EOSC-SYNERGY Landscape Gap Analysis and recommendations

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Abstract:

This deliverable presents the outcome of the EOSC landscape and policy gap analysis in the countries covered by the project: Czech Republic, The Netherlands, Slovakia, Spain, Poland, Portugal and the United Kingdom. It formulates an initial set of recommendations for national and international stakeholders about the measures for alignment and harmonization of policies to facilitate the implementation of the EOSC. They will be validated and updated in the next phase, based on dedicated liaisons and engagement activities.

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Executive Summary

This deliverable reports on the analysis of the policy landscape and related gaps in the countries that participate in the EOSC Synergy project: the Czech Republic, The Netherlands, Slovakia, Spain, Poland, Portugal and the United Kingdom. The gap analysis is the basis for recommendations for national and international stakeholders about the measures for alignment and harmonisation of policies to facilitate the implementation of the EOSC at the national, regional and international level.

To analyse the difference between the current situation and the EOSC goals described in EOSC SRIA, we defined the following subject areas to focus the gap analysis: Open Science Strategy, Permanent Identifiers (PID), Funding, and Access provisioning; Awareness, Maturity and Interest have been grouped as a single area. The underlying indicators and data were derived from country landscape reports, whose first, very detailed version was published in summer 2020. The brief updates of the evolution of countries' situation since last year, are provided as an appendix to this deliverable.

The findings show a visible positive correlation between earlier adoption of Open Access and Open Science policies and the adoption of Open/FAIR Data strategies. Related recommendations propose bridging the identified gaps by strengthening and actually implementing RDM and FAIR data policies and practices and raising awareness on these subjects. Analogous activities are recommended for the PIDs for all digital artefacts, coupled with the adoption of specific PID standards and cross border coordination of PID policies. The analysis of indicators in the Funding area shows a particular need to sustain e-infrastructure, research facilities, etc., with appropriate coordination of funding policies and investment plans at the country and the European level, with clear long-term targets.

Harmonisation of cross-border access criteria for both the data and service providers and consumers targets another set of recommendations to reduce the difference in access restrictions and the relevant access policies implementation. The awareness of EOSC among researchers and policymakers, the state of deployment of EOSC services and a subjective assessment of EOSC maturity differs widely, with countries on all sides of the range of the indicators. The findings show significant acceleration in Open Science principles adoption in 2020, as the COVID-19 pandemic and the implied enormous scientific collaboration contributed to the increase in awareness and commitments of Governments in later coming countries. We also see different self-organisation towards the EOSC, from single coordinating organisations to more distributed schemes and the establishment of National Open Science Initiatives.

With the European and national landscape changing so rapidly, this deliverable inevitably provides a time-limited picture, which will need to be updated soon. Therefore, the next steps during the project will be to liaise and engage with national stakeholders in dedicated meetings and workshops to seek feedback, discuss and validate our findings and the relevant recommendations and modify them accordingly. The recommendations will also be discussed in the international context to guarantee harmonisation in the broader context.

1. General Introduction

This document is a formal deliverable that reports on the results of the work carried out in tasks 5.1 and 5.2 of the EOSC Synergy project. It is a living document, which combines landscaping with gap analysis to provide support for EOSC implementation through a set of recommendations that will lead the future interaction with EOSC stakeholder's primary at the country level. Further updates of this report may be provided as the landscape evolves in the course of the project.

The activity started with a combination of surveys and desk research about the EOSC-related landscape in the countries that participate in the project: Czech Republic, The Netherlands, Slovakia, Spain, Poland, Portugal and the United Kingdom. The work was aligned with the EOSC Executive Board and the Landscaping WG effort and coordinated with the other INFRA EOSC 5b projects through a joint Landscaping taskforce. The intermediate results of the landscape analysis have been published in the summer of 2020[1]. The gap analysis has been carried out based on the data collected and grouped in several gap areas, highlighting the essential policy issues and determining the way forward towards a possible harmonization of such policies across all the countries concerned. Per-area and per-country gaps have been studied and are analysed in this document. The gaps identify the difference in the status of the EOSC in the concerned countries with respect to an ideal implementation of the EOSC, as well as to identify the differences that exist between these countries.

The recommendations made in this report are the result of the gap analysis mentioned above. They are addressed primarily to national stakeholders responsible for deciding on EOSC partnership, EOSC funding, and implementation/use of the EOSC by national research communities. This is particularly true regarding the per-country recommendations; however, the national level is not exclusive. The per-area gap analysis looks at patterns and trends common to several countries, and a significant number of the relevant recommendations target the international stakeholder level, esp. EOSC Association and its Advisory Groups and task forces and also European Commission.

While the gap analysis works with an intuitive understanding of the "ideal" EOSC, the formal definition is not available and perhaps not required as the understanding gradually evolves in time. However, the EOSC Strategic Research and Innovation Agenda provides a usual framework for that. In particular, the KPIs identified in the SRIA can be regarded as the criteria for assessing the EOSC maturity also at the country level. The assessment of KPI and, more generally, EOSC readiness indicators is a complex task that has recently started within several players, including the EOSC Future project and the Landscaping Task Force. In the future, the developments around this work are expected to contribute to an update of our gap analysis and to complement the recommendation refinements that will come out from a planned interaction with major EOSC stakeholders.

In order to keep the main body of the document in a reasonable length, substantial information had been moved to the Appendices and to the separate documents, the individual landscaping country reports. The document is divided into the following four major chapters:

[1] https://www.eosc-synergy.eu/national-eosc-landscapes/

- **Methodology description and context setting** that focuses on the description of the gap analysis and the methodology used in our work. The chapter also discusses the selection process and selected gap areas that are further analysed in this deliverable.
- **Per-area gap analysis reports** that describe in more detail the selected areas of gap analysis, including discussion of their more detailed structure and individual used indicators. This chapter is complemented by the detailed tables in the Appendix B, where a reader can find all the information used in the gap analysis. Each gap area is concluded by the list of recommendations targeting found problems and presenting proposals for future activities.
- **Per-country recommendations** in the main body are focused on how to improve and fasten the EOSC implementation in each country. These recommendations complement the recommendations presented in the previous chapter. The actual per-country landscaping information is available in separated landscaping country reports published already in May 2020. Up to date complement to these reports is available in Appendix A, where a reader can also find descriptions of the major stakeholders responsible for the EOSC implementation at country level.
- **Summary chapter** touches on future work, especially the expected interaction with stakeholders to discuss the gap analysis results and refine and support implementation of the individual recommendations.

2. Methodology description and context setting

2.1. What is a gap analysis?

A gap analysis is a process that compares actual performance or results with what is expected or desired. The method provides a way to identify suboptimal or missing strategies, structures, capabilities, processes, practices, technologies or skills, and then recommends steps that will help an organisation to meet its goals.

By comparing the current state with the target state, organisations can determine what they need to work on to make their performance or results better and to get on the right path quicker. One can also use a gap analysis to elevate the performance of individuals or teams, and look at attributes such as task competency, performance level, and productivity. In the case of the EOSC-Synergy gap analysis, this means that the method can provide insight into where countries or EOSC components within countries stand on their path to the EOSC.

As opposed to a risk assessment, which tends to be forward-looking, a gap analysis focuses on the current state of affairs. However, a gap analysis can also serve to compare current performance to a potential future situation. For instance, how far does an EOSC resource/service or group of resources/services fall from their capacity? Do the resources fall short of the needs?

Gap analysis is a method which, when applied to the process of the EOSC formation, becomes a reporting tool used for improvement. It can help balance the allotment and integration of resources from their current allocation level closer to an optimal level. Such resources can be time, money, material or human resources.

2.2. Concrete/Conceptual and Strategic/Operational

You can perform a concrete gap analysis that looks at the real world, or a conceptual one that examines hypothetical scenarios. When performing a conceptual gap analysis, you need to make assumptions about which parameters to use. In our case of applying a gap analysis to the EOSC process in the countries participating in the Synergy-project, we are necessarily dealing with a mix of real and hypothetical scenarios. This is because the “end goal” of the EOSC is not defined in terms of a fixed set of indicators of which it is possible to say: “if these are fulfilled, the nirvana of EOSC is reached”. On the contrary, the technical part of EOSC is currently being shaped to large extent by the involved service providers, which do not always know what will be expected from them in concrete terms. The EOSC goals are rather high-level and need to be operationalised in order to specify the indicators that are necessary to perform any kind of measurement between the actual and the desired situation.

A gap analysis can be strategic and focus on the overall organisation, planning and execution at that level, or it can be operational and focus on the day-to-day work of individual organisations. Obviously, in our case the analysis is at the country level, which often requires generalisations across multiple EOSC actors within each country, but nevertheless it is always based on real-world situations. However, it means that individual gap indicators cannot always be measured quantitatively, and often they are based on interpretations (and sometimes educated guesses) of the situation per country. The participants in this gap analysis were all involved in a prior landscape study of each country[2], and the gap indicators and scores are to a large extent based on these studies.

2.3. Indicator approach

Methodologically, a gap analysis bears resemblance to what is called the "indicator approach", which is for instance found in studies on economic development. In that approach you select indicators reflecting different dimensions of economic progress, such as healthcare, education, income, etc.[3]

In our gap analysis of the difference between the current situation and the desired end goal of the EOSC, we defined a number of subject areas or "dimensions" shorted by categories related to the EOSC ambitions and formulated operational indicators to measure the size of the gap. All dimensions and individual indicators were extensively discussed in weekly meetings of the gap-analysis task group and tested by providing "test scores" for each country and indicator.

The identified subject areas, which are individually presented in the next chapter, are:

1. **Open Science strategy**: the Gap Analysis takes into consideration whether national strategies and roadmaps with regard to open science, research data, etc. are in place.
2. **Persistent Identifiers**: although this subject area can be seen as part of data policy, it was decided to group indicators with respect to policies and implementations of various kinds of PIDs (of data, researchers, etc.).
3. **Funding** of Open Science infrastructure: indicators with respect to the funding of science and in particular scientific infrastructure (e- infrastructure, research facilities, etc.)
4. **Access provisioning**: this section regards different aspects of access to scientific resources and facilities.
5. **EOSC Awareness, Maturity, and Interest**: under this heading we include indicators reflecting the awareness among researchers and policy makers regarding the EOSC, as well as (an interpretation of) the state of deployment of EOSC services.

[2] See the national landscape reports at https://www.eosc-synergy.eu/national-eosc-landscapes/

[3] There is a rich literature on the indicator approach in economic development, and of course, there are also very critical reflections, especially on the lack of explanatory power and theoretical value of the approach, which is purely descriptive. But as our aim is descriptive in order to arrive at strategic and policy recommendations, this is not relevant here.

For each area we collected relevant data, available in tables in the Appendix B. Where possible we used a five-point scale, where 5 indicates a minimal gap ("goal reached") and 1 indicates a rather wide gap ("far from goal"). The scores are provided by the analysts involved in the landscape studies in the EOSC-Synergy project and drawing on their relevant expertise and knowledge of EOSC activities in their respective countries. An advantage of this approach is that it is possible to calculate average indicator scores per dimension or Gap area, and per country.

Not all indicators could be measured so easily and using scores only might easily lead to an oversimplification. Many indicators need a qualification or can only be assessed in narrative form. This is why every table of scores is accompanied by a qualitative interpretation in text form. Conversely, a number of numerical scores had already been provided earlier in the context of the landscape analysis for the dimension of "EOSC-readiness".

One should bear in mind that all indicators are based on interpretations of situations, reflecting a certain point in time in a process that is changing all the time. Although one might hope that the process has a clear direction "toward the EOSC", there are disturbances along the path, for instance because of changes in government policies and priorities.

Although all indicators are grouped under just one dimension, and ideally should measure different aspects of the "gaps" on the pathway to the EOSC (and be statistically independent from each other), it is obvious that such an assumption is not realistic. Obviously, many indicators are interrelated, and in some cases a whole dimension could be considered as part of another subject area: for instance, funding is related to the presence of policies; PID policies and implementations are part of data policies, and so on. And although several indicators are overlapping, we still decided to keep them in the analysis as separate units of information.

On the other hand, it was not always possible to specify operational and measurable indicators for abstract dimensions. One area in which we experienced such difficulty was for the dimension of procurement of EOSC-related services or equipment.

Other reports, projects and groups have also made lists and tables of EOSC-related indicators, usually with different goals in mind. Where possible we used such reports as sources (e.g., Landscape TF, EOSC Marketplace, Sustainability WG, Landscape WG, EOSC SRIA) but due to the parallel "work in progress" we adopted the methodology that fitted well the EOSC Synergy countries. In the next stage we plan to contribute to better homogenization of the approaches, through continued active collaboration with other INFRA ESOC 5b projects and EOSC Association Task Forces.

2.4. Recommendations

All per area and per country Gap analyses are concluded with a list of recommendations that targets different target groups. The per area recommendations represent more general findings while the per country recommendations are directly reflecting different situations in individual countries.

3. Per area reports

3.1. Open Science Strategy

3.1.1. Introduction

Open Science ensures the widest possible access to and reuse of publications, data, code and other intermediate outputs. It contributes to scientific productivity growth, as well as to the dissemination of knowledge.
Open Science strategy was included in the gap analysis because it provides a comprehensive vision for the management of data across countries and represents a key element to ensure EOSC sustainability. This gap area addresses several topics, including: the existence of countries' policies on Open Science, FAIRness of data, services and infrastructures that promote and support Open Science, level of maturity of the scientific community in research data management practices and alignment with relevant national and international projects and initiatives.

3.1.2. Indicators

The indicators in the ***national specificities*** category capture countries' existence of standardised national Open Science strategies, including the related policies on open access to publications, on open and FAIR data and reference to EOSC. The countries were also asked about the existence of national representatives that handle and promote Open Science practices. From the perspective of the scientific community, the perception of Open Science at national level, the degree of maturity in what concerns research data management practices, the existence of working groups or national initiatives and the existence of incentives/recognition related to data sharing were also assessed.

The ***implementation of FAIR principles at national level*** category addresses the level of compliance with these principles that support knowledge discovery and innovation, data and knowledge integration, and promote sharing and reuse of data.
Currently, a growing number of RFOs present some requirements to assure an accurate data management process, such as the submission of a data management plan (DMP) and the deposit of research data in a trustworthy data repository. The existence of national services that might support the adoption and compliance of these requirements are crucial.

Information on the ***status of the implementation of the data strategy*** was also included in the analysis. Here, the focus was on national data infrastructures and services available to the community, the existence of competence centres at national level that might contribute to the adoption of best research data management practices, the international scientific collaborations that enable an increase of storage over national sites and large-scale data preservation and maintenance of data through international projects/organisations.

3.1.3. Open Science Strategy Gap Analysis

The majority of the countries have already adopted a policy on open access to publications. Slovakia is currently planning to adopt such a policy.

Concerning open and FAIR data, four countries, the Czech Republic, Spain, the Netherlands and Poland already have a national policy in place. In the case of the Czech Republic, the activities related to the "National Strategy on Open Access to Scientific Information Plan" are mainly focused on publications, whereas open and FAIR data are not so prominent. Slovakia, Portugal and the UK plan to implement these policies soon.

All seven countries have a national contact point for Open Science which can provide guidance, practical information and assistance on relevant aspects. This is a crucial role, because it contributes to establishing a network of key stakeholders involved in the activities of Open Science and EOSC.

Concerning explicit references to EOSC and its implementation in current national policies, only Spain and the Netherlands meet this requirement. The Czech Republic and Portugal are planning to add this reference to their national policies.

The countries were also asked about their perception of Open Science adoption, based on practical examples and initiatives, such as the adoption of institutional policies on open access by universities, RPOs and funding agencies. The Netherlands and Slovakia present a higher evaluation, in comparison to the remaining countries.

In terms of the level of maturity of the scientific community in research data management practices assessment, it is clear that there is room for improvement. The countries that present a higher evaluation are Spain, the Netherlands and the UK. There are also differences between individual research areas in the same country.

