed that principles throughout the Nordics and Baltics differ, ranging from access requiring technical and scientific review to access being granted on demand.

The second EOSC Nordic report D2.5, OS *policies and resource provisioning in the Nordic and Baltic countries - second report* (Hammargren, Arvola, Rauste 2021) was published in February 2021. This deliverable surveyed and described any policy and similar documentation, such as written guidelines,

[2] Deliverable 2.1 Open science policies and resource provisioning in the Nordic and Baltic countries (first report) - EOSC-Nordic

policies, relating to policy-implemented incentives for FAIR, policies for OS training/training for making data FAIR, policies for making other research objects FAIR and policies facilitating cross border research. The study showed that some countries had implemented policies for FAIR incentives in different ways, either in the form of national policies or laws. Policies were found to be authored by different organisations, both by organisations with national mandates, such as funders, and by organisations with a subnational mandate, such as Higher Education Institutions (HEI:s). This illustrated that different stakeholders are involved, ranging from ministries and funders to HEI:s and libraries.
Policies for OS training/training for making data FAIR, or policies that involve OS training, were available in some countries. In countries where neither policies nor training were available, there was found to be awareness of the importance of policies for OS training/training for making data FAIR, as was reflected in available drafts for policies. OS training was found to be provided by HEI:s in a majority of countries. Most countries inventoried did not have policies in place for making other research objects, such as software, FAIR. A conclusion was that making other research objects FAIR is an area in need of focus to ensure transparency, reproducibility, and reusability of research. A majority of the countries had national policies in place for access to resources, with a focus on researchers with national affiliation access to services. A conclusion was that the facilitation of cross-border research is not a focus in the policies, the policies rather have a national scope.

1.3 Structure of the document

The document is structured in the following manner:

- Purpose and scope of the document
- Methodology
    - OS elements as defined in the EOSC Steering Board survey on national contribution to EOSC.
- Results: Update on the state of Open Science - A result section with the policy documents:
    - Presentation of the policy-making organisations in the different countries (country-wise).
    - References to the policies (country-wise) are thematically organised? by the abovementioned Open Science elements (policy documents before 202102 that were covered in WP2.5 are only listed while the policy documents after 202102 are fully described in this deliverable).
    - Presentation of the content in the policy documents with key points for summoning up the content. Key points cover the priorities for the country in terms of policy needs and guidelines and EOSC mentions/correlations
    - Resource provisioning for the infrastructures (country-wise).
- Analysis
- Recommendations for future work for policymakers and EOSC.

2. Methodology

The methodology included a qualitative investigation based on document analysis. The policy documents from the different countries were analysed using the framework of Open Science elements from the EOSC Steering Board survey.

National policies and other relevant documentation produced by nationally mandated organisations form the basis for the inventory in this deliverable, supplemented by pertinent sub-national policies when necessary.

2.1 Open science elements from the EOSC Steering Board survey

To utilise the OS elements proposed by the EOSC Steering Board survey, this deliverable has provided an expanded explanation to build a common understanding of the terminology to then map the content of the different policy documents analysed. This has been done by utilising the different sources defining the different aspects of OS. The elements will provide a clearer picture of which OS elements a particular country's policies are addressing and also information to increase understanding of which elements are missing in each country. These elements could also be adopted in the future to harmonise the future policy priorities. There are ten elements in the EOSC Steering Board survey. Definitions for the elements listed have been gathered from multiple sources:

- **Research culture**
    - Research culture encompasses the behaviours, expectations, values, attitudes and norms of the research communities. It influences researchers' career paths and determines the way that research is conducted and communicated (Research University of Stirling, n.d.)
- **Open access to research publications**
    - The practice of providing online access to scientific information that is free of charge to the end-user and reusable.
    - Routes to Open Access are mainly self-archiving / green open access or Open access publishing/gold open access (European Commission, n.d.-a).
- **Open access to data, data management and FAIR**
    - Access to and reuse of digital research data under the terms and conditions according to national legislation and/or grants.
    - Findability, Accessibility, Interoperability, and Reuse of digital assets (GO FAIR, n.d.).
- **Open access to research data and methods**
    - Authors of research publications can provide open access to their data and methods.
    - Scholarly publishers allow or require authors to save their research data or methods in repositories that can be closed, open or behind paywalls (Tieteen Koordinaatio & Seurain Valtuuskunta, 2021).
- **Open education and open access to educational resources**

    - Worldwide free online access to high-quality educational material.
    - Materials and courses are available online and free of charge (OpenAccess.nl, n.d.).
- **Incentives & rewards**
    - Science is evaluated by quality, use, impact and openness characteristics (Utrecht University, n.d.).
- **Skills and competences**
    - Coordinate and align relevant skills and training by generating a consensus on a European higher education curriculum to deliver FAIR and open science skills at the university level (EOSCSecretariat, 2021).
- **Infrastructures that include aspects of open science**
    - Provide a trusted open environment for storing, sharing, and re-using scientific data and results (Science Europe, 2017).
- **Preservation and reuse of scientific information**
    - Findability, Accessibility, Interoperability, and Reuse of digital assets (GO FAIR, n.d.).
- **Citizen science**
    - Scientific research conducted, in whole or in part, by amateur (or non-professional) scientists (Wikipedia, 2022)

Figure 1 visualises the ten OS elements. The policies from each country have been mapped to the elements, providing an extended image of the frequency with which these elements are mentioned in the policy documents. Showcasing the frequency aims to provide a snapshot of the current policy landscape as a whole, and in each country.

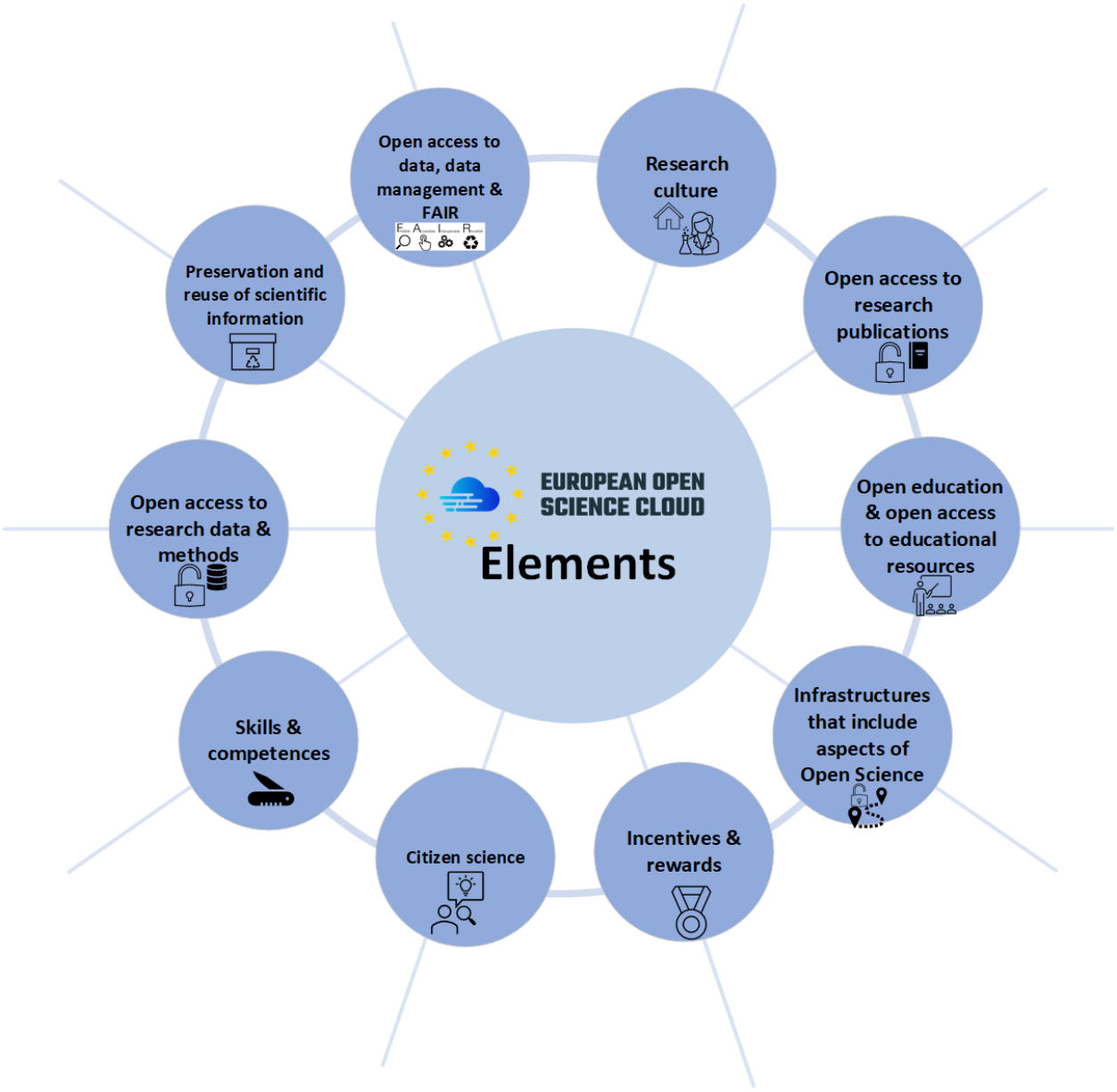

Figure 1: The Open Science elements, as proposed in the EOSC Steering Board survey

3. Update on the state of open science policies in the Nordic and Baltic countries

As required by the deliverable description in the EOSC Nordic Grant Agreement, this document provides an update on the previous deliverable 2.5. Hence, this chapter provides an updated overview of OS policy development taking place in the Nordic and Baltic countries between February 2021 and March 2022. All policies from each country have been mapped to the OS elements suggested by the

EOSC Steering Board surveys and provided with an illustration showing the frequency of the OS elements mentioned in the policy documents. For each country the following topics are addressed:

- Presentation of the policy-making organisations in the country;
- List of the policy documents released before and after February 2021;
- Description of the content of the policy documents released after 2021 (the description of those released before February 2021 is part of D2.5);
- Key topics and priorities addressed by the policy documents;
- Resource provisioning policies in the country.

Beware that a single policy may cover more than one element, and if it is favourable or not that multiple policies do has not been assessed.

3.1 Denmark

Denmark does not have a formal OS policy nor an authoritative list of OS actors with a very clear role and mandates at a national level but many active stakeholders, which is described in D2.5: Open Science policies and resource provisioning in the Nordic and Baltic countries - second report (Hammargren, 2021).

OS policy at a national level is mainly coordinated by

- **Ministry of Higher Education and Science**, Danish Agency for Science and Higher Education. The Danish Agency for Science and Higher Education contributes with expert knowledge in the provision of ministerial services and policy development also on OS-policy issues.

3.1.1 Denmark - Policy documents

Selection of documents in Denmark related to OS

3.1.1.1 Policies before February 2021

- The Danish Code of Conduct for Research Integrity was published in 2014 (Ministry of Higher Education and Science - Denmark, 2014).
    - Elements: Research culture
- Denmark's National Strategy for Open Access, published 2018 (Ministry of Higher Education and Science, 2018)
    - Elements: Open Access to research publications
- Strategy for National Cooperation on Digital Research Infrastructures (in Danish), published 2019 (Styrelsen for Forskning og Uddannelse, 2019)
    - Elements: Infrastructures that include aspects of Open Science

3.1.1.2 Policies after February 2021

- National Strategy for Research Data Management based on the FAIR Principles, published 2021 (Danish e-infrastructure Cooperation - DeiC, 2021b)

- Elements: Open access to data, data management & FAIR, Infrastructures that include aspects of Open Science

Figure 2: Element framework for Denmark - Frequency of elements in Danish policies

3.1.2 Denmark - Policy documents and content with keypoints

In 2021, a new *National Strategy for Research Data Management based on the FAIR Principles* (Danish e-infrastructure Cooperation - DeiC, 2021b) was released by Danish e-infrastructure Cooperation (DeiC), on behalf of The Danish Agency for Education and Research. The *Strategy for National Cooperation on Digital Research infrastructures'* (Styrelsen for Forskning og Uddannelse, 2019) pointed

to the demand for the FAIR strategy. The Danish Agency for Education and Research appointed DeiC to lead the work.

The strategy targets research institutions and research funding foundations. It defines several principles and associated areas of action that can strengthen the dissemination and financing of good data management practices, resulting in more FAIR research data (GO FAIR) in Denmark.

The strategy takes the role of a national policy, required in the *EU directive on open data, article 10* (den Europæiske Unions Tidende, 2019). It must thus contribute to meeting the expectations of research and society for increasing accessibility of publicly funded research.

The purpose of the new national strategy is to establish a basis for decisions on the national implementation and financing of a data management practice based on the FAIR principles. The strategy describes

- Principles of data management practices that support FAIR
- Efforts to establish data management practices that support FAIR
- Principles for the allocation of data management and physical data storage costs
- Principles for establishing the cost level of e-infrastructure

Prerequisites for the strategy to succeed are changes in the credit and incentive structure, recognition of several types of research outputs, the provision of necessary infrastructure, presence of necessary data stewards, and financing of additional work if necessary.

To support the implementation of the FAIR strategy, the Danish Agency of Higher education and Science has set up a reference group with responsibility for national coordination (Danish e-infrastructure Cooperation - DeiC, 2021).

3.1.3 Denmark - EOSC in the national policies

Denmark is supporting the European Open Science Cloud (EOSC) and the national strategy is influenced by the recommendations from EOSC on FAIR principles and practices and points to steps to be taken to facilitate access to research data via EOSC.

3.2 Estonia

In Estonia, the following organisations are responsible for the national policy-making:

- Estonian Research Council
    - Estonian Research Council is a governmental foundation that was established to concentrate the funding of R&D and guarantee the better functioning of financing systems. Besides funding, ERC in Estonia is also responsible for supporting the development and implementation of research and innovation policy and supporting international research cooperation.

- Ministry of Education and Research
    - The Ministry of Education and Research 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. The Ministry of Education and Research is directly responsible for the development and implementation of the Estonian OS Framework.
- Estonian Scientific Computing Infrastructure (ETAIS)
    - ETAIS belongs to the Estonian roadmap of research infrastructures providing computing and storage resources for the Estonian scientific community. ETAIS is a full member of the Nordic e-Infrastructure Collaboration (NeIC) and plays an important role in the process as well as coordination of projects from the Estonian side. ETAIS is responsible for EOSC coordination and engagement activities in Estonia. In addition, ETAIS is offering both expertise as well as infrastructure to support Estonian OS policy development and implementation in practice.
- The University of Tartu is a mandated member organisation in EOSC representing Estonia. As the largest and oldest university in Estonia, UT is playing a vital role both in national as well as international OS policy developments, including participation in international networks and projects which promote OS.
- The University of Tartu Library has been a pioneer of OS among research libraries in Estonia. UT Library is actively contributing to the development and implementation of the OS National Framework, offers extensive training for researchers in research data management, and participates actively in European networks and projects dealing with various aspects of OS.

3.2.1 Estonia - Policy documents

3.2.1.1 Policies before February 2021

Before February 2021 there was one policy document produced:

- Open Science Framework (draft, in Estonian), published by the Ministry of Education and Research, 2020 (The Ministry of Education and Research - Estonia, 2020). The framework addresses the following topics:

    - Elements: Research culture, Open access to research publications, Preservation and reuse of scientific information, Open access to data, data management and FAIR, Infrastructure that include aspects of open science, Skills and competencies, Open education and educational resources, Incentives and rewards.

The Estonian Open Science Framework has not received its final confirmation, as it is still in development. However, there is a supporting document of the *Development plan for research and development, innovation and entrepreneurship for 2021-2035 - TAIE*[3] (The Ministry of Economic Affairs and Communications - Estonia, 2021).

[3] In Estonian, an English version it yet to be published

3.2.1.1 Policies after February 2021

After February 2021 there was one policy document produced:

- Development plan for research and development, innovation and entrepreneurship for 2021-2035 - TAIE (document is in Estonian, the English version is ready but not published yet), published by Ministry of Economic Affairs and Communications, 2021 (The Ministry of Economic Affairs and Communications - Estonia, 2021). The development plan addresses the following topics:
    - Elements: Research culture, Open access to research publications, Preservation and reuse of scientific information, Skills and competencies.

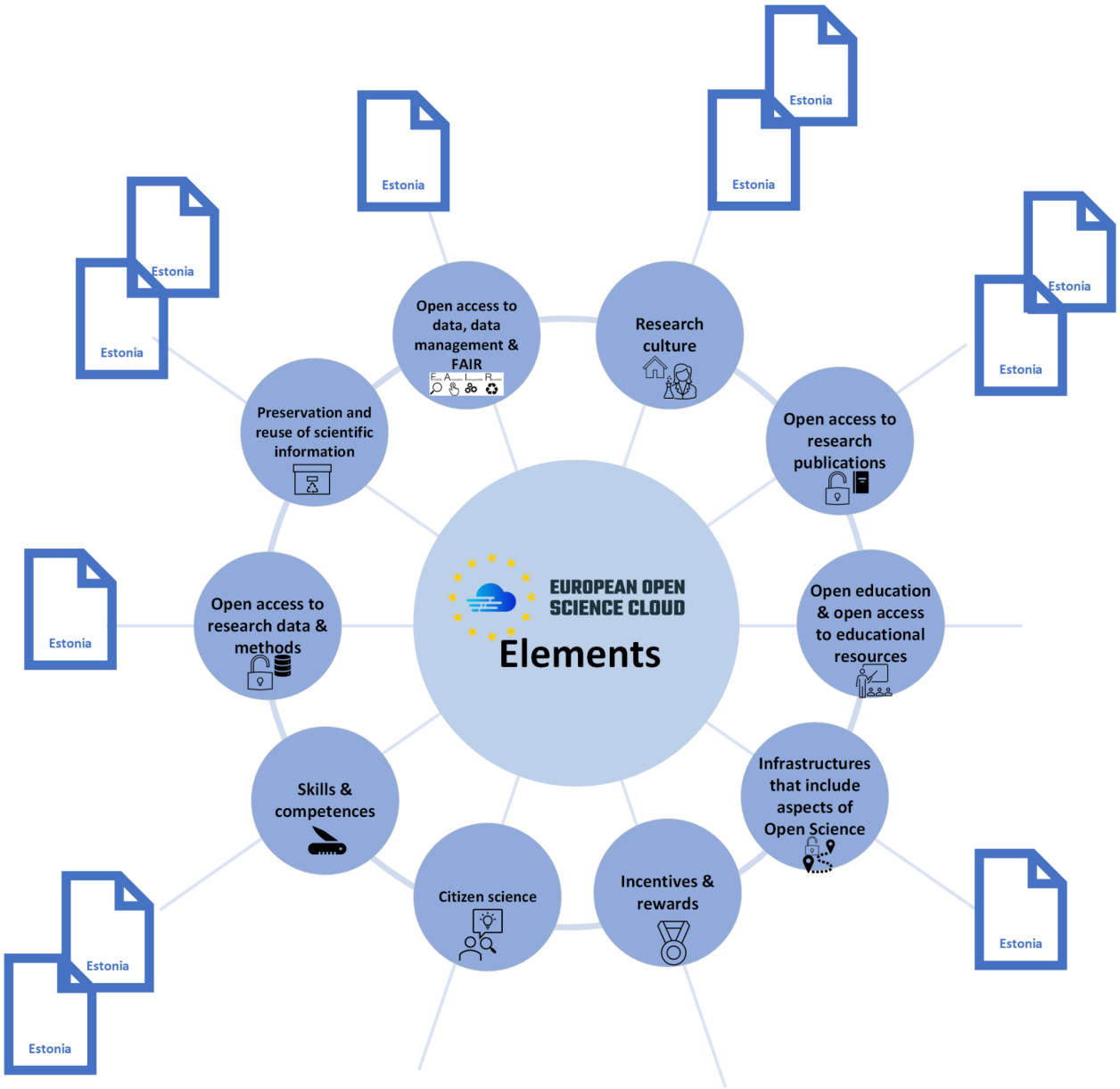

Figure 3: Element framework for Estonia - Frequency of elements in Estonian policies

3.2.2 Estonia - Policy documents and content with keypoints

The TAIE plan has two goals related to Open Science; first, developing principles for ensuring open science and high-performance computing power and action plan, securing the necessary repositories and services, and second, supporting the implementation of the Open Science principles to improve research performance and the availability and use of data by researchers, businesses and citizens.

