EUROPEAN COMMISSION

# Evaluation of the first implementation phase (2018-2020) of the European Open Science Cloud (EOSC)

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# 1. INTRODUCTION

## 1.1. Purpose and scope of the report

The Council Conclusions on the European Open Science Cloud (EOSC) of May 2018 [1] acknowledge the two-stage approach for the roll out of the EOSC, as introduced in the Commission Staff Working Document (SWD) on the Implementation Roadmap for the EOSC [2]. The first phase will be completed at the end of 2020, and the second phase, if such, will be supported if EU resources become available after 2020 (e.g. via Horizon Europe). The Council Conclusions underline that "(…) *the start of the second phase is dependent on an evaluation by the Commission and Member States of the first phase (...)*".

This assessment report provides a high-level evaluation of progress towards developing the European Open Science Cloud (EOSC) during its initial phase of implementation 2018-2020. The report has been produced by the Commission [3] to inform the Member States and Associated Countries on progress achieved based on information available until early September 2020. It aims to be submitted for opinion in the last quarter 2020 to the EOSC Governance Board (GB) and the Strategic Configuration of the Programme Committee for the specific programme implementing Horizon 2020 to which this board belongs.

## 1.2. Evaluation Questions

To address the request in the Council Conclusions in 2018, and considering that the Member States and Associated Countries have been fully involved in the implementation of the first phase of EOSC, the Commission services have produced this assessment report, taking into consideration of the study performed by the EOSC Secretariat [4] and annexed to this document (**ANNEX 2: EOSC SECRETARIAT STUDY**).

The baseline used for this assessment is the EOSC Implementation Roadmap (so-called "the Roadmap") communicated by the Commission in March 2018. In addition, the assessment also reflects upon a set of key evaluation questions along the lines of the evaluation SWD in accordance with the Commission's Better Regulation Guidelines. The report will address respectively the added value, the effectiveness, efficiency, relevance and coherence of the actions taken in the first phase of EOSC implementation (2018-2020), following the next principles:

- ✓ Relevance: assessment of whether EOSC as originally designed remains relevant;
- ✓ Effectiveness: assessment of the effectiveness of EOSC and the extent to which it has delivered against its objectives;
- ✓ Coherence: with other EU and national initiatives;
- ✓ EU added value: assessment of the value resulting from EOSC activities that is additional to the value that would have resulted from other initiatives at a national level.

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[1] http://data.consilium.europa.eu/doc/document/ST-9029-2018-INIT/en/pdf

[2] https://ec.europa.eu/research/openscience/pdf/swd_2018_83_f1_staff_working_paper_en.pdf

[3] DG RTD and DG CNECT

[4] H2020 project EOSCSecretariat: grant agreement number 831644 resulting from the call H2020-INFRAEOSC-05-2018-2019Horizon 2020: www.eoscsecretariat.eu

## 2. EOSC POLICY 'ROOTS'

The European Open Science Cloud (EOSC) has been a policy priority for European research and innovation since 2016[5]. The EOSC vision was presented as part of the *European Cloud Initiative*[6] as a key enabler to move rapidly towards Open Science and to maximise the growth potential of the European digital economy. The European Cloud Initiative outlined the EOSC as a process to develop a trusted, open environment for the scientific community for storing, sharing and reusing scientific data and results. Key elements associated to the EOSC in this Initiative included the deployment of a European super-computing capacity to process the data and the high bandwidth networks, via a European Data Infrastructure, for fast connectivity to transport the data.

In March 2018, the *Implementation Roadmap for the European Open Science Cloud*[7] was published as a Commission Staff Working Document. The proposed EOSC Roadmap reflected the outcome of an extensive consultation conducted with scientific and institutional stakeholders in 2016 and 2017. The Roadmap provided an overview of the implementation of the EOSC during its initial phase of implementation (2018–2020), with possible action lines, proposed orientations for appropriate governance and financing mechanisms, as well as measures taken under the Horizon 2020 programme to start implementing the EOSC.

In its conclusions[8] on the European Open Science Cloud of May 2018, the Council welcomed the Roadmap including the proposed EOSC federated model and a two-stage approach for the roll out of the EOSC. The Council took note of the planned support to the first phase of EOSC implementation by means of projects funded by the EU Framework Programme for Research and Innovation (Horizon 2020). It stressed the importance of coordinating the various ongoing and future projects funded by the EU Framework Programmes on EOSC. The Council also underlined that the start of the second phase is dependent on an evaluation by the Commission and the Member States of the first phase and without prejudice to the Multiannual Financial Framework after 2020.

The official launch of the initial phase of EOSC implementation (2018–2020) took place on 23 November 2018, under the Austrian Presidency of the Council of the European Union. The 'Vienna Declaration' was adopted by the participants at the end of the event confirming the vision laid down in the Roadmap. The event also introduced the EOSC Governance and the prototype of the EOSC Portal.

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[5] https://ec.europa.eu/research/openscience/pdf/EOSC_main_background_documents.pdf#view= fit&pagemode=none

[6] COM(2016) 178 final

[7] SWD(2018) 83 final

[8] 9029/18 RECH

**The extract from the Vienna Declaration[9] (23 November 2018)**

*We, "Ministers, delegates and other participants attending the launch event of the European Open Science Cloud (EOSC):*

- *Resolve to harness the many ongoing and planned activities at EU and Member States level to cooperate in establishing an inclusive partnership with a view to developing the European Open Science Cloud as a federated infrastructure that can enhance value-based, open, trusted, user-centric digital services across borders within the Digital Single Market (DSM).*

- *Invite all Member States, as well as public and private stakeholders in Europe, to support actively this joint effort and the new European Open Science Cloud governance structure for a successful implementation of the initiative.*

- *Call for the European Open Science Cloud to provide all researchers in Europe with seamless access to an open-by-default, efficient and cross-disciplinary environment for storing, accessing, reusing and processing research data supported by FAIR data principles.*

- *Commit to support service provision for the European Open Science Cloud by helping connecting relevant national and disciplinary nodes to the pan-European level.*

- *Reaffirm the potential of the European Open Science Cloud to enable first-class data-driven science and to stimulate new business models benefiting our society and the economy. Recognise that such services will create opportunities for both public and private sectors, notably by intensifying reuse of public sector information while preserving data integrity, and ensuring access, transparency within and across borders.*

    *We therefore declare to work together towards realising the potential of the European Open Science Cloud for the benefit of citizens, society and the economy."*

## 3. METHODOLOGICAL FRAMEWORK, LIMITATIONS AND ROBUSTNESS OF FINDINGS

### 3.1. Method

The evaluation of the Commission takes into account:

a) The Roadmap (SWD) (March 2018).
b) The outcome of the study by the EOSC Secretariat (July 2020).
c) Key deliverables in 2019 and 2020 by the EOSC Executive Board and the Governance Board

### 3.1.1. The EOSC Implementation Roadmap (SWD)

From a methodological perspective, the evaluation has been focussing on sources of information coming from the two main implementation mechanisms foreseen in the EOSC Roadmap:

✓ The batch of *grants* of direct EOSC relevance (Annex 1: list of H2020 Projects of direct relevance to the EOSC implementation) put in place by the Commission in response to H2020 calls (including the series of dedicated EINFRA and INFRAEOSC calls under the

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[9] https://eosc-launch.eu/declaration/

Horizon 2020 Work Programme 2018-2020 for European research infrastructures including eInfrastructures).

- ✓ The *interim 3-tier EOSC Governance structure* put in place by the Commission for the period 2018-2020, including:
  - the *EOSC Executive Board* set up by Commission Decision[10] to provide advice and support on the strategy, implementation, monitoring and reporting on the progress of the implementation of the EOSC;
  - the *EOSC Governance Board,* set up as a working-group of the Strategic Configuration of the Programme Committee for the specific programme implementing Horizon 2020, consisting of Representatives from the Member States, Associated Countries and the European Commission who jointly decide the implementation of EOSC;
  - the *Stakeholder Forum,* giving voice to the wider community of users, service providers, industry and public sector.

### 3.1.2. Study by the EOSC Secretariat

The EOSC Secretariat conducted a study in Q2 2020 to assess EOSC achievements from the perspective of the relevant H2020 grants supporting the first implementation phase of EOSC.

The study is largely based on an online survey conducted in May-June 2020 which targeted all H2020 projects of direct relevance to EOSC (some of them being already known and identified in March 2018 when the EOSC Roadmap was published). In addition, it also took into account of the opinion of the EOSC Executive Board (EB) on the items of the survey.

For each of the milestones identified against the action lines of the EOSC model described in the EOSC Roadmap, the survey did examine:

- ✓ The understanding of progress towards the milestone;
- ✓ Key results, outputs, quantitative indicators;
- ✓ Outstanding work required to reach the milestone by December 2020;
- ✓ Future outlook in case the milestone was perceived as likely not to be achieved.

With the responses of twenty-nine H2020 projects involving several hundreds of beneficiaries across the Union and Associated Countries, the survey offers insight into the *EOSC community perspective on the progress* of the first phase of the implementation along the six action areas (Architecture, Data, Services, Access & Interface, Rules of Participation, and Governance) defined in the EOSC Roadmap.

### 3.1.3. The key deliverables by the EOSC Executive and Governance Boards

In parallel to the grant approach surveyed by the EOSC Secretariat, the EOSC Executive and Governing Boards, supported by the Commission, have been actively steering the first phase of implementation of the EOSC. It is worth mentioning some of the key deliverables by these Boards: the EOSC Strategic Implementation Plan[11], the EOSC Work Plan 2020[12], the EOSC Partnership proposal[13], reports issued by the Executive Board Working Groups[14], as well as

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[10] C(2018) 5552 final

[11] https://ec.europa.eu/info/publications/european-open-science-cloud-eosc-strategic-implementation-plan_en

[12] https://www.eoscsecretariat.eu/news-opinion/eosc-work-plan-2020-published

[13] https://ec.europa.eu/info/files/european-open-science-cloud-eosc_en

outcomes form key events[15] such as the EOSC Consultation Day (online, May 2020), the EOSC Symposium (November 2019), the EOSC session at the 14th Plenary meeting of the Research Data Alliance (Helsinki, October 2019), the EOSC Concertation meeting (Brussels, September 2019) and the recurrent meetings held by the EOSC Governance Board and Executive Board.