All the countries present community working groups or national initiatives related to Open Science. The Netherlands presents the higher evaluation, followed by Spain and Slovakia.

In terms of incentives and recognition related to data sharing within the community, we might observe that the Czech Republic, Poland, Portugal and the UK are still at a stage of awareness creation.

As previously mentioned, the second group of indicators is focused on the national adoption of the FAIR principles.

RPOs in the Netherlands, Poland and the UK already require the submission of a DMP, as a best research data management practice. Spain and Portugal, currently recommend researchers to follow this practice, whilst the Czech Republic and Slovakia do not have that requirement at a national level.

At the moment, only the Netherlands and the UK have implemented a national DMP service, based on DMPOnline[4] from the Data Curation Centre (DCC). Portugal is currently configuring the national service that will be based on Argos[5] from OpenAIRE[6].

Regarding data preservation, access, distribution and sharing, the Netherlands and Poland require data to be deposited in a trusted repository. In the UK the policies require data and software underlying published research findings to be deposited where possible, via mechanisms that provide sustainable services with appropriate policies, such as an established repository of a discipline-specific research community, funding body, publisher or research institution. In Spain, FECYT recommends the standardisation of research data. Slovakia and Portugal plan to implement this requirement.

The support for FAIR research data management at institutional/policy level presents a higher assessment in the UK, followed by the Netherlands. The remaining countries present a low or very low support in these activities.

Finally, focusing on data strategy implementation status, we can observe that only the UK has sufficient and appropriate data services and infrastructures available to the community. The other countries are considered to have sufficient but to be improved services and infrastructures, whereas in Spain they are considered to be insufficient.

The Netherlands, Slovakia and the UK have several competence centres, whilst the remaining countries have not yet nominated these specialised centres.

3.1.4. Open Science Strategy Gap Analysis Recommendations

Based on the analysis of the Open Science Strategy indicators, the following recommendations are suggested:

G-OS 1. Define and implement, if not yet present, national strategies and policies on Open Science and FAIR data, based on Open Science principles and research data management best practices and recommendations.

G-OS 2. Promote reference to EOSC in national policies as an initiative that aims to establish a trusted digital platform for the management and processing of research data, supporting EU Open Science policy.

G-OS 3. Adopt and implement National Open Science Cloud Initiatives (NOSCI) to ensure engagement and sustainability towards EOSC.

G-OS 4. Invest in the communication and dissemination of Open Science practices, namely through forums, training activities, working groups and other initiatives, promoting the share of best

[4] DMPonline Service: https://dmponline.dcc.ac.uk/

[5] Argos Service: https://argos.openaire.eu/splash/

[6] OpenAIRE: https://www.openaire.eu/

practices and experiences. Also promote EOSC at all levels by engaging with relevant communities and stakeholders.

G-OS 5. Encourage and reward researchers and organisations that apply Open Science and FAIR data principles.

G-OS 6. Require the submission of DMPs as standard, following the requirements and guide from Science Europe[7], ensuring the existence of national services and infrastructures to support this.

G-OS 7. Require research data to be deposited in trustworthy repositories as standard, assuring data preservation, access and distribution. Also ensure that there are services and infrastructures to support this requirement.

G-OS 8. Implement national competence centres in key areas, considering, if needed, a distinction between local, thematic, and digital areas.

G-OS 9. Ensure optimal levels of data storage, preservation, and maintenance, especially through federation of infrastructures and services.

3.2. Permanent Identifiers (PIDs)

3.2.1. Introduction

Persistent identifiers (PIDs) are an important piece of the Open Science ecosystem and an indispensable part of interoperability within the framework of the European Open Science Cloud (EOSC). PIDs can be used to uniquely and persistently identify various types of entities. In the context of Open Science and EOSC, examples of basic PIDs are identifiers for scientific publications and data collections as outputs of research. PIDs are also needed for identification of physical persons (e.g. researchers and authors of publications), data and software. Physical persons can be affiliated with an institution, and for this reason, PIDs for institutions are also important. These are the basic types of PIDs which are currently commonly in use. However, the current development of science, with its focus on data and its electronic processing, brings the need for persistent identification of other entities, for example software artefacts, containers and workflows, as well as other entities such as research grants, projects etc. These types of PIDs, however, are not as commonly supported and in use on a daily basis as those listed above.

Unique identification of the entities in the research environment is essential for their correct referencing/citation, use, and reuse, identification of authors and contributors, lawful use etc. It is important to distinguish between various versions of the artefacts. For example, software components are commonly under continuous development with regular release of new versions. Similar

[7] https://www.scienceeurope.org/our-resources/practical-guide-to-the-international-alignment-of-research-data-management/

developments take place in datasets which are under active research use and as such should be properly versioned and the versions persistently identified.

3.2.2. Indicators

In the GAP analysis of PIDs, we focused on several categories of PIDs to be used for unambiguous identification of different categories of artefacts. There are ***PIDs for data***, that references collections of research data, i.e. tables of numerical data, images, 3D models, databases or collections of data, for example. Existence of PIDs for data is important for citation and referencing particular data that are the foundation of scientific findings (shared and described in scientific publications) and unambiguous identification of used data for verification of the findings or reuse of the data itself.

Other categories are ***PIDs for researchers***, used for unambiguous identification of physical persons, ***PIDs for institutions***, used for unambiguous identification of institutions the projects, researchers etc. are associated with. ***PIDs for publications*** are used for unambiguous identification of particular text documents (publications) and their different versions.

Similarly, ***PIDs for other artefacts***, such as software, containers, workflows etc. can be useful. However, these are less mature than the common PID categories mentioned above, so a specific category of indicators was used for them.

Although categories of PIDs differ in the type of entity they are used for, their aim is the same – permanent and unambiguous identification of the entity. As such, most of indicators are common for multiple categories of PIDs although some indicators are specific to particular PIDs. In general, we focussed on standards and compatibility – the existence of national policies on the use of PIDs; compatibility of PIDs deployed with *PID architecture for the EOSC: Report from the EOSC Executive Board Working Group (WG) Architecture PID Task Force (TF)*[8], … ; and the existence of support for the use of PIDs in practice – the proportion of repositories or information systems supporting assignment or use of PIDs; global/reverse resolvability; and the proportion of objects with PIDs assigned.

3.2.3. Gap Analysis

The information collected from the country reports shows gaps in the existence of national policies for PIDs. For compatibility reasons, it is important to have common procedures in the use of PIDs across scientific disciplines, within countries and across borders. Existence of national policies on the use of PIDs helps with this. The national policy situation for PIDs differs not only between countries but also between entities. Whilst PIDs for publications and researchers are covered by a national policy in most

[8] Available at https://dx.doi.org/10.2777/525581

of the countries, there are almost no national policies for PIDs for institutions[9] or data sets although in some countries (Poland, Portugal, United Kingdom) such policies are under development.

Overall, PID assignment for publications seems to be the most established in practice and the most mature and standardised area[10] where no significant gaps were identified. Research institutions across the Synergy countries routinely assign PIDs for publications but few are ready to assign PIDs to datasets.

Use of PIDs for physical persons seems similar in all the countries: at least half of researchers or other involved individuals have a PID such as ORCID assigned, and related information systems (CRIS, repositories, …) support them. Use of PIDs for other types of artefacts (software, workflows, …) is not yet common practice across any of the countries.

Across all the countries, the PIDs in use are common international standards compatible with the EOSC PID architecture[11]. Where local standards exist, usually an international standard PID is supported in parallel. Where multiple common standards exist (for example DOI and Handle for datasets), institutions usually support multiple PID types in their systems for compatibility reasons.

3.2.4. Recommendations

G-PID 1. A PID standard should be recommended by EOSC for every PID type for assigning new PIDs, to avoid assignment of multiple identifiers per object. However, systems should support multiple standards so as to be compatible with other PID types already assigned.

G-PID 2. Creation and adoption of national policies for PIDs for the identified important artefact types (publications, datasets, physical persons, institutions, projects, grant numbers, software, software containers, software pipelines/workflows, ...) should be supported.

G-PID 3. International coordination of the national policies is highly recommended for compatibility reasons.

G-PID 4. Raise awareness and support standardisation and use of PIDs for 'uncommon' artefacts such as software, containers, workflows, institutions, research projects and grants.

G-PID 5. For PIDs for institutions, we recommend using ROR[12] as a usable standard; mapping of national IDs for ROR should be possible in all Synergy countries.

[9] There are countries that do not use PIDs for institutions at all.

[10] DOI is the most popular standard.

[11] Available at https://dx.doi.org/10.2777/525581

[12] https://ror.org/

3.3. Funding

3.3.1. Introduction

Funding was included in the gap analysis due not only to the fundamental importance for EOSC of sustainable infrastructures in each country, but also to their availability to be used – and paid for – by users from other countries. The funding gap area addresses countries' research funding and strategy, the availability of funding for infrastructures of relevance to EOSC, and infrastructures' ability to cost and provide their services other than in return for grant funding.

3.3.2. Funding Gap Indicators

The indicators in the ***research spending and strategy*** category capture countries' overall research spending and strategic approach to investment in infrastructure of relevance to the EOSC. They were chosen so as to assess the priority assigned to research in each country, and the extent to which investment in infrastructure for research is performed not only in accordance with a strategic plan but also whether this is integrated with other strategic plans nationally or at the European level. Alignment between overall national research strategies and national investment strategies of interest for EOSC was also examined[13]. The indicators focussed on infrastructure as the major cost component for which EOSC presents the most significant challenges, although skills and training were also considered (see below).

The ***EOSC-related funding*** category examined the availability of funding in each country for different categories of infrastructure costs as well as assessing the sustainability of EOSC-related services. The motivation was to determine how well-funded infrastructures are considered to be and the degree of confidence in their longevity.

Information about infrastructures' ***costing and charging*** was included due to its potential importance in the context of the EOSC for allowing usage outside of their traditional user base, for example by users from other countries or from different research communities. The aim was to assess the extent to which infrastructures are ready for such usage.

3.3.3. Funding Gap Analysis

The percentage of GDP spent on research[14] is below the target of 3% by 2020 in all countries. The percentages range from a low of 0.83% in Slovakia to a high of 2.16% in the Netherlands. These results are no surprise, with wide variations in research funding being well known.

[13] The importance of such alignment was identified by the EOSC-hub project – see https://www.eosc-hub.eu/publications/briefing-paper-provision-cross-border-services

[14] This indicator is used due to it being widely known and used, having been initially defined in 2010 in the context of the EU's Europe 2020 targets. See http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf

The existence and alignment of investment roadmaps or strategies was quite varied across the seven EOSC-Synergy countries. In most of the countries, strategies for research infrastructures, e-infrastructures and data infrastructures are aligned to either national or European roadmaps, whereas only around half of the countries have Open Science investment strategies in place - with a mixture of national and European alignment - and even fewer have investment strategies for EOSC as yet. The relaunch of the ERA and the creation of the EOSC Partnership may precipitate more widespread alignment at the European level.

The UK, the Netherlands and Spain reported the strongest alignment between national research strategies and national investment strategies, with other countries reporting some alignment. The picture is also mixed when it comes to the availability of funding for different cost categories for infrastructures in each country. Funding requirements are substantially met for most costs in the UK and Czechia, and partially met in the Netherlands, Slovakia and Portugal, whilst in Poland and Spain overhead costs tend not to be provided for. Overall, skills development appears to be the category whose funding requirements are least likely to be fully met.

It was considered that in Czechia, Spain, the Netherlands, Slovakia and Portugal infrastructures are not funded adequately enough to guarantee the stability or continuity of vital EOSC-related services, and this was also the case in Poland for research infrastructures. As far as costing is concerned, many infrastructures in Poland already know their services' unit costs. This was the case for a few infrastructures in the other countries, with most infrastructures expected to be able to calculate their costs if and when needed. Finally, infrastructures in Spain and Slovakia rely entirely on funding (e.g. grants) for their income, whilst in the other Synergy countries a few infrastructures receive revenues from other sources (e.g. fee income for services provided) with the exception of the UK where this is the case for many infrastructures.

3.3.4. Funding Gap Recommendations

Based on the analysis of the funding indicators, the following recommendations are suggested.

G-FU 1. Ensure confidence in the level and longevity/stability/continuity of national and, where possible, also international funding for research, Open Science, EOSC and research-related infrastructures in each country, addressing all cost categories (operational costs, capital investment/capacity expansion, support costs – support staff, HR, accounting etc – and in particular skills development).

G-FU 2. Coordinate funding for national strategies for OS/EOSC/RI/DI/e-Inf/related skills and training at European level.

G-FU 3. Ensure investment strategies are in place in each country for Open Science, EOSC, research infrastructure, data infrastructure, e-Infrastructure and related skills and training; for each area, coordinate funding policies and investment plans with overall research strategy and funding plans, at the country and at the European level.

G-FU 4. Ensure service providers are able to calculate and justify their service unit costs so providers can provide their services across borders and get reimbursed.

G-FU 5. Address infrastructures' legal and funding structures such that they are able to receive non-grant revenues in return for service usage.

3.4. Access Provisioning

3.4.1. Introduction

Access provisioning to EOSC resources and infrastructures is a key issue to guarantee sustainability, preservation and reusability. This section deals with the access conditions to the infrastructures supporting the storage and processing of research data. This section is based on the analysis of sections 3.2.2 and 4 of the country reports[15], which cover the "Data Sharing and Access" and the "Procurement of and transnational access to services and resources compatible with EOSC".

From these sections, the study considered the following categories to analyse:

- Infrastructure Access Restrictions
    - Excellence, focusing on the application of excellence-based criteria or competitive calls to access the resources.
    - Origin, related to the limitations based on the institution or geographic location of the user.
    - International limitations, related to the access conditions for users from abroad.
    - Cost, related to the application of costs to the access to the infrastructures.
    - Publicly Access Policy, if the infrastructures require the publication of the results under public access conditions.
    - User groups, if the infrastructures are limited to specific groups or profiles of users.
- Data Repositories Restrictions
    - Mandatory, if they are mandatory for specific types of information or for specific actions, according to the research activities.
    - DMPs, considering if the research activity has to develop a DMP or if it is compulsory when using such repositories.
    - FAIR, analysing if the repositories impose or provide FAIR guidelines for storing the data.
    - Access, considering if the deposited data will be deposited will have any access restriction.

Access conditions differ between countries. Although in most cases differences do not necessarily imply a gap or a lack of development, comparisons may bring suggestions or comments that can be made to the RIs and policy makers.

[15] https://www.eosc-synergy.eu/national-eosc-landscapes/

3.4.2. Indicators

The landscape analysis included a set of questions under the "accessing services and resources" category that were the source for the information that was compiled in the country reports. The sub-categories and their indicators selected for the gap analysis are:

- Access restriction (funding body approval, competitive calls, organization membership, regional criteria, etc.) which is the main aspect defining the access conditions to infrastructures and data.
- Organisation procedural or technical barriers or policies limiting the access. This indicator defines the limitations in the access to the infrastructures.
- Access costs and procedures to charge users. Cost conditions are also an important point to consider for sustainability and access limitations.
- Most prominent target groups. This will give an indication of missing groups and key stakeholders.
- Services or data policies. This indicator could define the implication of policy organizations and be a source for understanding the alignment of approaches along countries.
- Public access policies and data access authorization criteria. Specific indicator that addresses the public access conditions.
- Management of personal data. Similar to the above two indicators, this one addresses if there are special considerations for personal data.
- Data access licenses. Suggesting or requesting specific access licenses could help in increasing the reuse of the data.
- Authentication model and usage of IdPs. Support for EduGAIN. A very specific indicator that addresses the support of seamless authentication and a specific and well established framework.
- Authorization based on external service. Authorization means giving access rights to authenticated users. In this case this indicator addresses the availability of external services.
- Availability of processing services, which is highly relevant for the users, as they reflect the way the data will be consumed.
- Need for external implementation support to federate to EOSC, which could prevent providers from contributing with services and data.