The general principle is that Open Science makes research results for society accessible to businesses and researchers, and makes research more transparent and efficient. In Open Science in Estonia, the horizontal value passes through the research system and practice is taken into account, among other

things, in scientific communication, research results evaluation, funding decisions, research career development and scientific information access.

The OS Framework content and key points:

The principles set out to formulate developments in OS, divided into one central, pervasive principle and then, in turn, into thematic principles:

- publications
- scientific data
- communication and skills
- infrastructure
- evaluation of research

In addition, a management model is described and separate attention is inverted to infrastructure.

Thematic principles are:

- Scientific publications with the support of public funding are freely available;
    - Publicly funded research results must be publicly available no later than 12 months after appearing either in the publication's database, on the website, on the publishing platform, or following OpenAIRE guidelines for repositories, preferably under the Creative Commons Attribution (CC BY) Licence.
    - Scientific journals published in Estonia, supported by the public sector resources, must have immediate open access, respond to ubiquitous open access policies, use an open licence (e.g. CC BY) and ensure the long-term preservation of publications and access to the archive of articles.
    - Support for open access publishing is important to ensure that the implementation of the principles of OS does not worsen Estonia's researchers' access to scientific information, such as subscription-based scientific publications.
- Research data collected with the support of public funding are freely available;
    - Publicly funded research should measures results based on the FAIR principle.
    - It is recommended to use open scientific data licences, similar to the ones fit for publications. The licence must allow access to the data, recording, copying, transmitting and reusing.
    - As an exception, it is allowed not to open data due to intellectual property regulations.
- Researchers, entrepreneurs and society at large are aware of the nature of OS, value and adhere to the practices of OS in their daily activities;
    - Awareness of OS and related topics is rising, as a result of which Estonian scientists feel and recognise OS as a natural part of the research process. Companies and organisations are aware of open access opportunities for both publications and data, and society at large has access to research results.
    - Development of OS skills among researchers in Estonia translates into increased awareness of publishing choices and data processing and increased data management competence.

- The necessary infrastructure is in place for implementing the principles of OS:
    - Research institutions have open research objectives, as they offer infrastructure to support researchers in their dissemination of research outputs on the one hand, and companies and society at large on the other hand in finding these outputs. This means that there are tools available for archiving, storing and reusing research data and publications.
    - Research institutions have the opportunity to develop institutional repositories of their own, but critical support services for data management and top data management competencies are concentrated in the OS Competence Centre
    - Open research is strongly linked to infrastructure, especially e-infrastructure, and thus OS needs to be separated when executing planning activities.

The OS Competence Centre comprises:

    - A joint initiative across institutions,
    - Data management and related services,
    - Data preservation or archiving services.
- The principles of OS are valued and assessed in funding decisions as per the following:
    - Both national and institutional research evaluations are based on the DORA principles, meaning that the evaluation focuses on content and avoids journal-based indicators such as Journal Impact Factor, the evaluation criteria are clear and different research results (including data) are taken into account.
    - OS assessment of research results requires open access publication and repositories setting requirements and quality criteria allowing such assessment.

Presentation in English by Martin Eessalu, Estonian Ministry of Education and Research "Open Science in Estonia". *EOSC-Nordic Policy Workshop, together as EOSC enablers,* 9 March 2021 (Eessalu, 2021).

3.2.3 Estonia - EOSC in the national policies

Neither the *Development plan for research and development, innovation and entrepreneurship for 2021-2035* nor *Open Science Framework* mentions EOSC specifically, however, the University of Tartu is a mandated member organisation in EOSC representing Estonia. EOSC's national structure is in place and includes EOSC coordination and engagement activities in Estonia. The mandated organisation of these efforts is the Estonian Scientific Computing Infrastructure (ETAIS) (Garavelli et al., 2021).

3.3 Finland

Finland's goal is to become one of the leading countries in OS and research and and that Open Science would become an integral part of the Finnish research society.

The coordination of OS in Finland has been commissioned to the research community itself in 2018, specifically by the Federation of Finnish Learned Societies (TSV), by the Ministry of Education and Culture. The Ministry supports the coordination work but does not steer its content.

The Finnish research community consists of researchers, Finnish research organisations, research libraries and archives and scholarly publishers. In addition, funders, service providers, academies, and scientific boards and committees are part of the research community in Finland. All these actors are engaged in expert panels and working groups (Secretariat for the National Open Science and Research Coordination Federation of Finnish Learned Societies, 2021) facilitated by TSV to jointly discuss and create policies of OS and research. The research community has executive responsibility while the TSV is responsible for facilitation. After a public commenting round, the policies are published on the avointiede.fi platform (Secretariat for the National Open Science and Research Coordination Federation of Finnish Learned Societies, n.d.).

The Finnish OS policy landscape is complemented by regulations directly defined by normal legislation.

3.3.1 Finland - Policy documents

3.3.1.1 Policies before February 2021

Before February 2021, six OS-related policy documents were available in Finland:

- Declaration for OS and Research published 2020 (Open Science Coordination in Finland, Federation of Finnish Learned Societies, 2020).
    - Elements: Research culture, Open access to the research publications, Open access to research data and methods, Open education and educational resources
- Open access to scholarly publications. National Policy and executive plan by the research community in Finland for 2020–2025 (1): Policy component for open access to journal and conference articles, published 2019 (Open Science Coordination in Finland: Federation of Finnish Learned Societies, 2019).
    - Elements: Research culture, Open access to research publications, Preservation and reuse of scientific information
- Good practice in researcher evaluation. Recommendation for the responsible evaluation of a researcher in Finland published 2020 (Working group for the responsible evaluation of a researcher, The Federation of Finnish Learned Societies. 2020).
    - Elements: Research culture, Incentives and rewards
- Open education and educational resources. National policy and executive plan by the higher education and research community for 2021-2025. Policy component 1 – Open access to educational resources, published 2020 (Open Science Coordination in Finland, 2020).
    - Elements: Research culture, Open education and open access to educational resources, Preservation and reuse of scientific information, Incentives & reward, Skills and competences
- Strategy for National Research Infrastructures in Finland 2020–2030, published 2019 (Academy

of Finland, 2019b).
    - Elements: Research culture, Skills and competencies, Infrastructures that include aspects of open science, Preservation and reuse of scientific information
- Data. Action Programme for the Finnish Scholarly Community (UNIFI. 2018), published in 2018
    - Elements: Research culture, Open access to research publications, Preservation and reuse of scientific information, Open access to data, data management and FAIR, Infrastructures that include aspects of open science

3.3.1.2 Policies after February 2021

After February 2021, three main policy documents have been produced:

- Open research data and methods. National policy and executive plan by the higher education and research community for 2021–2025. Policy component 1: Open access to research data, published 2021 (Open Science Coordination, 2021a).
    - **Elements**: Research culture, Open access to data, data management and FAIR, Skills and competencies, Incentives and rewards, Infrastructures that include aspects of open science, Preservation and reuse of scientific information
- Recommendations for Open education, published 2021 (Open Science Coordination, 2021)
    - Elements: Open education & open access to educational resources, Incentives and rewards and Skills and competencies
- The law about re-use of publicly funded research material, published 2021 (FINLEX, 2021).
    - **Elements:** Preservation and reuse of scientific information

In March 2022, the following topics will have been addressed by the Finnish policy landscape:

Research culture:

- Data. Action Programme for the Finnish Scholarly Community (UNIFI. 2018).
- Open access to scholarly publications. National Policy and executive plan by the research community in Finland for 2020–2025 (1): Policy component for open access to journal and conference articles, published 2019 (Open Science Coordination, 2020).
- The strategy for National Research Infrastructures in Finland 2020–2030 (2019) (Academy of Finland, 2019)
- Declaration for Open Science and Research, the year 2020 (Open Science Coordination in Finland Federation of Finnish Learned Societies, 2020)
- Open education and educational resources. National policy and executive plan by the higher education and research community for 2021-2025. Policy component 1 – Open access to educational resources, the year 2020 (Open Science Coordination in Finland, 2020).
- Good practice in researcher evaluation. Recommendation for the responsible evaluation of a researcher in Finland, the year 2020 (Working group for the responsible evaluation of a researcher, The Federation of Finnish Learned Societies, 2020).
- Open research data and methods. National policy and executive plan by the higher education

and research community for 2021–2025. Policy component 1: Open access to research data, the year 2021 (Open Science Coordination, 2021).

Open access to research publications

- Data. Action Programme for the Finnish Scholarly Community, the year 2018 (UNIFI. 2018)
- Open access to scholarly publications. National Policy and executive plan by the research community in Finland for 2020–2025 (1): Policy component for open access to journal and conference articles, the year 2019 (Open Science Coordination, 2020).
- Declaration for Open Science and Research, the year 2020 (Open Science Coordination in Finland, Federation of Finnish Learned Societies, 2020).

Open access to data, data management and FAIR

- Data. Action Programme for the Finnish Scholarly Community, the year 2018 (UNIFI. 2018).
- Open research data and methods. National policy and executive plan by the higher education and research community for 2021–2025. Policy component 1: Open access to research data, year 2021 (Open Science Coordination, 2021).

Open access to research data and methods

- Declaration for Open Science and Research, the year 2020 (Open Science Coordination in Finland, Federation of Finnish Learned Societies, 2020).

Open education and open access to educational resources

- Declaration for Open Science and Research, the year 2020 (Open Science Coordination in Finland, Federation of Finnish Learned Societies, 2020).
- Open education and educational resources. National policy and executive plan by the higher education and research community for 2021-2025. Policy component 1 – Open access to educational resources, year 2020 (Open Science Coordination in Finland, 2020).
- Recommendations for Open education, the year 2021 (Open Science Coordination, 2021).

Incentives & rewards

- Open education and educational resources. National policy and executive plan by the higher education and research community for 2021-2025. Policy component 1 – Open access to educational resources, the year 2020 (Open Science Coordination in Finland, 2020).
- Good practice in researcher evaluation. Recommendation for the responsible evaluation of a researcher in Finland, year 2020 (Working group for the responsible evaluation of a researcher, The Federation of Finnish Learned Societies, 2020).
- Open research data and methods. National policy and executive plan by the higher education and research community for 2021–2025. Policy component 1: Open access to research data, the year 2021 (Open Science Coordination, 2021).
- Recommendations for Open education, the year 2021 (Open Science Coordination, 2021).

Skills and competences

- The strategy for National Research Infrastructures in Finland 2020–2030 (2019) (Academy of Finland, 2019a).
- Open education and educational resources. National policy and executive plan by the higher education and research community for 2021-2025. Policy component 1 – Open access to educational resources, the year 2020 (Open Science Coordination in Finland, 2020).
- Open research data and methods. National policy and executive plan by the higher education and research community for 2021–2025. Policy component 1: Open access to research data, the year 2021 (Open Science Coordination, 2021).
- Recommendations for Open education, the year 2021 (Open Science Coordination, 2021).

Infrastructures that include aspects of open science

- Data. Action Programme for the Finnish Scholarly Community, the year 2018 (UNIFI. 2018).
- The strategy for National Research Infrastructures in Finland 2020–2030 (2019) (Academy of Finland, 2019a).
- Open research data and methods. National policy and executive plan by the higher education and research community for 2021–2025. Policy component 1: Open access to research data, the year 2021 (Open Science Coordination, 2021).

Preservation and reuse of scientific information

- Data. Action Programme for the Finnish Scholarly Community, the year 2018 (UNIFI. 2018).
- Open access to scholarly publications. National Policy and executive plan by the research community in Finland for 2020–2025 (1): Policy component for open access to journal and conference articles, the year 2019 (Open Science Coordination, 2020).
- The strategy for National Research Infrastructures in Finland 2020–2030 (2019) (Academy of Finland, 2019).
- Open education and educational resources. National policy and executive plan by the higher education and research community for 2021-2025. Policy component 1 – Open access to educational resources, the year 2020 (Open Science Coordination, 2021).
- Open research data and methods. National policy and executive plan by the higher education and research community for 2021–2025. Policy component 1: Open access to research data, the year 2021 (Open Science Coordination, 2021).
- The law about re-use of publicly funded research material (FINLEX, 2021).

Citizen science

- Draft, not yet sent for comments.

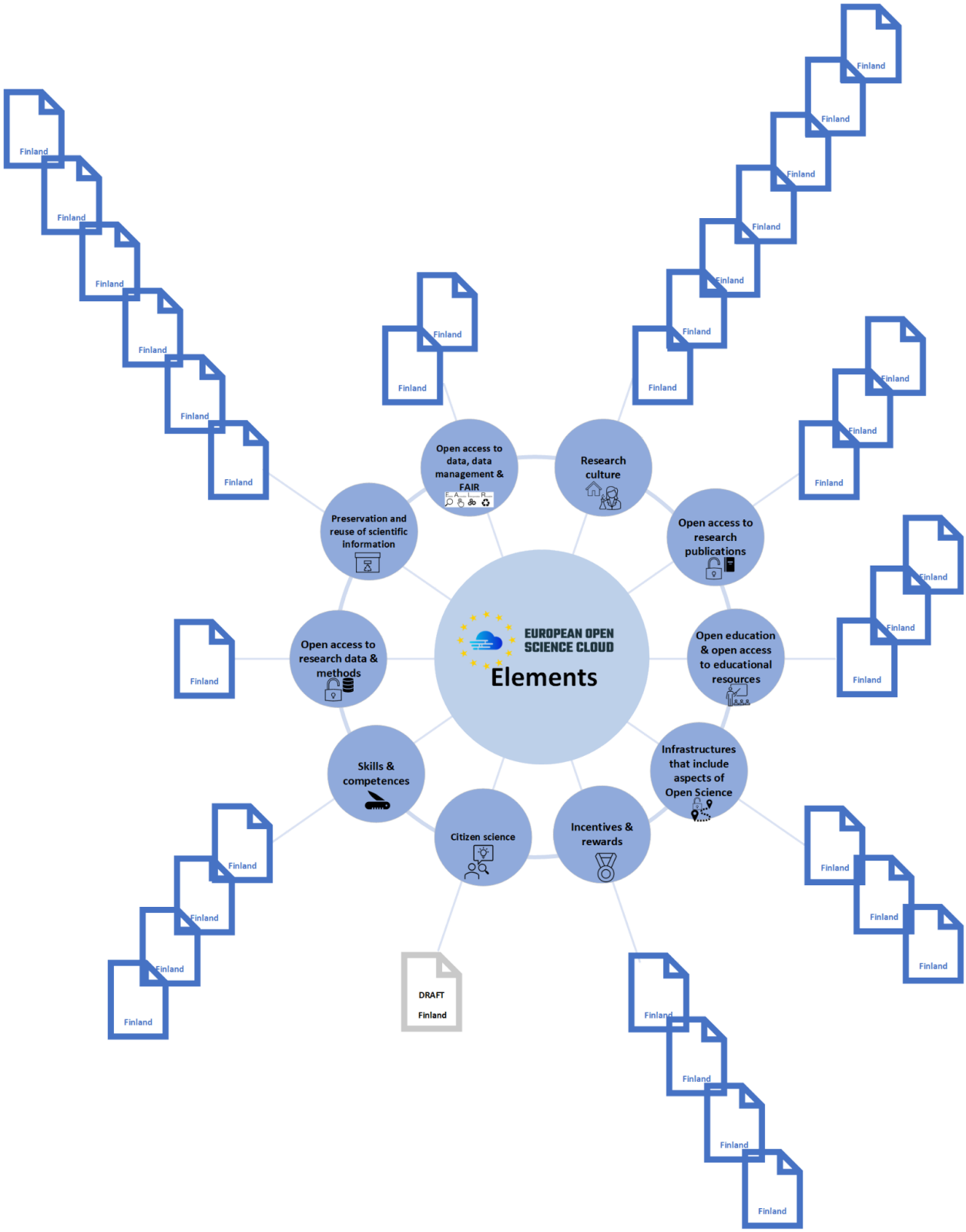

Figure 4: Element framework for Finland - Frequency of elements in Finnish policies

3.3.2 Finland - Policy documents and keypoints

Open research data and methods. National policy and executive plan by the higher education and research community for 2021–2025, the year 2021

This policy document is composed of two main parts:

- Policy component 1: Open access to research data published in spring 2021. (National Open Science Coordination, 2021b)
- A second policy component on Open Access to Research Methods and Infrastructures will be available in autumn 2022.

Policy component 1: Open access to research data was published in spring 2021. This national policy component is the Finnish research community's shared guideline for the advancement of open access to research data. The policy component does not include research methods as these will, following the policy structure, be discussed in a separate policy component.

> **Elements**: Research culture, Open access to data, data management and FAIR, Skills and competencies, Incentives and rewards, Infrastructures that include aspects of open science, Preservation and reuse of scientific information

Recommendations for Open education, the year 2021 (Open Science Coordination, 2021)
Quality criteria for open educational resources, guidelines on the accessibility of open educational resources, recommendations on gaining merit in open education and open educational resources and competence requirements for open education.

> **Elements**: Open education & open access to educational resources, Incentives and rewards and Skills and competencies

These policies are part of the broader Declaration for Open Science and Research jointly created and published by the Finnish research community in 2019.

The declaration defines four strategic objectives that specify how openness will become part of the daily life of researchers. The goals are defined by the research community for:

- culture of open scholarship
- open access to scholarly publications,
- open access to research data and methods; and
- open education and educational resources as promoted by the research community.

The other policy components part of the Declaration for Open Science and Research are:

- Open access to scholarly publications. National Policy and executive plan by the research community in Finland for 2020–2025 (1): Policy component for open access to journal and conference articles (Open Science Coordination, 2020) published in 2019. This policy aligns with

the international developments and existing policies. In particular, the recommendations of the Open Science Policy Platform, the Declaration on Research Assessment (DORA), the Competitiveness Council's decision in 2016 that all scientific publications should be openly accessible by 2020, the OA2020 Initiative, the European Commission's objectives for open access, and Plan S for research funders (2019) are shaping the future of open access on the international stage.

- Open education and educational resources. National policy and executive plan by the higher education and research community for 2021-2025. Policy component 1 – Open access to educational resources (Open Science Coordination, 2021a) published in 2020. This policy applies to open education, open access to educational resources and open educational practices.
- Good practice in researcher evaluation. Recommendation for the responsible evaluation of a researcher in Finland (Working group for the responsible evaluation of a researcher, The Federation of Finnish Learned Societies, 2020), the year 2020. Researcher evaluation shapes and directs research. The entire research community should take responsibility for the principles and practices of researcher evaluation. This recommendation for the responsible evaluation of a researcher provides the basis for a functioning, diverse and flourishing research community.

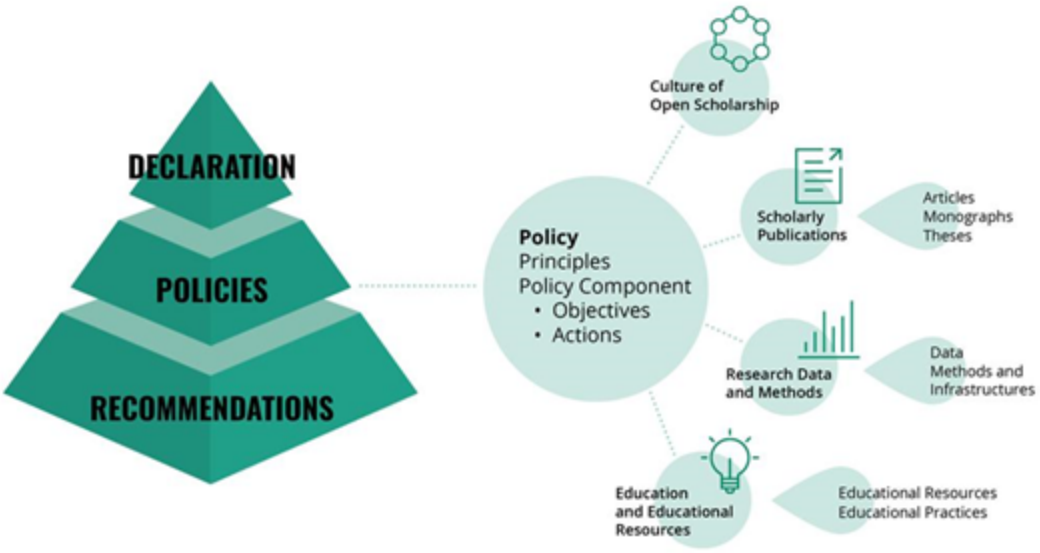

Figure 5: Policy in relation to other national open science documents

The law about re-use of publicly funded research material, the year 2021

A new law about the re-use of publicly funded research material (FINLEX, 2021) has entered into force in July 2021 in Finland. The law is based on the Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information. *"To facilitate re-use, public sector bodies should, where possible and appropriate, make documents, including those published on websites, available through an open and machine-readable format and*

together with related metadata, at the best level of precision and granularity, in a format that ensures interoperability, for example by processing them in a way consistent with the principles governing the compatibility and usability requirements for spatial information under Directive 2007/2/EC."