## 3.2. Limitations

From a methodological perspective, the clear limitation of the assessment is the timing of the evaluation. The first phase of EOSC implementation will end on 31 December 2020. This cut-off date has been fixed to align with the end of the current Multi-Annual Financial Framework (2014–2020) of the Union, which provides, through Horizon 2020, the resources that have been committed to support the initial development of the EOSC. The end of 2020 also marks the termination of the mandate of the current EOSC governance structure. However, the project based implementation mechanism is still in progress with recently published calls for proposals and on-going projects. Some ongoing projects will present more results later this year; others that started later in 2020 should deliver in 2022. This time gap limits the precision of the analysis, provided here as wider impacts of initiated EU investments will continue emerging in the coming years.

## 4. IMPLEMENTATION STATE-OF-PLAY

The study conducted by the EOSC Secretariat to support the assessment of the first phase of EOSC implementation, has offered insight into the project community and Executive Board's perspectives on the progress of each of the six action lines of the Roadmap: Architecture, Data, Services, Access & Interface, Rules of Participation, and Governance.

To have an understanding of the state-of-play we need also to consider that the objectives and milestones identified in the SWD, issued in 2018, reflect expectations which have since evolved, but nevertheless remain a key point of reference for understanding the progress of the implementation of the first phase.

The study's survey recognizes that progress is being made towards many of the milestones in the SWD (Figure 1). A majority of respondents assessed that milestones have been partially reached, with more advanced deliveries regarding the policy for FAIR Persistent Identifier (D3) and the EOSC Catalogue of Services and EOSC Portal (S1&2). While the interpretation of each milestone's definition may vary from one to another respondent, it should be acknowledged that actions launched in the H2020 Work Programme 2018-2020 are still ongoing in all these fields and that only partial results are currently available.

Overall, we can derive some common key messages:
- there is a need to strengthen the coordination among the projects;
- community engagement should be reinforced based on a common understanding of EOSC values and benefits;
- policy development should be coupled to practical approaches and implementations (e.g. pilot testing);
- a clearer roadmap for on-boarding datasets and services in EOSC is desirable.

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[14] https://www.eoscsecretariat.eu/eosc-working-groups

[15] https://www.eoscsecretariat.eu/news-events-opinion/events

The Commission is confident that the more technical aspects of the listed key points will be addressed by the forthcoming H2020 projects. Other key points are clearly a call for a reinforced multi-stakeholder approach facilitated by the EOSC Association which shall help to increasing the level of coordination among the different parties involved in EOSC.

In the following paragraphs, the progress along each of the six priority areas (or action lines) is addressed in more details.
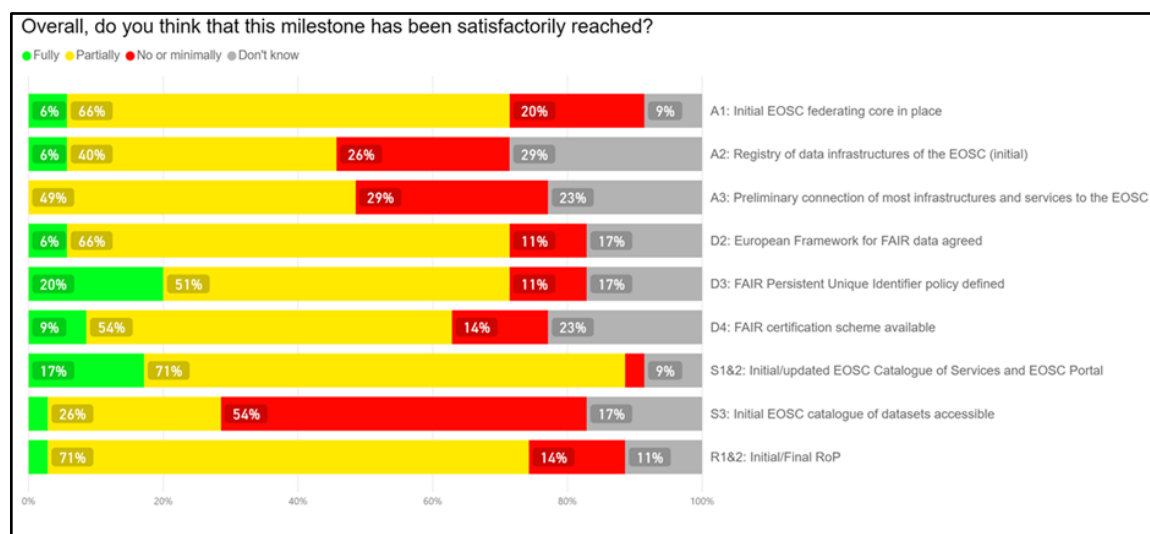


*Figure 1 - Achievement of milestones per SWD (Source: EOSC Secretariat study)*

## 4.1. Progress along the six priority areas in the EOSC Roadmap

### 4.1.1. Architecture

As per the Roadmap, the EOSC architecture would comprise a federating core and a variety of federated research data infrastructures committed to providing services as part of the EOSC. The federating core would include EOSC shared resources and a compliance framework including the Rules of Participation (see section 5.1.5). The federation of research data infrastructures would be implemented gradually, on a voluntary basis, based on the capacity, commitment and added value of infrastructures. The milestones below were foreseen:

| Starting from | Committed resources (nonexhaustive) | Action | Milestones |
|---|---|---|---|
| 2018, Q1 | - EOSC -hub project OpenAIRE-Advance project<br>- FREYA project | Develop initial EOSC federating core including the EOSC shared resources | Q4 2019: Initial EOSC federating core in place |
| 2019, Q1 | - EOSCpilot project<br>- INFRASUPP-01-2018-2019 (b3) | Develop catalogue of interested and eligible (per Rules of Participation) data infrastructures to be federated into the EOSC and identify EOSC federate centres | Q4 2019: Registry of data infrastructures of the EOSC (initial) |
| 2018, Q4 | - INFRAEOSC-04-2018 | Connection the research infrastructures identified in the ESFRI Roadmap to the EOSC. Support to this activity will be provided through cluster projects. | Q2 2020: Preliminary connection of most infrastructures and services to the EOSC |

*Table 1 – Milestones of the action line Architecture (Source: European Commission SWD)*

During the first implementation period, there has been significant progress on the implementation of the initial EOSC federating core. Indicatively, 329 integrated service providers have been on-boarded by December 2019, a year earlier than originally foreseen. There is also progress on the EOSC Catalogue of Services (https://catalogue.eosc-portal.eu/), the EOSC Portal (https://eosc-portal.eu/), the shared resources and the compliance framework.

Regarding the initial registry of data infrastructures of the EOSC, i.e. the catalogue of interested and eligible (per Rules of Participation) data infrastructures to be federated into the EOSC, the EOSC Catalogue and the EOSC Marketplace currently comprise 270 horizontal and thematic services. Thematic data infrastructures services and artefacts resulting from the Regional projects [16] dealing with the coordination of EOSC-relevant national initiatives, the Cluster projects[17] in charge of connecting ESFRI infrastructures and other Thematic Cloud projects, which were not referred in the Roadmap, are expected to be on-boarded in 2022-2023, enriching the diversity of the EOSC resources.

It should be noted that the Rules for Participation, including guidelines for the registration, on-boarding, assessment of compliance, etc., will be finalised by the EOSC Governance by the end of the year. Once approved, validation and monitoring tools will be developed, as well as mechanisms for automated bulk service on-boarding. This is still work in progress.

Regarding the preliminary connection of most infrastructures and services to the EOSC, in particular those of the INFRAEOSC-04-2018 ("Clusters") projects mentioned in the Roadmap, links have been established,. Thematic infrastructures have started registering their services in the EOSC catalogue, and the validation will be finalised soon after the endorsement of the Rules of Participation. Further work is needed on the federation of data, the interoperability of the thematic portals/catalogues operated by the Clusters' projects and the machine-actionable interfaces for automated on-boarding.

For future activities, there is strong need for better coordination and consolidation, both among the different projects, and between the projects and the future EOSC Governance. The project to be awarded under the INFRAEOSC-03-2020 call (currently under contract preparation) is expected to contribute to this end, and further consolidate and scale the EOSC Portal by 2023. Simplified processes, clear rules and common understanding of all EOSC components by the whole community are also needed.

Finally, the Working Group Architecture, set up by the Executive Board in Q2 2019, is currently reviewing key topics, such as the EOSC core services and their interfaces, open source APIs for reuse by thematic services, Portal components and federated catalogues of service offerings, data description standards and other standards and best practices necessary to ensure the evolution of EOSC and the widening of its user base to the industry and the public sectors. The results of the Working Group will be publicly available by the end of 2020.