3.4.3. Gaps description

Countries show a high level of alignment in the way access to the resources is granted. Most of them grant access to part of the resources through competitive calls and support transnational access to part of the resources through international collaborations. Access model is habitually free of charge at the point of use, with some exceptions where specific resources are offered on a pay per use base (e.g. part of the supercomputer capacity in the Czech Republic). Similarities also arise in the incipient request of DMPs, lack of FAIR policies, the availability of metadata searching engines and the low support to sensitive data (with exceptions from vertical communities).

This section analyses each one of the topics identified along the different countries.

- Infrastructure Access Restrictions

- Excellence. In general, limitations on the access based on competitive calls or evaluations based on excellence depends on the type of resource. Access to “unlimited” resources, considering unlimited as those that are large enough to meet the demand (such as publication repositories, researcher production databases, etc.) is not limited, but infrastructures that have limited resources (e.g. eInfrastructures) include conditions based on competitive calls or being framed in projects funded by national research programmes. Consumption of data deposited on the RIs is provided without restriction.
- Origin of the users. In this topic we consider users that consume resources providing data or services. Users accessing the services or data deposited are not normally restricted. Limitations in the origin of the users normally depend on the source of the funding of the infrastructure. Regional or national funding usually limits part of the resources to users from institutions located in the area. Resources funded by organizations typically (in all countries) limit completely the access to the infrastructure to members of such organizations, with some exceptions.
- International limitations. In most of the cases, the access of international users is granted through the support to international collaborations (such as EGI, PRACE, or specific projects through Virtual Organizations). In a few cases there is no distinction between international or national users.
- Cost. In most cases, access is free for all or at least a fraction of the resources. In most of the cases, invoicing is complex due to the source of the funding of the resources or administrative or legal restrictions. This could be an issue for sustainability, transferring the costs to the infrastructures. In some cases the costs depend on the services and in a few cases there is a possibility of charging users for the access to data and services.
- Publicly Access Policy. Although not available in all the cases, most of the countries and infrastructures have a clear and publicly available access policy, which in some cases is aligned at national level. Infrastructures that do not have it, are already implementing it and expect to have it in the short term.
- User groups. The user groups are typically aligned with the sizes of the research collectives in the countries, being in all cases university researchers the most frequent users. Second level depends on the country but ranges from researchers from other institutions and students.

- Data Repositories Restrictions
  - Mandatory level in national policies. At this moment, only the publications have to be deposited in repositories. This is mandatory for research funded by public calls and for career recognition. There are a few recommendations in several countries for the deposit of research data.
  - DMPs. It is starting to be considered as a recommendation in some countries. Data infrastructures are requesting them to grant access for storing research data.
  - FAIR. Most repositories already provide or use a metadata schema, which is available for searching in most cases. The level of compliance to FAIR principles is not clearly stated.

- Access. Some repositories provide the capability of using licenses with access limitations for commercial users or even for users from other countries. In a very few cases, infrastructures support the management of sensitive data. In this case, infrastructures do not host data but just references to the data sources.

3.4.4. Recommendations

The analysis of the country reports revealed some issues in the access criteria for both the data and service providers and consumers. Moreover, access restrictions are also linked to sustainability in some cases. In general, the access restrictions relate to differences in implementation of relevant policies in individual countries. The proposed recommendations are thus similar to the ones already presented under the general Open Science strategy and Funding; the recommendations here focus primarily on cross-border harmonization.

G-AW 1. Increase the uptake of the implementation and fulfilment of Data Management Plans and FAIR principles in a coordinated way across countries. In order to ease the access to data and services by the researchers, data providers must work on ways to ensure these points. Research Infrastructures should include the obligation and evaluation of DMPs and (automatic) mechanisms for the evaluation of FAIR principles should be provided, assessing the quality of the data deposited. This will facilitate the uptake of FAIR data and metadata searching.

G-AW 2. Harmonize policies, licensing, and procedures for storing and accessing data and resources at national and international level. National policies should align with international policies to minimize impacts and effort on making data and services FAIR and to facilitate requesting resources at different international initiatives.

G-AW 3. Analyse sustainable models to fund (international/cross-border) access. Several models are being implemented and prototyped, with complexities and differences. The model of Virtual access from the EC is complex to implement and only addresses newcomers, so it does not contribute to fund sustainability. There is a need to define clear paths for implementing such revenue channels. Moreover, there is a need for higher-level commitments on the support of access from international collaborations, potentially by shares.

Overall, these points should help reduce the researcher's reluctance to share data, as infrastructures will help in increasing the reusability and quality of the data and will provide means to account for the access and provide recognition and maximise impact.

3.5. Awareness, maturity, and interest

This gap area deals with indicators which we have grouped in three sets: Awareness, Interest and Maturity, all of them based on data from the EOSC Synergy country landscape reports. The classification is the result of an assessment of the data and findings carried out by the reports' authors and the authors are aware of an inherent degree of subjective judgement. It must be noted that the

objective assessment requires consistent, authoritative and reliable information across countries, which is not yet available.

The inclusion of "awareness" gaps in an assessment of policy areas is not an obvious one. We not only refer to awareness of policy-related matters by EOSC stakeholders, but we regard the level of awareness as critical information for policy makers. We also believe that these indicators are useful to illustrate the context and variety of the national landscapes as part of the overall interests of policy decision makers.

By "maturity" we mean a measurement of the difference between the actual status and the ideal (mature) deployment of EOSC services and policies. Other studies (Landscape WG[16], Landscape TF) use the term "readiness" with a similar meaning. The assessment of "readiness" and related benchmarking is useful as a policy instrument for decision makers. Current EOSC projects and literature have identified a long set of "readiness" indicators[17]. We chose only a subset of indicators for which we had factual evidence in our country landscape reports. These vary from the level of national support for recognition of data sharing to the degree of government-level support for the EOSC. We gave particular importance to the level of effectiveness in the implementation of policies for Open Science, Open Access, Open Data and the EOSC at national level.

In the "interest" set we included indicators such as researchers' perception of the added value of the EOSC researchers' and service providers' degree of interest in participating in the EOSC, and the acceptance and adherence to FAIR principles and rules of participation. These were areas most discussed in seminars and other interaction with researchers.

3.5.1. Awareness gaps and trends analysis

The scoring of awareness indicators shows interesting trends. Awareness of the EOSC amongst national decision makers is perceived to be moderate in most countries, except in Poland and Slovakia, which apparently due to a late start, are slightly behind the other countries. At the other end of the spectrum, general awareness is perceived to be high in the Netherlands, which was quite an early starter in Open Science. However, there have been changes recently in the ministerial agencies which are responsible for the EOSC and as a result overall awareness may have dropped slightly. This shows two important aspects: 1) even in countries with long and consolidated experience, awareness may fluctuate due to the changing roles of key players in the national political environment, 2) don't take for granted that once a particular level of awareness is reached, it will be maintained without the need for consistent and continued dissemination and advocacy activities.

Despite the differences in terms of political support for and awareness of the EOSC in the countries under consideration, researchers' levels of awareness of available infrastructures and research facilities are broadly similar: most countries find themselves in the medium/medium-high awareness range. This is not unexpected, as researchers rely on such facilities in their daily work. Perhaps not unexpected, too,

16 https://www.eoscsecretariat.eu/working-groups/landscape-working-group

17 https://www.eoscsecretariat.eu/news-opinion/eosc-landscape-shifting-living-indicators

is that they don't seem to be as highly aware of what the EOSC is in practice, even though it is clearly built on top of those facilities. On this indicator, all countries in our group feel that awareness is low or very low.

We also studied researchers' and service providers' awareness of the EOSC rules of participation. The trend here is very similar across all countries: researchers' awareness is very low, but service providers' awareness, although slightly higher, is also generally low in most countries. In Spain, major stakeholders' awareness is higher due to effective dissemination actions carried out there.

Until recently very few activities and plans to raise EOSC awareness nationally had taken place, but more national activities are planned. A similar trend can be seen in the establishment of incentives to align national policies with the EOSC: levels of activity have been low until now but there is currently an increasing level of discussion at the official level. This shift can be clearly demonstrated in Slovakia, where the official support is very strong nowadays. Finally, it is worth signalling a (still) relatively low implementation of training and education activities, at many levels (DMP, FAIR data, Federated cloud tools) across all countries. The overall situation is fragmented, with actions mostly taken at the level of single projects or specific institutions. Our analysis shows that two independent events have been playing a key role in creating the momentum for national EOSC initiatives to flourish: the establishment of the EOSC Association and the involvement of many national organisations in its governance structure, and the Covid-19 pandemic, which has catalysed investments and energy into the implementation of positive national experiences involving research infrastructures and institutions in all seven countries.

3.5.2. Maturity gaps and trends analysis

The scoring of maturity indicators shows higher values in the Netherlands and Spain with respect to the respective Governments' support for the EOSC, to the existence of national support actions in recognition of data sharing, and support for research data management (RDM). A similar pattern can be seen in relation to the number of research data repositories in the country, although this time with the UK scoring the highest. Government support for ESOC is perceived as low in Slovakia and in the UK, whilst in the Czech Republic, Poland, and Portugal this indicator gets a medium score. On recognition and valuing of data sharing and RDM at national level, all other countries have low or very low values. This does not mean that individual centres of excellence are missing in those countries, but that their experience is somehow isolated and there is insufficient evidence of consistent and coordinated activities to leverage those best practices.

Interesting trends can be seen around the effectiveness of national policy implementations in four aspects of Open Science. The implementation of Open Access policies is perceived as moderately effective (medium) in all countries in our group, with the exception of Spain, where it is medium/high. Conversely, all countries perceive a very low level of effectiveness of EOSC policies. The perceptions of the effectiveness of Open Science policies and Open Data policies are a lot more mixed. Not surprisingly, the countries on the higher end of this spectrum started earlier and have more established official national policies than the others. The gaps that exist, both vertically between these indicators as well as horizontally between the countries in our group, may be determined by three factors, 1) relative early/late introduction of policies in the country, as is the case for Open Access to publications, which

started a lot earlier in all countries than, for instance, Open Science, 2) relative complexity of all aspects of Open Science (in technical, organisational, as well as business terms), in this case, we see the EOSC scoring very low, followed by open data policies, and 3) awareness of the importance of the Open Science-related policies at decision making/funding level, where again the large amount of information and dissemination activities started with the Open Access movement shows a large advantage with respect to the EOSC, which started to gain momentum only a few years ago.

Finally, most countries in our group have a medium/high degree of cooperation culture at various levels (national, international, across disciplines), with the UK standing out as high and only Slovakia as low.

3.5.3. Interest gaps and trends analysis

In this group of indicators, it is particularly interesting to compare researchers' perceived low value of the EOSC with service providers' much stronger interest in the EOSC as indicated by their participation in EOSC projects. Whilst most countries in EOSC Synergy sit in the upper half of the spectrum for the number of providers involved in EOSC projects, all countries except Spain and the UK report low or very low interest by researchers. Some made the remark that researchers are just starting to show some interest in the EOSC, but they expect it to increase as awareness increases.

The visible trends with respect to the acceptance of FAIR principles are low in many countries with the minimum interest apparently in the Czech Republic, while medium interest is shown in the Netherlands and the UK. Similar trends can be seen in acceptance of the EOSC Rules of Participation by service providers. Here, interest is still on the low side, with the Czech Republic being the lowest, while medium interest is signalled in the Netherlands, Poland and Portugal.

3.5.4. Recommendations

In an ideal world, decision makers in a country would be fully aware of the EOSC and ready to properly support it, researchers would not only be aware of the facilities available to them but also knowledgeable about their role in implementing the EOSC; researchers and service providers would be fully aware of the rules of participation and wherever an awareness gap needs to be filled, appropriate measures would be in place to plug it, by means of specific dissemination and training activities. The analysis of gaps captured in the table provided in Appendix B shows clearly that despite some major differences in the levels of awareness and maturity across all countries, there are a few gaps which are common to all of them. In particular, all countries in our group sit far from the ideal with respect to researchers' awareness of the EOSC and the rules of participation, and also generally with respect to the effectiveness of the EOSC implementation.

As part of our analysis, it became clear that the minimum set of criteria defining a mature EOSC at country level consist of: national incentives and support for the recognition and valuation of data sharing; a high degree of support for the EOSC at the Government level, coupled with a stable long-term horizon of research funding and a strong cooperation culture (national, between disciplines, international); effective implementation of national policies for the EOSC and other elements of Open Science such as Open Access and Open Data. On the latter, an appropriate amount of research data

repositories should be available in the country and institutional policies should strongly and effectively support RDM.

Overall, the following recommendations for national and international EOSC stakeholders are provided.

G-AW 1. Raise awareness about the EOSC especially among researchers and research institutions by focusing on practical aspects and the rules of participation. Clarify the relation of the EOSC to existing research facilities and known practices. Provide examples of effective EOSC implementation and success stories.

G-AW 2. Address potential fluctuations in awareness levels among decision makers by consistent and continued dissemination and advocacy activities.

G-AW 3. Maintain and build on the momentum created by the establishment of the EOSC Association and the impressive collaborative research around Covid-19 for national EOSC initiatives to flourish.

G-AW 4. Promote recognition and valuation of data sharing and RDM at national level. Ensure that consistent and coordinated activities are put in place to leverage existing best practices.

G-AW 5. Bridge the gaps that exist, both vertically and horizontally between countries by speeding up the introduction of EOSC policies in the country; addressing and explaining the relative complexity (in technical, organisational, as well as business terms) of the EOSC; and raising awareness of the importance of EOSC policies at decision making/funding level.

4. Per-Country Recommendations

Individual per country landscape reports were already published in May 2020 as part of the collection of inputs to the EOSC Landscaping WWG. As the EOSC implementation is gaining momentum, in the Appendix A we provide a summary and an update on the developments which have taken place since then. This chapter includes only summaries of the major findings from the per country gap analyses and a list of per-country recommendations.

4.1. Czech Republic

Currently, there is no coherent Open Science strategy at the national level, the focus has been on Open Access to Scientific Information only. This is also reflected in the PID strategy, reasonably well established for publications. Roadmap/strategy and funding are reasonably established for research infrastructures and e-Infrastructures, but a similar backing of a national data infrastructure is currently under discussion.

There is overall a low level of awareness of EOSC and its Rules of Participation among researchers in the Czech Republic. The perceived added value and acceptance of FAIR principles is also low. With only a few exceptions, only e-infrastructures widely participate in EOSC related H2020 projects.

CZ 1. Raising awareness of EOSC in general is necessary, including its Rules of Participation, related areas of Open Science such as PIDs, FAIR principles, etc.

CZ 2. Creation and adoption of national policies for FAIR data should be supported. Coordination of these policies at the country and European level would be beneficial.

CZ 3. Define roadmap/strategy and structural funding to guarantee stability/continuity of vital EOSC-related services.

CZ 4. Motivate the researchers, for example by adopting the system of giving credit to research by not only honouring the traditional publication, but also other scientific resources, including data and software.

4.2. Poland

In Poland, developing and adopting open access policy is recommended by the Ministry of Science and Higher Education and several universities and institutions have already adopted OA policies. The National Science Center has been appointed by the Ministry of Science and Higher Education to represent Poland's interests in the EOSC Association and to contribute to the provision of open scientific data.

The general awareness of EOSC, its principles and goals, is still rather limited in the country.

PL 1. Stable funding model independent from the projects – EOSC infrastructure OPEX and CAPEX.

PL 2. Creation of the uniform governance model on the national level. Public governmental data services might be more integrated into the EOSC ecosystem.

PL 3. Increasing awareness within the research community and the dissemination of EOSC data services.

PL 4. Creation of a business model for exchanging the data and resources between EU countries and non-EU.