Elements: Preservation and reuse of scientific information

Policy documents released before February 2021:

This section briefly recaps the policy documents available in Finland before February 2021.

Data. Action Programme for the Finnish Scholarly Community

In the summer of 2018, UNIFI: the Rectors' Council of Finnish Universities, set up a working group to consider solutions for research data management at different stages of the research lifecycle. It was decided to produce an Action Programme for the Finnish Scholarly Community (UNIFI. 2018) for the entire scholarly community.

Elements: Research culture, Open access to research publications, Preservation and reuse of scientific information, Open access to data, data management and FAIR, Infrastructures that include aspects of open science

National Research Infrastructures

In **the Strategy for National Research Infrastructures in Finland 2020–2030** (Academy of Finland, 2019a) the vision is that high-class research infrastructure services increase the impact and international attraction of the Finnish research, education and innovation system. *".. both Europe (ESFRI Secretariat 2018) and the rest of the world have identified a need to significantly step up investments in the systematic construction, use and utilisation of research infrastructures both in the scientific community and in society at large.."*

Elements: Research culture, Skills and competencies, Infrastructures that include aspects of open science, Preservation and reuse of scientific information

Digivision

Higher education institutions in Finland signed a letter of intent on Digivision (DIGIVISIO 2022) **on 11 February 2020**. The aim of the joint digivision of all Finnish higher education institutions is to make Finland a model country for learner-centred and flexible learning by 2030. In 2030, Finland will have an open and recognised learning ecosystem, which will also benefit both research and innovation activities and working life.

Elements: Open education and open access to educational resources, skills and competencies, Preservation and reuse of scientific information

3.3.2.3 Policy documents under preparation

At the time of writing the deliverable new policy documents are under preparation by the working groups under the national coordination:

- The second policy component of Open Research Data and Methods, the Policy component for Open Methods, will be published in 2022.
- The second policy component of Open education and educational resources, the Policy component for Open Educational Practices, will be published in 2022.
- Policy for Open Scholarship is ready to be published in the spring of 2022.
- A working group is writing recommendations on the application of FAIR principles.
- The guide to citizen science will be ready to be published in the spring of 2022.
- Recommendation for OS in Corporate Collaboration will be ready to be published in the spring 2022
- Self-evaluation Tool for OS Services will be under pilot process
- The policy component for open access to anthologies and monographs will have a public commentary round in early 2022.
- Working groups have been founded to draw up the Recommendation on the quality criteria for open education, the Recommendation on the accessibility of open learning environments and the Recommendation for responsible, inclusive and reliable open education.

- There is also a working group in place planning a roadmap describing the professional qualification requirements of a data management specialist.

Law under preparation:

Online Broadcasting Directive

The Ministry of Education and Culture is requesting comments on a proposed bill (Finnish Government 2021) to implement the provisions of the EU DSM Directive and Online Broadcasting Directive as part of Finnish law. In the draft Government proposal, Finnish copyright law is amended to better take into account situations found in the digital operating environment. The amendments will improve, among other things, opportunities for using copyrighted works in data mining, teaching, and the provision of access to cultural heritage. To promote OS, the role of authors would be strengthened by allowing authors to store copies of scientific articles in open access publication archives.

Elements: Research culture, Open access to research publications, Open education and open access to educational resources, Preservation and reuse of scientific information

Highlights from the Finnish OS policy documents:

The following highlights can be extracted from the current Finnish policy document:

- Promotion of national OS is a key priority for Finland as well as the promotion of strategic OS goals and objectives in the research organisations

- Active participation in the European and international work
- The risks and threats of OS need to be identified
- Strengthening researchers' possibilities of distributing and utilising research-based knowledge
- The research community must guarantee the skills, incentives, resources and structures for opening research data and methods (e.g. infrastructures and services) in a way that supports and respects the work and equality of researchers
- The implementation and monitoring of OS measures should be addressed
- Research data and methods should be managed, opened and used responsibly and appropriately
- The merit issues of OS need to be addressed for both researchers and support staff
- Organisations should initiate necessary development measures and promote the use of national and international services, develop guidelines for the services and provide adequate support services
- Publicly funded research data must be re-usable and available for both commercial and non-commercial purposes and must be free of charge
- To facilitate the establishment, operation and development of international cooperation, an easy to access shared knowledge base should be in place
- All new scholarly publications should be immediately openly accessible
- All researchers should have an equal opportunity to publish their research through open access, regardless of their field of research, funding basis, or career stage
- The total cost of scholarly publication channels and individual publications should be transparent and publicly available
- High quality open educational resources should be created extensively in universities for the benefit of the individuals and the society
- Key OS infrastructures should be not profit-oriented to pursue economically sustainable research
- One of the best practices in the Finnish OS policy landscape is the national evaluation process for research organisations: Finnish research organisations' openness to operational cultures (Forsström, Pirjo-Leena; Lilja, Erika; Ala-Mantila, Minna 2020) has been evaluated by the Finnish Ministry of Education and Culture and published in January 2020. Evaluation of openness and understanding the maturity levels helps in implementing OS into practice. The new Model for OS monitoring in Finland has been sent for consultations and will be evaluated. The monitoring of open science and research supports the key principles of responsible research and is carried out accordingly. The applicable principles include: the freedom of research and higher education, good scientific practice, research ethics, responsible evaluation of researchers, transparency, integrity and fairness of operating culture, diversity of operating culture, good governance, good contract practice and responsible contract practises, and high scientific and artistic performance. The indicators of the new monitoring model are based on the objectives set out in the Declaration and Guidelines of open science and research. Piloting of the new model will take place in 2022.

3.3.3 Finland - EOSC in the national policies

The Finnish Declaration for Open Science and Research published in 2019 is the Finnish research community's response to the international policies of open science that tie Finland as an EU Member State and its research communities to the international arena.

One of the measures of the Open Science and data operational programme (UNIFI, 2018) is to commit to the European Open Science Cloud Declaration. *"Finnish research organisations will sign the EOSC declaration and undertake one of the measures outlined therein."* In 2018, universities, both in Finland and more broadly in Europe, found the EOSC unknown and difficult to approach. Proclamation and commitment seemed like good tools to raise awareness of EOSC among universities.

In the policy component on Open research data (National Open Science Coordination, 2021b), EOSC is mentioned as follows:
"By ensuring that the Finnish policy reflects international development, the Finnish research community participates in the creation of common international practices in this swiftly growing and developing area. Finnish operators actively participate in European and international work, e.g. in the European Open Science Cloud (EOSC) and Research Data Alliance (RDA) communities. The Finnish research community participates in a dialogue where it can obtain good practices and contribute to the creation of workable solutions."
The aim was to keep the policy document short, but it was considered to be vital to highlight the international collaborations and efforts in the document.

The recognition of EOSC as an important element of the Finnish Open Science policies has resulted in the set up of the EOSC Finnish Forum (EOSC-FF) as a branch of the EOSC National Open Science Coordination (Open Science, 2022).

The EOSC-FF is the coordination instrument that allows the Finnish stakeholders to:

- discuss and exchange information on the latest EOSC developments and assess implications on other national initiatives,
- represent the collective interest of Finland in EOSC by formulating a shared approach/message to be communicated to the EOSC Governance
- discuss potential future EOSC-related collaborations and opportunities at the national level
- strengthen the collaboration between Finnish RDI actors.

The EOSC Finnish Forum was founded in January 2021 by the Ministry of Education and Culture, Academy of Finland, the Federation of Finnish Learned Societies and CSC - IT Center for Science. The EOSC Finnish Forum is supported by the Finnish Ministry of Education and Culture and coordinated by CSC - IT Center for Science.

The EOSC Finnish Forum does not substitute the participation of the Finnish organisations in the EOSC Association but it is an extra instrument to make sure that all the national stakeholders are informed and engaged in the EOSC developments. At the time of writing the deliverable, CSC is the only Finnish

member of the EOSC Association. However, many Finnish researchers and organisations participate in the development of the EOSC through RIs or various EOSC projects.

3.4 Iceland

In Iceland, the following actors are responsible for the national policymaking

- Ministry of Higher Education, Science and Innovation
    - The main responsibilities of the ministry will concern science and research, including universities, industry and innovation, and telecommunications .
- The Science and Technology Policy Council
    - The Science and Technology Policy Council (STPC) (Government of Iceland, n.d.-b) is responsible for setting public policy in matters of science and technology in Iceland. The STPC is convened 2-3 times a year. The Prime Minister is Chair of the Council and other members include the Minister of Finance and Economic Affairs, the Minister of Education, Science and Culture, and the Minister of Tourism, Industry and Innovation. Sixteen representatives are nominated by different ministries, higher education institutions and by social partners. The Council sets the official science and technology policy for three years. Deliberations in the two fields are prepared by working committees, the Science Board and the Technology Board. The last council's term was 2019-2021. The council's last meeting was in November 2020; a new council has not been appointed since the general election and change of government in late 2021. The legislation governing the STPC and its committees is currently under review.
- The Science Board
    - The Science Board is one of two working committees of the Science and Technology Council and prepares the council's deliberations in its field. The Minister of Education, Science and Culture appoints members of the Science and Technology Policy Council to the Science Board, on the Council's nominations, including the Board's chair and vice-chair. The Board members' term was 2019-2021 and a new one has not been appointed. The board's last meeting was in April 2021.
- The Icelandic Centre for Research - RANNIS
    - The Icelandic Centre for Research supports research, innovation, education and culture in Iceland. RANNIS cooperates closely with the Icelandic Science and Technology Policy Council and provides professional assistance in the preparation and implementation of the national science and technology policy.
    - RANNIS is responsible for administering competitive research funds and strategic research programmes.
    - RANNIS coordinates and promotes Icelandic participation in European research programmes, monitors resources and performance in R&D and promotes public awareness of research and innovation.
- The National Library

    - The National Library is not formally a policymaker in the area, but plays an important and leading role in OA-related matters, mainly in publications. The National Library actively promotes OA[4].
- The University of Iceland and other HEIs
    - While not formally a policymaker, the University of Iceland, the country's leading HEI, can set an example and thus influence public policy, as can the smaller HEIs.

3.4.1 Iceland - Policy documents

The following documents in Iceland are on open science:

3.4.1.1 Policies before February 2021

Before February 2021 there were nine policy documents produced:

- Act on public support for research no.3/2003, Published by the Icelandic Parliament, 2012 (Icelandic Parliament, 2012)
    - An amendment to the 2003 act [Act 149-2012] came into force on January 1st 2013: The results of research financed by grants from funds covered by this Act shall be made public through open access publication and shall be available to everyone unless otherwise agreed.
    - Elements: Research culture, Open access to research publications
- Scientific Publication: Policy on Open Access, The Icelandic Centre for Research - RANNIS, 2013 (The Icelandic Centre for Research - RANNIS, 2013).
    - All scientific publications based on projects, funded entirely or partially by Rannís must be published in open access unless otherwise agreed upon. Green OA is allowed and an embargo period of up to 12 months. Applies to all peer-reviewed articles; Books, book chapters and student theses are exempted from the rule. Projects supported before the adoption of the OA policy do not need to adhere to it but all researchers are encouraged to publish Open Access.
    - Elements: Research culture, Open access to research publications
- Open Access Policy, Published by Bifröst University College, 2019 (revision of the 2011 policy) (Bifröst University College, 2019)
    - University staff agree that they will endeavour to publish journal articles in OA or deposit a version in an open repository. Exemptions and embargoes are allowed. The policy does not apply to books, teaching materials, reports, advisory opinions or materials other than scholarly articles published in academic journals.
    - Elements: Research culture, Open access to research publications,
- Open Access Policy, Published by the University of Iceland, approved Feb. 2014. (University of Iceland, 2014)
    - The University encourages staff to publish articles in open access outlets, such as open access journals, archives, preprint databases, etc. The policy does not apply to books or

[4] www.openaccess.is

book chapters, but it applies to all scientific articles authored by university staff, alone or with co-authors, during their period of employment. The University of Iceland is authorised to deposit articles to an open repository. Exemptions from the policy may be applied; the costs of OA publications are not covered by the University.
    - Elements: Research culture, Open access to research publications, Infrastructures that include aspects of open science
- Policy on Open Access, Published by Reykjavík University, approved November 2014 (Reykjavík University, 2014)
    - Academic employees at Reykjavik University (RU) are expected to publish the results of their research and teaching activities in open access. RU encourages that scholarly articles, educational resources, and other material written by the University's academic employees, alone or with others, and published in the name of the University (RU affiliated), be published in open access. Use of CC licence recommended. OA costs are not covered by RU. The policy encourages academics outside RU to publish OA.
    - Elements: Research culture, Open access to research publications, Open education and open access to educational resources, Infrastructures that include aspects of open science
- Policy on Open Access and Open Science, published by the National and University Library of Iceland in November 2016.(National and University Library of Iceland, 2016)
    - Statement supporting open access to publications of all sorts and to open data, and affirming the library's aim to encourage and support OA and OS policy work in Iceland; to encourage HEIs to adopt policies on OA, to collect and ensure access to research findings, and in general work for the cause of open access and open science.
    - Elements: Research culture, Open access to research publications, Open education and open access to educational resources, Infrastructures that include aspects of open science, Skills and competences
- Policy on Open Access & Open Data The Árni Magnússon Institute for Icelandic Studies, June 2020 (The Árni Magnússon Institute for Icelandic Studies, 2020).
    - Applies to publications, data and databases. Recommends that staff publish articles in open access and encourages the use of CC licences in the institute's journals and staff publications while allowing exemptions when needed and justified. Older material shall be made available online as far as possible and assigned a PID, and guidelines are to be prepared regarding online access to books published by the institute. The institute endeavours to make all of its databases searchable online unless prevented by special circumstances.
    - Elements: Research culture, Open access to research publications, Open access to data, data management, Preservation and reuse of scientific information, Infrastructures that include aspects of open science
- Open Access to Research - Policy Suggestions [in Icelandic only], published by the Ministry of Education, Science and Culture, September 2019 _(Icelandic Ministry of Education, 2019)
    - Results of the working group, founded in 2018 by the Minister of Education, Science and Culture, on OA policy. The policy suggestions were published on the government's public consultation website in September 2019; work is now in progress within the new

Ministry of Higher Education, Science and Innovation to draw up a policy on open access to publications, based on the recommendations.

- According to the recommendations, universities and research institutes are to ensure that research staff publish following the public policy, and to provide the necessary services for researchers who publish in open access. The use of open licences is encouraged, and the focus is on green open access. The development of incentives for open access publications is included in the recommendations.
- The policy suggestions include definitions of responsibilities and how they are to be divided. STPC will publish a policy on open access to research results, and define objectives, strategies and actions, while the Ministry of Education and Culture will include open access in its scientific policy published in each financial plan of the year as well as monitor and review policy results regularly. The National and University Library and Research funds play pertient roles in education, services, and monitoring.
- Elements: Research culture, Open access to research publications, Preservation and reuse of scientific information, Incentives & rewards, and Infrastructures that include aspects of open science.

- Science and Technology Policy 2020-2022, published by The Prime Minister's Office, September 2020 (The Prime Minister's Office of the Icelandic Government, 2020).
  - One of the key actions under the 2020–2022 policy is *Open access to data* as part of a plan for successful research and innovation for the future, where societal benefits from public investment in data are to be increased by enabling access. The first task undertaken by the commissioned working group working towards achieving the key actions set out by the policy is to leverage a change with regards to open access to public data from universities and research institutes as well as data generated in research supported by public competitive funds in research and innovation, IPR and GDPR permitting. An analysis of costs and obstacles, and an action plan were to be available in 2021; the work was delayed but is expected to be resumed soon. At the date of publication, the Ministry of Education, Science and Culture was responsible for this part of the policy but the responsibility is now with the new Ministry for Innovation, Industry and Universities.
  - Elements: Research culture, Open access to data, data management, open access to research data and methods, Preservation and reuse of scientific information, Infrastructures that include aspects of open science, Citizen science

3.4.1.2 Policies after February 2021

After February 2021 there was one policy document produced:

- Open Science Plan, published by University of Iceland (UoI), October 2021 (University of Iceland, 2021)
  - Statement of intent to set an Open Science Policy as part of the UoI's strategic plan for 2021-2026. There is a need for infrastructure and training, to recognise different research cultures, and to consider FAIR data. The Open Science Plan states: " During the UI26 strategic period, the University will work systematically towards improving digital

infrastructure and support services to achieve these goals and ensure that researchers can meet data management and open access requirements set by funding providers and academic journals. The University will also expand services to help staff create data management plans and metadata."

- Elements: Research culture, Open access to research publications, Open access to data, data management and FAIR, and Open access to research data and methods. Preservation and reuse of scientific information, Incentives & rewards, and Infrastructures that include aspects of open science.

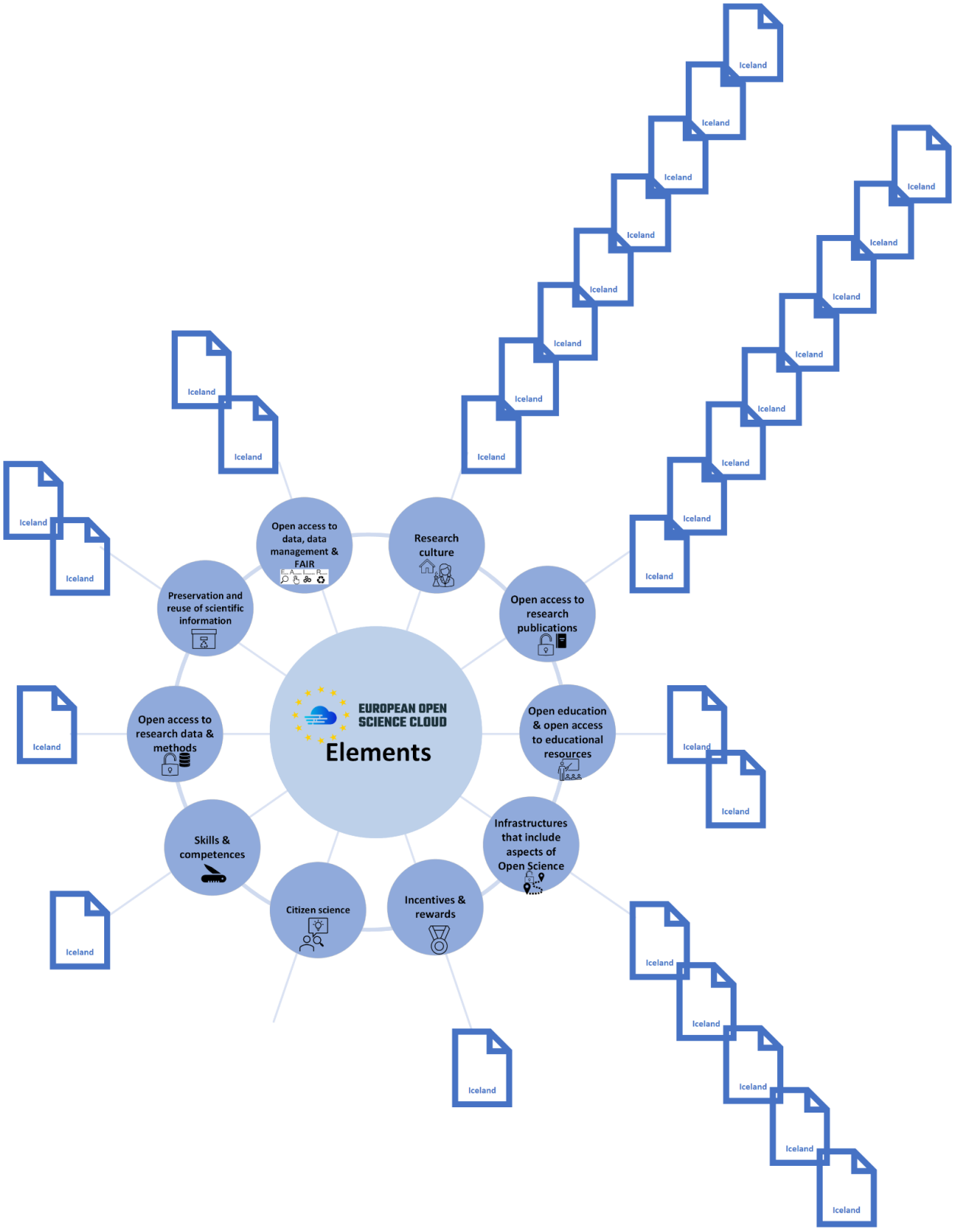

Figure 6: Element framework for Iceland- Frequency of elements in Icelandic policies

3.4.2 Iceland - Policy documents and content with keypoints

Policy work in Iceland during the period in question has been delayed by a break in the work of The Science and Technology Policy Council and the Science Board. A new bill to change the legal environment of these councils and boards was put before parliament in the winter of 2020–2021 but it did not pass. The bill was directed to Parliament's Judicial Affairs and Education Committee for further discussion and is expected to be reintroduced. The Science and Technology Policy Council has not been convened since November 2020 and neither has the Science Board since April 2021.