### 4.1.2. Data

The Data priority area focuses on building a set of EOSC shared resources for data management that can contribute to the development of professional practices of research data management and stewardship in Europe. In particular, the actions included in the Roadmap were the following:

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[16] INFRAEOSC-05b-2018-2019
[17] INFRAEOSC-04-2018

| Starting from | Committed resources (non-exhaustive) | Action | Milestones |
|---|---|---|---|
| 2018, Q1 | - FAIR data Expert Group (E03464), in consultation with stakeholders | Prepare a FAIR data Action Plan | Q3 2018: FAIR data Action Plan published |
| 2018, Q3 | - DG RTD<br>- RDA Europe 4.0<br>- INFRAEOSC-05-2018-2019 (b) | Define a European framework for FAIR research data | Q2 2019: European framework for FAIR research data agreed |
| 2019, Q1 | - FREYA project<br>- RDA Europe 4.0 | Define a Persistent Unique Identifier policy for FAIR data | Q4 2019: FAIR persistent unique identifier policy defined |
| 2019, Q1 | - INFRAEOSC-05-2018-2019 (c) | Develop a FAIR data accreditation /certification scheme for repositories | Q4 2019: FAIR certification scheme available. |

*Table 2 – Milestones of the action line Data (source: European Commission SWD)*

According to the Roadmap, EOSC shared resources would be developed to cover all the aspects of FAIR data: findable, accessible, interoperable and re-usable. Therefore, together with the efforts foreseen by the projects, the EOSC Executive Board put together a Working Group dedicated to FAIR.

The starting point of this WG was the "FAIR Action Plan" proposed in the "Turning FAIR into reality"[18] report published in November 2018 by the FAIR Data Expert group. The adopted action plan constituted the achievement of the first milestone listed by the Roadmap. The report describes the broad range of changes required for the implementation of the FAIR data principles. It offers a survey and analysis of what is needed to implement FAIR and it provides a set of concrete recommendations and actions for stakeholders in Europe and beyond.

Together with the report "Turning FAIR into a reality", ongoing community initiatives and outputs from key projects like FAIRsFAIR, RDA Europe 4.0 and FREYA have continuously nurtured the work of the Working Group. Moreover, the WG has cooperated in close alignment with the EOSC Architecture Working Group.

According to the EOSC implementation first phase assessment report carried out by the Secretariat, there seems to exist an overall agreement that significant progress has been achieved in the area of FAIR data in relation to the other three milestones listed in the table. The foreseen actions are currently in an advanced status and thus, the milestones are considered by the most part of the community consulted as "partially implemented". This is coherent with the timeline established for the work of the FAIR Working Group and the other Working Groups of the Executive Board concerned in the achievement of these milestones, in which it is clear that work is still to be done during the last part of 2020. In a nutshell, this is the status for each of those milestones:

- **European framework for FAIR research data**: while theoretical framework and high level guidelines are already available, the operational implementation part is still work in progress with important elements being developed like the RDA Data Maturity Model

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[18] https://op.europa.eu/en/publication-detail/-/publication/7769a148-f1f6-11e8-9982-01aa75ed71a1/language-en/format-PDF/source-80611283

(endorsed and approved by RDA) and the EOSC interoperability framework documents, which are currently in consultation and are expected to be finalised later in the year. The EOSC FAIR WG will also propose FAIR metrics and certification by the end of 2020.

- **FAIR persistent unique identifier policy**: the Task Force on PID policies - a sub-group of the EOSC Architecture Working Group, FAIR Working Group and the FREYA project – has developed a draft Persistent Identifier (PID) policy for EOSC released in December 2019 for consultation with the community. Overall, the policy document seems to be considered as a good policy framework, covering a broad range of identifiers needed for data and other outputs, researchers, organisations, funders, research activities, services and other entities. However, the current draft does not sufficiently develop implementation approaches. The final policy is expected to be delivered to the EOSC Governance Board in the last quarter of 2020 and include concrete implementation guidelines.

- **FAIR Certification scheme for repositories**: The FAIRsFAIR project has been tasked with supporting the co-development and implementation of certification schemes for data repositories. The recommendations and outcomes of this project will be taken up in the INFRAEOSC National Initiative and ESFRI Cluster projects. The FAIR Working Group has been liaising closely with FAIRsFAIR and others undertaking activities on assessing services to ensure the EOSC is a trusted environment with appropriate functionality. Two initial consultation papers were released in early 2020[19]. These detail existing work and the considerations to specify initial metrics for FAIR data and frameworks for service certification.

- **EOSC examples of FAIR data progress by thematic communities**: The European COVID-19 Data Platform, developed under the EOSC umbrella by the European Commission together with EMBL-EBI, ELIXIR, and other partners enables researchers to store, share, access, analyse and reuse research data and metadata on COVID-19 more rapidly, openly and effectively. The Platform is a priority pilot of EOSC that demonstrates how different data types can be made interoperable and available for accelerating research. The data offering ranges from omics, pre-clinical research, clinical trials and observational studies, to microbiome data, serology data, patient-level clinical data, epidemiological data and other data flows from the Social Sciences and Humanities. The Platform is now in the process of harmonising and linking the genetic data on the virus, and genetic data on the patients, with the clinical data of the patients, as well as other data such as behavioural data. H2020 projects contributing to this effort include the ESFRI cluster project EOSC-life and ELIXIR-Converge. EOSC-Life and ELIXIR-CONVERGE provided input to the European Commission's Guidelines for Open Access to Publications, Data and Other Research Outputs. These guidelines were aimed at all research projects managing data related to the COVID-19 outbreak, specifically the nineteen funded projects under the SC1-PHE-CORONAVIRUS-2020 call, and provide standards and repositories for researchers to adhere to, enhancing the FAIRness and interoperability of their data, as well as detailed deposition guidelines for an efficient interaction with the European COVID-19 Data Platform.

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[19] https://www.eoscsecretariat.eu/eosc-liaison-platform/post/interim-recommendations-fair-metrics-and-service-certification-apply

The other four ESFRI clusters have also delivered initial actions to improve data FAIRness and enhance data interoperability. For instance, the project ENVRI-FAIR is gradually implementing a FAIR roadmap for atmospheric data, marine data, as well as biodiversity data.

### 4.1.3. Services

As per the Roadmap, EOSC could offer five main types of services: a unique identification and authentication service and an access point/routing system to EOSC resources; a protected and personalised work environment/space; access to relevant service information (status of the EOSC, policy info, etc.) and guidelines; services to find, access, re-use and analyse research data generated by others, accessible through appropriate catalogues; services to make data FAIR, to store them and ensure long-term preservation. The below milestones were foreseen:

| Starting from | Committed resources (non-exhaustive) | Action | Milestones |
|---|---|---|---|
| 2018, Q2 | - EOSC-hub project<br>- eInfraCentral project OpenAIRE-Advance project<br>- INFRAEOSC-01-2018<br>- INFRAEOSC-04-2018<br>- INFRAEOSC-05-2018-2019 (b)<br>- INFRAEOSC-02-2019<br>- INFRAEOSC-03-2020<br>- INFRAEOSC-06-2019-2020 (a)<br>- INFRAEOSC-06-2019-2020 (b) | Develop **initial catalogue of services** to be provided via the EOSC (to be enriched periodically) and define delivery model(s) | Q4 2018: Initial EOSC Catalogue of services accessible & prototype EOSC Portal accessible<br><br>Q4 2019: Updated EOSC Catalogue of services & EOSC Portal |
| 2018, Q2 | - EOSCpilot project<br>- EOSC-hub project<br>- INFRAEOSC-04-2018<br>- INFRAEOSC-05-2018-2019 (b) | Develop **initial catalogue of datasets** accessible via the EOSC (to be enriched periodically) | Q2 2019: Initial EOSC Catalogue of datasets accessible. |

*Table 3 - Milestones of the action line Services (Source: European Commission SWD)*

The EOSC Catalogue of services (https://catalogue.eosc-portal.eu/) and the EOSC Portal (https://eosc-portal.eu/) have been developed and contain a good number of entries (currently, 270 horizontal and thematic services). However, there is still need for a more user friendly and interactive Catalogue, connecting supply and demand of services. There is still work on monitoring and assessing services, and making them interoperable. Commercial services that are currently provided under the project funded under the INFRAEOSC-01-2018 call (OCRE) are not yet integrated in the EOSC Portal. Many of these issues will be addressed under the INFRAEOSC-03-2020 project (currently under contract negotiation) that foresees further consolidation and scaling of the EOSC Portal by 2023.

Regarding datasets, there are some catalogues/repositories registered as "services" in the EOSC. However, there is still significant work to be done for creating a distinctive entry point for all

datasets in the Catalogue, and increasing the resources (e.g. according to an on-boarding roadmap).

For future activities, there is clear need for increasing the utility of the Catalogue, assessing its applicability, enriching it and enhancing its interoperability. Finally, the added value of the Catalogue should be clear for the end users, the service providers and national authorities that could contribute to its long-term sustainability.

### 4.1.4. Access & interfaces

As per the Roadmap, there could be different entry points for accessing EOSC services ensuring a smooth transition from legacy research data systems (in contrast to implementing a single access point). These entry points would consist of web-based user interfaces, tailored to the specific needs of particular user communities. In addition, a common platform, building on the EOSC-hub and EOSC-Enhance projects, would be accessible via machine-to-machine interface, offering access to the full range of EOSC services.

In addition, the EOSC Portal, acting as a *universal entry point for all potential users*, would have a full-fledged user interface supported by the common platform. There were no milestones foreseen in the Roadmap, however, there is a degree of overlap with the milestones for 'Services' and 'Architecture'.

Currently, the EOSC Portal is operational and further developed by the INFRAEOSC-06-2020 (EOSC-Enhance) project that started in December 2019. Other projects have also planned, or already implemented, entry points either on regional (e.g. EOSCNordic), or thematic (e.g. PaNOSC for Photon Neutron Open Science Cloud) basis. Some of these Portals plan to extend their resources to software and tools that may not be suitable/compatible with EOSC.

The project to be awarded under INFRAEOSC-03-2020 call aims to consolidate the different approaches and boost a common understanding and approach on the EOSC Portal and the other entry points.