4.3. Portugal

Portugal started its Open Science efforts more than 15 years ago. In 2008, the national open access initiative RCAAP[18] was launched. Today, Portugal has a robust network of institutional repositories and Open Access publishing infrastructures. Recently Fundação para a Ciência e a Tecnologia (FCT), the major national funder, has joined Plan S. A policy and supporting services/infrastructures for Open and FAIR data is expected to come into force soon. A national data strategy is also under preparation.

In 2014, Portugal took a sustainable and coherent approach to implement an integrated national information ecosystem to support the management of scientific activity by launching the PTCRIS[19] initiative, which aims to ensure the creation and sustained development of a regulatory framework and infrastructures. This initiative considers the use of PIDs in particular associated with researchers, organizations, funding and outputs.

In the domain of accessing services and resources, there is work to be done to facilitate access for both the data and service providers and consumers. There is overall a low level of awareness of EOSC, its rules of participation, and benefits among researchers and research infrastructures. The perceived added value and acceptance of FAIR principles are equally low. In addition, a significant number of services and infrastructures depend to a substantial degree on project funding.

PT 1. Higher awareness of EOSC within the community, namely through the dissemination of services, rules of participation and positive use cases.

PT 2. Definition of a governance and a sustainability model, through the adoption of a "National Open Science Cloud Initiative" (NOSCI).

PT 3. Promote continuous collaboration with EU level infrastructures via European ESFRI research infrastructures, e-infrastructures and other European research initiatives.

PT 4. Contribute to increase the level of maturity of the scientific community on the Open Science principles and research data management practices, promoting dissemination and training activities.

PT 5. Implement a data strategy and adoption of FAIR principles at a national level.

[18] https://www.rcaap.pt/
[19] https://ptcris.pt/

PT 6. Definition of a strategy and structural funding to assure stability and continuity of EOSC-related services.

4.4. Slovakia

The recently accepted KOMIS project "*The Comprehensive Information System for acquiring, processing, preservation and provision of research and bibliometric information and publications"* aims to support Open Science implementation in the country. The plan is to set up a SK-OSC infrastructure that will provide high performance processing and it will also include repositories and data storage.

There is a lack of information about established national EOSC initiatives, with sustainable funding, which would support the sustainability of the EOSC infrastructure.

SK 1. Address the sustainability of the EOSC infrastructure at European Research Area level. The importance of the EOSC should be at the similar level of support as of GEANT or EuroHPC.

SK 2. Initiate the establishment of national EOSC initiatives; specify basic services for the support of national EOSC infrastructures in order to ensure compatibility with the European EOSC infrastructure.

SK 3. Encourage national research agencies to pay attention to the development of EOSC activities.

SK 4. Inform about successful outputs of EOSC application, including outputs of virtual organizations dedicated to specific scientific disciplines, which can accelerate the adoption of EOSC infrastructure by national initiatives.

4.5. Spain

Spain has a partially developed Data Strategy, with some measures already adopted; more effective implementation of EOSC policies are being addressed. More mature implementation will need to address issues like considerable effort required to publish data in accordance with the FAIR principles; the difficulty of the recognition of data sharing, the fear of losing control of intellectual property and the perception that open data are of lower quality. Open data management is mainly organised along disciplinary lines and international collaboration is well structured. The usage of PIDs varies in accordance with the maturity of the object category, with the highest adoption for publications. Spain has one of the lowest percentages of GDP spent on research of the 7 countries covered in the EOSC Synergy project. Research Infrastructures and e-Infrastructures are funded in Spain through different means.

Spain has three main ambitions towards EOSC: to align national initiatives related to EOSC and influence the development of the EOSC; to contribute to the implementation of EOSC by providing services, data and resources through the Spanish RIs; and to boost the international positioning of Spanish researchers by exposing their services to a wider audience and leveraging other institutions' services, data and resources to improve their research.

Despite a medium to low awareness of EOSC, thirty Spanish institutions have joined the EOSC Association.

ES 1. Increase awareness of EOSC in the scientific community. The level of awareness of the initiative, concepts, resources and procedures is low. We propose to organize a dissemination campaign to make the EOSC and its principles better known in the scientific communities through a series of seminars, webinars and other events.

ES 2. Facilitate the registration of data and services, the allocation of resources to support the services, the verification of the quality and the adherence to the FAIR principles by providing tools, examples, tutorials and support teams.

ES 3. Increase recognition and motivation. The researchers see the preparation and management of FAIR data as a cumbersome task with reduced value. By including data, software and services as research recognition objects along with publications to evaluate researchers' career and competitive calls will foster researchers to focus on sharing those types of objects. Moreover, competitive calls may also consider compulsory registration of data and software under FAIR principles.

ES 4. Define exploitation means for sustaining the infrastructures. Depositing data in a repository requires effort and resources from the provider also. Making large data accessible through services will increase such a cost. Mechanisms of funding such efforts and resources should be considered beyond those related to project cycles, focused on real usage and impact.

ES 5. Leverage the highly distributed nature of the research infrastructures. Spain has a large number of institutions providing and consuming data and resources, many of them focused on verticals (such as bioinformatics or astrophysics) and highly developed. This distributed nature is an opportunity to reach a wider audience and to end up with more versatile services. Actions towards the construction of EOSC at Spanish level should focus on this.

4.6. The Netherlands

The Netherlands has official Open Science policies, RDM requirements and support for FAIR data, but there is still a considerable gap between practice and reality in many places. One issue is that the hosting organisations are often tied to particular scientific communities and/or they are part of autonomous institutions, which implement the recommendations as they deem appropriate. A second major issue is that many services and infrastructures depend to a substantial degree on project funding, with calls stressing innovation over consolidation and continuity. Although the system of national facilities is also rather fragmented, this is not necessarily problematic.

NL 1. Pay more attention to awareness raising among scientific communities (and more: getting the support of) on how the services they rely on may be strengthened by the EOSC.

NL 2. Make the national system of facilities and services supporting Open Science work together by a seamless workflow, honouring a division of tasks at the local and national level, without forcing services for domains and specific research communities in a straightjacket.

NL 3. Make sure that the funding system for research sets apart enough structural funds for the continuity of Open Science support services.

NL 4. Adapt the system of giving credit to research by not only honouring the traditional publication, but also other research outputs, including data and software.

NL 5. Provide a solution for the FAIR sharing of research objects such as software and workflows, for instance in the form of an international infrastructure for software sustainability.

NL 6. Promote the inclusion of Open Science practices in its many aspects in the regular curricula of universities and other research-performing organisations.

4.7. United Kingdom

Strategic-level responsibility for policy making on Open Science and FAIR data in the UK resides mainly with UKRI (UK Research & Innovation), and with the government ministry BEIS (the Department for Business, Energy and Industrial Strategy) which is responsible for research and innovation in universities and research institutions. UK research resources are therefore in general expected to be openly available wherever reasonably possible, and data management plans and good metadata practices are required. UK policies require data and software underlying published research findings to be deposited in appropriate sustainable repositories. Jisc provides an extensive range of discovery, repository and preservation services for resources and research outputs from UK universities in support of the FAIR principles. Most of the government investment in UK R&D is allocated by UKRI, but there is an additional variety of commercial and non-commercial sources.

There is moderate awareness and perception in the UK of initiatives relating to open science and the country's research community is relatively mature in terms of research data management. Awareness of the EOSC and its rules of participation is low amongst both researchers and service providers. It is slightly higher amongst UK decision makers. There are currently few cases of UK service providers committed to providing their services through the EOSC. Individual institutions develop and provide training in aspects of open science such as DMPs and making data FAIR, and share these with the community; DCC also provides free tools and guidance.

UK 1. Continue constructive UK engagement with European ESFRI research infrastructures, e-Infrastructures and other European research collaborations.

UK 2. Conclude UK Horizon Europe Association Agreement.

UK 3. Adopt a policy decision on UK participation in and engagement with EOSC including commitment to interoperability.

UK 4. Agree business models for EOSC which ensure compensation is provided for the additional marginal costs generated by cross-border consumption of resources in EOSC.

UK 5. Continue and increase EOSC awareness-raising and training efforts in the research community through activities such as conference and webinar presentations, workshops and training sessions.

UK 6. Build a data management community of good practice.

5. Summary and conclusion

The recommendations that will guide the future interaction with stakeholders to contribute to the EOSC implementation at the country level for all seven countries covered by the EOSC Synergy project are the major contribution of this deliverable. The recommendations are derived from vast and extensive information collected during the landscaping activities, followed by the gap analysis that critically analyzed available data. The findings depict the differences in individual countries' starting positions, the evolution of the status in time, but also the similarities and a potential for more synergic cross-country collaboration.

The acceleration of EOSC implementation at country and international levels calls for continuous work and update of the findings and especially the recommendations. Therefore, in the next project phase, they will be scrutinized through dedicated meetings, seminars, and other events to liaise and engage stakeholders to receive appropriate feedback and contribute to cross country harmonization of EOSC implementation directly.

6. Appendices

A Individual per-country reports

B Gap analysis tables

C List of acronyms and abbreviations

7. Appendix A – Per-Country Reports

7.1. Czech Republic

7.1.1. Landscape Analysis Summary and Update

The proposals for public funding of large research infrastructures from the budgetary chapter of the MEYS (Ministry of Education, Youth and Sports) are submitted for the approval of the Government of the Czech Republic as the only research, development and innovation projects in the Czech Republic. The latest edition of the Roadmap of Large Research Infrastructures of the Czech Republic, issued in 2019, sets out the large research infrastructures' policy making and public funding strategy for the years 2016–2022. The Roadmap represents the Czech Republic's contribution to the landscape of European and global research infrastructures

The Landscape analysis of Research Infrastructures and e-Infrastructures identified the following main categories in the Czech Republic:

- The national large research e/infrastructure e-INFRA CZ is a category in its own right, representing the Czech Republic in all EOSC-related core organisations and initiatives.
- The second category is RIs which serve both as capacity and service providers and as consumers of their own thematic services and of general (future) EOSC services.
- The third category is RIs which are "pure" service consumers, and do not add any significant capacity but expect others (such as their home institutions, e-INFRA CZ, free-of-charge capacity providers from abroad, etc.) to cover their capacity needs.

There are three main categories of national actors:

Cross-ministry actors: The Research, Development and Innovation Council (R&D&I Council) advising the whole Government of the Czech Republic. The R&D&I Council is a professional and consultancy body of the Government of the Czech Republic in the field of research, experimental development and innovation.

Ministries: The Ministry of Education, Youth and Sports (MEYS). MEYS is primarily responsible for the EOSC, but its own research-oriented programmes are also independently realised by other ministries, especially the Ministry of Health, Ministry of Culture, Ministry of Interior and Ministry of Industry and Trade. The Ministry of Regional Development has a special position as it oversees the ESF implementation.

The primary stakeholders responsible for the national research policy and its implementation are described below. They interact in many formal and informal ways, and together create a system that governs (but does not implement) the research landscape in the Czech Republic. Only the major stakeholders are noted.

Preparatory work towards a vision and strategy more closely aligned with EOSC in the next funding period (from 2023) is ongoing. This work is primarily coordinated by MEYS. The strategy is focused on Open Science, covering both publication (Open Access) and data (FAIRification, Data Management Plans, data repositories) requirements for publicly funded research projects. Awareness-raising and educational activities will be conducted as an important part of the Open Science ecosystem. Since April 2021, there have been regular meetings of the Czech National Working Platform for EOSC, the activity organized by MEYS focusing on EOSC planning activities in the Czech Republic. The Platform gathers important stakeholders, such as MEYS, universities, research libraries and research and research-supporting institutions. Currently[20], MEYS is discussing in this Platform the preparation of the Operational Program John Amos Comenius which will support project calls in 2022 and 2024 for projects supporting Open Science and EOSC compatibility in the Czech Republic.

The Open Access community under the Initiative of Open Access of Assoc. of Libraries of Czech Universities was in 2021 transformed into two main areas of interest :

- Publications (Open Access), supported by the group of Open Access Managers, associated primarily with the Open Access activities of HR Award projects implemented in many universities in the Czech Republic since 2020.
- Data (FAIR/Open Data), supported by the WG-RDM.cz group, focussing on many aspects of research data management (RDM). The working group consists of representatives of various academic and research supporting institutions who work in the area of RDM and inform and coordinate their activities through this group.

Since 2021, the National Centre for Information Support for Research, Development and Innovation (NCIP VaVaI) has been supported by MEYS[21]: *The aim of the NCIP VaVaI project is to increase the efficiency of the national research environment through the establishment of a new comprehensive platform 'One-Stop-Shop for Researchers (OSS4R)', which will provide information services and other advanced assisted and self-service support services, which will contribute to the creation of prerequisites for the implementation of the visions of the Innovation Strategy of the Czech Republic 2019–2030 and the National Policy on Research, Development and Innovation of the Czech Republic 2021+. The National Technical Library is the project coordinator of the NCIP VaVaI project.*

Masaryk University[22] is the Regular Member of OpenAIRE AMKE[23] which continues the mission of OpenAIRE projects[24] to bring together national networks of Open Science experts across Europe.

There is an active community supporting the Creative Commons in the Czech Republic[25] (members of NGO Open Content). This group is directly linked to the initiative of the Assoc. of Libraries of Czech

[20] as of June 2021

[21] https://www.msmt.cz/vyzkum-a-vyvoj-2/narodni-centrum-pro-informacni-podporu-vyzkumu-vyvoje-a?lang=1

[22] https://www.muni.cz/

[23] https://www.openaire.eu/openaire-amke

[24] https://www.openaire.eu/

[25] https://www.creativecommons.cz/

Universities mentioned above to the OpenAIRE AMKE national contact point, and to the National Information Centre for European Research (National Contact Point for H2020).

7.1.2. Country Situation with Respect to the Gap Analysis

Currently, there is no coherent Open Science (especially Open Access and FAIR data) strategy at the national level. The Czech Government approved an Action Plan for the Implementation of the National Strategy of the Czech Republic's Open Access to Scientific Information for 2017–2020. However, these activities dealt primarily with Open Access to published material, only touching on the topic of Open and FAIR data. Since 2019, the Innovation Strategy of the Czech Republic 2019–2030[26] and the National Research, Development and Innovation Policy of the Czech Republic 2021+[27] have been put in place.

Roadmap/strategy and funding are reasonably established for research infrastructures and e-Infrastructures at the national level, however, there is a lack of roadmap/strategy and funding for data infrastructures and there is not enough structural funding to guarantee stability/continuity of vital EOSC-related services.

PIDs for publications are well established in the Czech Republic. PIDs for physical persons are becoming more widely adopted. PIDs for institutions are often assigned, but there is low awareness and use of them; national (local) standards (tax numbers) are commonly used instead. There is a lack of established PIDs for data: only a few institutions are able to assign PIDs for datasets. Awareness of the existence and need for other types of artefacts is rather low.

There is overall a low level of awareness of EOSC and its Rules of Participation among researchers in the Czech Republic. The perceived added value and acceptance of FAIR principles is also low. Training in related areas such as preparation of Data Management Plans (DMPs), FAIRification of data or use of the federated cloud tools is fragmented; individual teams and institutions are starting to embrace and work in these areas. There is strong interest from service providers in participating in EOSC projects, however. The overall "EOSC maturity" is low, although there is a strong culture of cooperation (national, between disciplines, international) which would be further improved if appropriate care and support is provided.

7.2. Poland

7.2.1. Landscape Analysis Summary and Update

The first Polish Road Map of Research Infrastructure (PMDIB) was created in 2011, featuring 33 strategic research infrastructure projects in various fields of science. In January 2013, the Ministry of

[26] https://www.vlada.cz/assets/urad-vlady/poskytovani-informaci/poskytnute-informace-na-zadost/Priloha_1_Inovacni-strategie.pdf

[27] https://www.vyzkum.cz/FrontClanek.aspx?idsekce=913172

Science and Higher Education (MEiN) invited scientists to update the map, also including proposed new investment projects.