Parliament was also on an unusually long break in 2021, lasting from July to November. A new cabinet took office on November 28th 2021, following a general election in September 2021 and a lengthy process of forming a new coalition government, which also involved the extensive realignment of government offices, together with an increase in the number from ten to 12 and a redistribution of responsibilities among ministries. A new Ministry of Higher Education, Science and Innovation will oversee the work on Open Science called for in the STPC's Science and Technology Policy mentioned above and is expected to commence soon.

In July 2021, the *Icelandic Roadmap for Research Infrastructures 2021* (Icelandic Ministry of Education et al., 2021) was published, in line with the STPC's policy and action plan for 2017-2019 and its intention to focus on strengthening and establishing research infrastructures and working towards a culture that embraces open data and enables and strengthens participation by the Icelandic research community in European and international research cooperation.

3.4.3 Iceland - EOSC in the national policies

In the call for proposals for infrastructure projects to be included in the Icelandic Roadmap for Research Infrastructures, international - especially European - links and cooperation potential were among the aspects considered in the evaluation process. Iceland takes part in four ESFRI/ERIC projects. Although EOSC is not directly mentioned, participation will be a feature in future policies.

3.5 Latvia

In Latvia, the Ministry of Education and Science (IZM) is responsible for the national policy-making and the development of "The Latvian National Open Science Strategy 2021-2027". IZM representative was attending the first EOSC-Nordic Policy Workshop in Copenhagen (2020) and joined the second Policy Workshop (2021) as presenter and expert in the panel discussion.

The Latvian National Open Science Strategy 2021-2027 (the Government of Latvia, 2021) (in Latvian) was published for discussion in September 2021 and then passed to the Government of Latvia for approval.

3.5.1 Latvia - Policy documents

In 2021, the policy document "The Latvian National Open Science Strategy 2021-2027" was under development and was published by the Ministry of Education and Science in September of that same year. It is the main policy document related to Open Science and EOSC.

3.5.1.1 Policies before February 2021

No policy documents published *before* February 2021.

3.5.1.2 Policies after February 2021

After February 2021 there was one policy document produced:

- The strategy document was discussed with the government and some corrections were demanded. The final version of the document is likely to be approved in Q1, 2022.
    - Elements: Open access to research publications, FAIR, Skills & competencies, incentives & rewards

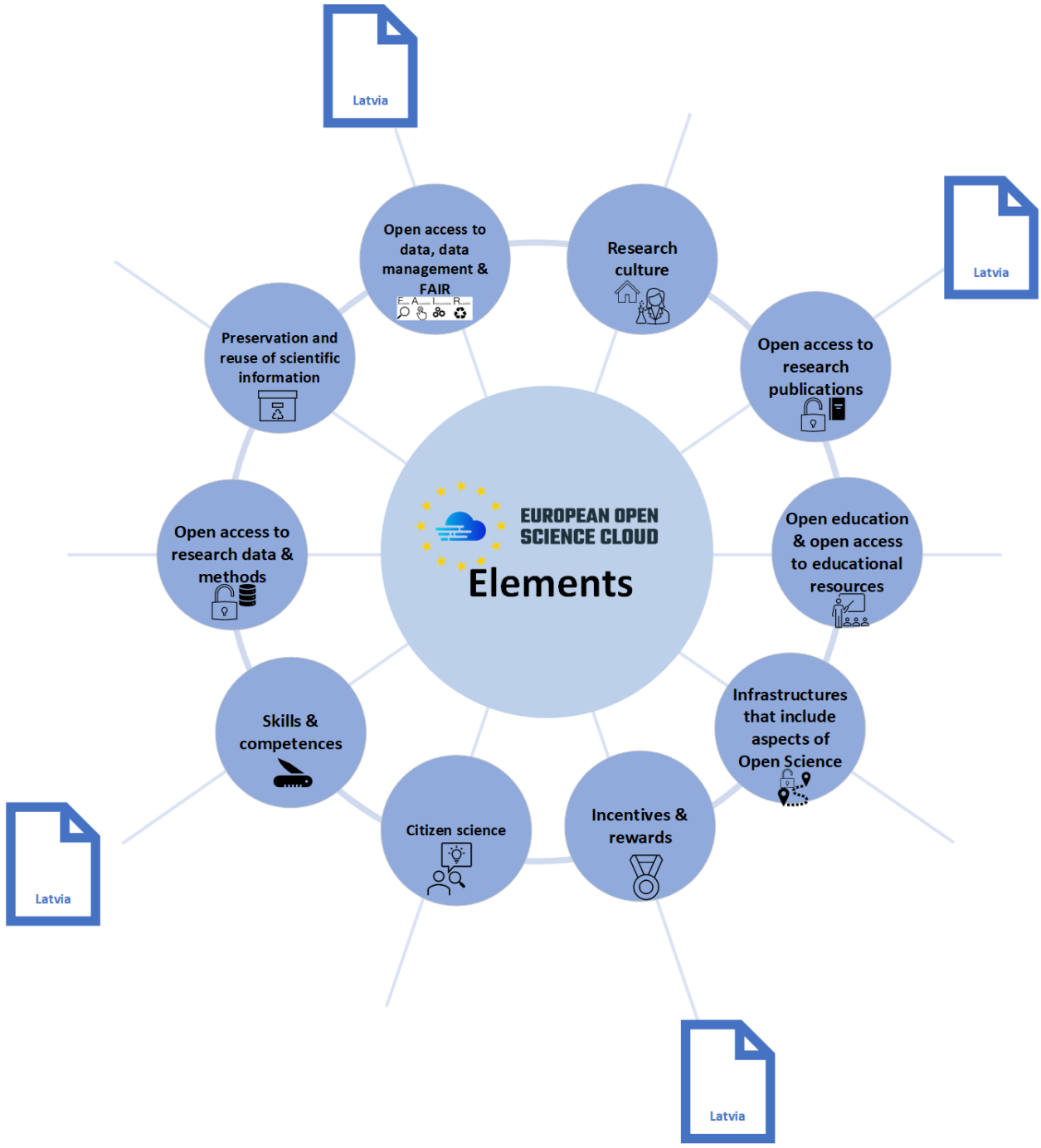

Figure 7: Element framework for Latvian - Frequency of elements in Latvian policies (the denotation of Citizen Science and Open access to research data is missing in the figure)

3.5.2 Latvia - Policy documents and content with key points

The Latvian National Open Science Strategy 2021-2027 states that Open Science development in Latvia should be formed around three pillars: Open Access, FAIR Data and Citizen Science. The strategy document requires that all publicly funded research data should be available in Open Access databases

and comply with the FAIR principles. The introduction of Dataverse data repositories based on FAIR principles is one of the priorities set out in the strategy.

Key points in the strategy document:

- Develop Open Access further,
- Create a science data repository network with the FAIR principles as a key focal point and implement incentives for researchers based on developed evaluation criteria,
- Create a community of data stewards and implement an appropriate training programme for data stewards,
- Create the Higher Education and Science Information Technology Shared Service Centre to manage processes and represent Latvia in the EOSC Association.

3.5.3 Latvia - EOSC in the national policies

The Latvian National Open Science Strategy 2021-2027 is directly devoted to the development of EOSC related activities, competencies and infrastructure. There is also especially devoted funding planned for implementation.

Some activities on implementation have already started. For example, The Latvian National Library in collaboration with universities launched a training course on data management for librarians and researchers, titled "Open Science and Science Communication" (76 hours). The first group consisting of 24 participants took part in the training in September 2021 and in February 2022 the next group will start.

3.6 Lithuania

In Lithuania, one of the goals of the Ministry of Education, Science and Sport (MESS) is to form the state policy in the field of research and development, and to organise, coordinate and control their implementation. MESS is governed by the main laws, strategies, and resolutions approved by the Parliament and the Government of the Republic of Lithuania.

The Research Council of Lithuania has a mandate of coordinating Open Access activities in Lithuania. The Research Council of Lithuania and MESS are represented on the EOSC Governance Board.

At the institutional level Universities actively promote and do their best to implement open science ideas by adopting institutional policies, giving training to researchers on open science practices and ensuring open access to research results.

- Ministry of Education, Science and Sport of Lithuania
    - The MESS of Lithuania is the main policymaker that is a part of acting government policy-making as well as the main fosterer of education, science and sport-related national agreements, strategies, and international involvement in platforms.
- Research Council of Lithuania

- The Research Council of Lithuania is the main institution coordinating open access science activities in Lithuania. The Council supports and participates in the open-access policy formation and encourages the dissemination of the open access concept, collects and systematises the data on open access databases used in Lithuania, approves of reuse and content mining in open access publications and data, participates in the Open Science movement, advocates open access among policymakers, scientists and knowledge managers, support global, national, regional and institutional initiatives fostering open access.
  In 2014, the Research Council of Lithuania became a partner of the international project 'Open Access Policy Alignment Strategies for European Union Researchers'. In Lithuania, the public and private institutions are required by law to make any research results public. Article no. 45 of the Republic of Lithuania the Law on Science and Higher Education incentifies usage of public funds from the state budget to make produced results (deliverables) openly accessible for the general public insofar as it is consistent with the laws regulating intellectual property rights and commercial, state and public service secrecy protection.

- National library consortiums
  - The Consortium of the Lithuanian Academic Electronic Library (eLABa). The eLABa Consortium carries out activities under the Lithuanian Research and Study Informational Infrastructure Development Program for the years 2021-2024, approved by the order of the Minister of Education, Science, and Sport of the Republic of Lithuania on June 9, 2021, related to the maintenance and development of eLABa information system. The Consortium was established on March 26, 2010. Currently, it unites 45 Lithuanian research and higher education institutions operating based on joint activities. The eLABa information system consists of several parts, one of which is the eLABa Repository. The eLABa Repository, as a national aggregated open access (OA) repository, following its legal regulation, was started at the end of 2006. The main goals of the eLABa Repository creation were the development of the environment and tools, allowing preparation, collection, long-term preservation, and permitting access to research and studies e-documents, created in Lithuania. The functioning of the eLABa Repository is based on the usage of the Fedora repository software and infrastructure, allowing collections and storage of various e-objects concerning science, art, and studies of different types and access to their metadata for the search systems using the OAI-PMH protocol and popular metadata standards, e.g., Dublin Core, MARC 21. The eLABa Repository consists of several e-document collections: ETDs (theses and dissertations), Books, Articles, Proceedings, and Art Works. At the beginning of 2022, the eLABa Repository contained more than 112 thousand full-text e-documents, including more than 86 thousand open-access e-documents.

  - Lithuanian Research Library Consortium (LRLC). LRLC is a voluntary association of Lithuanian research libraries and institutions with research libraries, which has been established under an agreement among the research libraries of Lithuania. The main activity of the consortium is the subscription to research and study databases. Vilnius

University is one of the founding members of the consortium. Among the goals of the LRLC is Defending the freedom of reading and providing possibilities to the users to access information resources in libraries and remote databases without any restrictions.

- Open R&D Lithuania network
    - Institutional involvement in open access activities and practices is an essential aspect of open access implementation. Include open-access R&D centres of 14 Lithuanian Universities, 13 Public Research Institutes as well as 8 Science and Technology Parks.

3.6.1 Lithuania - Policy documents

Policy documents from Lithuania

3.6.1.1 Policies before February 2021

Before February 2021 there were 3 policy documents produced in Lithuania:

- Law on Research and Higher Education, published by Parliament of Lithuania, 2009 (revised 2015 and 2016) (House of Parliament of Lithuania, 2015)
    - Elements: Research culture, Open access to research publications, Open access to data, data management and FAIR, Preservation and reuse of scientific information
- Guidelines on Open Access to Scientific Publications and Data, published by Research Council of Lithuania, 2016.
    - Elements: Research culture, Open access to data, data management and FAIR, Preservation and reuse of scientific information.

3.6.1.2 Policies after February 2021

After February 2021 there were three policy documents produced:

- Lithuanian political parties Agreement on National Education Policy (2021-2030) made by Parliament political parties (Lithuania House of Parliament political parties, 2021)
    - Elements: Research culture
- The Order Regarding the Application of Guidelines for the Open Access to Research Publications and Data, issued by Director of the Lithuanian Research Council, Aug 25, 2021 (Lithuanian Research Council, 2021)
    - Elements: Research culture, Open access to research publications, Open access to data, data management and FAIR, Infrastructures that include aspects of open science, Preservation and reuse of scientific information
- The Order issued by the Director of the Lithuanian Research Council Regarding the update of the Order issued Aug 25, 2021, Regarding the Application of Guidelines for Open Access, Jan 28, 2022. (Lithuanian Research Council, 2022)
    - Elements: Research culture, Open access to research publications, Open access to data, data management and FAIR, Infrastructures that include aspects of open science, Preservation and reuse of scientific information

Other related to open access and open science documents:

- National Progress Plan 2021-2030 (adopted 2020/09 https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/c1259440f7dd11eab72ddb4a109da1b5/asr)
  One of the tasks is to create and purposefully apply high-level scientific knowledge, increase the quality of research and its impact on society and the economy - to ***ensure better and more efficient use of research infrastructure by integrating it into international infrastructures****, increase institutional involvement in international organisations and expand their networks. , to strengthen the institutional framework of STI, to promote the demand for high-level scientific knowledge in the public sector.*
- Economic Recovery and Resilience Building Plan "New Generation Lithuania" (RRF LT) (adopted 2021/05 https://finmin.lrv.lt/uploads/finmin/documents/files/Naujos%20kartos%20Lietuva%202021.pdf)
  *One of the goals is to increase the attractiveness of researchers' careers, and to motivate them to create competitive scientific products. The aim is to develop and implement a toolkit to promote the careers of researchers, attract them and meet the objectives of the European Research Area and innovation. The model for conducting doctoral studies and planning state-funded study places will be reviewed and industrial doctoral studies will be introduced. The evaluation of the implementation procedures for competitive research projects will aim to simplify them.****A set of tools will also be developed to enable researchers to share Lithuanian research results through the European Open Science Cloud*** *and access international research resources (international research databases and infrastructure (from 241 page)*
- Research Development programme 2022-2030 (adopted 2022/01/10 https://smsm.lrv.lt/uploads/smsm/documents/files/Administracine%20informacija/planavimo%20dokumentai/pletros%20programos/priemones/www_Mokslo%20PP%20pagrindimas%20(2022-01-10).pdf).
- *One of the targets (1.2) of this programme is to create a high level of scientific knowledge that increases the country's competitiveness. The document identifies the causes of the problems. One of them is the unsustainable availability of scientific databases, and limited opening to scientific information (publications, data).*

- Plan for implementing the provisions of the Government program (adopted 2021/03 https://www.e-tar.lt/portal/lt/legalAct/d698ded086fe11eb9fecb5ecd3bd711c)
  One of the principles of the Lithuanian Government is open data. Actions will aim to promote the opening up of public data in various areas of public policy, to improve the quality of this data and the platforms on which it is made available to the public, the scientific and business communities. The use of open data in public decision-making and the development of public services will be promoted through the development and improvement of technical infrastructure, data management capabilities and the need for data-driven management decisions.
  Planned actions:
  - Develop a set of tools to enable researchers to share Lithuanian research results through the European Open Science Cloud and access international research resources (international science databases and infrastructures), and start implementing these tools.
  - Develop and implement a toolbox to promote researchers' careers, attractiveness and the objectives of the European Research Area and innovation.

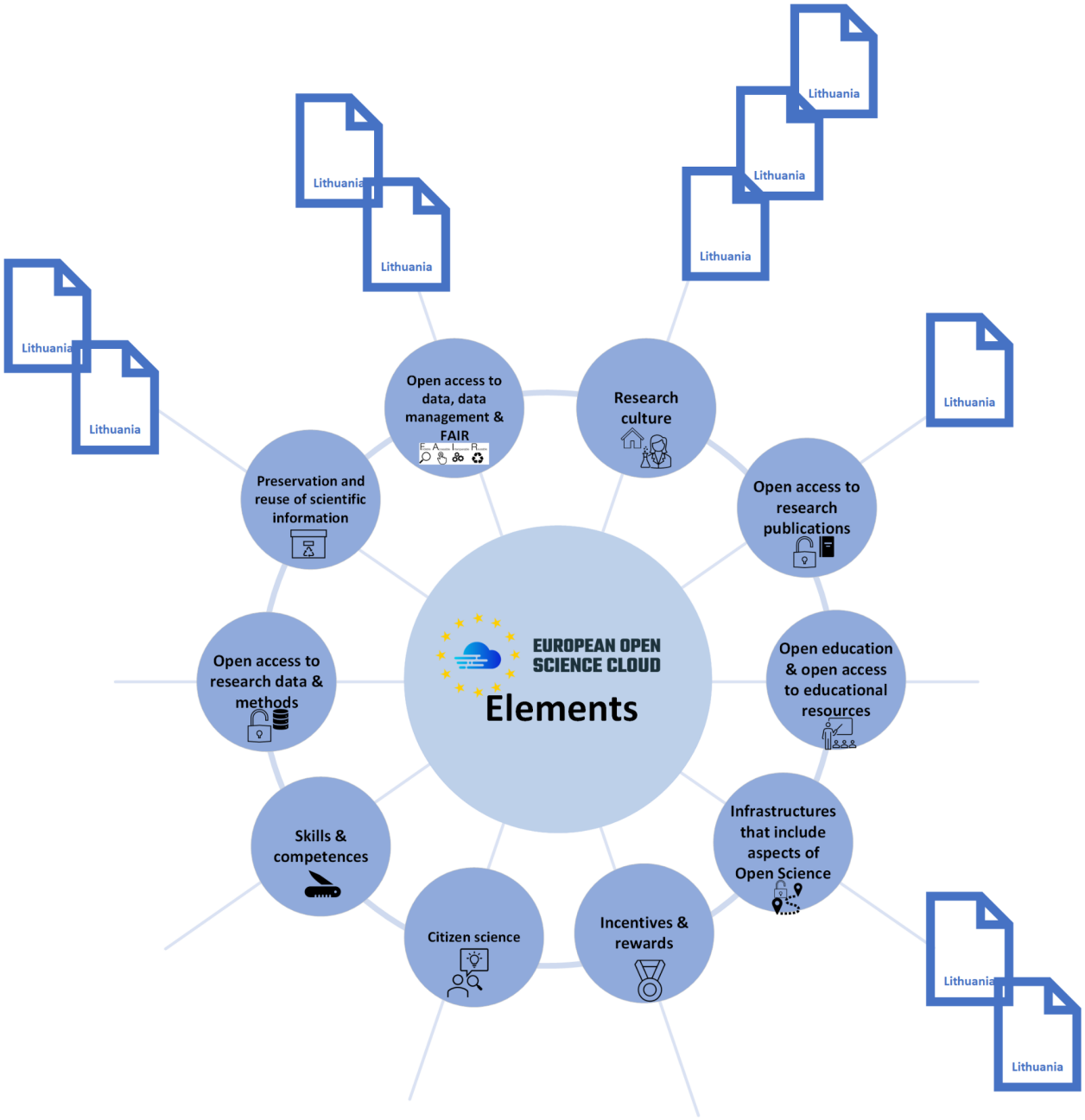

Figure 8: Element framework for Lithuania - Frequency of elements in Lithuanian policies

3.6.2 Lithuania - Policy documents and content with keypoints

Law on Higher Education and Research 2009 (revised 2015 and 2016):

Lithuania has a Law on Research and Higher Education (2009, revised 2015 and 2016) which covers Open Access and research data, stipulating that "the results of all research work carried out in state higher education and research institutions must be communicated to the public,"

Lithuanian political parties Agreement on National Education Policy (2021-2030) made by the House of Parliament political parties:

Agree on commitments where point 15. Is to strengthen, by 2024, the career development of researchers, in line with the principles of the European Research Area and the European Higher Education Area.