### 4.1.5. Rules

A specific action line of the Roadmap foresees the development of Rules of Participation that take into account of established practices and current needs of all researchers and service providers. More specifically, the "Rules action line" of the EOSC model included the following two milestones:

| Starting from | Committed resources (non-exhaustive) | Action | Milestones |
|---|---|---|---|
| 2018, Q2 | - DG RTD<br>- EOSCpilot project<br>- EOSC-hub project<br>- High Level Expert Group EOSC<br>- INFRAEOSC-05-2018-2019 (a) | Develop Rules of Participation in consultation with stakeholders | Q1 2019: Initial EOSC Rules of Participation<br><br>Q4 2019: Final EOSC Rules of Participation |

*Table 4 - Milestones of the action line Rules (source: European Commission SWD)*

To achieve this objective, the Executive Board has set up in Q2 2019 a dedicated Working Group (the "*RoP Working Group*")[20] tasked to recommend a minimal set of clear Rules of Participation that shall define the rights, obligations and accountability governing all EOSC transactions by the various EOSC users, providers and operators. The RoP WG has met on a monthly basis since June 2019.

As groundwork for this task, the RoP Working Group has been able to build upon several reports and briefings including by the Commission, the EOSCPilot H2020 project[21], and the Commission High Level Expert Group on the EOSC[22] (just to mention a few).

As reported in the EOSC Work Plan 2020[23], feedback by the research community on key questions and directions for the Rules of Participation was called for at the EOSC Symposium in Budapest in November 2019. A first version of the Rules was released for feedback by the EOSC Governance in Q1 2020 and by the wider community in Q2 2020 (online public consultation in March-April 2020).

Further iterations will take place within the Executive Board till Q3 2020, notably to align the final Rules with latest outcome by the other Working Groups of the Executive Board. A consolidated version of the Rules will be presented at the EOSC Symposium on 19-22 October 2020. A final version should be ready for handover in Q3 2020 alongside *living* commentary guidelines for the interpretation of the Rules and a proposal for a concrete process to implement the Rules after 2020. The assumption made by the RoP Working Group is that the EOSC Association could take ownership of the Rules as part of its bylaws and define a process for the revision of the Rules which is anchored in its governance.

Overall, there appears to be a high degree of confidence that the milestones defined in the EOSC Roadmap will be reached by the end of 2020.

### 4.1.6. Interim governance

The EOSC Roadmap called for a stable, inclusive and effective governance mechanism for the implementation of the EOSC to help prevent duplication of efforts and isolated solutions, as well as to streamline decision-making on research data sharing through a 'one-stop shop' in Europe. The model proposed in the EOSC Roadmap consisted in a multi-level and multi-stakeholder governance with clear institutional, executive and advisory roles supporting strategic functions such as setting the long-term orientation and priorities, setting out key performance indicators or deciding on compliance. The EOSC Roadmap introduced a two-staged approach with a first (interim) governance structure till 2020 entailing steering and oversight of the initial development of the EOSC primarily led by the Member States and the Commission, and a second governance structure becoming more stakeholder-driven, with Member States and the Commission keeping a higher-level oversight role.

More specifically, the "Governance action line" of the EOSC model included the following two actions and milestones:

| Starting from | Committed resources (non-exhaustive) | Action | Milestones |
| --- | --- | --- | --- |

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[20] https://www.eoscsecretariat.eu/working-groups/rules-participation-working-group

[21] https://eoscpilot.eu/content/d25-recommendations-minimal-set-rules-participation

[22] https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/5253a1af-ee10-11e8-b690-01aa75ed71a1

[23] https://op.europa.eu/en/publication-detail/-/publication/3c379ccc-ee2c-11e9-a32c-01aa75ed71a1

| 2018, Q1 | - EC, with support of EOSCpilot project, High Level Expert Group EOSC, OSPP and other sources | Set up the EOSC governance framework in consultation with MS | Q4 2018: EOSC Governance established |
|---|---|---|---|
| 2019, Q1 | - INFRAEOSC-05-2018-2019 (a) | Prepare legacy for 2nd implementation phase (post 2020) | Q3 2020: Recommendations on strategic and financing orientations and organisational settings for the future of the EOSC, post 2020 |

*Table 5 - Milestones of the action line Governance (Source: European Commission SWD)*

In consultation with the Member States, the Commission succeeded to set up - in a very short timeframe – a three-level EOSC governance structure. This governance structure was unveiled at the EOSC launch event in November 2018. Progressively put into motion in early 2019, this governance structure includes:

- A **Governance Board**[24] (GB) with the Member States, Associated Countries and the Commission. This Board is constituted as a formal Working Group of the Strategic Configuration of the Horizon 2020 Programme Committee;

- An **Executive Board**[25] (EB) composed of three independent experts and eight representatives of organisations with a Pan-European research mandate. Following an open call for applications managed by the Commission and an evaluation by an independent group of experts nominated by the Commission, this board has been constituted in 2018 by Commission decision[26] as an Expert Group to the Commission. In the course of 2019, the Executive Board has convened a series of Working Groups and Tasks Forces involving about a hundred of experts to help reviewing the state-of-the-art in EOSC priority areas, to help providing strategic recommendations and to link to relevant H2020 projects and national or community initiatives;

- A **Stakeholders Forum**[27] consisting of annual Stakeholders Forum Events organized by the EOSC Secretariat, as well as the EOSC Liaison Platform, an online discussion environment that allows the collection of input and provision of feedback to EOSC Governance bodies.

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[24] https://ec.europa.eu/research/openscience/pdf/ec_rtd_eosc-governance-board-delegates.pdf#view=fit&pagemode=none

[25] https://www.eoscsecretariat.eu/eosc-governance/eosc-executive-board

[26] C(2018)5552 - COMMISSION DECISION of 27.8.2018 Setting up the Expert Group - Executive Board of the European Open Science Cloud ('EOSC') and laying down rules for its financing
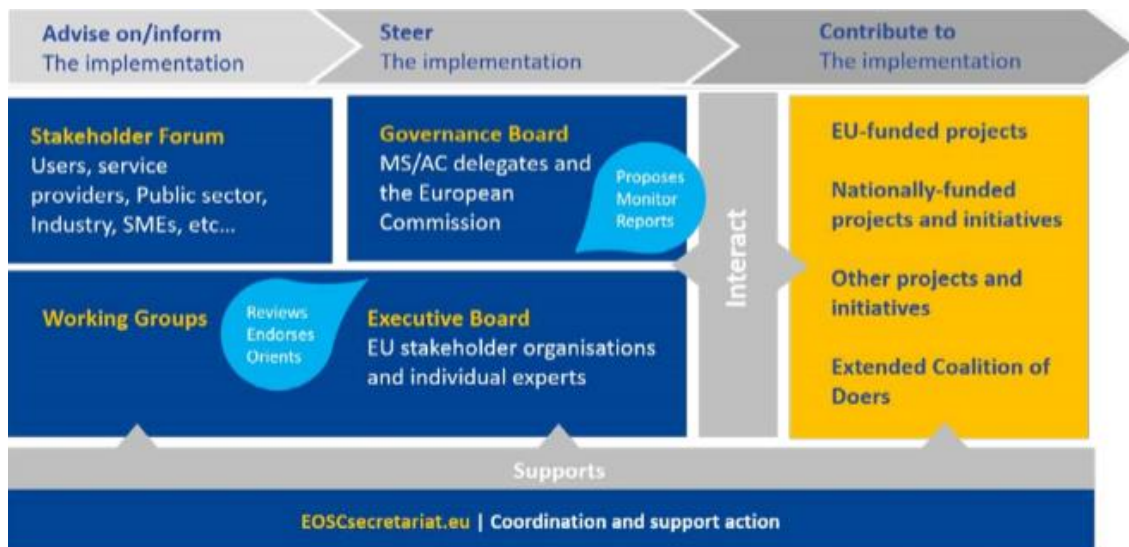
[27] https://www.eoscsecretariat.eu/eosc-governance/eosc-stakeholder-forum

*Figure 2 - EOSC Governance*

This (interim) EOSC Governance has received the mandate [28] to steer the first phase of implementation and to establish a cooperation between the Commission and R&I stakeholders on questions relating to the Implementation Roadmap for the EOSC in coordination with the Member States. This governance is playing an essential role to build ownership and momentum until 2020 and to co-create the transition to the second phase of development of the EOSC after 2020.

Secretariat support started in Q1 2019 following the kick-off of the H2020 project EOSCSecratariat.eu [29]. With continuous support of the Commission, the EOSC governance structure came progressively into operations in the period Q1 to Q3 2019. Pre-requisites included the adoption of Terms of References for the two EOSC Boards (GB and EB), the completion of the nomination process involving the Members States and Associated countries, the development of an interaction process between the two Boards. The organisation of team building events involving members of the whole Governance structure greatly contributed to consolidate the common vision and collaborative spirit required within and across the structure.

The Work Plan 2020 produced by the Executive Board outlines the key deliverables expected during the first implementation phase. Some of them have been delivered (interim versions) in the first 6 months of activity. They include:

- ✓ Strawman and Tinman versions of the report Solutions for a sustainable EOSC (Sustainability Working Group);
- ✓ Report on the landscape of EOSC relevant national infrastructures, funding models, strategies and policies (Landscape Working Group);
- ✓ A draft Persistent IDentifier (PID) Policy[30] (FAIR Working Group);
- ✓ Initial Rules of Participation[31] (RoP Working Group);
- ✓ Initial papers on FAIR metrics[32] and service certification[33] (FAIR Working Groups);

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[28] Setting up the Expert Group - Executive Board of the EOSC and laying down rules for its financing C(2018) 5552 final (2018)

[29] https://www.eoscsecretariat.eu/about-us

[30] Second draft Persistent Identifier (PID) policy at https://zenodo.org/record/3780423#.X1IkbExuK3A

[31] Draft for consultation at https://repository.eoscsecretariat.eu/index.php/s/QWd7tZ7xSWJsesn#pdfviewer

[32] Draft for consultation at
https://repository.eoscsecretariat.eu/index.php/s/C3a5WkpsFHL6GD3#pdfviewer

[33] Draft for consultation at https://repository.eoscsecretariat.eu/index.php/s/zCnHTcytBHaLjRp#pdfviewer

✓ A [partnership proposal](#) for the continuation of EOSC as a Co-Programmed Partnership of Horizon Europe (Executive Board).