The Ministry of Education and Science has conducted a competitive, transparent procedure based on the best international standards to create the updated Polish Research Infrastructure Map, which brings together infrastructures with the highest potential to achieve scientific excellence, consolidating research potential in fields important for the development of science and the country. As of 2021, there are seventy infrastructures on the map, 65 of them on the basis of a positive recommendation of the relevant advisory team and 5 solely in connection with the existing international obligations of the Government of the Republic of Poland[28]. The infrastructures have been grouped, in accordance with the classification used by the European Strategy Forum on Research Infrastructures, by six research areas.

In Poland, developing and adopting open access policy is recommended by the Ministry of Science and Higher Education: "The first step towards defining the principles of open access should be the adoption of open access policy by each scientific unit and university."[29]

Currently, Open access policies have been deployed in fourteen Higher education institutions, 7 medical universities and 7 research institutes. One scientific institute has adopted the joint open access policy of the Polish Medical Platform (Polska Platforma Medyczna, a project financed under the Digital Poland Operational Programme; Action 2.3 Sub-activity 2.3.1, type II: digital availability of science resources). A further twelve institutions are developing open access policies. Given that according to the official list[30] of scientific institutions in Poland, there are 334 universities and 269 research institutes, we can conclude that the process of open access policy implementation is still under development.

Poland has several positive pieces of evidence relating to the EOSC. Numerous institutions (partners) from Poland belong to DARIA-H[31],which aims to enhance and support digitally-enabled research and teaching across the arts and humanities. DARIAH is a network of people, expertise, information, knowledge, content, methods, tools and technologies from its member countries. It develops, maintains and operates an infrastructure in support of ICT-based research practices and sustains researchers in using them to build, analyse and interpret digital resources.

The PIONIER network and federation is a nationwide broadband optical network providing the basis for scientific research and development works in the field of IT and telecommunications, computational sciences, applications and services for the information society. It connects 21 centers of Metropolitan Academic Networks (MANs) and 5 High-Performance Computing Centres by means of its own fibre-optic connections. PIONEER also provides the infrastructure for personal identification – PionierID, based on EduGAIN.

[28] Lista strategicznych infrastruktur badawczych umieszczonych na Polskiej Mapie Infrastruktury Badawczej, http://www.bip.nauka.gov.pl/polska-mapa-drogowa-infrastruktury-badawczej/lista-strategicznych-infrastruktur-badawczych-umieszczonych-na-polskiej-mapie-infrastruktury-badawczej.html

[29] https://www.gov.pl/web/nauka/otwarty-dostep-do-publikacji-naukowych

[30] https://polon.nauka.gov.pl/opi/aa/rejestry/nauka?execution=e4s1

[31] the Digital Research Infrastructure for the Arts and Humanities

The Digital Libraries Federation (FBC) is a web service whose primary goal is to collect, process and share online information about the collections of Polish scientific and cultural institutions. Institutions such as libraries, archives or museums can digitise their collections and make them available on-line, forming digital services. The databases of all digital objects has over 6.6 million records!

There is also more general planning of data openness in the form of programme targeting government administration bodies and organisational units reporting to or overseen by them. The office supporting the minister responsible for digitisation will also encourage other entities that create or store data with high potential for re-use, in particular local government units and private entities, to participate in this programme. The increased quantity and quality of data available as a result of this programme will benefit the general public, in particular citizens, businesses and public administrations[32].. The programme detailed objectives are:

1. Increasing the availability of data on the Dane.gov.pl portal
2. Improving data interoperability and quality
3. Increase in data use and exchange
4. Stimulating the market for the re-use of cultural resources and scientific data
5. Collaborate with national and international data stakeholders
6. Raising the knowledge and skills of public administration employees in the field of opening and managing data and increasing social awareness of the potential of open data.

The National Science Center has been appointed by MEiN to represent Poland's interests in the EOSC Association. The Center work programme has five main objectives:

(a) developing, consolidating and optimising the landscape of European research infrastructures;

(b) creating an open, optimised and trusted EOSC ecosystem to deliver the FAIR data network and services for science, a trusted virtual environment supporting open science with a corresponding IT infrastructure and a range of services available to researchers from different disciplines across Europe;

c) creating scientific infrastructure services to support health sciences, accelerating their ecological and digital transformation and increasing knowledge, with an emphasis on providing services that respond to societal challenges, particularly in the field of health, and supporting curiosity-based research to foster frontier knowledge in many large domains of scientific disciplines;

(d) supporting next-generation solutions, instruments, tools and advanced methods enabling scientific discovery and the maintenance of the European research infrastructure at the highest level, while paving the way for innovative solutions to societal challenges and new industrial applications, products and services;

e) establishing network connectivity in science and education by enabling borderless collaboration, providing high-capacity networks and network services to connect scientists, data and computing

[32] RESOLUTION NO. 28 OF THE COUNCIL OF MINISTERS of February 18, 2021 on the Data Opening Program for the years 2021–2027, MONITOR OF THE POLISH OFFICIAL DIRECTORY OF THE REPUBLIC OF POLAND, Warsaw, March 23, 2021 Item. 290

resources in a non-discriminatory manner, regardless of the location of users and data, which will enable scientists to conduct research at the highest level.

The implementation of the above assumptions, enabling development in the above-mentioned directions are being orchestrated by NCN[33].

7.3. Portugal

7.3.1. Landscape Analysis Summary and Update

The Portuguese Research and Innovation System reflects the cooperation between different stakeholders which contribute as a whole to the educational, scientific, technological and innovation sectors in Portugal.

At the top level, the Portuguese Government (Council of Ministers) is responsible for the policy and strategic direction of Higher Education, Research and Innovation, and for implementation of the European Union Structural and Investment Funds in Portugal, in line with European Union guidelines.

Underneath this, the governance consists of individual line Ministries headed by Ministers with specific portfolios. The Minister of Science, Technology and Higher Education (MCTES) is responsible for formulating, conducting, executing and evaluating national policies for science, technology and higher education, including scientific and technological innovation, guidelines for digital repositories, scientific computation, diffusion of science and technology culture and scientific and technological cooperation worldwide.

A third level of governance is composed of several agencies with implementation or regulatory responsibilities, such as:

- The Portuguese Foundation for Science and Technology (FCT), which corresponds to the national funding agency for science, research and technology;
- The National Innovation Agency (ANI), which aims to develop actions to support technological and business innovation .

Finally, the fourth level of the Research and Innovation System governance includes organisations dedicated to the production of knowledge, such as Universities, Polytechnics, R&D Units and Research Infrastructures. It also includes Interface Institutions that serve as a link between these entities and knowledge receptors, like business enterprises.

Open Science is considered a priority by the Portuguese Government and the MCTES. In that context, FCT has been tasked with developing the Open Science agenda.

[33] Plan działalności Narodowego Centrum Nauki Rok 2021, ncn.gov.pl/sites/default/files/pliki/uchwaly-rady/2020/uchwala128_2020-zal1.pdf

FCT has been actively implementing Open Access strategies, namely by supporting the national open access initiative RCAAP (Open Access Scientific Repositories of Portugal), adopting an open access policy, supporting open access publishing platforms[34] and also implementing Plan S.
With respect to Open and FAIR data, FCT will soon make available a data policy with specific requirements on management and sharing of data, and is currently implementing research data management services.

PTCRIS, the Portuguese Current Research Information System, a programme initiated by the National Scientific Computing Unit (FCCN) from FCT, has been promoting the integration of the science management systems of the various entities that operate in the national academic-scientific ecosystem. To this end, PTCRIS has been assuming a key role in the PIDs area. A DOI national service has been implemented, aiming to increase the use of PIDs in the national ecosystem.

FCT supports research infrastructures of strategic interest that sustain scientific and technological advances and strengthen the capacity of the R&D community in Portugal. To this end, FCT launched in 2013 a call for the creation of the Portuguese Roadmap of Research Infrastructures of Strategic Interest (RNIE), which was updated in 2020[35].

The Portuguese Roadmap now includes 56 research infrastructures in six thematic domains: energy (4), environment (7), health and food (20), physical sciences and engineering (14), social and cultural innovation (7) and digital (4).

About 66% of these research infrastructures are aligned or associated with an ESFRI Roadmap Infrastructure or other European Organizations/Initiatives in the respective area.
The landscape in Portugal shows two main categories of research infrastructures:

- Entities which produce and consume computing and data processing services, that bridge with European research infrastructures;
- Entities such as computing and data service providers, which work towards international coordination with projects such as EUDAT, EGI, PRACE, GÉANT, EuroHPC Joint Undertaking, OpenAIRE and IBERGRID.

FCT has developed a strong collaboration with the research communities since the beginning of FAIR activities in Portugal, providing services related to scientific information, open access journals, institutional repositories, research data and open educational resources.

FCT is also a mandated organization in EOSC-Association.

[34] https://www.pubin.pt/
[35] Portuguese Roadmap of Research Infrastructures of Strategic Interest. Available at: https://www.fct.pt/media/docs/Portuguese_Roadmap_Infrastructures2020.pdf

7.3.2. Country Situation with Respect to the Gap Analysis

In 2014, FCT adopted an Open Access policy in line with European Commission recommendations. Recently, FCT joined cOAlition-S[36] and is implementing Plan S. Therefore, will update and review the policy in accordance.

Concerning Open and FAIR Data, at the moment there is not a mandatory policy, only a set of recommendations. A data policy is expected to come into force very soon, aligned with the FAIR principles and making a reference to EOSC. This policy will include as requirements the submission of DMPs and the deposit of research data in trustworthy repositories. For this purpose, FCT is also developing research data infrastructures and services, namely, a national service for DMPs and a long tail research data repository service.

A National Data Strategy is currently being prepared, under the scope of INCoDe.2030[37], a public initiative that aims at enhancing digital competences.

A significant number of services and infrastructures depend, to a substantial extent, on project funding. The stability and sustainability of funding are crucial, to ensure the continuity of services and infrastructures related to Open Science and EOSC.

With respect to PIDs for publications we can consider that they are well established in Portugal. PIDs for physical persons, institutions and data are becoming more widely adopted. The use of PIDs for other types of artefacts is rather low.

A significant number of national infrastructures are still not familiar with the EOSC initiative. It also seems unclear to some infrastructures what the benefits of implementing EOSC would be. The perceived added value and acceptance of FAIR principles is also low. Training in related areas such as preparation of DMPs, FAIRification of data or use of federated cloud tools is fragmented. Individual teams and organizations are starting to introduce work in these areas.

The overall level of maturity in RDM is low, although there is a good culture of cooperation (nationally, between disciplines and internationally) which could be further strengthened if appropriate care and support is provided. Also, RDM processes need to be implemented and improved within the community, as well as encouragement and reward of Open Science and FAIR data practices.

Finally, Portugal does not have enough qualified resources on RDM activities, such as data stewards and data curators, that might support the adoption of data policies and standards.

[36] https://www.coalition-s.org/
[37] https://www.incode2030.gov.pt/en/incode2030

7.4. Slovakia

7.4.1. Landscape Analysis Summary and Update

Responsibility for the EOSC in Slovakia lies with the Center for Scientific and Technical Information (CSTI) of the The Ministry of Education, Science, Research and Sport (MESRS) and the Institute of Informatics of the Slovak Academy of Sciences (IISAS). The activities of both institutions are described in deliverable D5.1. CSTI has proposed a national project, KOMIS, for open science, which has been accepted for funding and public procurement has taken place. The project has started to be implemented and its results should be handed over to users in 2023.

The KOMIS project, "*The Comprehensive Information System for acquiring, processing, preservation and provision of research and bibliometric information and publications*", is focused on the development and use of ICT to support Open Science in Slovakia. Its aim is data exchange between systems through compatible open formats, their transfer, cleaning, transformation, linkage and presentation via recommended secure protocols, formats and standardised presentation interfaces. It is implemented in cooperation with designated partners with similar services in the international space. Technologically, the project focuses on quality (data management), interconnection and linking of data and metadata (open data and semantic web), compliance with existing de facto standards, and data credibility. Its presentation platform will use integration platform solutions to provide a comprehensive and flexible user interface for accessing various kinds of textual and structured information and a mechanism for managing communication with users. If the implementation of the KOMIS is successful, Slovakia will have at its disposal a comprehensive information system for acquiring, processing, preservation and provision of research and bibliometric information and publications, together with a modern data centre. The infrastructure will provide a benefit for all stakeholders, whether public or private sector.

The IISAS is responsible for the preparation of the EOSC infrastructure in Slovakia. Thanks to its successful participation in infrastructure projects EGEE, EGEE II, EGEE III, EGI-INSPIRE, EGI-Engage, EOSC-hub and currently in the EGI-ACE and EOSC-Synergy projects, the IISAS has experience with the maintenance and use of EOSC infrastructure with technical support for users in Slovakia. IISAS is the initiator of the national project SK-OSC (Slovak Open Science Cloud) with the participation of 6 providers: IISAS, the Slovak University of Technology in Bratislava, CSTI, Technical University of Košice, University of Žilina and Matej Bel University.

TheSK-OSC infrastructure will provide high performance processing based on powerful processors and GPUs. It will also include repositories and data storage. Negotiations are currently underway with more than 100 users in the academic sphere from the Slovak Academy of Sciences, universities and state research organisations. The main activities of the SK-OSC are:

Activity 1: Project coordination and cooperation with EOSC organisations

Activity 2: Infrastructure specification and public procurement

Activity 3: Building SK-OSC at the infrastructure level

Activity 4: Research and development of platforms for SK-OSC infrastructure

Activity 5: Thematic cloud services

Activity 6: Education and training of future users.

SKOSC is being implemented in collaboration with MESRS and users. It forms part of Slovakia's strategy towards EOSC.

IISAS, with its activities in the EGEE and EGI.eu series of infrastructure projects, has created an expert team with considerable experience in supporting many applications in Slovakia. The SIVVP (Slovak Infrastructure for High Performance Computing) national project was a successful milestone, implementing six powerful clusters and a supercomputer. The SIVVP infrastructure had many users, which we are now adapting to the SKOSC infrastructure. CSTI has been supporting open science with its infrastructure for a long time and has many users, from different scientific areas. It is now taking its infrastructure to a new level within the KOMIS national project.

7.4.2. Country Situation with Respect to the Gap Analysis

During its long experience in building e-infrastructures to support European science – more recently EOSC infrastructure – IISAS saw sustainability as one of the most serious problems. The projects mentioned above had a duration of 24-30 months, at the end of which it was unclear who would maintain the infrastructure which had been built. Fortunately, infrastructure projects continued, but it was unsatisfactory for users to participate in infrastructure validation without a longer-term sustainability guarantee. National infrastructures are not able to build all that has been developed over a long period of time by many European organisations. The other problem is the lack of success stories of the use of EOSC infrastructure: users turn more to HPC infrastructure, which has guaranteed availability of software support and services. There is a lack of information about established national EOSC initiatives, with sustainable funding, which would support the sustainability of the EOSC infrastructure.

7.5. Spain

7.5.1. Landscape Analysis Summary and Update

The Spanish stakeholders in the EOSC involve many different types of actors. If we consider Research Infrastructures (RIs) relevant to EOSC, on the one hand we identify RIs that act as producers and consumers of Computing and Data processing services. In this category we can find first those included in the ESFRI Roadmap (with Spanish participation in 31 ESFRI projects) and those included in the Spanish Map of Unique Scientific and Technological Infrastructures (ICTS-RI), with 62 sites. On the other hand, we identify RIs as Computing and Data service providers, including supercomputing (the Spanish Supercomputing Network - RES); the Spanish Academic & Research Network (RedIRIS); the Iberian Grid Infrastructure (IBERGRID & NGI-EGI); and the Recolecta (Open Science Harvester) platform which harvests all the national scientific repositories.