Development of Research 2022–2030 years Program by the Ministry of Education, Science and Sport: Addressing Inactive Involvement in Open Science Initiatives Provides Progress to "Improve the Science and Learning Environment".

Guidelines on Open Access to Scientific Publications and Data, published by Research Council of Lithuania, 2016:

This legal document included policies on open access and open research data, covering both publications and data. Skills are not addressed, but responsibilities for various aspects of Open Access and Open Data are covered in detail. The Guidelines encourage other research performing institutions in the country to adopt similar open access and open research data policies. According to these guidelines, researchers should not delay depositing their publications in a repository and should ensure open access to them after an embargo period. The Guidelines indicate that universities are responsible for the development and adoption of institutional policies, procedures and monitoring systems, aligned with the Research Council guidelines, procedures, guidance and monitoring systems.

The Order Regarding the Application of Guidelines for the Open Access to Research Publications and Data 2021:

The transitional guidelines' implementation phase was extended to 31 Dec 2022. The order initiates evaluation of the guidelines application status before 31 Jan 2022, and orders to prepare the update of the guidelines based on the evaluation results before 30 Sep 2022.

The Order Regarding the Application of Guidelines for the Open Access to Research Publications and Data 2022:

The evaluation of the application of guidelines, impact of the guidelines, and practices is extended to 1 May 2022.

Policy documents under preparation: Data management plan template (Office of the Ombudsperson for Academic Ethics and Procedures (established by the Parliament of the Republic of Lithuania)

3.6.3 Lithuania - EOSC in the national policies

The Research Council of Lithuania has a mandate of coordinating Open Access activities in Lithuania. The Research Council of Lithuania and MESS are represented on the EOSC Governance Board. The Research Council of Lithuania, the main national research funding body, supports the policy of the EU regarding open access, approves of reuse and content mining in open access publications and data, participates in the Open Science movement, advocates open access among policymakers, scientists and knowledge managers, supports global, national, regional and institutional initiatives fostering OA. Following the Law on Higher Education and Research of the Republic of Lithuania (2009, revised 2015 and 2016), "to ensure the quality of research conducted with funds of the state budget, the transparency of the use of funds of the state budget, and to enhance scientific progress, the results of all research work carried out in state higher education and research institutions must be announced publicly (in the Internet or any other way), to the extent this is complying with the legal acts regulating the protection of intellectual property, commercial or state and official secrets" (Article 51).

The Research Council of Lithuania adopted the Guidelines on Open Access to Scientific Publications and Data on the 29th of February 2016 and seeks further implementation of the document. The Guidelines include the policy on open access and open research data in full alignment with the Horizon 2020 (H2020) open access mandate, the Open Research Data Pilot, and the Commission's Recommendations on access to and preservation of scientific information. Seven higher-education institutions have open access policies.

A Working Group for developing a national Open Access / Open Science Policy was set up on the 16th of January 2020 by the Minister of Education, Science and Sport (https://eosc-portal.eu/lithuania). Description of the procedure for selecting and subscription funding of science and study databases (Ministry of Education, Science and Sport, 2022). The description of the procedure provides a recommendation for database subscription that, if possible, transitional agreements shall be concluded, allowing the possibility to publish articles in open access.

3.7 Norway

In Norway, both the Ministry of Education and Research and the Research Council of Norway (RCN) have a key role in the definition of the policies for Open Access and Open Science. The Ministry of Education and Research published relevant guidelines and policies in 2017. The RCN published its guidelines on access to research data already in 2014 and revised them in 2017. In 2019, the Research Council of Norway published an overall policy for open science, where access to research data is one aspect of it.

Recently, the ministry has transferred the coordination of the national participation and activities in the EOSC to the Norwegian Research Council.

The guidelines regarding open access and data management are implemented and adapted at the research institutions and by communities.

3.7.1 Norway - Policy documents

3.7.1.1 Policies before February 2021

Before February 2021 several policy documents have been published. Among them it is relevant to mention the following (the list is not exhaustive):

- "National goals and guidelines for open access to research articles", August 2017
    - Elements: Open access to research publications, Open access to research data and methods, Incentives & rewards, Open access to research data and methods
- National strategy on access to and sharing of research data, November 2017
    - Elements: Research culture, Open access to data, data management and FAIR, Skills and competencies, Infrastructures that include aspects of open science, Preservation and reuse of scientific information
- The Research Council of Norway's Policy for Open Access to Research Data, December 2017
    - Elements: open access to data, data management & FAIR, Open access to research data and methods, Infrastructures that include aspects of open science, Preservation and reuse of scientific information
- The Research Council's Policy for Open Science, December 2019 (Norwegian Research Council, 2019)
    - Elements: Research culture, Skills and competencies, Infrastructures that include aspects of open science, Preservation and reuse of scientific information, open access to research publications, open access to research data and methods, Incentives & rewards, Citizen science
- In June 2019, the Ministry of Local Government and Modernisation published a digital strategy for the public sector 2019–2025 called *One digital public sector*[5]. One of the goals for the government towards 2025 is that the public sector shall exploit the potential of sharing and using data to create user-friendly services and to promote value creation in the business sector. Increased data sharing and value creation is one of six focus areas.

- In October 2021 the document "How should we share research data?? Report and recommendations relating to licensing and making research data available(The Research Council of Norway, 2021) was published as a result of a working group mandated by the Ministry. According to the guidelines, research data that is shared and made available openly should be published with a licence or terms of use that makes it clear what the framework is for further use and sharing. This is relevant for both the reuse and publication of data.

5 https://www.regjeringen.no/contentassets/db9bf2bf10594ab88a470db40da0d10f/en-gb/pdfs/digital_strategy.pdf

- Elements: Research culture, Open access to research publications, Open access to research data and methods, Open education and open access to educational resources, Preservation and reuse of scientific information

3.7.1.2 Policies after February 2021

After February 2021, one policy document has been published.

- The new digitalisation strategy for higher education and research, *Strategy for digital transformation in the higher education sector 2021–2025*[6], was published in September 2021. Open science and new research opportunities are one of the six strategic focus areas mapped out in the document.

- A new web resource for Open Science policy (Åpen Forskning, 2021) and a recommendation were established in 2021, developed and maintained by UNIT - the directorate for ICT and joint services for education and research, now partially transformed into Sikt - The Norwegian Agency for shared services in education (since 2022).
    - Elements: Open access to research publications, Open access to research data and methods, Open education and open access to educational resources, Preservation and reuse of scientific information

- The Research Council has joined the international coalition, cOAlition S, which is behind Plan S. For calls for proposals from and including 2021, the Research Council requires all scientific articles from the projects we fund to be made available immediately, which means without embargo and with an open licence that permits reuse of the publication.

3.7.2 Norway - Policy documents and content with keypoints

National policies and guidelines for Open Access, and for sharing and re-use of scientific data were to a large extent published in August and December 2017, but the Research Council had a policy on open access to research data already in place in 2014.

In the "National goals and guidelines for open access to research articles" (August 2017), the government's goal is that all publicly funded Norwegian research articles should be made openly available by 2024, and the government has established guidelines and measures for open access to research articles. This can be done via publication in open journals or self-archiving in open research archives. In addition, open access is also achieved through negotiation and transformative agreements with academic publishers.

In the "National strategy on access to and sharing of research data" (November 2017), it is stated that data from research projects should also be open and FAIR. The strategy encompasses three main principles:

[6] In Norwegian: https://www.regjeringen.no/no/dokumenter/strategi-for-digital-omstilling-i-universitets-og-hoyskolesektoren/id2870981/

- Research data should be as open as possible, and as closed as necessary.
- Research data should be handled and adapted so that the scientific values in the data can be utilised in the best possible way.
- Decisions on archiving and facilitating research data must be made among research communities.

The first overall open research policy published by the Research Council of Norway is from December 2019 and covers the horizon from 2020 to 2025. 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 in collaboration with other relevant stakeholders such as the research institutions and other relevant national and international stakeholders. Some of the proposed measures include: offering training and competence building; testing open science and innovation in projects; fostering access and reuse of research results; promoting data infrastructure for handling and making research data accessible in line with the FAIR principles; enforcing responsible research assessment of researchers and research; promoting socially responsible research and innovation.

In recent years, the main goal has been to create the knowledge and the infrastructure to allow the implementation of these policies. This includes the creation of the Open Science webpage (read above), that reports the policies and guidelines for Open Access in Norway - national and local, provides a status for the negotiations with publishers, and gives access to important resources.

Furthermore, unresolved issues regarding rights and licences often prevent the results of research from being made publicly available. This motivated the Ministry of Education and Research to ask the Research Council of Norway and UNIT to set up a committee to examine rights and licensing issues related to sharing of data sets produced in scientific research. The Research Council has held the secretariat for the committee. The work has produced a rapport which was published in the autumn of 2021: *"How should we share research data? Report and recommendations relating to licensing and making research data available"* (The Research Council of Norway, 2021). Among the funding in the document, it is relevant to mention that the use of licences both on access and re-use is suggested to be a good tool for achieving more sharing and re-use of research data.

A similar committee has also been mandated by the Research Council of Norway and the Norwegian Directorate for Higher Education and Skills, on behalf of the ministry. The committee will review the infrastructure landscape for FAIR data in terms of organisation, management and financial models and recommend investment strategies for infrastructure supporting FAIR research data and public data with particular relevance to research. This group is currently in the final stage of its work and a first draft of the report containing recommendations is currently under revision nationally (January 2022).

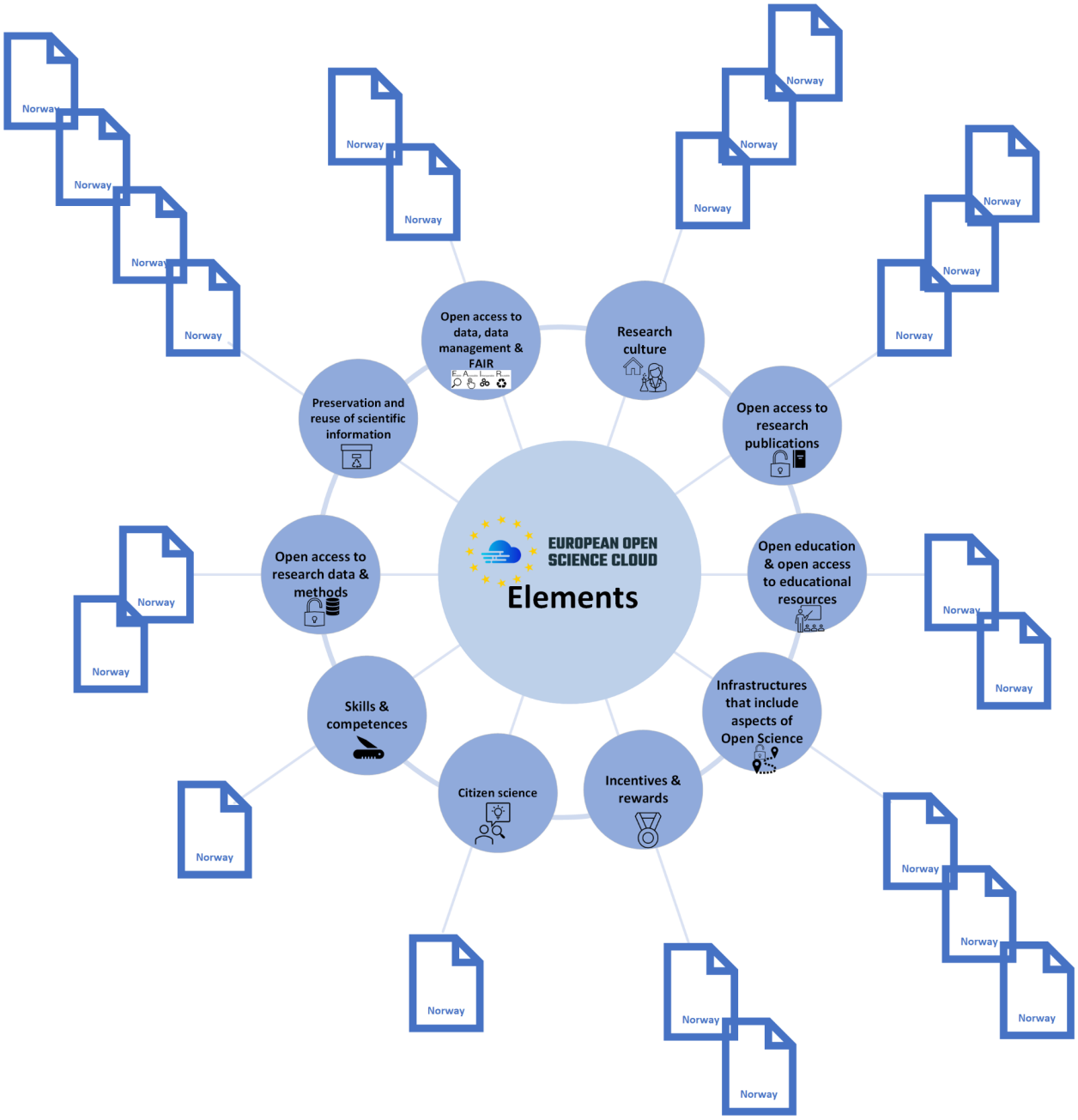

Figure 9: Element framework for Norway - Frequency of elements in Norwegian policies

3.7.3 Norway - EOSC in the national policies

EOSC - together with OpenAIRE - is mentioned in the guidelines as the platforms to concretely support the implementation of Open Science and Open Access at the European level. Norway is involved in these initiatives through several activities and projects. The Research Council of Norway has been mandated by the ministry to coordinate Norwegian participation in the EOSC and represent national interests in the EOSC Association.

Currently, the Research Council is involved in the establishment of a national EOSC forum.

EOSC is mentioned in the strategy for digital transformation in the higher education sector, in the section on open science and new research opportunities. It is stated that EOSC will support the goal of greater transparency and better utilisation of publicly funded data in research and innovation. Further, it is asserted that the opportunities for good interaction with research institutes, health trusts and international research actors will be strengthened through more sharing of data and research resources, joint infrastructure solutions and better IT support for collaboration. This will advance new research opportunities.

3.8 Sweden

In Sweden, different governmental organs are responsible for the national policy-making, as well as the Royal Library (Kungliga biblioteket).

- The National Library of Sweden
    - The National Library of Sweden (Kungliga biblioteket) collects, preserves and gives access to almost everything that is published in Sweden – from manuscripts, books and newspapers to music, TV programs and pictures. The National Library is a Government Authority under the ambit of the Ministry of Education, headed by the National Librarian.
- The Swedish Research Council (Vetenskapsrådet)
    - Director-General, directs the daily work of the Swedish Research Council together with the Executive Director. The operation is divided into five departments. The Research Council has three scientific councils, one council and five committees that decide on the allocation of research funds. The entire operation is headed by a board, which is appointed by higher education institutions and the Government.
- Ministry of Infrastructure
    - The Ministry of Infrastructure is responsible for matters relating to infrastructure, digital policy, post issues and energy.
- The Ministry of Education and Research
    - The Ministry of Education and Research is responsible for the Government's education and research policies. The Ministry works on issues including school performance, conditions for teachers and study financing.
- The Agency for digital government

- The purpose of the Agency for digital government (DIGG) is to achieve a sustainable welfare society. The digitalisation of Sweden needs to be intensified. Together with the entire public administration, we strive to make the transition happen – and benefit all. Several reports and inquiries have concluded that the governance of digital administration is complex and overly fragmented. DIGG has collective responsibility for these issues to achieve more transparent governance toward the goals set by the central government.

3.8.1 Sweden - Policy documents

The following documents in Sweden are on open science:

3.8.1.1 Policies before February 2021

Before February 2021, there were 5 policy documents produced:

- Regeringens proposition 2020/21:60 Forskning, frihet, framtid – kunskap och innovation för Sverige (in Swedish), published by The Ministry of Education and Research, 2020 (The Ministry of Education and Research - Sweden, 2020).
  - Elements: Research culture, Open Access to publications, Infrastructure that includes aspects of Open Science, Open Access to data, data management & FAIR, Skills and competence, Preservation and reuse of scientific information
- Financial and technical support for open access scholarly journals, published by The Royal Library, 2019 (Swedish National Library, 2019).
  - Elements: Open Access to research publications, Infrastructures that include aspects of open science, incentives & rewards, skills and competencies, Preservation and reuse of scientific information.
- *Policy för utveckling av programvara,* published by the Agency for digital government, 2019 (Swedish Agency for Digital Government, 2019)
  - Elements: Open access to research data & methods
- Nationell färdplan för det europeiska forskningsområdet 2019–2020, published by The Ministry of Education and Research, 2019 (Swedish Ministry of Education, 2019)
  - Elements: Open access to data, data management & FAIR
- Kriterer för FAIR, published by the Swedish Research Council, 2018 (Swedish Research Council, 2018)
  - Elements: Open access to data, data management & FAIR
- Government's research bill 2016/17:50, 2020 (Hellmark Knutsson, 2016).
  - Elements: Research culture, Open Access to publications.
- Appropriation direction to SRC 2017. Assignment to nationally coordinate the work on transitioning to open access to research data. Target by 2026
- Appropriation direction to SRC **2021**

    - Updated assignment to nationally **coordinate and promote** the work on transitioning to open access to research data
- Appropriation direction to NLS 2017:
    - Assignment to nationally coordinate the work on open access to publications. Target by 2021
    - When performing the assignment, needs to consult with SRC and HEIs
- Appropriation direction to NLS 2021
    - Updated assignment to nationally **coordinate and promote** the work on open access to publications
    - Additional assignment to map and analyse the use of open educational resources and general public engagement in scientific research activities (2021).
- Assignment to Universities and Higher Education Institutions to continue to develop the work with open science (2021)
- Nationell strategi för deltagande i Horisont Europa
    - Sweden should be leading in open science.
    - The work on open science should benefit from participation in HEU and vice versa.
    - Participation in EOSC and CoalitionS contributes to that**.**

3.8.1.2 Policies after February 2021

After February 2021 there were five policy documents produced:

- Vetenskapsrådets samordningsuppdrag om öppen tillgång till forskningsdata - delredovisning, published by The Swedish Research Council (Swedish Vetenskapsrådet) 2021 (Swedish Research Council, 2021)
    - Elements: Research culture, Open Access to publications, Infrastructure that includes aspects of Open Science, Open Access to data, data management & FAIR, Skills and competence, Preservation and reuse of scientific information
- Data – en underutnyttjad resurs för Sverige: En strategi för ökad tillgång av data för bl.a. artificiell intelligens och digital innovation, published by The Department of Infrastructure 2021.(Swedish Government, 2021)
    - Elements: Open access to research data & methods
- En nationell strategi för svenskt deltagande i Horisont Europa 2021–2027, published by the Department of Education, 2021.(Regeringen, 2021)
    - Elements: Skills & competencies, Open access to data, data management & FAIR,
- Vägledning för implementering av kriterier för FAIR forskningsdata, published by the Swedish research council, 2021. (The Research Council, 2021)
    - Elements: Open access to data, data management & FAIR
- Samordning av arbete för öppen tillgång till vetenskapliga publikationer, published by the National library, 2021 (Swedish Research Council, 2021).
    - Elements: Open Access to research publications, Open access to data, data management and FAIR, Infrastructures that include aspects of open science, Incentives and rewards,