In addition, the EOSC Secretariat has commissioned a number of studies requested by the Executive Board to help defining the second phase of EOSC implementation. These studies will deliver in Q3 2020 and will help the relevant EB Working Groups to produce their final recommendations by the time of the EOSC symposium.

In order to provide final recommendations on the topics above, the Executive Board is also planning to submit in Q4 2020 the following additional strategic deliverables:

✓ A legal entity and post 2020 governance structure (Landscape & Sustainability WGs)
✓ A Strategic Research & Innovation Agenda (SRIA) (Executive Board)
✓ A Multi-Annual Roadmap (MAR) (Executive Board)
    ✓ AAI Principles and Architecture document (Architecture WG)
    ✓ PID Technical Architecture document (Architecture WG)
    ✓ EOSC Interoperability Framework[34] (FAIR, Architecture and RoP WGs)
✓ Training catalogue specifications, a minimal skill set for EOSC, and organisational models for competence centres (Skills and Training WG)

In conclusion, one can note that the objectives of the 'Governance action line' of the EOSC Roadmap have been fully achieved in the period 2019–2020.

## 4.2. Relevance, efficiency, effectiveness, coherence and EU added value

### 4.2.1. Relevance

Open Science[35] and Open Innovation[36] have been policy priorities for the Commission since May 2016[37]. They continue to be widely recognised as key transformative, enabling elements of the European R&I policy driving a renewed European Research Area (ERA).

The momentum existing at European level offers the opportunity to set a coherent Open Science policy framework among the EU Member States. The landscape of policy development across Europe regarding open science and EOSC presents a positive situation (according to a survey run by the Landscape Working Group of the EOSC Executive Board[38]):

- Almost all EU Member States and Associated countries have research evaluation policies in place but generally linked to bibliometric methods;
- The majority (61%) of the Member States and Associated Countries have policies in place regarding open access to scholarly publications, but only 34% have defined policies regarding FAIR data (though encouragingly 44% have one either in planning or under development).
- Relatively few countries (21%) mention EOSC in their policies, but 38% plan to do so in the future.

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[34] Draft for consultation at https://www.eoscsecretariat.eu/sites/default/files/eosc-interoperability-framework-v1.0.pdf

[35] Open Science will help Europe benefit from digitisation and support new ways of doing research and innovation as well as opening up access to research data and results via digital technologies and collaborative tools.

[36] Open Innovation will help Europe to capitalise socially and economically on research and innovation results by bringing more actors and investments into the research and innovation process.

[37] https://ec.europa.eu/digital-single-market/en/news/open-innovation-open-science-open-world-vision-europe

[38] EOSC Landscape report published in Q32020 https://op.europa.eu/en/publication-detail/-/publication/cbb40bf3-f6fb-11ea-991b-01aa75ed71a1/language-en/format-PDF/source-155851248 , figures might need some correction

The objectives of EOSC are today more relevant than ever. EOSC can become the Open Science commons serving all European researchers, addressing challenges, such as:

- The exponential growth in the quantity of research data;
- The fact that science and innovation becoming increasingly data-intensive;
- The need to bridge existing European infrastructures and to connect research data silos by creating interoperable data commons addressing global challenges;
- The need to connect research data with robust computing technologies and fast connectivity networks to allow mastering and (re)using the increasing volumes and complexity of research data;
- The policy drive for Open Science and Open Innovation in Europe, requiring more coordination at institutional, national and European levels.

### 4.2.2. Efficiency

*Horizon 2020 contribution*

The Commission has provided the planned financial and programmatic support to start implementing the EOSC along the six action lines foreseen in the EOSC Roadmap (data, services, architecture, access, rules and governance). Actions of direct EOSC-relevance were included in the European Research Infrastructures (including e-Infrastructures) Work Programme 2016-2017 (€70m under the calls "European Open Science Cloud for Research", "Data and Distributed Computing e-infrastructures for Open Science" and "Platform-driven e-infrastructure innovation") and Work Programme 2018-2020, (€250m under the a-dedicated Call entitled "*Implementing the European Open Science Cloud*"). The latter call aimed to help realising an EOSC that truly supports interdisciplinary research and Open Science, responds to the emerging needs of the scientific community and supports the whole research data lifecycle.

The proposed model supported by the Call was considering the development of an EOSC ecosystem and its pan-European service access mechanism – the EOSC hub – providing all European researchers with seamless, non-discriminatory and secure access to public and commercial services and appropriate access modalities to a wider user community like industry, public sector, citizen scientists, etc. The Call was designed to support, amongst other things, the coordination between national initiatives aiming at making data FAIR, as well as the connection to the EOSC of priority European Research Infrastructures (in particular the ESFRI ones) susceptible to share a wealth of services and curated resources in a wide range of scientific domains. The Call was also supporting the piloting of innovative financial schemes and/or pan-European joint procurements for storage, computing, software and other resources or services in close conjunction with funders in Europe, with the objective to seize opportunities arising from an aggregated demand by the researchers. Finally, the Call also supported the setup of an appropriate EOSC Governance taking into account the outcomes of previous efforts and the active contribution of all scientific stakeholders.

*Overview of all EOSC related Calls*

**Call H2020- INFRADEV-04-2016: European Open Science Cloud for Research**

**Call H2020-EINFRA-12-2017: Data and Distributed Computing e-infrastructures for Open Science**

**Call H2020- EINFRA-21-2017: Platform-driven e-infrastructure innovation**

**Call H2020-INFRAEOSC-2018-2020 - Implementing the European Open Science Cloud**[10]

- INFRAEOSC-01-2018: Access to commercial services through the EOSC hub
- INFRAEOSC-02-2019: Prototyping new innovative services
- INFRAEOSC-03-2020: Integration and consolidation of the existing pan-European access mechanism to

- public research infrastructures and commercial services through the EOSC Portal
- INFRAEOSC-04-2018: Connecting ESFRI infrastructures through Cluster projects
- INFRAEOSC-05-2018-2019: Support to the EOSC Governance
- INFRAEOSC-06-2019-2020: Enhancing the EOSC portal and connecting thematic clouds
- INFRAEOSC-07-2020: Increasing the service offer of the EOSC Portal

EOSC has driven a wide R&I agenda in Horizon 2020 since 2016. The call for proposals/grant approach used in Horizon 2020 has been successful to prototype the EOSC in its initial phase of implementation. It has allowed to engage a wide range of research institutions across countries and communities and to run parallel research investigations on a wide range of questions related to the EOSC. This EU grant approach has delivered (is still delivering) a rich series of results such as use cases, demos, data service tools and policy documents of direct EOSC-relevance.

At the same time, lessons learnt during the initial phase of EOSC implementation show that:
- The succession of H2020 calls has generated EOSC-related projects with different timelines for delivery;
- Developing and implementing collaboration agreement between projects requires time and resources;
- In general, there is no guaranteed follow-up after the end of the projects' lifetime; EOSC requires, in addition to a grant-approach, a structural transition towards longer term, largely self-supporting, community-driven structures;
- Given that Horizon 2020 beneficiaries own the results they generate, legal arrangements have to be made if an EOSC entity needs to exploit these results afterwards.

The Commission – with help from the EOSC Secretariat – has been making all efforts to facilitate collaboration between the projects themselves, as well as between the projects and the Executive Board and its Working Groups. A series of thematic webinars and concertation meetings have been organised in order to collect evidences and use cases, to trigger joint activities, exchange best practices or contribute to the stocktaking exercise undertaken by the Executive Board. The Joint project workshop[39] organised by the Commission on 9–10 September 2019 illustrates this joint effort to bring the INFRAEOSC community together and inform it about respective EOSC activities. Some 100 stakeholders representing the EOSC Governance bodies and more than thirty EOSC-related H2020 projects participated in a series of breakout sessions and intense discussion designed to identify key assets, coordinate efforts, exploit synergies and, ultimately, build collectively an EOSC which is greater than the sum of its parts.

Other coordination mechanisms have been explored by the Commission such as the development of collaboration agreements between relevant H2020 consortia with the objective to foster and create synergies in the mutual activities related to EOSC and avoid unnecessary overlaps. Typical examples include the agreements between flagship projects supporting directly the EOSC governance: a Memorandum of Understanding (MoU) was signed between the projects EOSC-hub, OpenAIRE Advance, eINFRACentral and EOSC Enhance for joint activities and monitoring of the EOSC Portal and the EOSC catalogue of services, as well as between the FAIRsFAIR project [40] Fostering Fair Data Practices in Europe and the EOSC Secretariat [41]. Another collaboration agreement was established between the five research and innovation actions helping with the coordination of EOSC-relevant national initiatives across Europe (INFRAEOSC-05b), allowing for a joint approach to provide more complementary and coherent information and relevant data at pan-European scale.