Spain has organised distributed computing and supercomputing service provisioning in two different forms. On one hand, the Spanish Supercomputing Network (RES) is a distributed virtual infrastructure of 11 supercomputers which provides a single access to a set of federated resources (reserving part of the data centres' resources for regional use). On the other side, Spain created a Joint Research Unit (ES-GRID) in the area of Distributed Computing RIs to set up the National Grid Initiative in 2007, with 14 signatory institutions. The participation of the institutions is coordinated under the Iberian Grid Infrastructure (IBERGRID) which federates and operates High-Throughput Cloud computing and data resources across the Iberian area, tightly coordinated with Portugal.

Spanish policies in Open Science and Research Infrastructures are aligned with EU EOSC Policies, with an emphasis on strengthening planning and coordination of the Spanish ESFRIs and e-infrastructures. EOSC is considered an opportunity to strengthen the development or improvement of data infrastructures. Spain plans to align national initiatives related to EOSC and contribute to the EOSC design and implementation by providing services, data, and resources. With respect to Open Data and research data preservation, the Spanish Strategy for Science, Technology, and Innovation 2013-2020 envisages access to data, as well as publications and results of publicly funded research. The main aims of this initiative are to drive the development of repositories (own or shared); open access to the publications of research staff; establish systems to connect with similar initiatives in other countries; strengthen strategic planning and coordination of the Spanish RI Landscape; promote usage of e-Infrastructures and data sharing; promote the development or improvement of data infrastructures and promote open access to publications and publicly funded research results.

7.5.2. Country Situation With Respect To The Gap Analysis

Spain has a partially developed Data Strategy. Some Data Strategy measures have been adopted but a more mature approach would require management of open scientific data at large, more data infrastructures, and more effective implementation of EOSC policies, although the latter will shortly be addressed. Spain does, however, have infrastructures related to EOSC. The results of the gap analysis are quite well-aligned with several articles which discuss aspects of this point according to the knowledge they have on the discipline. Issues identified include the considerable effort required to publish data in accordance with FAIR principles; the difficulty of the recognition of data sharing, the fear of losing control of intellectual property and the perception that open data are of lower quality. Open data management is mainly organised along disciplinary and international collaboration is well structured.

The usage of PIDs varies in accordance with the maturity of the object category, with the highest adoption for publications, followed by authors and with low adoption for datasets except for specific disciplines (such as the bioinformatics). The situation is similar to other countries, except for the management of user IDs at institutional level which is well developed in Spain. With respect to certification, only the DIGITAL.CSIC repository has been certified with the Data Seal of Approval since 2015.

Spain has one of the lowest percentages of GDP spent on research of the seven EOSC Synergy countries. Research Infrastructures and e-Infrastructures are funded in Spain through different means. At the national level, the State Plan of Scientific and Technical Research (2017-2020) allocates the RDI

public national budget in line with the specific goals outlined in the Strategy. The promotion of open science and open access and the strengthening of Research Infrastructures are covered in this plan. In addition, the Spanish Roadmap for the European Research Area Development 2016-2020 supports the contribution of national RIs and Research Centres to the EOSC. Spanish institutions do not support implementation of exclusion policies based on the geographic location. In the specific case of supercomputing, Spain participates through BSC in the European High Performance Computing Joint Undertaking (EuroHPC JU) which has recently launched a call for tenders for the procurement of three world-class precursors to exascale supercomputers, one of them for Spain. The legal complexity and the administrative procedures make collaborative service or hardware procurement complex. Recurrent service procurements take place at the institutional level although some efforts are being made around joint procurement of services related to publications.

An important feature of the Spanish landscape is the international character of Spanish RIs, reflected in their strong participation in international initiatives. Spain has been a member of EGI through a JRU since 2007, has participated in PRACE (where BSC-CNS is a key member of the EuroHPC Joint Undertaking) since its start, and the Spanish ICTs and other RIs participate in 48 ESFRIs. Spanish RIs are open to international access with generally no differences in cost or SLAs between Spanish and foreign users.

The main sources of funding for Research Infrastructures are through competitive processes involving external evaluation agencies. At the regional level, the regional governments have provided research grants mainly from the European Regional Development Funds. At the national level, the State Plan for Scientific and Technical Research (2017-2020) and Spanish Roadmap for the ERA Development 2016-2020 – allocated a budget of 257M€. At the European level, there is strong Spanish participation in the European Research Infrastructures part of the Excellent Science pillar of Horizon 2020, with 6,675 projects (24% of the total) including Spanish partners up to March 2020. There is however an important challenge around coordination and cross-connection between HPC, Distributed Computing, Data Repositories and Networks.

Spain has the main ambitions towards the EOSC: to align national initiatives related to EOSC by adopting European best practices and influence the design of the EOSC; to contribute to the implementation of EOSC by providing services, data and resources through the Spanish RIs; and to boost the international positioning of Spanish researchers by exposing their services to a wider audience and leveraging other institutions' services, data and resources to improve their research.

Spanish institutions consider strong positioning towards the EOSC to be strategically important. To this end, the Spanish Network for Open e-Science, (RED2018-102377-T) - a thematic research network grant-funded by the State Agency for Research (AEI) – gathers together Spanish stakeholders in the area of EOSC. Significantly, four of the 5 Working Groups organised by the former EOSC Executive Board featured members of this network. In addition, researchers from the network have obtained or maintain their presence in groups such as the e-IRG, the EOSC Governance Board, GO-FAIR, the Executive Board of the ERIC FORUM, EOSC Association Board of Directors or the Steering Committee of the EOSC Association. Eight of the ten entities participate in the EOSC Association as members or observers. Moreover, the Spanish Ministry of Science and Innovation created the Spanish e-Science Network on July 13, 2020 to promote and coordinate the development of e-Science in Spain,

by promoting the cooperation of the agents of the Spanish R+D+i system, among themselves and with other national and international e-Science programmes and initiatives, and to promote the coordination of the scientific and technical e-Science infrastructures, particularly but not only RedIRIS and the Spanish Supercomputing Network.

Despite the gap analysis showing a medium/low awareness of EOSC, in fact thirty Spanish institutions have joined the EOSC Association. Clearly, there is a need to increase awareness of the EOSC and to provide training on EOSC concepts, FAIR principles and specific EOSC services. The role of the EOSC-SYNERGY project and the e-Science Network will be key in this regard. In addition, Spanish RI services have a low visibility in the EOSC, with only ten services from Spanish institutions listed in the EOSC Marketplace (which represent only the 4% of the total number of services). This is mainly due to a lack of information, but in some cases, there is a perception that it implies a low cost-benefit ratio.

7.6. The Netherlands

7.6.1. Landscape Analysis Summary and Update

The Dutch landscape is richly variegated: it counts many services and service providers (50–150, depending on what and how to count: individual services, service providers, legal entities and/or projects), ranging from small to fairly big, and from aspiring projects to well-established institutes.

The downside to this variety is that the landscape is also characterised by a considerable degree of fragmentation. It is often heard that more coordination is desirable (this is for instance voiced by the Netherlands Platform for Open science, NPOS, in a data landscape report in 2020), although a host of coordinating platforms exists. Restricting ourselves to national consultative bodies (and also disregarding disciplinary coordinating efforts), there are certainly around a dozen, perhaps more, platforms, networking groups, coordination committees, etc. Apparently, the Dutch data landscape displays a similarity in this respect to the polder landscape, which has a long history of coordination and negotiation that goes back to the Middle Ages[38].

Moreover, open science has not yet deeply permeated the Dutch academic culture, or at least the awareness of its implications varies considerably among research communities. There are indications in the literature that age may be an important factor. Training in FAIR research data management is not yet part of the university curriculum, which may explain a lack of skills or experience.

To make the national system of facilities more efficient is a national puzzle, closely connected to optimising the system internationally, which is the big challenge of the EOSC at the European level. Of course, the science system itself is enormously varied and extremely specialised, which is why it is no surprise that so many facilities exist on the level of domains and (sub)disciplines. Moreover, every

[38] see https://en.wikipedia.org/wiki/Polder_model about the “polder model”, a “typically Dutch” way of consensus decision-making

Dutch university in the past few years has set up its own data support desk, which often includes running a repository service for its own academic community.

Although the NPOS report of 2020 proposed yet another level of national coordination, somewhat comparable to the EOSC at the European level, in order to optimise the system, this proposal was not met with much enthusiasm. How that coordination layer should take shape is still under debate, but there appears to be an overkill of coordinating bodies in the Netherlands rather than a lack of them.

7.6.2. Country Situation with Respect to the Gap Analysis

Although the Netherlands has official Open Science policies, RDM requirements and support for FAIR data, we can observe a considerable gap between practice and reality in many places. The number of data sets in the data repositories of most universities is probably lower than desirable (although firm statistics about what we miss are lacking). It is likely that the majority of the data of university researchers is hidden on personal disks or institutional drives, inaccessible to researchers from other institutions. In spite of good intentions, estimates are that the majority of the research data in many academic communities is not FAIR and open at all.

Even when agreement on common standards or practices is reached, the challenges lie in their implementation. The first issue is that the hosting organisations of the facilities and services described in the Dutch Landscape Report are often tied to particular scientific communities and/or they are part of autonomous institutions, which are free to implement an agreement or not. Local requirements or priorities are an all too easy excuse for not enforcing a common ruling, norm or shared service.

A second major issue is that many services and infrastructures depend to a substantial degree on project funding, which seems to be inherent in a science system based on competition for grants. This means that there is a continuous struggle among project proposals, which are often forced by the conditions of the calls to stress innovation over consolidation and continuity. Understandable as it is from the standpoint of research funders focusing on pushing the limits of scientific progress, there is also an element of capital destruction if the funding of proven facilities is discontinued, when an existing service is less innovative than a new proposal. Research funders often explicitly require that the host institutions of projects cover the costs of maintenance after the project funding has ended, which demand in practice is seldomly realistic.

Perhaps this is also an explanation of why the maturity of many scientific facilities is less than it could be, as formalisation (expressed by things such as certification, licensing and SLAs) is less appreciated in funding proposals than scientific status and quality, expressed for example by peer reviewed publications. The NPOS also stresses the need for adaptation of the system of scientific valuation and recognition to address the traditional emphasis on measures such as the h-index.

Thirdly, although other types of research outputs, such as software and workflows, are mentioned in the NPOS report, these have so far received relatively little attention in infrastructural services. The Netherlands does not stand alone in this respect: facilities for the FAIR sharing of e.g. research software are absent in most countries. Therefore, there is an opportunity for the EOSC to provide solutions for sustaining such outputs internationally.

7.7. United Kingdom

7.7.1. Landscape Analysis Summary and Update

The UK research infrastructure landscape is large, varied and notably international in outlook: of more than 500 infrastructures of national and international significance identified by the 2019 UKRI landscape analysis, more than 90% collaborate with international partners and these include numerous infrastructures in the ESFRI roadmap, and headquarters or participating sites of pan-European research facilities. The UK has an ecosystem of computational infrastructure and e-Infrastructure provided by a variety of organisations and agencies including UKRI, Jisc, universities and research centres. Notable research institutes or facilities also include the Janet network operated by Jisc, the Alan Turing Institute, the Edinburgh Parallel Computing Centre, the Software Sustainability Institute, the Francis Crick Institute, the Hartree Centre, the UK Data Service, the Wellcome Trust, the National Archives, Public Health England, and Jisc's Open Research Service.

The UK continues to be involved in many European and international e-Infrastructure initiatives including EGI, EUDAT, GÉANT, OpenAIRE, PRACE and RDA, and participates in many collaborative projects in the area of e-Infrastructures and the European Open Science Cloud.

The UK left the EU on 31 January 2020 and inevitably this is and will continue to be reflected in policy and legislative changes. Since the EOSC-Synergy UK landscape country report was published in May 2020, a UK Research and Development Roadmap has been published (1 July 2020), setting out the UK's vision and ambition for science, research and innovation and starting debate on future actions with aims including ensuring a regulatory system to support R&D, providing long-term flexible investment into infrastructure and institutions, and developing funding for international scientific collaboration. Building on this and other policy documents, the National Data Strategy was published on 9 September 2020 and set out a framework for unlocking the value of data as a driver of economic growth. Actions to implement the strategy include publishing metadata standards, guidance on use of APIs in data sharing, and training public sector workers in Data Science. Publication of a Digital Strategy policy document is also awaited.

Strategic-level responsibility for policy making on Open Science and FAIR data in the UK resides mainly with UKRI (UK Research & Innovation), the UK's largest public research funding organisation, acting in consultation with stakeholders such as universities, and with the government ministry BEIS (the Department for Business, Energy and Industrial Strategy) which is responsible for research and innovation in universities and research institutions. UK research resources are therefore in general expected to be openly available wherever reasonably possible, and data management plans and good metadata practices are required. DMPOnline, provided by DCC (Digital Curation Centre), supports creation of data management plans which meet institutional funder requirements. UK policies require data and software underlying published research findings to be deposited in appropriate sustainable repositories. Jisc provides an extensive range of discovery, repository and preservation services for resources and research outputs from UK universities in support of the FAIR principles. Involvement in international scientific collaborations such as CERN, EMBL, INSTRUCT, ESS and SKA provides additional data storage, preservation and maintenance resources.

There is moderate awareness and perception in the UK of initiatives relating to open science and the country's research community is relatively mature in terms of research data management. UKRI, via its predecessor organisation RCUK, published a statement on the responsible use of metrics in February 2018 and is a signatory of the San Francisco Declaration on Research Assessment (DORA). In May 2021 the initiation of a Future Research Assessment Programme was announced, which aims to explore possible approaches to the assessment of UK higher education research performance based on evaluation and is due to conclude by late 2022.

The UK has led the way in encouraging and mandating open access. Current policy principles are that outputs of publicly funded research in the UK should be made widely and freely accessible as soon as possible by either the Gold or Green OA routes, and costs of scholarly communication (e.g. APCs) are considered a legitimate and embedded part of research funding. Licences are expected to allow maximum re-use. UKRI is in the final stage of reviewing and developing its existing open access policies for peer-reviewed research articles and academic books that result from research supported by UKRI. A public consultation is currently nearing completion, seeking feedback on whether the use of UKRI OA funds should be permitted for publication in hybrid journals or hybrid publishing platforms or whether this should only be permitted as part of a transformative agreement or similar arrangement. The new policy is likely to extend to research monographs. UKRI and the Wellcome Trust are both members of COAlition S, the international consortium of research funders supporting the Plan S initiative.

Research in the UK is funded from a variety of commercial and non-commercial sources. Most of the government investment in UK R&D is allocated by UKRI. Although many researchers may be using research facilities which receive funding from a variety of sources, in practice UKRI's policies prevail due to the influence of its funding. UKRI is principally funded by BEIS. Total investment in R&D in the UK in 2017 was 1.7% of GDP. The government has committed to meet a target of 2.4% of GDP invested in UK R&D by 2027, and a longer-term goal of 3%. The UK currently has investment strategies in place covering Research Infrastructures, Data Infrastructures and e-Infrastructures but not Open Science, EOSC or skills and training relating to infrastructures for research. The investment strategies are aligned with the national research strategy. Funding needs of infrastructures for research (RIs, RDIs and e-Infrastructures) are generally met and are sufficient to guarantee stability of services which might be considered vital for EOSC, with the exception of some shortfalls in funding for skills development. The government recently announced the launch, expected by 2022, of the Advanced Research & Invention Agency (ARIA), a new independent research body to support high risk, high reward science, modelled on the US Advanced Research Projects Agency (ARPA).

Many UK infrastructures for research receive revenues other than grant funding; most do not currently know their service unit costs, but could calculate these if required.

Access to unlimited research resources is usually open, whereas limited or depletable resources generally have a competitive allocation mechanism applied to them. Restrictions on or barriers to access and use of UK research infrastructure resources by those based in other countries, where they exist, are more at the level of governance issues (i.e., relating to consumption of rivalrous resources) than specific regulatory or policy issues at the level of the resources themselves.