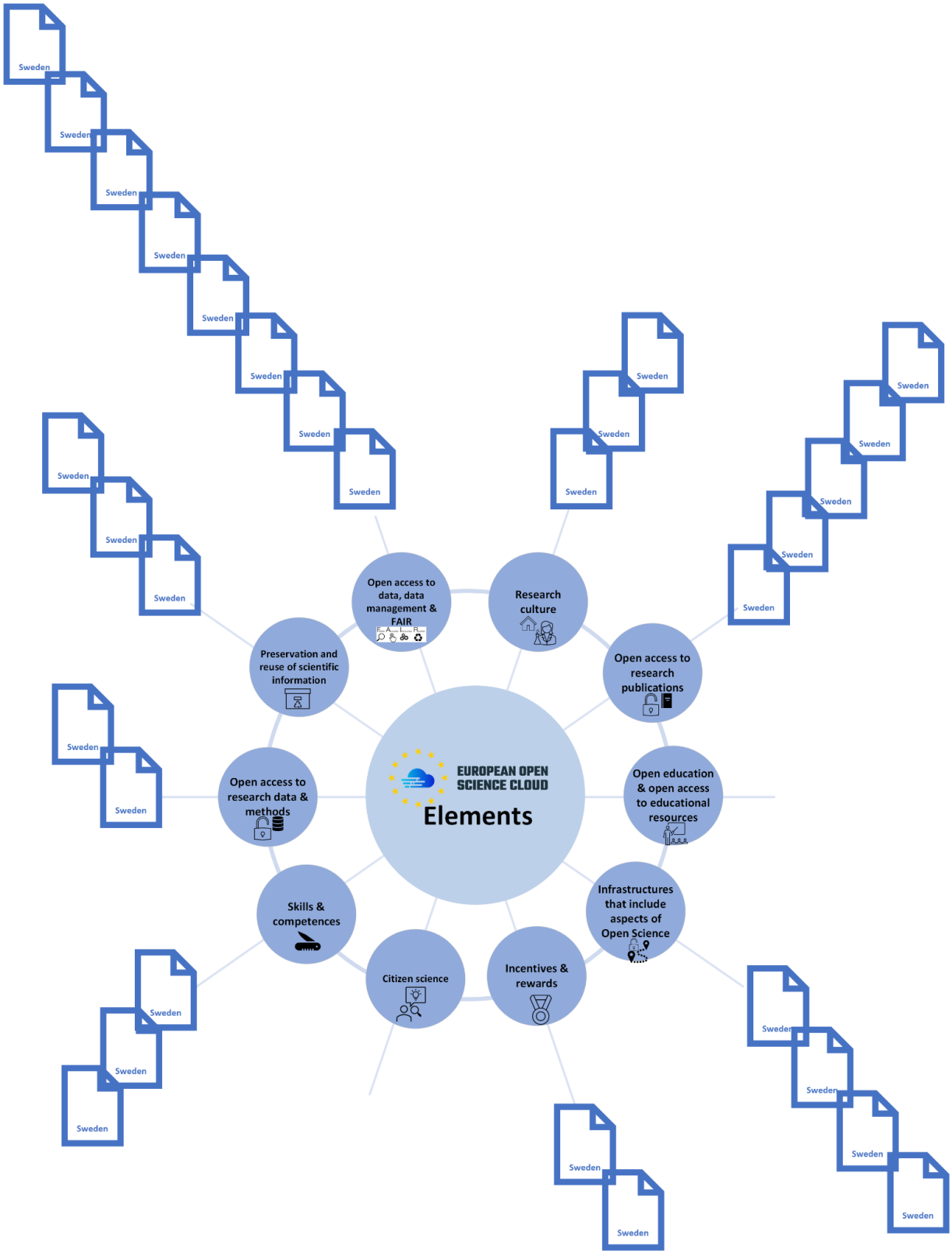

Figure 10: Element framework for Sweden - Frequency of elements in Swedish policies

3.8.2 Sweden - Policy documents and content with key points

National coordination of open access to publications

The National Library has had a coordination assignment since 2017 - the assignment was updated in 2021 to "coordinate and promote" the national work on open access to publications and to perform mapping, analysis and assessment of the national work on open access to publications. "The assignment includes submitting a comprehensive mapping, analysis and assessment of the national work with open access to scientific publications. In carrying out the assignment, the National Library needs to consult with the Swedish Research Council as well as universities and colleges. The National library must partially report the assignment to the Government (Ministry of Education) no later than 4 October 2021 and final report on the assignment to the Government (Ministry of Education) no later than 10 March 2022. The partial report focuses on mapping the situation for openly available scientific publications in Sweden today.

Key points:

The prioritised topics areas from the partial report are:

- Increased costs
- Harmonisation of principles
- Copyright prerequisites
- Technical conditions
- The incentive structures of research
- These could be excluded if it is updated with the information from the report mentioned above

The National Library of Sweden (NLS) proposes a national policy for Open Science. NLS deems national and international coordination as necessary when it comes to researchers' understanding of this area. In NLS' recent mapping of university and funder policies for Open Access (or the wider concept of Open Science) in Sweden, a need for updated and harmonised policies was found. UNESCO's new recommendation on Open Science is also clear on the need for national policies.

Since 2006 NLS has worked on advancing open access to scholarly output. In 2017 the NLS received an appropriation directive from the Swedish Government to act as a national coordinating body in the work towards a transition to open access to scholarly publications. The directive states that NLS shall promote and coordinate this work, and last year the government asked for two reports; one interim report in October 2021 and a concluding one in March 2022, which will also be annual from now on. It is in this concluding report that the proposal for a national policy as stated above is made.

The mapping referred to above is reported in the interim report chapter 11, here are two excerpts, first for HEIs:

"A review of policy documents from universities and university colleges shows that the majority have policy or guideline documents that address open access. At the same time, both their scope and how up-to-date they vary considerably, which in light of the strong development that has taken place in the last decade within open science means that they can appear both obsolete and too limited."

And for RFOs:

"The four major Swedish governmental research funding bodies express in instructions, guidelines or requirements and terms and conditions that findings from research funded by them must be published with open access. FORTE, FORMAS, and Vinnova are all part of the international network cOAlition S and their requirements follow the principles set out in Plan S. The requirements from the Swedish Research Council, who are not part of cOAlition S, are similar except that they allow for open access after a six-month embargo in all areas except educational sciences and the humanities and social sciences, where twelve months are allowed. For all funders, the requirements apply to peer-reviewed articles, while exceptions are made for publication types such as books, book chapters, reports, etc."

NLS also received a new assignment related to Open Science 2021: to map and analyse the use of Open Educational Resources (OERs) and the general public engagement in scientific research activities, with special regard to the public library system.

The Swedish Research Council's national coordination assignment on open access to research data (interim report):

The report is an interim account of the Swedish Research Council's mandate from the Government to coordinate and promote the work of implementing open access to research data. The report is divided into four sections, as stated in the report. The third section of the report *"places the national work on open access to research data into a European perspective, in particular in relation to the ongoing work on the European Open Science Cloud, EOSC".*

With regards to EOSC, the report highlights that in November 2020, the Swedish Research Council was nominated by the Government Offices as a mandated organisation in the EOSC Association, a mechanism within the newly established EOSC partnership that enables key organisations for the implementation of EOSC to participate in its strategic governance. Being a mandated organisation means that the Swedish Research Council shall represent national interests and stakeholders in the association and work for national policies and strategies to harmonise with the implementation of the EOSC. The Swedish Research Council collaborates with key national organisations to ensure information exchange. Within the framework of EOSC, the Swedish Research Council also has an assignment on Swedish coordination and Swedish participation in the European Commission covid-19-platform.

The Swedish Research Council also participated in the Science Europe working group Data Infrastructures and Data Sharing during 2020-2021 and will participate in Science Europe's working group on Open Science henceforward.

The coordination assignment is led at the Swedish Research Council by the unit for Data as a Strategic Resource within the Department of Research Infrastructures. The work with the assignment is handled

by an assignment leader, an internal working group, a steering group, a reference group and a working group for national coordination of data management plans.

As EOSC is an instrument for fulfilling open access to research data internationally, the Swedish Research Council now integrates their work as a mandated organisation for EOSC within the coordination assignment on open access to research data. As a result, both the assignment's reference group and steering group received an extended mandate to also include EOSC in 2021.

From April 2020 to October 2021, the assignment of coordinating the national work with open access to research data has been based on the following priorities:

Focus areas

- guidance for the work with open access to research data,
- collaboration and cultural change,
- information about laws and regulations
- data management and infrastructural conditions
- incentives for and effects of open access.

The focus areas have been developed as a result of the needs assessment as the Swedish Research Council refer to in the previous reporting as well as based on discussions in the Swedish Research Council's reference group. In connection with the new reference group's first meeting in January 2021, comments from the reference group were collected on the most important issues for the transition to open access to research data respectively within the framework of EOSC and about what the Swedish Research Council can do within their national and international commitment to support stakeholders in the best possible way.

In 2018, the Swedish Research Council established a reference group for the work on the assignment open access, for key stakeholders' experiences and views to be reflected in the work. The scope of the reference group has included the EOSC since January 2021 and has got a new constellation where now also Swedish organisations that have become members of the EOSC Association are included. The updated focus for the reference group is to contribute to a good overview of the landscape when it applies to the work with open access to research data both nationally and within the European Commission's initiatives and initiatives. In addition, the group has a special focus on EOSC; on creating engagement, anchoring and disseminating knowledge of the government assignment on open access to research data and European cooperation on these issues; and facilitating the implementation of the FAIR principles to promote access to research data.

The work within the focus areas takes place in consideration of the ongoing national and international development and coordination with relevant actors. In January 2021, the Swedish Research Council's reference group on open access and EOSC discussed what they perceived as the most important issues for this work. Among other issues, the group expressed need for: promoting increased understanding and collaboration on open access and EOSC; support through more information, guidelines and recommendations on FAIR and open access to research data and what it means in practice; more clarity about legal frameworks, roles and responsibilities for research data; more clarity about when research

data should be made available below the research process; increased understanding of common and specific needs within different research disciplines and subject areas as well as for different types of data; more clarity about terms for the use of existing source data (for example register data), to develop incentive structures that include open access to data, for example, a system for evaluation of merits and quality control of the entire research process; sufficient resources for data publishing; to draw attention to the fact that there is concern among researchers about how data is used and for an increased workload in preparing data for publication, as well as the points listed below:

- various supportive initiatives towards the higher education institutions, which indirectly support researchers in their work with research data
- to draw attention to major infrastructural issues regarding, among other things interoperability, interconnections between data and publications and the role of publishers in data publishing
- communication about EOSC aimed at the research community, among other things to inform about the opportunities the EOSC can provide research as well as to meet the needs of researchers
- data storage for making available as well as adequate services and support
- to draw attention to how infrastructural connections to the EOSC can be implemented
- to create broad coordination nationally, as well as to cooperate and jointly discuss a roadmap for EOSC in Sweden

The views of the group contribute to the fact that expressed needs can be reflected in the priorities that the Swedish Research Council makes in its work and to communicate whether open access to research data and the EOSC can be adapted.

To investigate the development of open access, there will be a need to measure and monitor the increase in open access to research data. A compilation of how research data is made available through different types of research infrastructures was developed in 2019 and reported in the status report from the coordination assignment in March 2020. To make visible and measure the increase of publicly available research data is an activity that is closely linked with EOSC and which thus needs to take place in step with current developments which the Swedish Research Council monitors and actively participates. To be able to measure both the increase of openly available research data and their use is important to inform future promotion efforts.

The Swedish Research Council works to ensure that the recommendations produced within the coordination assignment take into account current development at the national level concerning developments around open public data, and European level, including through the role of the mandated organisation in EOSC and as a National Point of Reference (NPR) on Scientific Information.

Data – en underutnyttjad resurs för Sverige: En strategi för ökad tillgång av data för bl.a. artificiell intelligens och digital innovation

Objective: Sweden will be a leading data-sharing nation in AI and digital innovation with the purpose of strengthening welfare, competitiveness and sustainable society. The state administrative authorities that can streamline operations and simplify for companies and citizens with the help of shared data, AI and data-driven analysis must have begun that work by 2025. Publicly funded research data shall, where

appropriate, be open and available by 2026 and Swedish companies shall be leading players in the internal market for data by 2030. Requirements for information and cyber security, protection of personal integrity and national security and respect for intellectual property rights and the legitimate interest of companies not to share certain data should be integrated into the work. This strategy focuses on data sharing between organisations.

The EU wants to be at the forefront of the development of a data-driven society that sets people at the centre. The goal is to create an internal market for data by 2030 where data can flow freely between countries, sectors and companies. As a result, Swedish companies, authorities, regions and municipalities need to develop the ability to share and use data at the national and European levels to take advantage of the internal market created. The government's ambition is to actively contribute to the implementation of the EU data strategy and OECD recommendation on increasing data sharing. The work must ensure national security, information security and protection of personal integrity.

The strategy is divided into six focus areas: 1: Increased access to data, 2: Open and controlled data sharing, 3: Collaboration and culture, 4: Governance, regulation and follow-up, 5: Research, development and competence, 6: EU and international cooperation. Each focus area has an intermediate goal that can be followed up. An important focus for the strategy is to promote data sharing with different degrees of control within the so-called data spaces.

En nationell strategi för svenskt deltagande i Horisont Europa 2021–2027, published by the Department of Education (Swedish Utbildningsdepartementet), 2021

Purpose:

European research and innovation cooperation is of great importance to Swedish universities and colleges, businesses, institutes, public enterprises and other actors. The collaboration has served Sweden well and increased the opportunity to solve common societal challenges with new knowledge and innovation. The European Union's ninth Framework Program for Research and Innovation, Horizon Europe, is now underway, covering the period 2021-2027. The framework program is strategically important for Swedish research and innovation, and the government intends with this strategy to strengthen Swedish participation.

The strategy contains the government's overall goals and eight more specific goals for participation in Horizon Europe. The strategy also focuses on how research funders, universities and colleges and project participants can contribute to achieving the goals.

The overall goal of Swedish research policy is for Sweden to be one of the world's foremost research and innovation countries and a leading nation of knowledge, where high-quality research, higher education, and innovation lead to society's development and welfare, business competitiveness ,and response to the societal challenges we face, in Sweden and globally. The overall goal will also apply to Swedish participation in Horizon Europe.

See objective 7 in the strategy – Sweden should be leading in open science

Swedish authorities participate in the European project on research data, FAIR (Findable, Accessible, Interoperable, Reuseable, i.e. searchable, available, harmonised with other systems and reusable). FAIR, which is based on the principle of being as open as possible but as closed as necessary, makes it easier for individual researchers to use in their own research others' previous research data. The European cooperation on open data within the European open science cloud (EOSC), makes this possible through the development of a common framework around methods and infrastructure services for collaboration and sharing of research data. The project develops existing infrastructures for research data so that these can be linked, shared and used over disciplines and national borders and drives technology development in the area.

At the European level, the transition to open access to scientific publications is driven by, among others, the Commission and organisations such as Science Europe. This is done, for example, through Plan S, which is an initiative for open access to research publications. The plan is supported by cOAlition S, which is an international consortium of research funders and researchers, including Swedish research funders. The coalition is supported by the Commission and the European Research Council (ERC).

It is important to ensure that Swedish work for open science benefits from Horizon Europe and vice versa to promote open access to research data and publications. Swedish participation in EOSC and cOAlition S contributes to that.

Efforts that contribute to achieving the goal:

There are good opportunities to strengthen cooperation for open access to scientifically based knowledge and that stakeholders contribute to and influence the development of routines and principles for open science. This includes that merit and research assessment need to be changed to adapt to an open science system.

Vägledning för implementering av kriterier för FAIR forskningsdata: (Guidance for implementation of the criteria for FAIR research data)

FAIR is an internationally recognised concept that is made up of 15 guiding principles for open research data and data management. According to the FAIR principles, research data must be searchable (Findable), accessible (Accessible), interoperable (Interoperable) and reusable (Reusable).

The Swedish Research Council has developed criteria for all 15 FAIR principles. The purpose of the FAIR criteria is to increase understanding of and knowledge of what the FAIR principles mean in practice.

For FAIR data management to be implemented in the research process, the SRC has produced guidance, which at a more detailed level supports the practical implementation of the criteria. The guidance can be used as a support for anyone who supports researchers in planning data management, especially the supporting functions for data management at universities and infrastructures where adaptation to FAIR data management and practical implementation of the FAIR principles often takes place.

Key Points

The documents are on strategy for increased data access, open access to research data, and strategy for Swedish participation in Horizon Europe.

Guidance for how FAIR data management to be implemented in the research process, the guidance can be used as a support for anyone who supports researchers in planning data management, especially the supporting functions for data management at universities and infrastructures where adaptation to FAIR data management and practical implementation of the FAIR principles often takes place.

Key Points: En nationell strategi för svenskt deltagande i Horisont Europa 2021–2027, published by the Department of Education (Swedish Utbildningsdepartementet), 2021:

Sweden must have a high level of participation in Horizon Europe which will lead to:

- contribution to raising the quality of Swedish research and strengthening the business community's competitiveness and ability to innovate, strengthen,
- contribute to strengthening Sweden's national initiatives
- knowledge use and development for Swedish society and Swedish higher education.
- researchers and the Swedish business community must be able to use and benefit from research infrastructures and test and demonstration environments in Europe
- leading within Open Science
- to an increasing extent influence the EU's research and innovation policy through active participation
- EOSC is mentioned in the document as a role within Open Science and European collaboration enabling the development of common frameworks and methods for infrastructure services, collaboration and sharing of research data.

Key points Vetenskapsrådets samordningsuppdrag om öppen tillgång till forskningsdata - delredovisning

- The document has in total of 45 mentions about EOSC (this includes also references in the document).
- the Swedish Research Council was nominated by the Government Offices as a mandated organisation in the association for the European Open Research Cloud - EOSC. The Swedish Research Council shall represent national interests and stakeholders in the association and work for national policies and strategies to harmonise with the implementation of the EOSC. The Swedish Research Council collaborates with key national organisations to ensure information exchange.

- The establishment of the EOSC Association enables institutional participation in EOSC's strategic direction.
- Participation enables the harmonisation of national strategies with EOSC implementation collaboration on a European data portal (covid-19)
- EOSC as an instrument for implementing open science

- the Swedish reference group is spreading knowledge and dedication to EOSC and the implementation of FAIR. Also in cooperation with other actors in seminars to inform about open science, data management plans and EOSC.
- coordinate the national work and transition with open science guidelines and policies with the European Commission and ESOC.
- future work that mentions EOSC is the promotion of increased understanding and cooperation.
- Communication on EOSC directed to the Swedish research community, informing on the possibilities for the research communities with EOSC that meet the needs of the researchers. how infrastructural connections to EOSC can be implemented.
- national coordination and collaboration and discussion on a roadmap for EOSC and Sweden are needed.

Keypoints Data – en underutnyttjad resurs för Sverige: En strategi för ökad tillgång av data för bl.a. artificiell intelligens och digital innovation

- EOSC is mentioned in this document in an explanatory way; initiative from the EU commission, EOSC cloud and services related to EOSC. The Swedish Research Council is the mandated member, assigned by the government, and represents Sweden.
- Sweden has a strategy for open data that includes a national perspective as well as a European perspective.
- The strategy is divided into six focus areas with reachable targets to be reached.

3.8.3 EOSC in the national policies

In *Data – en underutnyttjad resurs för Sverige: En strategi för ökad tillgång av data för bl.a. artificiell intelligens och digital innovation,* EOSC is mentioned in this document in an explanatory way; initiativ from the EU commission, EOSC cloud and services related to EOSC. The Swedish research council is assigned by the government and represents Sweden.