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[39] https://www.eoscsecretariat.eu/news-opinion/eosc-concertation-report-public
[40] https://www.fairsfair.eu/
[41] https://www.eoscsecretariat.eu/

The Commission also embedded a cluster approach in the topic call supporting the connection to the EOSC of research infrastructures identified in the ESFRI Roadmap (INFRAEOSC-04-2018). The five Science Clusters projects[42] resulting from this call involve forty-five ESFRI research Infrastructures and other national research infrastructures in their work. They meet regularly to coordinate the interfaces of their projects with other EOSC stakeholders, with the pan-European e-infrastructures, with the EOSC secretariat and the ESFRI EOSC Task Force. They have written position papers[43] expressing their expectations and planned contributions to the EOSC. The "cluster action" is recognised as a powerful enabler of European research excellence and competitiveness. A strong enabler comes from the formal commitment to these clusters of the management boards of pan-European RI and research organizations. Through this approach, the cluster action has helped to implement a cross-fertilization of the innovation environment by federating large scientific communities. The five Science Clusters are helping to engage more researchers in the co-design of the EOSC and to enhance researchers' Open Science practices.

Finally, to ensure the sustainability of the EOSC Portal, the project to be awarded under the INFRAEOSC-03-2020 call for proposals, has the contractual obligation to use open source software, and make tools, standards, specifications and all other relevant outputs generated in the action available, through a well-defined mechanism, to the EOSC governance and any other institution responsible for the continuity of the EOSC Portal beyond the lifespan of the Grant Agreement.

### 4.2.3. Effectiveness

As presented in the Commission's vision for the European Open Science Cloud (EOSC) in April 2016 within the Communication on the 'European Cloud Initiative', the objective of the EOSC was to give the Union a global lead in research data management and ensure that European scientists reap the full benefits of data-driven science, by offering "1.7 million European researchers and 70 million professionals in science and technology a virtual environment with free at the point of use, open and seamless services for storage, management, analysis and re-use of research data, across borders and scientific disciplines".

The European Open Science Cloud has been an incremental process, building upon a working infrastructure already and a €320 million (see section **EFFICIENCY**) invested into the early stages of the initiative. Results stemming from the EOSC related activities are starting to be visible. This is especially true for:

✓ Enabling interdisciplinary research.

The launch of initial EOSC projects and the work of the Commission expert group on FAIR data has allowed agreement on the shared FAIR principles that are now at the core of EOSC.

Within the report "Turning FAIR in Reality", several components of a FAIR ecosystem were proposed that address the core metadata and identifiers, as well as the policies, plans and repository services to enable FAIR. Task Forces within the Architecture and FAIR Working Groups of the EOSC Executive Board delivered recommendations on: a Persistent Identifier (PID) policy, FAIR metrics, repository certification, AAI protocols, common APIs and the overall EOSC Architecture. Jointly an EOSC Interoperability Framework is being designed which will specify base level requirements for semantic, legal, technical and organisational interoperability, ultimately enabling interdisciplinary research.

✓ Connecting research data silos and ensuring seamless access.

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[42] ENVRI-FAIR, EOSC-LIFE, ESCAPE, PaNOSC, and SSHOC
[43] https://zenodo.org/record/3675081#.XomdZHtS8uW, DOI 10.5281/zenodo.3675081

The on-going EOSC related e-infrastructures projects, together with initiatives promoted by thematic research infrastructures such as the ESFRIs, EIROForum and open (national) infrastructures, are identifying the common and the specific services that are potentially intended for populating and continuously enriching the EOSC. Moreover, the Member States are supported by the 'EOSC regional projects' (topic INFRAEOSC-0515) to identify national and local services that have the potential to be on-boarded in the federated environment.

Although further integration effort would be required for a coherent and seamless EOSC environment (especially around data management), the EOSC portal, catalogue of services, AAI, on-boarding process have been implemented or are in an advanced state.

A growing number of thematic and generic data-related services can be discovered in the EOSC service catalogue and used by European researchers.

✓ Preliminary connection of research infrastructures (RIs) to EOSC.

The connection has been established and thematic RIs have started registering their services within the EOSC catalogue. The cluster projects' engagement with EOSC is "work in progress", and more results are expected towards the end of the year, including a clear model to federate and on-board thematic communities into EOSC.

### 4.2.4. Coherence

During the first phase of EOSC implementation, the landscape of EOSC-relevant infrastructures and initiatives has been mapped in close collaboration with the Member States and Associated Countries. This was achieved via a series of surveys[44] and other activities to collect information by the national authorities. The resulting overview is presented in the report '*Landscape of EOSC-Related Infrastructures and Initiatives*'[45] by the Landscape Working Group of the EOSC Executive Board.

The report shows that many European countries have EOSC-relevant policies either planned or in place. The majority of the Member States and Associated Countries (61% of the respondents) have policies in place regarding open access to scholarly publications. Only 34% have active policies on FAIR data, but 44% have a FAIR data policy either in the planning or under development. The report also highlights that clear potential exists of federating existing e-infrastructures to the EOSC. Most countries have confirmed that the identification of EOSC-ready infrastructures is ongoing; the reports notes that at least twelve countries are already well advanced in identifying such EOSC-ready e-infrastructures.

The report also stresses that there has been significant investments across Europe in e-infrastructures and data-oriented research infrastructures that could be federated to the EOSC. While getting definitive information on related investments at national level, there is a clear motivation by Member States and Associated Countries to align relevant policies and strategies around the EOSC. The co-programmed EOSC Partnership is seen as an appropriate mechanism to help aligning national investments or federating access to national capacities through the EOSC.

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[44] With contribution from several H2020 projects arising from Call INFRAEOSC-05-2018-2019: Support to the EOSC Governance, sub-topic (b) Coordination of EOSC-relevant national initiatives across Europe and support to prospective EOSC service providers

[45] https://op.europa.eu/en/publication-detail/-/publication/cbb40bf3-f6fb-11ea-991b-01aa75ed71a1

*Towards a European partnership approach*

There is a need to move from the current Horizon 2020 approach to a wide and inclusive partnership in Horizon Europe with clear directionality and additionality characteristics at EU, national, community and institutional levels.

EOSC addresses the European/global challenge of excellent research in a context of data-intensive science. This challenge cannot be fully addressed nor by the Union alone nor by any Member State or associated country in isolation. Developing wider synergies between multiple EOSC stakeholders will be essential to realise the EOSC ambition.

The motivation by all Member States to establish an EOSC co-programmed partnership in Horizon Europe has been clearly expressed through the EOSC Governance Board since Q4 2019. This reflects a general interest by the Member States to target the whole research ecosystem in Europe and not only the EU tier implemented through calls. Such a partnership would strengthen ownership by the research communities, achieve scale by aggregating demand by researchers and other users and pool existing capacities at European, national and regional levels. An EOSC partnership can be seen as a means to get commitments to realise the EOSC Core and expand it iteratively – possibly with new partners - to realise the wider, trusted and open EOSC distributed environment.

The need for a continued R&I agenda supporting EOSC development in the period 2021–2027 has been acknowledged in several meetings of the EOSC Governance. A partnership approach to EOSC R&I is now agreed as the means to achieve the ambitions and policy objectives set for EOSC.

### 4.2.5. EU added value

*EOSC and the European Data Strategy*

The European Data Strategy (released by the Commission[46] in February 2020) recognises EOSC as the nucleus for a science, research and innovation data space, which shall become articulated with the nine new sectoral data spaces foreseen by the Strategy. These new data spaces shall build on the ongoing EOSC experience gained with the research community. Therefore, there is huge opportunity to exploit the EOSC as a flagship example of synergies between EU policies given its role in the renewed ERA, the European Data Strategy and more widely the European data economy.

*Possible EOSC role to safeguard data sovereignty*

President von der Leyen presented EOSC at the World Economic Forum in Davos as "an enormous repository of research results that is due to go live later this year".[47] EOSC adoption by the researchers will likely be proportional to the EOSC capacity to provide seamless access to FAIR-certified data. As a large virtual pool of data, EOSC can be instrumental to stimulate the growth of a European cloud industry and to ensure that research data stay in Europe and remain in the control of the researchers.

Moreover, the Commission will foster synergies, at governance and technical level, between EOSC and other federation initiatives such as GAIA-X. The GAIA-X initiative was launched in October 2019 by Germany and France to support both the digital sovereignty of cloud services users and the scalability of European cloud providers. It aims at developing a trustworthy and sovereign digital infrastructure for Europe giving users access to a broad range of specialised

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[46] COM(2020)66 final

[47] https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_20_102

products and services from a federation of cloud providers across the EU. GAIA-X aims to trigger in particular new opportunities for data-driven business models by European companies of all sizes and industries to scale up and compete globally. While driven by different policies and targeting different stakeholders in the short term, GAIA-X and EOSC are governed by the same principles of openness, interoperability, transparency and trust. Both initiatives have to address common issues related to standards, certifications, technical architecture, long-term sustainability, and the interoperability of data.

*EOSC in Horizon Europe*

The EOSC initiative aims to accelerate the transition to more effective Open Science and Open Innovation with new opportunities for multi-disciplinary research, frontier science and data-intensive science. Therefore, the future EOSC Partnership will have a unique transversal role (cross-Pillar, cross-Cluster) in Horizon Europe, bringing prospects of collaboration with most of the proposed European partnerships.

All thematic partnerships can take benefit from a successful development of the EOSC as this will equip them with minimal, rigorous standards and protocols and maximum freedom of implementation to share and reuse data and other digital objects across relevant domains of research. As demonstrated in the case of the COVID-19 crisis, rapid open sharing of data greatly accelerates research and discovery, allowing for an effective response to society's need. Interaction with many of these partnerships, in particular, challenge-driven ones, will thus increase the potential to bring value to researchers in Europe and beyond and to underpin and consolidate a European Research Area that is fit for the digital age.

## 5. CONCLUSIONS

In conclusion, the assessment by the Commission of the first phase (2018-2020) of EOSC implementation is that good progress is being made towards the milestones defined in the EOSC Roadmap. These milestones have been either partially or fully reached at this stage.