Jisc led the formation of, and runs, the national ORCID consortium. Many UK researchers now have an ORCID, and most UK CRIS systems recognise ORCIDs; nearly all institutions have PIDs, although ROR is not yet widely adopted; nearly all institutions and publication repositories can assign PIDs to publications. Jisc has been leading a project[39] to develop and refine a national strategy and roadmap for persistent identifiers. A national "multi-PID consortium" will shortly be set up to optimise access to and adoption of the five priority PIDs (grants, people, outputs, organisations and projects). This may be expected to increase the number of data repositories – currently around half – which can assign PIDs to data and the many RPOs which can assign PIDs to datasets, and also to increase awareness and assignment of PIDs for other research artefacts (software, containers, workflows, …), both of which are currently very low.

Awareness of the EOSC and its rules of participation is low amongst both researchers and service providers. It is slightly higher amongst UK decision makers. There are few incentives currently on offer to align with EOSC. Jisc has begun a programme of activities to raise EOSC awareness and encourage participation and there is evidence of interest amongst those who have participated to date. There are currently few cases of UK service providers committed to providing their services through the EOSC due to the need to identify the motivation and compensation for doing so: at a national level, services are funded to supply to the UK research community so the additional costs of provision beyond that scope would need to be provided for. Individual institutions develop and provide training in aspects of open science such as DMPs and making data FAIR, and share these with the community; DCC also provides free tools and guidance.

[39] https://scholarlykitchen.sspnet.org/2020/06/29/the-uk-national-pid-consortium-a-pathway-to-increased-adoption/

8. Appendix B – Gap Analysis Details

8.1. Open Science Strategy Gap Analysis Data

			Countries						
Category	**Indicator**	**Evaluation scale**	**CZ**	**ES**	**NL**	**SK**	**PL**	**PT**	**UK**
National specificities including lack of any strategy	National policy on Open Access to publications	**Y/N/Plan**	Y	Y	Y	Plan	Y	Y	Y
	National policy on Open and FAIR data	**Y/N/Plan**	Y The Czech Government approved an Action Plan for the Implementation of the National Strategy of the Czech Republic's	Y	Y	Plan Currently, there are official policies on Open Access and FAIR data at the national level within the National project KOMIS.	Y	Plan The policy will come into force very soon.	Plan

			Open Access to Scientific Information for 2017–2020. However, these activities deal primarily with Open Access to the published material, just touching the topic of Open and FAIR data.						
	National contact point for Open Science	**Y/N/Plan**	Y	Y	Y	Y	Y	Y	Y
	Reference to EOSC in current national or sectorial policies	**Y/N/Plan**	Plan	Y	Y	N	N	Plan	N

	Open Science at national level - Perception *Examples:* - Adoption of institutional policies on open access by Universities, RPOs and funding agencies - # of open access repositories - Etc.	**Null** **1** - Very low **2** - Low **3** - Medium **4** - Medium high **5** - High	2	3	4	4	3	2/3	3
	Assessment of the level of maturity of the scientific community in terms of RDM	**Null** **1** - Very low **2** - Low **3** - Medium **4** - Medium high **5** - High	1	3	A growing number of organisations are using harmonized RDM requirements in their policies.	2	2	2	3

	Existence of community working groups or national initiatives related to Open Science	**Y/N** **If "Yes", what is the perception of its impact at national level:** **Null** **1 - Very low** **2 - Low** **3 - Medium** **4 - Medium high** **5 - High**	Y/4 - Association of Libraries of Czech Universities. - The National Information Centre for European Research. - Active group supporting Creative Commons. - CzechELib – National Centre for Electronic Information Resources - www.wg-rdm.cz	Y 4	Y 5	Y 4	Y 2	Y 2	Y 3

	Existence of incentives/ recognition related to data sharing within the scientific community	**Null** **1 - Very low** **2 - Low** **3 - Medium** **4 - Medium high** **5 - High**	1	3	4	3	2	1	1
FAIR principles (implementation at the national level)	Submission of DMPs as a requirement in the national open data policy?	**Y/N/Plan**	N	Plan Currently optional, compulsory in next Research Programmes.	Y Researchers who are funded by NWO or ZONMW have to specify in the DMP what is going to happen with the data after the conclusion of a project.	N	Y In April, 2019 NCN announced plans to introduce open science policy, as well as the requirement for DMP, publishing guidelines for applicants to complete the DMP form in the proposal.	Plan Currently recommended. It will be a requirement in the new data policy.	Y

	Existence of a national service for DMPs	**Y/N/Plan** **If "Yes", please confirm if it considers machine-actionable plans**	N	N	Y DMPonline (NWO)	N	Plan. Several institutional services, no single nation-wide so far. (RepOD, BridgeOfData, CeON).	Plan Work in progress - Argos OpenAIRE #ma plans	Y DMPonline #ma plans
	Deposit of data in a trustworthy data repository as a requirement in the national open data policy?	**Y/N/Plan**	N	FECYT issued a report on good practices for the management of research data (2012), aiming to assist in the standardization of research data management in repositories to facilitate its preservation, access and distribution.	Y There is a clear tendency that depositing the data in a trusted repository is recommended or obligatory, and that the repository complies with a certification standard such as the CoreTrustSeal. In practice, what will	Plan	Y RepOD – Repository for Open Data CLARIN ERIC AZON	Plan The new data policy will include that requirement. As a start, it will be presented with a basic list with the top general trustworthy requirements. Gradually, the criteria will be updated.	Whilst publication of data in certified repositories is not mandated by either the Concordat or the Common Principles, the policies do require data and software underlying published research findings to be deposited, where possible, via

					happen with the data often depends on the predominant culture of the research community involved. The data volume is also important. For truly Big Data, the assumption is that the organisations responsible for data creation will somehow keep the data alive or know what is best.				mechanisms that provide sustainable services with appropriate policies, such as an established repository of a discipline-specific research community, funding body, publisher or research institution.

	Support for FAIR RDM at institutional/policy level *(EOSC maturity indicator)*	**Null** **1 - Very low** **2 - Low** **3 - Medium** **4 - Medium high** **5 - High**	1	2	3 The policy of most research organisations in The Netherlands is to promote "optimal" access to "FAIR" research data, using the motto "Open if possible, protected when needed".	1	1	2	4
Status of the implementation of the data strategy (data managem	National data infrastructures and services available to the community	**Y/N** **If "Yes", please select the most appropriate:** **1 - Not sufficient**	Y 2	1	2	2	Y 2	Y 2	Y 3

ent, curation, preservation, sharing)		**2 - Sufficient, but could be improved 3 - Sufficient and appropriate**							
	Competence centers at national level (exs: training, data curation, certification, etc)	**Please detail**	Not yet nominated		SURF, DANS, NLeSC, perhaps 4TU, DTL	Center of Scientific and Technical Information, project KOMIS	Not yet nominated officially	Not yet nominated officially	Jisc, DCC, UK Data Service
	International scientific collaborations that contribute to an increase of storage over national sites	**Y/N** **If "Yes", please detail**	ESFRI related RIs have their own plans for storage capacity	Yes, through ESFRIs		Yes, through Egi.eu projects	N	Y Through ESFRIs, Egi.eu	Y (many, e.g. ELIXIR/EMBL, INSTRUCT, ESS, SKA...)
	Large-scale data preservation and maintenance of	**Y/N** **If "Yes", please detail**	Same as above	Yes, through ESFRIS and INFRAEOSC projects.		plan within KOMIS project	Y EUDAT LOFAR/SKA	Y Through ESFRIs/EUDAT	Y CERN, ELIXIR, ESS ERIC

	data through international projects/organisations									

8.2. Persistent Identifiers Gap Analysis Data

			Countries						
Category	**Indicator**	**evaluation scale**	**CZ**	**ES**	**NL**	**SK**	**PL**	**PT**	**UK**
PIDs for data	National policy	**Y/N/Plan**	N	N	N	N	Plan	Plan	Plan
	Data repositories (national, institutional, topical) settled in the country	**1** – Very few of them **2** – Few of them **3** – Half of them	1 source: re3data.org	1	3	Null source: re3data.org	2	4	3

	are able to assign PIDs to data	**4** – Many of them **5** – (Almost) all of them							
	Research institutions in the country are able to assign PIDs to the datasets their researchers produce	**1** – Very few of them **2** – Few of them **3** – Half of them **4** – Many of them **5** – (Almost) all of them	1	1	4		2	4	4
	Used PIDs are compatible with EOSC PID Architecture	**Null/Y/N/Plan**	Y	Y	Y		?	Y	Y
	Global resolution of used PIDs is possible	**Null/Y/N/Plan**	Y	Y	Y		Y	Y	Y

	Institutions are ready to support multiple PID per object	1 – Very few of them 2 – Few of them 3 – Half of them 4 – Many of them 5 – (Almost) all of them	4	4	3		3	?	?
	PIDs owners support reverse lookup of PIDs for data	1 – Very few of them 2 – Few of them 3 – Half of them 4 – Many of them 5 – (Almost) all of them	5	4			4	?	?
	Comment	N/A	Research data management and sharing of research data is in the	The maturity is higher for documental information rather than for research	See NL Landscape report for usage of the different PID systems in	No awareness about this area in Slovakia.	Research data management and sharing of research data is in the	The maturity is higher for documental information rather than	DOIs for outputs is a priority PID for research organisations as part of

			early adoption stage. Institutional/ national data repositories are almos missing.	data. There is one trust-seal certified repository in Spain.	data repositories		early adoption stage. There is no single uniform access to the repositories. "Program otwierania danych na lata 2021-2027" in polish. - Ministry of Digital Affairs	for research data.	the Jisc PIDs for OA work. RDM and data sharing well established.
PIDs for	National policy	**Y/N/Plan**	Y				Y	Y	Y

researchers (ORCID, ISNI, etc.)	Portion of researchers in the country has assigned unique ORCID or researcher's PID	1 – Very few of them 2 – Few of them 3 – Half of them 4 – Many of them 5 – (Almost) all of them	3	3	4/5		5 Obligatory for researchers.	4	4
	Information systems (CRIS, national/institutional/topical publication repositories, universities' personal systems, ...) settled in the country are able to work with ORCID or other PIDs	1 – Very few of them 2 – Few of them 3 – Half of them 4 – Many of them 5 – (Almost) all of them	4	3	5		3	3/4	5

	Research institutions in the country are able to fill in ORCID profile of their researches	**1** – Very few of them **2** – Few of them **3** – Half of them **4** – Many of them **5** – (Almost) all of them	1	1			3	2/3	4
	Used researcher PIDs are compatible with EOSC PID Architecture	**Null/Y/N/Plan**	Y	Y	Y		Y	Y	Y
	Institutions are ready to support multiple PIDs per person	**1** – Very few of them **2** – Few of them **3** – Half of them	4	Y			3	?	?

		4 – Many of them 5 – (Almost) all of them							
	PIDs owners support reverse lookup of PIDs for person	1 – Very few of them 2 – Few of them 3 – Half of them 4 – Many of them 5 – (Almost) all of them	3	5			3	?	3
	Comment	N/A	There is usually only informal policy at the universities, funders do not require researcher PIDs, there is	Supported in the Normalized CV of the Spanish FECYT and in the institutional repositories.	DAI (Digital Author Identifier, compatible with ISNI) and ORCID are both used, where ORCIDs are	In the future there will be a trend that every researcher is supposed to have ORCID and will be evaluated	The registration is obligatory in POL-on as well. If not registered, any publication will not be considered		Researchers are supported via the UK ORCID Consortium run by Jisc

			government request for ORCID; basic implementation is generally in place at institutions (information systems).		replacing DAIs	according to it (now for evaluation they have to be searched in bibliographical databases). There is also ResearcherID in use.	in the scientific evaluation process, nominations etc...		
PIDs for institutions	National policy	**Y/N/Plan**	N	N	N		Y	N	Plan
	Any kind of PIDs for institutions in use in the country	**Null/Y/N/Plan**	Y source: ror.org	Y source: ror.org	N		POL-on, ror.org	Y	Y

	If PIDs for institutions is in use, it is an internationally recognized standard	**Null/Y/N/Plan**	Y	Y	N/A		Y	Y	Y/N
	If PIDs for institutions is in use, it is ROR or mapping is possible	**Null/Y/N**	Y	Y	N/A		Y	Y	Y
	Used PIDs are compatible with EOSC PID Architecture	**Null/Y/N/Plan**	Y	Y	N/A		Y	Y	Y
	Global resolution of	**Null/Y/N/Plan**	Y	Y	N/A		Y		Y

	used PIDs is possible								
	PIDs owners support reverse lookup of PIDs for institutions	1 – Very few of them 2 – Few of them 3 – Half of them 4 – Many of them 5 – (Almost) all of them	2	2	N/A		2		?
	Comment	N/A	VAT number (DIČ in CZ) is not usually used as an institutional PID, ROR is in use (https://ror.org/), GRID ID was used before	Usually, institutions are identified through VAT or PIC. I believe that ROR will be generalized if the journals start using them		In Scopus or WOS we found no PIDs at institutions.			ROR is a priority PID for research organisations as part of the Jisc PIDs for OA work. UKPRN is used by UKRI but this is a UK identifier.

			(https://grid.ac/). The vast majority of Czech institutions is in ROR; however, awareness is low. In CZ, IČO and IS VaVaV department number is in use. CZ has a fully functional national system, but the explicit mapping to international standards is missing.	for the publications.					ROR isn't yet widely adopted.

PIDs for publications	National policy	Y/N/Plan	N	Y	Y		Y	Y	Y
	Publication repositories (national, institutional, topical) settled in the country are able to assign PIDs to the publications	1 – Very few of them 2 – Few of them 3 – Half of them 4 – Many of them 5 – (Almost) all of them	4	4	5		4	4/5	5
	Research institutions in the country are able to assign PIDs to the publications their researchers produce	1 – Very few of them 2 – Few of them 3 – Half of them 4 – Many of them 5 – (Almost) all of them	4	4	4/5		4	4	5

	Used PIDs are compatible with EOSC PID Architecture	**Null/Y/N/Plan**	Y	Y	Y		Y	Y	Y
	Global resolution of used PIDs is possible	**Null/Y/N/Plan**	Y	Y	Y		Y	Y	Y
	Institutions are ready to support multiple PIDs per publication	**1** – Very few of them **2** – Few of them **3** – Half of them **4** – Many of them **5** – (Almost) all of them	3	4			3	4	?

	PIDs owners support reverse lookup of PIDs for publication	1 – Very few of them 2 – Few of them 3 – Half of them 4 – Many of them 5 – (Almost) all of them	5	5			5	?	?
	Comment	N/A	Majority of Czech journal publishers assign DOIs.	Highly organized at national level.	URN:NBN is supported through the National Library and DANS; DOI is allso supported	Journals are using mainly DOI, but there was never done overview about how many of journals are using it.	DOI is the most popular.	DOI is the most popular.	

PIDs for other artefacts (software, containers, workflows, ...)	PIDs are assigned to other artefacts (software, containers, workflows, ...) in recognized research or public institutions in the country	**1** – In very few of them **2** – In few of them **3** – In half of them **4** – In many of them **5** – In (almost) all of them	1	1	1		1	1	1
	If PIDs for other artefacts are in use, what artifacts are assigned	**Free form text**			?		n/a	?	?
	If PIDs for other artefacts are in use, PIDs are compatible with EOSC	**Null/Y/N/Plan**	Null	Null	?		NULL	?	?

	PID Architecture								
	If PIDs for other artefacts are in use, global resolution of used PIDs is possible	**Null/Y/N/Plan**	Null	Null	?		NULL	?	?
	Researchers/institutions are aware PIDs are needed for other artefacts (software, containers, workflows, ...)	**Null** **1** – Very few of them **2** – Few of them **3** – Half of them **4** – Many of them	1	Null	1		2	1	2

		5 – (Almost) all of them							
	Comment	N/A	Awareness/ knowledge is very low.	People use references to popular repositories instead.	PIDs for software are recommend ed by NLeSC and DANS; for other objects there may be subject-specific initiatives		People use HTTP references to popular repositories of software.	Awareness/ knowledge is very low.	PIDs for software are probably the ones researchers and institutions are most aware of.