In *The Swedish research councils samordningsuppdrag om öppen tillgång till forskningsdata - delredovisning* the document has in total of 45 mentions about EOSC (this includes also references in the document). The Swedish Research Council was nominated by the Government Offices as a mandated organisation in the association for the European Open Research Cloud - EOSC. The Swedish Research Council represents national interests and stakeholders in the association and works for national policies and strategies to harmonise with the implementation of the EOSC. The Swedish Research Council collaborates with key national organisations to ensure information exchange. The document also covers participation in EOSC strategic direction and extended mandate, collaboration on a European data portal (covid-19), EOSC as an instrument for open science, The Swedish reference group is also spreading knowledge on EOSC and the implementation of FAIR. Also in cooperation with other actors in seminars to inform about open science, data management plans and EOSC, they coordinate the national work and transition with open science guidelines and policies with the European Commission and ESOC. They discuss national coordination and collaboration and discussion on a roadmap for EOSC and Sweden and how infrastructural connections to EOSC can be implemented. They handle outgoing communication on EOSC, directed towards the Swedish research community,

informing on the possibilities for the research communities with EOSC that meet the needs of the researchers.

In 2020, the EU has taken a major step forward in terms of the technical conditions for open science through EOSC, European Open Science Cloud. EOSC is supposed to be one federated solution that brings together the EU's work with open science. KB participates in the work on the national level through the Swedish Research Council's reference group for EOSC and at the international level through membership in OpenAIRE, which manages some services within the EOSC. Such a service is OpenAIRE Research Graph which is intended to enable search and evaluation of EU research results including publications.

In *Vetenskapsrådets samordningsuppdrag om öppen tillgång till forskningsdata - delredovisning* the open European cloud of research, the European Open Science Cloud (EOSC), is seen as instrumental in supporting European cooperation in the research area as part of its priorities in open science, which means, among other things, making open science an accepted practice in the research community. The EOSC shall enable coordinated access to research data according to the FAIR principles and the re-use of open research data through a trusted and openly distributed data environment and related services.

Activities within the European partnership for EOSC are relevant for the assignment in that they have an impact on guidelines for open access to research data, on recommendations and principles, anchoring and coordination at the national level, as well as on the standards and best practices adopted forward. Within the framework of the work with EOSC, several relevant reports and recommendations have been developed that contribute to the implementation of open access to research data.

Through EOSC, good examples of the availability and use of research data are created and highlighted. The activities are also relevant through infrastructural conditions to which the EOSC can contribute. An important aspect is interoperability which has effects on technological development and joint services. Incentives can also be affected by developments within the EOSC.

Under the section "Future needs" in the document conclusions are made for the future ongoing work. EOSC is mentioned in following up and measuring the increase and effects of made available research data (strategic action) and EOSC is involved in this work. EOSC is also mentioned in mapping the need for common technical solutions related to long-term open access to research data on the Internet (strategic and technical measure) where EOSC can be monitored as an important aspect of development.

4. Resource provisioning policies

The D2.5 deliverable provided an overview and update of the state of resource provisioning policies related to horizontal IT services in the Nordic and Baltic regions and identified gaps for facilitating cross-border research. A focus for this deliverable has been to investigate further the cross-border aspect of resource allocation, particularly regarding the emerging EuroHPC resources, as described in the EuroHPC work plans. (EuroHPC, n.d.).

The EuroHPC resources, while allocated nationally for the national parts, provide a framework within which cross-border allocation of resources, as well as pooling of resources, will be institutionalised within the European e-infrastructure landscape. As such, it may form the e-infrastructure landscape going forwards. In this context, it is also interesting to investigate the national responses and adaptation to the changing HPC landscape.

LUMI, one of the pan-European pre-exascale supercomputers located in Finland, is governed by a consortium of 10 countries. The consortium countries manage half of the resources, while half of them are governed by EuroHPC Joint Undertaking in European-wide calls. Hence, this section describes how EuroHPC resources, LUMI, enhances the national context, the roles EuroHPC resources aim to play within the national context, and how allocation mechanisms are enhanced.

Similarities and differences between the countries inventoried are analysed.

4.1. Denmark

Resources for Denmark regarding LUMI are handled the same way as the national HPC resources. The key part is that the resources are split in two (50% each). One is handled by biannual open calls, while the other is split between the eight Danish universities that manage their allocation policies internally. DeiC will manage the open calls on behalf of the ministry (Danish e-Infrastructure Cooperation - DeiC, 2022).

4.2. Estonia

Resources managed by Estonia are awarded in three units: GPU hours, CPU core-hours, and storage-hours. LUMI consists of a CPU partition (LUMI-C), GPU partition (LUMI-G, with most of LUMI performance) and other services (object storage LUMI-O et cetera). Estonia uses only Regula Access mode for LUMI access due to the overall small size of the Estonian share.

Principles of allocating resources for LUMI

The LUMI computing and data management resources allocated to Estonia are divided equally among ETAIS consortium members, with 20% reserved for SMEs. The applications are measured using technical analysis. LUMI adds about 20% to the overall Estonian CPU resource and quadruples the GPU resources.

4.3 Finland

Resources managed by Finland are awarded in three units: GPU hours, CPU core-hours and storage-hours. LUMI consists of a CPU partition (LUMI-C), GPU partition (LUMI-G, with most of LUMI performance) and other services (object storage LUMI-O et cetera). Finnish LUMI access modes are Extreme Scale Access, Regular Access, Benchmark Access and Development Access.

Principles of allocating resources for LUMI

The computing and data management resources are allocated by the CSC Resource Allocation Group. The applications are measured by their scientific effectiveness and quality (e.g. scientific publications). The Resource Allocation Group closely follows the national science policy and the priorities defined by the Finnish Government. Computing resources are mainly focused on national research use. The same CSC Resource Allocation Group also handles the other CSC´s allocations.

4.4 Iceland

Iceland joined the LUMI consortium in 2020; the University of Iceland is assigned the role of the responsible organisation. Reykjavik University is a partner to the University of Iceland in the project. The Icelandic shares in LUMI are divided into the two partner organisations proportional to their contribution to LUMI. Since Iceland's share is small and because of the low number of potential users, the allocation is managed ad hoc.

By joining LUMI, the aim is to support and increase the national strengths of HPC competencies as well as High-Performance Data Analytics and Artificial Intelligence capabilities and close existing gaps to increase the usability of these technologies in the different scientific, engineering, and business applications and thus provide a European excellence baseline.

4.5 Latvia

Latvia is not a member of the LUMI consortium. We are looking forward to accessing LUMI and other HPC resources via EuroHPC. Latvia is a member of EuroHPC and joined the EuroCC project. All EU countries are involved in EuroHPC and there will be provided access to all HPC resources available in the project member countries, including LUMI. Latvia can apply for resources via *EuroHPC - Access to our supercomputers*[7].

4.6 Lithuania

The laboratories, created or renewed implementing valley projects and the laboratories currently dislocated in research and higher education institutions work based on open access (the resources of laboratories are accessible for all interested persons/organisations from other institutions or business bodies following the Regulation of Management of Open-Access Centres).

Regulation of Management of Open-Access Centres is applied for the open-access centres, which function based on R&D infrastructure, created while implementing Joint Research Programmes, National Integrated Programmes and/or is acquired from other support of the EU structural funds and/or the budget of the Republic of Lithuania. Most open-access R&D and services are provided in *eScience Gateway – Open R&D*[8].

HPC services are served over the VU HPC open-access centre that is a member of EuroHPC and has plans to apply in EGI. Lithuania is not part of LUMI.

[7] https://eurohpc-ju.europa.eu/access-our-supercomputers

[8] https://www.e-mokslovartai.lt/welcome

4.7 Norway

In Norway, Sigma2 is mandated to allocate the Norwegian share of the resources in LUMI to the end-users. The general principle is that resources on LUMI will be allocated according to the same policies and guidelines adopted to allocate the national compute and storage resources. This allocation happens every 6 months and follows a strictly regulated and defined process. Access to the infrastructure is subject to criteria that are defined in a general policy and detailed guidelines for resource allocation. A summary of the criteria:

- scientific merit of the research activity
- the feasibility of using the infrastructure
- the type of usage
- guarantees for proper curation of the data collections

The commission evaluating the applications comprises leading Norwegian scientists from relevant user groups appointed by the Sigma2 board. In the case of the LUMI resources, an external expert is also consulted in the evaluation.

4.8 Sweden

Sweden is a part of the LUMI consortium via the Swedish Research Council (VR) (Swedish Research Council, 2019). VR has delegated the actual allocation of resources to SNIC/UU, the latter having the national mandate for allocating HPC resources (Swedish National Infrastructure for Computing - SNIC). The Swedish LUMI calls follow the same procedures as the Swedish national calls.

The Swedish participation in the LUMI consortium aims to provide access to large-scale resources, secure Swedish influence in EuroHPC, and give Swedish research access to the non-national parts of the EuroHPC resources (Swedish Research Council, 2019).

In a Swedish context the LUMI resources, allocated via SNIC, are primarily aimed at unloading already oversubscribed national resources. It will serve to offload major national resources (Swedish National Infrastructure for Computing, n.d.). From the viewpoint of the Swedish Research Council, the membership in the LUMI consortium aims to facilitate large, primarily established research groups to get access to novel/new architectures (Swedish Research Council, 2020). Additionally, the LUMI resource may serve as a platform for research communities wanting to use the LUMI resources as a coherent solution for cross-border collaborations.

5 Analysis

All the countries have made progress on policies, though their main focus is on the national level rather than on cross-border collaboration. Depending on the organisational and political authorities in the respective country, different actors are involved in policymaking. Implementation of OS has progressed

at a different pace in the countries. The lacking harmonisation is an issue, also raised in the SPARC report *An Analysis of OS Policies in Europe* (Sveinsdottir et al., 2021).

5.1 Update on the state of Open Science

The countries have continued to develop OS policies since deliverable D 2.5. Several countries have been working on an OS strategy or plan. As seen in the inventory, some countries have progressed farther in covering the entire, or almost, framework of elements. Other countries still need further development.

The FAIR principles have been considered in various ways, e.g. producing guides or working on FAIR in national policies. One country is making advancements on cost levels for infrastructures, and two are advancing on recommendations for open education. Some countries are also developing ways to incorporate FAIR in research funded by national funders.

Finland stands out by advancing at a higher pace, having already covered all the elements. One aspect that differs from the rest of the Nordic and Baltic countries is a strong focus on policy production rather than policy maturation. That is a remaining harmonisation issue for the Nordic and Baltic countries.

The country-specific mapping of elements gave coverage of the different topics per country. The most commonly represented elements represented are:

- Research Culture
- Open access to research publications
- Open access to data, data management & FAIR
- Preservation and reuse of scientific information

The least commonly represented elements are:

- Citizen science
- Open education & open access to educational resources
- Open access to research data & methods

Some elements have a very high or low frequency in the element framework, showing that the OS landscape for the Nordic and Baltic countries is oblique. Citizen Science is represented only by two countries.

The challenge is how to straighten the OS framework for the countries. Policy inequality cannot be solved solely with additional funding but deserves a coherent national strategy embracing all the OS elements. Harmonisation is important, but policies must still respect country-specific differences. A proper foundation needs to be put into place so that countries can start making a plan ahead for policymaking.

5.2 EOSC uptake in the national policies

The Nordic and Baltic countries have different approaches when addressing EOSC in their policies, as seen in this summarisation:

- One country does not mention EOSC in their policies.
- One country is working toward integrating its work with EOSC in its roadmap.
- One country is reusing recommendations from EOSC on FAIR principles and practices, operators actively participate in European and international work, and research organisations will sign the EOSC declaration.
- In one country, the National Library, in collaboration with universities, launched a training course on data management for librarians and researchers and has dedicated funding for the implementation.
- Guidelines are platforms for concrete support to implement Open Science and Open Access at the European level.

There is no harmonisation among the countries en route toward EOSC, and the countries have taken different approaches. The analysis of the element framework and how EOSC is treated in the policies show that the countries have an incoherent view vis-a-vis EOSC. There is also a misalignment in how far they have come in their policy work.

5.3 Resource provisioning

The inventory related to resource provisioning also shows a varied approach among the countries. A majority rely primarily on national resources, complemented by EuroHPC. To note is that some countries are not members of a consortium, such as the LUMI consortium. Until recently, resources have been nationally allocated, the novelty being the change to the supranational allocation via the JU part of the EuroHPC resources.

Figure 12 is a visualisation of how the eight countries have approached the resource provisioning of LUMI.

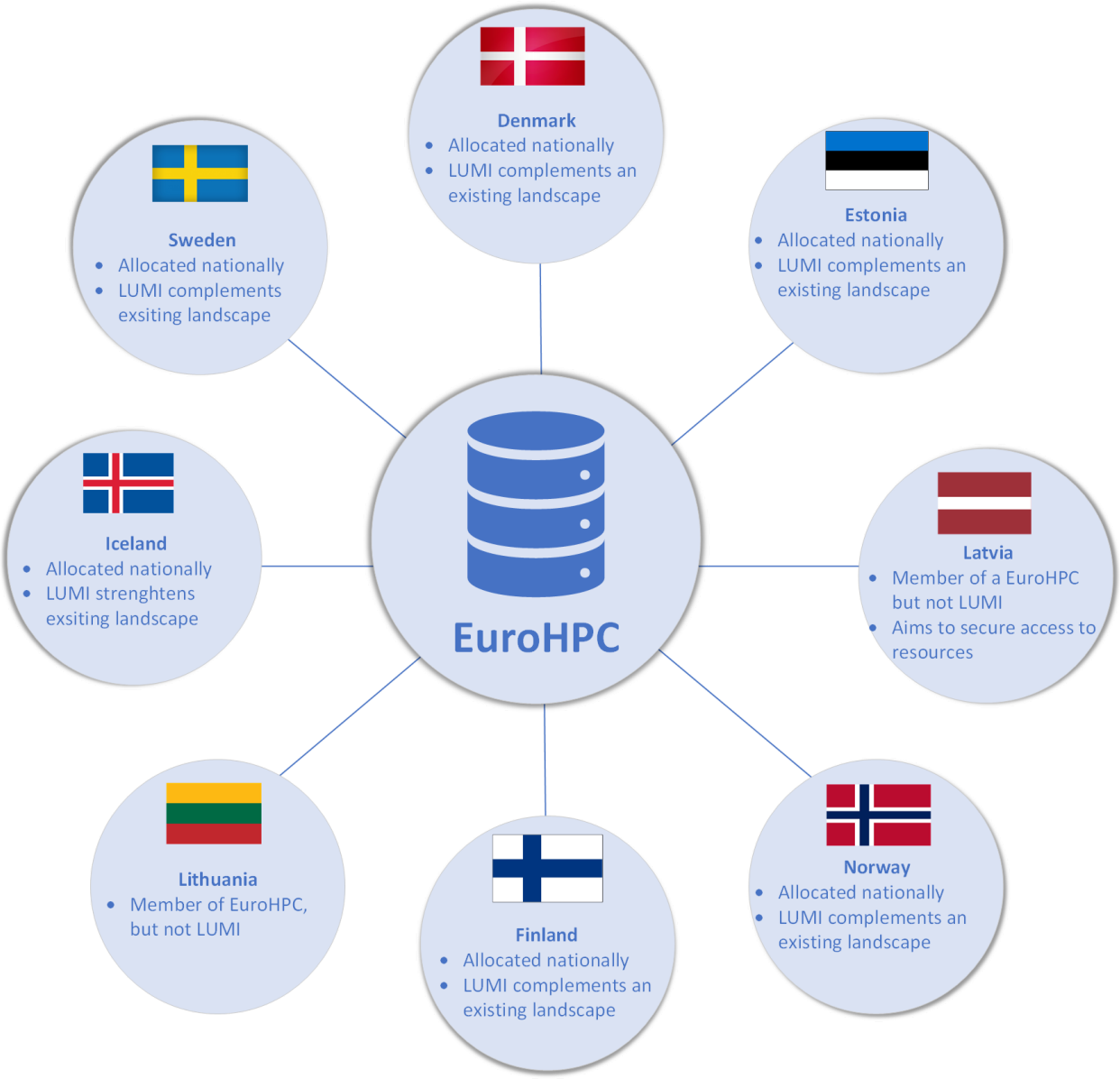

Figure 11: Mapping of EuroHPC landscape for all the countries.

6 Recommendations

The recommendations are based on the previous analysis and elements identified during the process. They also draw upon commonalities in the inventory produced.

The recommendations are divided into two categories: *The state of OS,* with the subcategories *EOSC in national policies* and *EU in the OS policymaking*, and *Resource Provisioning*.

6:1 The state of OS

Recommendation 1:

The OS elements, used in the EOSC Steering Board survey, should be enhanced by decreasing the number of elements from ten to six. The original elements are, in many cases, overlapping. Merging some would harmonise the reporting and benefit policymakers to build solid plans for their implementation.

- Research culture
    - Research culture encompasses the behaviours, expectations, values, attitudes and norms of the research communities. It influences researchers' career paths and determines the way that research is conducted and communicated.
    - Incentives & rewards, science judged by actual quality, the real use, the real impact, and openness characteristics.
- Open access
    - To research publications, data, data management, research data, and methods.
    - The practise of providing online access to reusable scientific information, free of charge to the end-user.
    - Routes to OA are mainly self-archiving/'green' open access or Open access publishing/'gold' open access.
    - Access and reuse of digital research data under the terms and conditions according to national legislation and/or grants.
    - FAIR principles, Findability, Accessibility, Interoperability, and Reuse of digital assets.
    - Preservation and reuse of scientific information.
    - Findability, Accessibility, Interoperability, and Reuse of digital assets.
- Open education and open access to educational resources
    - Worldwide, free online access to high-quality educational material.
    - Materials and courses are available online and free of charge.
- Skills and competences
    - Coordinate and align relevant skills and training by generating a consensus on a European higher education curriculum to deliver FAIR and open science skills at the university level.
- Infrastructures that include aspects of open science
    - Provide a trusted, open environment for storing, sharing, and reusing scientific data and results.
- Citizen science
    - Scientific research is conducted, in whole or in part, by amateur (or nonprofessional) scientists.

Figure 13 shows the enhanced OS elements. On the top-right of the circle, there is the element of *Infrastructures that include aspects of open science*, then going clockwise to *Open access*, *Research culture*, *Skills & competencies*, *Open education & open access to educational resources* and, lastly,

Citizen science. Elements on the top relate to the themes of infrastructures, HPC, and resources. Those on the right to open access and research culture. On the bottom are skills and competencies, while the elements to the left relate to education and contribution to society.

Juridical aspects must be considered in the OS framework and should be added as *compliance* since laws and regulations need clarification. That can happen in cooperation with legal professionals.

The new set of OS elements will be suggested to the EOSC Steering Board to improve the survey for 2022.