At the same time, major areas of work are still in progress and results will not become available before at least 2 years. The EOSC portal, catalogue of services and marketplace, as well as the provision of state-of-the-art research enabling services are now under further development. A clearer roadmap for on-boarding datasets and services in EOSC is required. The coordination among the different parties involved in EOSC should be addressed in the second phase of implementation under leadership of the new tri-partite EOSC Governance. Community engagement should be reinforced and policy development should be combined with practical tools, services and capacities supporting their concrete implementation.

In terms of relevance, the EOSC has successfully put in place the building blocks for an Open Science commons serving all European researchers. The momentum exists at European level for setting a coherent Open Science policy framework among the EU Member States and the adoption of policies towards open science and FAIR data is significant.

In terms of effectiveness, EOSC is very unique on the international scene to facilitate research across borders and disciplines based on FAIR principles. Seamless access through the EOSC portal, on-boarding, discovery and use of services by European researchers are in an advanced state. Preliminary connection of research infrastructures (RIs) to EOSC has been established and thematic RIs have started registering their services within the EOSC catalogue. The cluster projects' engagement with EOSC is "work in progress", and more results are expected towards the end of the year, including a clear model to federate and on-board thematic communities into EOSC. At the same time, it is clear that further integration effort would be required for a coherent and seamless EOSC environment, especially around data management. A clearer model to federate and on-board thematic communities into EOSC is also needed.

In terms of coherence, the EOSC partnership approach to EOSC R&I developed by the interim Governance will provide a wider framework for R&I alignment, not only at EU level through the Framework Programme for research and innovation, but also at national, community or institutional levels. Developing wider synergies between multiple EOSC stakeholders will be essential to realise the EOSC which will have to transition from a project-based to a more stakeholder-driven approach. The global challenge of excellent research in a context of data-intensive science cannot be addressed in isolation. Synergies will need to be further defined and prioritised by the EOSC Partnership with other European partnerships, with the European Data Spaces and with other programmes at EU, national and regional level. Relationships need to be extended with other global Open Science Commons to ensure complementarity.

The EOSC process in Europe is actually inspiring other regions of the world. Not a single other EU or Member State's mechanism can provide seamless access and reliable re-use of research data to European researchers, innovators, companies and citizens through a trusted open data environment. EOSC also adds EU value in reducing fragmentation and preventing duplication of efforts, and building stronger cooperation links and operating across border. EOSC provides gradually the basis for a science, research and innovation data space bringing together data resulting from research and deployment programmes, ultimately connected and fully articulated with the newly established sectoral data spaces. The research data made accessible through EOSC will be relevant for several dataspaces (e.g. health, Destination Earth). Access to FAIR data should be provided where appropriate.

In terms of efficiency, the H2020 grant approach 2020 has been successful to prototype the EOSC in its initial phase of implementation. Future EOSC operations should further explore how to combine funding from different sources and how to diversify funding instruments beyond the sole research grant approach.

The next implementation phase is necessary to streamline the actions and results achieved during the first implementation phase. The main challenge will be to move from prototyping to operationalisation while adapting the EOSC governance in function of its evolution.

President von der Leyen mentioned early this year in Davos that the "EOSC is set to start operating in 2020". Researchers are looking for practical solutions allowing them to access research data and services in few clicks, in the same way that they can access html pages through well-known search engines on the internet. Operational consolidation of a minimum viable EOSC in the period 2021-2027 will therefore be essential. This will require an operational EOSC capacity able for instance to run federating services, manage the EOSC compliance framework, provide user helpdesk functions, manage EOSC assets and trademarks, coordinate dissemination and outreach and ensure long-term continuity and sustainability.

There is room for an improved coordination structure to help steering at strategic level future EOSC evolution, convergence and expansion. The future EOSC Steering board can facilitate this by developing the National Coordination Teams that were introduced for the urgent coordination of expertise relevant to address the COVID-19 crisis and the development of the European COVID-19 Research Data Platform.  The initiative of forming National Coordination Teams was presented to the GB by the Commission in spring 2020. With each country's GB delegate being the main contact person in the team additional coordination roles (data, research, health care) were identified by countries. The principle of the Steering Board delegate being part of a national team can be developed to ensure the national coordination and alignment of EOSC relevant policies and infrastructures. The Landscape report discussed in the Validation Workshop in April 2020 showed that there is a will to engage and connect existing networks (NPR, Co-NOSC, ERAC SWG-OSI) to the manifold EOSC ambitions. A future delegate of the EOSC Steering Board will have a clear responsibility for national coordination and alignment of Open Science and EOSC, which will affect all researchers, research services and -infrastructures.

The mandate of the current EOSC Governance structure will terminate at the end of 2020. There is an opportunity to re-think the governance model taking into account of the wish by many Member States to get involved in the high-level strategic steering of the mission proposed by the new EOSC European Partnership.

## 6. ANNEXES

### o Annex 1: list of H2020 Projects of direct relevance to the EOSC implementation

H2020 Projects of direct relevance to the EOSC implementation

| Call | Topic | Project Number | Project Acronym | Project Title | Start | End | CORDIS link | Project website |
|---|---|---|---|---|---|---|---|---|
| H2020-INFRADEV-2016-2017 | INFRADEV-04-2016: European Open Science Cloud for Research | 739563 | EOSCpilot | The European Open Science Cloud for Research Pilot Project. | 01-2017 | 05-2019 | cordis | https://eoscpilot.eu/ |
| H2020-EINFRA-2016-2017 | EINFRA-12-2017: Data and Distributed Computing e-infrastructures for Open Science | 777536 | EOSC-hub | Integrating and managing services for the European Open Science Cloud | 01-2018 | 12-2020 | cordis | https://eosc-hub.eu/ |
| | | 777541 | OpenAIRE-Advance | OpenAIRE Advancing Open Scholarship | 01-2018 | 12-2020 | cordis | www.openaire.eu |
| H2020-EINFRA-2016-2017 | EINFRA-21-2017: Platform-driven e-infrastructure innovation | 777523 | FREYA | Connected Open Identifiers for Discovery, Access and Use of Research Resources | 12-2017 | 11-2020 | cordis | www.project-freya.eu |
| | | 777413 | DARE | Delivering Agile Research Excellence on European e-Infrastructures | 01-2018 | 12-2020 | cordis | http://project-dare.eu/ |
| | | 777435 | DEEP-HybridDataCloud | Designing and Enabling E-infrastructures for intensive Processing in a Hybrid DataCloud | 11-2017 | 04-2020 | cordis | https://deep-hybrid-datacloud.eu/ |
| | | 777549 | EUXDAT | European e-Infrastructure for Extreme Data Analytics in Sustainable Development | 11-2017 | 10-2020 | cordis | https://www.euxdat.eu/ |
| | | 777367 | XDC | eXtreme DataCloud | 11-2017 | 01-2020 | cordis | www.extreme-datacloud.eu |
| | | 777533 | PROCESS | PROviding Computing solutions for ExaScale ChallengeS | 11-2017 | 10-2020 | cordis | www.process-project.eu |
| | | 754271 | PPI4HPC | Public Procurement of Innovative Solutions for High-Performance Computing | 04-2017 | 09-2021 | cordis | https://ppi4hpc.eu/ |
| H2020-INFRAEOSC-2018-2020 - Implementing the European Open Science Cloud | INFRAEOSC-01-2018: Access to commercial services through the EOSC hub | 824079 | OCRE | Access to Commercial Services Through the EOSC-hub | 01-2019 | 12-2021 | cordis | www.ocre-project.eu |
| | INFRAEOSC-02-2019: Prototyping new innovative services | 863463 | COS4CLOUD | Co-designed Citizen Observatories Services for the EOS-Cloud | 11-2019 | 02-2023 | cordis | www.cos4cloud-eosc.eu |
| | | 863410 | INODE | INODE - Intelligent Open Data Exploration | 11-2019 | 10-2022 | cordis | www.inode-project.eu |
| | | 863353 | CS3MESH4E | Interactive and | 01-2020 | 12-2022 | cordis | |

| Call | Topic | Project Number | Project Acronym | Project Title | Start | End | CORDIS link | Project website |
|------|-------|----------------|-----------------|---------------|-------|-----|-------------|-----------------|
| | | | OSC | agile/responsive sharing mesh of storage, data and applications for EOSC | | | | |
| | | 863448 | NEANIAS | Novel EOSC services for Emerging Atmosphere, Underwater and Space Challenges | 11-2019 | 10-2022 | cordis | www.neanias.eu |
| | | 863420 | TRIPLE | Transforming Research through Innovative Practices for Linked interdisciplinary Exploration | 10-2019 | 10-2023 | cordis | |
| | INFRAEOSC-03-2020: Integration and consolidation of the existing pan-European access mechanism to public research infrastructures and commercial services through the EOSC Portal | | | | On Going | | _ | |
| | INFRAEOSC-04-2018: Connecting ESFRI infrastructures through Cluster projects | 824068 | ENVRI-FAIR | ENVironmental Research Infrastructures building Fair services Accessible for society, Innovation and Research | 01-2019 | 12-2022 | cordis | https://envri.eu/ |
| | | 824064 | ESCAPE | European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures | 02-2019 | 07-2022 | cordis | www.projectescape.eu |
| | | 823852 | PaNOSC | Photon and Neutron Open Science Cloud | 12-2018 | 11-2022 | cordis | https://www.panosc.eu/ |
| | | 824087 | EOSC-Life | Providing an open collaborative space for digital biology in Europe | 03-2019 | 02-2023 | cordis | www.eosc-life.eu |
| | | 823782 | SSHOC | Social Sciences & Humanities Open Cloud | 01-2019 | 04-2022 | cordis | https://sshopencloud.eu/ |
| | INFRAEOSC-05-2018-2019: Support to the EOSC Governance | 857650 | EOSC-Pillar | Coordination and Harmonisation of National Inititiatives, Infrastructures and Data services in Central and Western Europe | 06-2019 | 06-2022 | cordis | www.eosc-pillar.eu |
| | | 857641 | ExPaNDS | EOSC Photon and Neutron Data Services | 09-2019 | 08-2022 | cordis | https://expands.eu/ |
| | | 857652 | EOSC-Nordic | EOSC-Nordic | 09-2019 | 08-2022 | cordis | www.eosc-nordic.eu |
| | | 831644 | EOSCsecretariat.eu | EOSCsecretariat.eu | 01-2019 | 06-2021 | cordis | www.eoscsecretariat.eu |
| | | 857647 | EOSC-synergy | European Open Science Cloud - Expanding Capacities by building Capabilities | 09-2019 | 02-2022 | cordis | www.eosc-synergy.eu |
| | | 831558 | FAIRsFAIR | Fostering FAIR Data Practices in Europe | 03-2019 | 02-2022 | cordis | https://fairsfair.eu |
| | | 857645 | NI4OS-Europe | National Initiatives for Open Science in Europe | 09-2019 | 08-2022 | cordis | https://ni4os-europe.eu |
| | INFRAEOSC-06-2019-2020: Enhancing the EOSC portal and connecting thematic clouds | 871160 | EOSC Enhance | Enhancing the EOSC portal and connecting thematic clouds | 12-2019 | 11-2021 | cordis | www.eosc-portal.eu |
| | INFRAEOSC-07-2020: Increasing the service offer of the EOSC | | | | On going | | _ | |