8.3. Funding Gap Analysis Data

The indicators used for the funding gap analysis, and the data collected, can be seen in the table below.

GAP ANALYSIS - FUNDING									
			Countries						
Category	**Indicator**	**Evaluation scale**	**CZ**	**ES**	**NL**	**SK**	**PL**	**PT**	**UK**
Research spending and strategy	% of GDP spent on research (ideal is 3%)	%	1.93	1,25% (2019)	2,16 % (on R&D in 2019)	0.83	1,32 (2019)	1.4 (2019)	1.7
	My country has a roadmap/strategy in place for investment, covering:	1-No; 2-Yes, aligned to a European roadmap; 3-Yes, aligned to a national roadmap; 4-Yes, we maintain a roadmap according to our own specifications							
	- Open Science		1	3	2/3	2	3	2	1
	- EOSC		1	1	1/2 European Open Science policy mentioned in national policy/plan	2	3	1	1

	- Research Infrastructure		4	2	2/3	2	3	3	3
	- Data Infrastructure		1	4	no separate policy, part of R.I.	3	3	3	3
	- e-Infrastructure		3	2	no separate policy, part of R.I.	2	2	3	3
	- Skills and training for RI/RDI/e-Inf		1	4	1	2	1	2	1
	There is alignment between the national research strategy and the national investment strategy for Open Science/EOSC/research infrastructure/data infrastructure/e-Infrastructure	1-No; 2-Yes, some; 3-Yes, strong alignment	2	X	2/3	2		2	3
EOSC-related funding	Research Infrastructure funding is available in my country for:	1-No; 2-Some but does not fully meet requirements; 3-Yes, requirements							

		are met							
	- Operational costs		3	1	2	2	2	1	3
	- Capital investment/capacity expansion		2/3	3	2	2	2	3	3
	- Wider support costs (e.g. support staff, HR, accounting etc)		3	1	2	2	1	2	3
	- Skills development (e.g. training)		2	2	2	2	2	2	2
	Data Infrastructure funding is available in my country for:	1-No; 2-Some but does not fully meet requirements; 3-Yes, requirements are met							
	- Operational costs		1	1	2	2	2	1	3
	- Capital investment/capacity expansion		1	2	2	2	3	3	3

	- Wider support costs (e.g. support staff, HR, accounting etc)		1	1	2	2	1	2	3
	- Skills development (e.g. training)		1	2	2	2	2	2	2
	e-Infrastructure funding is available in my country for:	1-No; 2-Some but does not fully meet requirements; 3-Yes, requirements are met							
	- Operational costs		3	1	2	2	2	1	3
	- Capital investment/capacity expansion		2/3	3	2	2	3	3	3
	- Wider support costs (e.g. support staff, HR, accounting etc)		3	1	2	2	1	2	3
	- Skills development (e.g. training)		3	3	2	2	2	2	2

	The investment roadmap/programme in my country provides enough structural funding to guarantee stability/continuity of vital EOSC-related services for:	1-No; 2-Yes							
	Research infrastructures		1	1		1	1	1	2
	Data infrastructure		1	1		1	2	1	2
	e-Infrastructure		1	1		1	2	1	2
Costing and charging	Infrastructures in my country know their service cost information (unit costs)	1-No, not possible/not foreseen; 2-No/rarely, but in preparation; 3-Mostly not currently, but could be calculated; 4-Many do; 5-All or nearly all do	2 in general (including e-infra), but some have full cost assessment	3	3	3	4	3	3

	Infrastructures in my country receive revenues other than funding	1-No; 2-Some do; 3-Many/all do	2	1	2	1	2	2	3

8.2.1. Other Funding Gap Indicators

In preparing the funding gap analysis, several other indicators were initially considered for inclusion, but were rejected or altered/evolved during the process of distilling what the gap analysis needed to examine. These included:

- Sustainability of funding for EOSC-Core components. This indicator was not included because the core components are a specific and limited set of functions, and national infrastructures are more likely to form part of the EOSC-Exchange than the EOSC-Core
- Additional investment for innovating core infrastructure. Similarly, this was felt to be a separate concern from that of the participation of national services in EOSC and so it was not included in the gap analysis
- Long-term vs project funding of infrastructures. This relates to the distinction between development and operational funding. It can often be easier to get funding for developing new things (which can be funded on a project basis) than for funding the costs of ongoing operation of existing services/infrastructures (which requires sustained funding providing confidence in the longevity of the infrastructure). This indicator is relevant and was not rejected, but rather developed to help produce the – more measurable - indicators finally selected in the EOSC-related funding category
- Capacity expansion funding. This indicator was relevant and was included in the final set of indicators but as one of several funding categories for which information was gathered.

8.4. Access Provisioning Gap Analysis Data

		Countries						
Category	Indicator	UK	ES	SK	PT	PL	NL	CZ
Infrastructure Access Restrictions	Excellence	Access to unlimited resources is usually open, whereas limited resources generally have a competitive allocation mechanism applied to them	Not for publications. Sci panels or external evaluation in e-Infrastructures			Access to unlimited resources is usually open, whereas limited resources generally have a competitive allocation mechanism applied to them. 20-40% of new eInfrastructure can be used commercially.		16% of the infrastructures offer access through competition

	Origin	Depending on the funding, could be limited at national level or at institutional level	In some cases geographic limitation by shares (regional, national, intl). Network infrastructures limited to users from national centres.	Depending on the funding, could be limited at national level		No limitation	Mostly no limitation, with cases restricted to organizations.	In some cases to national users, depending on the funding.
	International	International access through preexisting agreements with international collaborations.	International access through preexisting agreements with international collaborations.	Transnational access through international projects.	Only in 20% of the infrastructures, although access conditions are the same as national users.	International access in some eInfrastructure belonging to international collaborations, such as EGI or PRACE,project based	Most of the infrastructure organisations provide access to the services they offer internationally. No distinction between national or international	Members of certain communities or organisations (e.g. virtual organisations)

							users in those cases.	
	Cost	Free of cost, limitations in invoicing depending on the source of funding. Indirect costs are considered in some international collaborations, as well as in some cases for the HPC-SIG	Free of cost, limitations in invoicing depending on the source of funding.	Free of cost, limitations in invoicing depending on the source of funding.	Only 10% do not apply charges. 40% for all services rendered and 50% for some services	No costs charged to users coming from public institutions.	Cost applied in some cases.	The majority of them (almost 70%) do not charge their users/clients for the services the participants provide to them. If charges are applied then usually to the full portfolio of

								the services.
	Publicly Access Policy	Access to unlimited resources is usually open.	Most of them. Access policies may vary depending on the source of the access (e.g. international collaboration, competitive calls, open access)	Most of them, or at least they will be available in 1-2 years time.	2/3 of them already have.	Available in 2022-23		Less than a half of the centres in practice. for the rest, this is mostly considered for future plans.

	User groups	The most frequent groups of users correspond to researchers based at universities, students and researchers of non-university research institutions		researchers based at universities, researchers of non-university research institutions, researchers of private, commercial institutions, governmental institutions (e.g. census bureaus), students, professionals, but no citizen scientists.	The most frequent groups of users correspond to researchers based at universities, students and researchers of non-university research institutions	researchers based at universities, researchers of non-university research institutions, researchers of private, commercial institutions, governmental institutions (e.g. census bureaus), students, professionals, but no citizen scientists.	Not identified	By order: Researchers based at universities, non-university research institutions and private or commercial institutions; Governmental institutions (e.g. census bureaus); E-students; Citizen scientists; and Professionals

Data Repositories Restrictions	Mandatory	Only for publications	Only for publications		Only for publications. This requirement will be included in the planned data policy, that will come into force soon.	Only for publications		Only for publications, but recommendations do exist for depositing and preserving research data.
	DMPs	Required by many major public funding sources	Currently optional, compulsory in next Research Programmes.		Currently recommended. It will be a mandatory requirement in the planned data policy, that will come into force soon.			Not required by the national funding agencies, may be part of the next funding cycle (starts 2023). People learning

								through participation in H2020 projects.
	FAIR	Most repositories provide or use a metadata schema	No explicit mention.		Data searching (planned or in place - 45%) and metadata searching (planned or in place - 40%)	Metasearchers available on particular web portals.	Most repositories provide or use a metadata schema	Only one-third of the participants have this service up and running. However, more than 30% of them are working on the feature. Metadata search is usually implemented. Repositories consider their data somewhat

								FAIR (50%)
	Access	Usually not restricted except in the case of sensitive data.	Usually not restricted except in the case of sensitive data.	On individual basis (dataset). No sensitive data is stored.	Usually not restricted except in the case of sensitive data.	Usually not restricted except in the case of sensitive data.	In some cases there are licenses preventing access from commercial users.	Repository dependent; special care taken of sensitive data. Most don't distinguish national users and users from abroad, but licences may be needed for access for commercial use

								(including royalties)

8.5. Awareness, Maturity and Interest Gap Analysis Data

				Countries						
Category	Indicator	Source	Proposed evaluation / scale	CZ	ES	NL	SK	PL	PT	UK

Awareness	The level of awareness about the EOSC amongst decision makers in the country is	Infosheet	1 - Very low 2 - Low 3 - Medium 4 - Medium high 5 - High	3	3	5 (in last year's spreadsheet ; I now think: 3/4 due to personnel changes in the ministry)	2	2	3	3
	Researchers awareness of the EOSC in practice is	Infosheet	1 - Very low 2 - Low 3 - Medium 4 - Medium high 5 - High	1	2	2	1	1	2	2
	Are researchers aware of what facilities are available to them?	Infosheet	1 - Very low 2 - Low 3 - Medium 4 - Medium high 5 - High	3	4	4	**2**	**2**	3	4

	Rules of Participations - See sub bullets below:										
	1. Are researchers aware of the rules of participation?	Infosheet	1 - Very low 2 - Low 3 - Medium 4 - Medium high 5 - High		1	2	1	**1**	**1**	1	1
	2. What's the level of awareness of the rules of participation among Service providers?	New	1 - Very low 2 - Low 3 - Medium 4 - Medium high 5 - High		1	2		**3**	**2**	2/3	2

	National activities/plans to raise EOSC awareness	P. Doorn/ WP5 brainst. Discussions	1 - Very few activities 2 - Few activities 3 - Medium activities 4 - Medium high activities 5 - High activities		2 (but plans to raise the awareness under official discussion)	3	2	4	2	2	2
	National incentives to align with EOSC	P. Doorn/ WP5 brainst. Discussions	1 - Very low incentives 2 - Low incentives 3 - Medium incentives 4 - Medium high incentives 5 - Strong incentives		Null at this moment, but plans are under official discussion	2	2/3	4	1	2	1

	National positive use cases?	P. Doorn/ WP5 brainst. Discussions	Narrative, not measurable		Not yet (at least not directly connected with EOSC)	EOSC-SYNERGY has 5 Thematic Services from Spain, as well as the support to the COVID-19 VO. There is activity from ESFRIs (e.g. ELIXIR contribution to the Spanish COVID19 EU portal) and other EOSC-related projects (such as the services registered in the EOSC		1 thematic service plus support of COVID 19 infrastructure	COVID-19 Data Portal	- EOSC Synergy - Thematic services - Worsica - COVID-19 Data Portal	COVID-19 Data Portal

					marketplace, being DEEPaaS a good popular example).					
	Training/Education- See sub-bullets below									

	Training on DMPs for researchers	New	Narrative		Fragmented landscape, individual teams/institutions are starting to introduce/work in this area	No official training, references on the project calls and initiatives (for example DIGITAL.CSIC - http://digital.csic.es/dc/politicas/preparacion-planes-gestion-datos.jsp).			Individual institutions are working on this area	Individual institutions are working on this area and share it with the community	Individual institutions are working on this area and share it with the community. The Digital Curation Centre http://www.dcc.ac.uk/ provides free online tools and guidance for DMPs. Training is available at a charge.

	Training on Making data FAIR	New	Narrative		Fragmented landscape, individual teams/institutions are starting to introduce/work in this area	No official training, actions from specific projects.		No official training	Individual institutions are working on this area	Individual institutions are working on this area and share it with the community	Individual institutions are working on this area and share it with the community. The Digital Curation Centre http://www.dcc.ac.uk/ provides free online guidance and training (charged).
	Training on Federated Cloud Tools	New	Narrative		Fragmented landscape, individual teams/institutions are starting to introduce/work in this area	No official training, actions from projects in the scope of EGI Federated Cloud mainly.			not known		

Interest	Perceived added value of EOSC by researchers	P. Doorn/ WP5 brainst. Discussions	**Null** **1** - Very low **2** - Low **3** - Medium **4** - Medium high **5** - High		1 (but just few really started to think about it)	3	1/2		2	2	3
	Participation in EOSC projects of service providers	P. Doorn/ WP5 brainst. Discussions	**Null** **1** - Very low **2** - Low **3** - Medium **4** - Medium high **5** - High		4/5	3	4		3	2/3	3

	Acceptance/implementation of FAIR principles	P. Doorn/ WP5 brainst. Discussions	**Null** **1** - Very low **2** - Low **3** - Medium **4** - Medium high **5** - High	1/2	2	3		2	2	3
	Acceptance of EOSC Rules of Participation among service providers	P. Doorn/ WP5 brainst. Discussions	**1** - Very low **2** - Low **3** - Medium **4** - Medium high **5** - High	Null/1	2	3		3	2/3	2
	Specific COVID-19 related examples/use cases	P. Doorn/ WP5 brainst. Discussions	Only temporarily relevant		EOSC-SYNERGY COVID19 VO and European Research			National COVID-19 data hub and research platform: https://covidh	COVID-19 Data Portal	COVID-19 Data Portal

					Data Platform from ELIXIR			ub.psnc.pl/eng/, EMBL-EBI		

9. Appendix C – List of Acronyms and Abbreviations

ANI National Innovation Agency in Portugal

CSTI Center for Scientific and Technical Information in Slovakia

DARIAH Digital Research Infrastructure for the Arts and Humanities in Poland

DCC Data Curation Center

DMP Data Management Plan

DORA San Francisco Declaration on Research Assessment

EduGAIN Interfederation service https://edugain.org/

EGI Advanced computing for research https://www.egi.eu/

EOSC SRIA Strategic Research and Innovation Agenda

FBC On-line collection of Polish cultural and scientific objects

FCCN National Scientific Computing Unit

FCT Portuguese Foundation for Science and Technology

FECYT Spanish Foundation for Science and Technology

GDP Gross domestic product

ICTS-RI Map of Unique Scientific and Technological Infrastructures in Spain

KOMIS National project in Slovakia

KPI Key Performance Indicator

MCTES Minister of Science, Technology and Higher Education in Portugal

MESRS Ministry of Education, Science, Research and Sport in Slovakia

MEYS Ministry of Education, Youth and Sports in Czech Republic

NCIP VaVaI National Centre for Information Support for Research, Development and Innovation in Czech Republic

NOSCI National Open Science Initiative

NPOS Netherlands Platform for Open science

OSS4R Platform 'One-Stop-Shop for Researchers in Czech Republic

PID Persistent identifiers

PIONIER Polish Optical Network Consortium and Infrastructure

PIONIER Id Polish Identity Provider

PMDIB Polish Road Map of Research Infrastructure

PRACE Partnership for Advanced Computing in Europe

RDM Research Data Management

RNIE Portuguese Roadmap of Research Infrastructures of Strategic Interest

SIVVP Slovak Infrastructure for High Performance Computing

SKOSC National Infrastructure in Slovakia

UKRI UK Research & Innovation

EOSC-related Glossary: https://www.eoscsecretariat.eu/eosc-glossary/post/december-2020-version-eosc-glossary-released