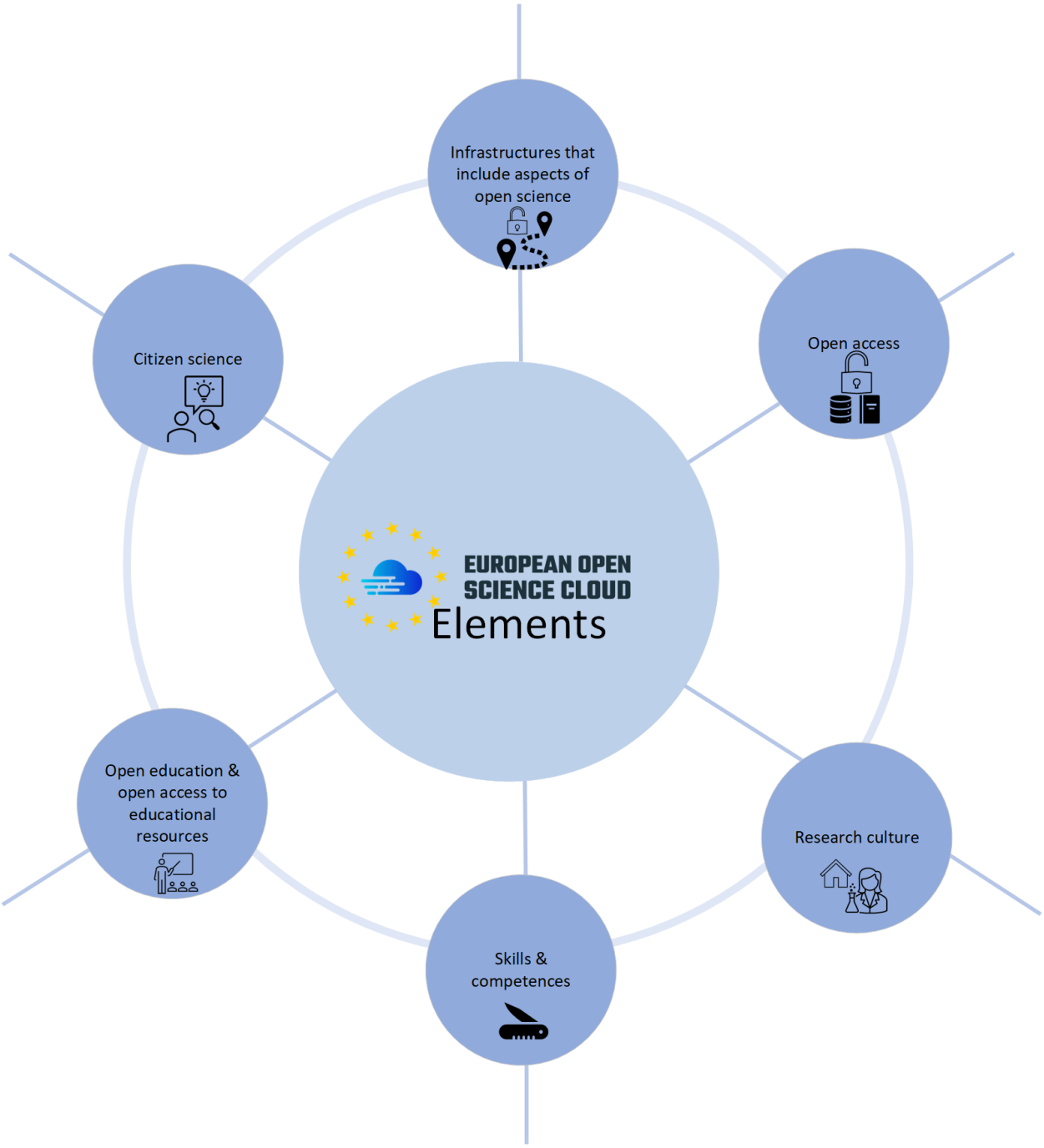

Figure 12: Recommended Framework of EOSC elements,

Recommendation 2:

The various countries should include all the different OS elements in their national policies. Thus, all participating countries will have a common ground on what to reach for concerning OS. The merged elements would offer a simple view for the policymakers. It is also pertinent that policymakers ensure

that the policies do not complicate the collaboration between countries. Instead, they should harmonise policies as much as possible, considering the country-specific differences.

Recommendation 3:

Establishing a regular dialogue among the policymakers from the different countries can bring benefits in terms of policy harmonisation, facilitating the development of a coherent EOSC. The EOSC Steering Board is a collaborative forum, though regional discussions could also be beneficial. EOSC Nordic is investigating how to support this regional policy forum after the end of the project.

Regularly attending regional and overall EOSC forums can help policymakers reach up to all the elements, harmonise the policies, and follow up on the OS development. Researchers should be confident that the rules for conducting science should be similar across the EU. The elements are a valuable toolbox to this end.

Recommendation 4:

The industry is an important collaborator regarding OS, and researchers often work together with the industry, leading to increased advancement in many academic fields. Afterwards, the data is typically tightly sealed within the industry. Thus, the elements must evolve and include the industry.

6.1:1 EOSC in national policy

Recommendation 5:

EOSC should offer contemporary directions and collaboration for policymakers by creating forums and workshops, providing templates and guidelines directed towards the work and progression on how to reach the OS elements (especially those related to FAIR data), taking into account the different contexts on how to set up policies across the countries engaged in EOSC.

Embracing country-specific differences, EOSC should work more with the governments and countries so that in the future, national goals/roadmaps/policies will reference EOSC.

Recommendation 6:

EOSC should work on marketing and making EOSC easier to understand. With information directed toward PhD students and senior researchers alike on what they gain from EOSC and OS, researchers will gain the ability to ask for development in policymaking.

Recommendation 7:

EOSC should build a network comprising different professions from different countries, opening possibilities for discussion and presentations on progressing work within the EU.

Recommendation 8:

EOSC should also offer, as a service, senior advisers on policymaking to members in EOSC. The senior adviser would provide advise and support to countries, building up harmonisation between the countries.

6.1.2 EU in the OS policymaking

Recommendation 9:

The EU could issue guidelines at the European level to encourage member states and associated countries to align their OS/EOSC policies.

6.2 Resource provisioning

Recommendation 1:

In the harmonising process for resource provisioning, it is important to consider the different goals, settings, and national contexts. The recommendation is to conduct a biennial survey, asking countries about their respective goals and national context, the current situation, and plans for the upcoming two years, followed up in the next round. That will be of assistance to the countries and create synergy effects. With the information available, the countries can see how the other countries develop, seek collaboration opportunities, and reflect on the upcoming development.

Recommendation 2:

EOSC can support the creation of a EU-funded project, like EuroCC, covering all EU countries with a common task to activate researchers and support sharing.

Recommendation 3:

It should be possible to apply for EU funding to harmonise existing resources and services. That encourages general collaboration and cross-border development.

Recommendation 4:

How the industry can cooperate with academia regarding OS needs further investigation. The industry is involved with academia in many ways, working together in joint projects, participating in academic publications, and utilising HPC resources.

Table of figures

Reference list

About LUMI - LUMI. (n.d.). Retrieved February 28, 2022, from https://lumi-supercomputer.eu/about-lumi/

Academy of Finland. (2019a). *Strategy for national research infrastructures in Finland 2020-2030*.

Academy of Finland. (2019b). *Strategy for national research infrastructures in Finland 2020-2030 Creativity, renewal and knowledge on a sustainable basis Creativity, renewal and knowledge on a sustainable basis*.

Åpen Forskning. (2021). *Open Science*. https://www.openscience.no/en

Bifröst University College. (2019). *Open Access Policy - Háskólinn á Bifröst*. https://www.bifrost.is/english/about-bifrost/policies-and-regulations/open-access-policy/

Danish e-Infrastructure Cooperation - DeiC. (2022). *Apply for HPC resources*. https://www.deic.dk/en/supercomputing/Apply-for-HPC-resources

Danish e-infrastructure Coorporation - DeiC. (2021a). *National coordination and implementation of the FAIR strategy | Danish e-Infrastructure Cooperation*. https://www.deic.dk/en/data-management/national-cooperation/national-coordination

Danish e-infrastructure Coorporation - DeiC. (2021b). *National Strategy for Research Data Management based on the FAIR Principles*.

den Europæiske Unions Tidende. (2019). *EUROPA-PARLAMENTETS OG RÅDETS DIREKTIV (EU) 2019/1024 - af 20. juni 2019 - om åbne data og videreanvendelse af den offentlige sektors informationer*.

DIGIVISIO (2022) www.Digivisio2030.fi https://digivisio2030.fi/wp-content/uploads/DV2030_020222_eng.pdf

Eessalu, M. (2021). *Open Science in Estonia*.

EOSC Association. (n.d.). *The framework of EOSC elements* . EOSC Association .

EOSCSecretariat. (2021). *Digital skills for FAIR and open science: Report from the EOSC Skills and Training Working Group |*. https://eoscsecretariat.eu/news-opinion/digital-skills-fair-open-science-report-eosc-skills-training-working-group

ESFRI Secretariat (2018) http://roadmap2018.esfri.eu/

EuroHPC. (n.d.). *Documents - European High Performance Computer Joint Undertaking*. Retrieved February 28, 2022, from https://eurohpc-ju.europa.eu/documents

European Comission. (n.d.-a). *Open access - H2020 Online Manual*. Retrieved February 28, 2022, from https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/open-access_en.htm

European Comission. (n.d.-b). *Open access - H2020 Online Manual, Funding & tender opportunities*. Retrieved February 28, 2022, from https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/open-access_en.htm

FINLEX. (2021). *Laki julkisin varoin tuotettujen… 713/2021 - Säädökset alkuperäisinä - FINLEX*. https://finlex.fi/fi/laki/alkup/2021/20210713

Finnish Gorvernment (2021) https://valtioneuvosto.fi/en/-/1410845/amendments-to-the-copyright-act-in-circulation-for-comments-?languageId=en_US

Forsström, Pirjo-Leena; Lilja, Erika; Ala-Mantila, Minna (2020) Atlas of open science and research in Finland 2019 : Evaluation of openness in the activities of higher education institutions, research institutes, research-funding organisations, Finnish academic and cultural institutes abroad and learned societies and academies. Final report http://urn.fi/URN:ISBN:978-952-263-689-8

Garavelli, S., Märkälä, A., & Liinamaa, I. (2021). *EOSC National Structures: an overview of the national EOSC coordination and engagement mechanisms in Europe*. https://doi.org/10.5281/ZENODO.5602949

GO FAIR. (n.d.). *FAIR Principles - GO FAIR*. Retrieved February 28, 2022, from https://www.go-fair.org/fair-principles/

Government of Iceland. (n.d.-a). Retrieved February 28, 2022, from https://www.government.is/

Government of Iceland. (n.d.-b). *Government of Iceland - Science and Technology Policy Council*. Retrieved February 28, 2022, from https://www.government.is/topics/science-research-and-innovation/science-and-technology-policy-council/

Hammargren, Per-Olov; Arvola, Maijastiina; Rauste, Päivi. (2021). *D2.5: Open Science policies and resource provisioning in the Nordic and Baltic countries (second report) | Zenodo*. https://zenodo.org/record/5537068#.Yhx0NOjMJmM

Hellmark Knutsson, H. (2016). *Regeringens proposition 2016/17:50, Kunskap i samverkan – för samhällets utmaningar och stärkt konkurrenskraft*.

House of Parliament of Lithuania. (2015). *XI-242 Republic of Lithuania Law on Higher Education and Research*. https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/548a2a30ead611e59b76f36d7fa634f8?jfwid=rp9xf47k7

Icelandic Ministry of Education, S. and C. (2019). *Opinn aðgangur að niðurstöðum rannsókna Tillögur verkefnishóps mennta-og menningarmálaráðherra*. https://doi.org/10.1787/5jrs2f963zs1-en

Icelandic Ministry of Education, S. and C., Infrastructure Fund, & The Icelandic Center for Research. (2021). *Icelandic Roadmap for Research Infrastructures 2021*.

Icelandic Parliament. (2012). *Act on public support for research no.3/2003*.

Lithuania House of Parliament political parties. (2021). *Agreement on National Education Policy (2021-2030) | Ministry of Education, Science and Sport*. https://smsm.lrv.lt/en/legal-information/agreement-on-national-education-policy-2021-2030

Lithuanian Research Council. (2021). *V-313 Dėl Atvirosios prieigos prie mokslo publikacijų ir duomenų gairių taikymo*. https://www.e-tar.lt/portal/lt/legalAct/902575200571111ec9f09e7df20500045

Lithuanian Research Council. (2022). *V-64 Dėl Lietuvos mokslo tarybos pirmininko 2021 m. rugpjūčio 25 d. įsakymo Nr. V-313 „Dėl Atvirosios ...* https://www.e-tar.lt/portal/lt/legalAct/b40bccb18266 11ecbd43a994b3e2e1cb

Ministry of Economics (now - Ministry of Innovation). (2011). *2V-91 Dėl Atviros prieigos centrų registro nuostatų patvirtinimo*. https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/TAIS.415725/asr

Ministry of Higher Education and Science. (2018). *Denmark's National Strategy for Open Access*. https://ufm.dk/en/research-and-innovation/cooperation-between-research-and-innovation/open-access/Publications/denmarks-national-strategy-for-open-access

Ministry of Higher Education and Science - Denmark. (2014). *Danish Code of Conduct for Research Integrity*. www.ufm.dk

National and University Library of Iceland. (2016). *Policy on Open Access and Open Science*.

Norwegian Research Council. (2019). *FORSKNING FOR INNOVASJON OG BAEREKRAFT - Forskningsrådets policy for åpen forskning*.

Open Science Coordination in Finland, Federation of Finnish Learned Societies, O. (2020). *RESPONSIBLE RESEARCH SERIES 3:2020 DECLARATION FOR OPEN SCIENCE AND RESEARCH (FINLAND) 2020-2025*. https://doi.org/10.23847/isbn.9789525995213

Open Science Coordination, F. of F. L. S. (2021b). *RESPONSIBLE RESEARCH SERIES 7:2021 OPEN RESEARCH DATA AND METHODS. NATIONAL POLICY AND EXECUTIVE PLAN BY THE HIGHER EDUCATION AND RESEARCH COMMUNITY FOR 2021-2025. POLICY COMPONENT 1: OPEN ACCESS TO RESEARCH DATA*. https://doi.org/10.23847/isbn.9789525995480

Open Science. (2022). *EOSC - Open Science*. https://avointiede.fi/en/networks/eosc

Open Science and Research Coordination, Federation of Finnish Learned Societies. (n.d.). *Open Science - avointiede.fi*. Retrieved February 28, 2022, from https://avointiede.fi/en

Open Science Coordination in Finland, F. of F. L. S. (2020). *OPEN EDUCATION AND EDUCATIONAL RESOURCES. NATIONAL POLICY AND EXECUTIVE PLAN BY THE HIGHER EDUCATION AND RESEARCH COMMUNITY FOR 2021-2025. POLICY COMPONENT 1-OPEN ACCESS TO EDUCATIONAL RESOURCES*. https://doi.org/10.23847/isbn.9789525995404

Open Science Coordination, F. of F. L. S. (2021). *Recommendations for open education 2021*. https://doi.org/https://doi.org/10.23847/tsv.84

Open Science Coordination in Finland : Federation of Finnish Learned Societies. (2019). *OPEN ACCESS TO SCHOLARLY PUBLICATIONS NATIONAL POLICY AND EXECUTIVE PLAN BY THE RESEARCH COMMUNITY IN FINLAND FOR 2020-2025 (1) RESPONSIBLE RESEARCH SERIES 3:2020*. https://doi.org/10.23847/isbn.9789525995329

OpenAccess.nl. (n.d.). *Open education*. Retrieved February 28, 2022, from https://www.openaccess.nl/en/what-is-open-access/open-education

Per-Olov Hammargren; Maijastiina Arvola; Päivi Rauste. (2020). *D2.1 Open science policies and resource provisioning in the Nordic and Baltic countries (first report) | Zenodo*. https://zenodo.org/record/4045529#.YhyOUejMJD9

Regeringen. (2021). *En nationell strategi för svenskt deltagande i Horisont Europa 2021–2027*. https://www.regeringen.se/4a8508/contentassets/43f13307668e464991847049cf468dd2/en-nationell-strategi-for-svenskt-deltagande-i-horisont-europa-20212027

Research University of Stirling. (n.d.). *Research culture*. Retrieved February 28, 2022, from https://www.stir.ac.uk/research/research-culture/

Reykjavík University. (2014). *Policy on Open Access*.

Science Europe. (2017). *Policy Brief on Research Infrastructures in EU Framework Programming | Zenodo*. https://zenodo.org/record/4980124#.YhyX8-jMJD9

Secretariat for the National Open Science and Research Coordination Federation of Finnish Learned Societies. (2021). *Open Science Expert Panels - Open Science avointiede.fi*. https://avointiede.fi/en/open-science-expert-panels

Styrelsen for Forskning og Uddannelse. (2019). *Strategi for nationalt samarbejde om digital forskningsinfrastruktur*. www.ufm.dkPublikationenkanhentespåufm.dk/publikationer

Sveinsdottir, T., Davidson, J., & Proudman, V. (2021). *An Analysis of Open Science Policies in Europe, v7*. https://doi.org/10.5281/ZENODO.4725817

Swedish Agency for Digital Government. (2019). *DIGG tar policybeslut kring öppen källkod | DIGG*. https://www.digg.se/om-oss/nyheter/2019/digg-tar-policybeslut-kring-oppen-kallkod/

Swedish Government. (2021). Data för ett kunskapsbaserat och innovativt Sverige. In *2021*.

Swedish Ministry of Education. (2019). *Nationell färdplan för det europeiska forskningsområdet 2019–2020*. www.regeringen.se

Swedish National Infrastructure for Computing. (n.d.). *Earlier Calls*. Retrieved February 28, 2022, from https://snic.se/allocations/compute/large-allocations/largehistory/

Swedish National Infrastructure for Computing - SNIC. (n.d.). *LUMI Sweden Allocations*. Retrieved February 28, 2022, from https://snic.se/allocations/compute/x-large/

Swedish National Library. (2019). *Financial and technical support for open access scholarly journals – Kungliga biblioteket*. https://www.kb.se/samverkan-och-utveckling/nytt-fran-kb/nyheter-samverkan-och-utveckling/2020-10-28-financial-and-technical-support-for-open-access-scholarly-journals.html

Swedish Research Council. (2018). *Kriterier för FAIR forskningsdata*.

Swedish Research Council. (2019). *Sverige går med i EuroHPC JU*. https://www.vr.se/aktuellt/nyheter/nyhetsarkiv/2019-02-22-sverige-gar-med-i-eurohpc-ju.html

Swedish Research Council. (2020). *Nu ska superdatorn LUMI byggas*. https://www.vr.se/aktuellt/nyheter/nyhetsarkiv/2020-10-21-nu-ska-superdatorn-lumi-byggas.html

Swedish Research Council. (2021). *Vetenskapsrådets samordningsuppdrag om öppen tillgång till forskningsdata Delredovisning*.

The Árni Magnússon Institute for Icelandic Studies. (2020). *Policy on Open Access & Open Data - Árnastofnun*. https://arnastofnun.is/is/node/4756

the Government of Latvia. (2021). *Aicina sabiedrību iesaistīties Latvijas Atvērtās zinātnes stratēģijas veidošanā | Izglītības un zinātnes ministrija*.

https://www.izm.gov.lv/lv/jaunums/aicina-sabiedribu-iesaistities-latvijas-atvertas-zinatnes-strategijas-veidosana

The Icelandic Centre for Research - RANNIS. (2013). *Scientific Publication - Policy on Open Access*. https://en.rannis.is/activities/open-access/

The Ministry of Economic Affairs and Communications - Estonia. (2021a). *Eesti teadus-ja arendustegevuse, innovatsiooni ning ettevõtluse arengukava 2021-2035*.

The Ministry of Economic Affairs and Communications - Estonia. (2021b). *Eesti teadus-ja arendustegevuse, innovatsiooni ning ettevõtluse arengukava 2021-2035*.

The Ministry of Education and Research - Estonia. (2020). *Haridus-ja Teadusministeeriumi töödokument*.

The Ministry of Education and Research - Sweden. (2020). Forskning, frihet, framtid – kunskap och innovation för Sverige. *Regeringens Proposition 2020/21:60* . https://www.regeringen.se/4af915/contentassets/da8732af87a14b689658dadcfb2d3777/forskning-frihet-framtid--kunskap-och-innovation-for-sverige.pdf

The Prime Minister's Office of the Icelandic Government. (2020). *Science and Technology Policy 2020–2022*. www.for.is

The Research Council. (2021). *Vägledning för implementering av kriterier för FAIR forskningsdata*.

The Research Council of Norway. (2021). *How should we share research data?*

UNIFI. (2018). *OPEN SCIENCE AND DATA ACTION PROGRAMME FOR THE FINNISH SCHOLARLY COMMUNITY*.

University of Iceland. (2014). *Open Access Policy*. https://english.hi.is/university/open_access_policy

University of Iceland. (2021). *Open Access Policy*. https://english.hi.is/university/open_access_policy#openscience

Utrecht University. (n.d.). *Recognition and rewards - Open Science*. Retrieved February 28, 2022, from https://www.uu.nl/en/research/open-science/tracks/recognition-and-rewards

Wikipedia. (2022). *Citizen science*.

Working group for the responsible evaluation of a researcher, The Federation of Finnish Learned Societies. (2020). *GOOD PRACTICE IN RESEARCHER EVALUATION. RECOMMENDATION FOR THE RESPONSIBLE EVALUATION OF A RESEARCHER IN FINLAND RESPONSIBLE RESEARCH SERIES 7:2020*. https://doi.org/10.23847/isbn.9789525995282