| Call | Topic | Project Number | Project Acronym | Project Title | Start | End | CORDIS link | Project website |
|------|-------|----------------|-----------------|---------------|-------|-----|-------------|-----------------|
|      | Portal |               |                 |               |       |     |             |                 |

*Table 6 - H2020 Projects of direct relevance to the EOSC implementation*

e-infrastructures, thematic clouds, FAIR data and other H2020 Projects of EOSC interest

| Topic | Project Number | Project Acronym | Project Name | Start Date | End Date | CORDIS link | Website |
|-------|----------------|-----------------|--------------|------------|----------|-------------|---------|
| ICT-08-2015 | 687614 | HNSciCloud | Helix Nebula Science Cloud | 01-2016 | 12-2018 | cordis | www.hnscicloud.eu |
| INFRASUPP-03-2016 | 731049 | eInfraCentral | European E-Infrastructure Services Gateway | 01-2017 | 06-2019 | cordis | https://einfracentral.eu |
| INFRASUPP-02-2017 | 777388 | RDA Europe 4.0 | Research Data Alliance | 03-2018 | 05-2020 | cordis | www.rd-alliance.org |
| INFRASUPP-01-2018-2019 | 823761 | e-IRGSP6 | e-Infrastructure Reflection Group Support Programme 6 | 01-2019 | 06-2021 | cordis | https://e-irgsp6.e-irg.eu |
| INFRASUPP-01-2018-2019 | 824173 | CatRIS | Catalogue of Research Infrastructure Services | 01-2019 | 06-2021 | cordis | https://project.catris.eu |
| ICT-34-2018-2019 | 824516 | ARCHIVER | Archiving and Preservation for Research Environments | 01-2019 | 12-2021 | cordis | www.archiver-project.eu |
| GEANT-2018-a | 856726 | GN4-3 | Horizon 2020: H2020-SGA-INFRA-GEANT-2018 Topic [b] Increase of Long-Term Backbone Capacity | 01-2019 | 12-2022 | cordis | www.geant.org |
| IMI2-2017-12-02 | 802750 | FAIRplus | FAIRplus | 01-2019 | 06-2022 | cordis | https://fairplus-project.eu |
| SwafS-04-2018 | 824666 | FAIR4Health | Improving Health Research in EU through FAIR Data | 12-2018 | 11-2021 | cordis | www.fair4health.eu |
| NFRP-2018-11 | 847612 | FAIR4Fusion | | 09-2019 | 08-2021 | cordis | www.fair4fusion.eu |
| EINFRA-22-2016 | 731001 | AGINFRA+ | Accelerating user-driven e-infrastructure innovation in Food Agriculture | 01-2017 | 12-2019 | cordis | https://plus.aginfra.eu |
| INFRASUPP-03-2016 | 731016 | AENEAS | Advanced European Network of E-infrastructures for Astronomy with the SKA | 01-2017 | 12-2019 | cordis | www.aeneas2020.eu |
| EINFRA-22-2016 | 731075 | OpenRIskNet | Open e-Infrastructure to Support Data Sharing, Knowledge Integration and in silico Analysis and Modelling in Risk Assessment | 12-2016 | 11-2019 | cordis | https://openrisknet.org |
| INFRADEV-01-2017 | 777483 | ICEDIG | Innovation and consolidation for large scale digitisation of natural heritage | 01-2018 | 03-2020 | cordis | www.icedig.eu |
| MG-4-2-2018 | 824323 | BE OPEN | European forum and oBsErvatory for OPEN science in transport | 01-2019 | 06-2021 | cordis | https://beopen-project.eu |
| SC1-BHC-05-2018 | 825775 | CINECA | Common Infrastructure for National Cohorts in Europe, Canada, and Africa | 01-2019 | 12-2022 | cordis | www.cineca-project.eu |
| SC1-HCC-05-2018 | 826353 | DigitalHealthEurope | Support to a Digital Health and Care Innovation initiative in the context of Digital Single Market strategy | 01-2019 | 12-2020 | cordis | https://digitalhealtheurope.eu |
| SC1-DTH-07-2018 | 826421 | VirtualBrainCloud | Personalized Recommendations for Neurodegenerative Disease | 12-2018 | 11-2022 | cordis | https://virtualbraincloud-2020.eu |
| SC1-DTH-07-2018 | 826494 | PRIMAGE | PRedictive In-silico Multiscale Analytics to support cancer personalized diaGnosis and prognosis, Empowered by imaging biomarkers | 12-2018 | 11-2022 | cordis | www.primageproject.eu |
| BG-07-2019-2020 | 862409 | Blue-Cloud | Piloting innovative services for Marine Research & the Blue Economy | 10-2019 | 09-2022 | cordis | www.blue-cloud.org |

| Topic | Project Number | Project Acronym | Project Name | Start Date | End Date | CORDIS link | Website |
|-------|----------------|-----------------|--------------|------------|----------|-------------|---------|
| DT-SFS-26-2019 | 863059 | FNS-Cloud | Food Nutrition Security Cloud | 10-2019 | 09-2023 | cordis | www.fns-cloud.eu |

*Table 7 - e-infrastructures, thematic clouds, FAIR data and other H2020 Projects of EOSC interest*

o    **Annex 2: EOSC Secretariat study**



**EOSC implementation first phase assessment report**

**V1.0**

**03/07/2020**

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Graphics: Topi Soivio (CSC)

Review: European Commission

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**Section 1:    Introduction**

The Council conclusions on the European Open Science Cloud (EOSC) of May 2018 [48] acknowledge the two-stage approach for the roll out of the EOSC, which is introduced by the Commission Staff Working Document (SWD) on the Implementation Roadmap for the EOSC[49]. Furthermore, the conclusions underline that the '**start of the second phase is dependent on an evaluation by the Commission and Member States of the first phase**'.

The formal evaluation of the first phase will be conducted by the European Commission, for subsequent approval by the EOSC Governance Board and the Programme Committee in Q4, 2020. In support of the assessment exercise, this study, prepared by the EOSC Secretariat, offers insight into the project community and Executive Board perspective on the progress of the first phase of the implementation according to the milestones identified in the Roadmap for each of the six model action lines; Architecture, Data, Services, Access & Interface, Rules of Participation, and Governance. The evaluation provides an opportunity to identify issues and inform future activities, both for the remainder of the first phase of the implementation and beyond in the transition to the second phase of development post-2020.

It should be recognised that the objectives and milestones identified in the EOSC IMPLMENTATION ROADMAP, issued in 2018, reflect expectations which have since evolved, but nevertheless remain a key point of reference for understanding the progress of the implementation of the first phase. The dynamic nature of the environment is evident in the survey responses, and at times there are inconsistencies in the responses caused by different interpretations of the milestones. In order to maintain the integrity of the evidence, the analysis of the responses contained within this study reflect the respondents *perspective of progress*, though noting of course where the overall interpretation may be at odds with what was intended by the Roadmap. An important overarching message emerges from this surrounding the need to have clearly defined, well-communicated and accepted common goals, even (or especially) in a fast-paced and changing environment. These issues will be at the heart of the SRIA and will be fundamental in the design and implementation of an effective monitoring framework going into the next phase.


**Section 2:    Approach**

The assessment of progress of the first phase of the implementation is informed by the responses to a survey of EOSC projects[50], which was open from 12th May and the last response was received on 24th June 2020. The survey was also circulated to the EOSC Executive Board and to key individuals involved in the EOSC Secretariat project.

For each of the milestones identified against the action lines of the EOSC model described in the Roadmap, the survey examines:

▪   Understanding of progress towards the milestone;

▪   Project/WG contributions; key results, outputs, quantitative indicators;

▪   Outstanding work required to reach the milestone by the end of the first phase (December 2020) and future outlook in case the milestone is likely not to be achieved.

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[48] http://data.consilium.europa.eu/doc/document/ST-9029-2018-INIT/en/pdf

[49] https://ec.europa.eu/research/openscience/pdf/swd_2018_83_f1_staff_working_paper_en.pdf

[50] The survey was developed by two of the authors (Thorley & Douglas) with support from members of the EOSC Secretariat project. The on-line survey was hosted by Trust-IT, one of the project partners.

The analysis of the survey responses provides an understanding of the overall position of progress, taking into account the convergence or divergence of opinion demonstrated by the responses. Evidence in support of the position is reviewed, and outstanding work required to reach the milestone (where not yet met) is evaluated.

A high-level overview is derived for each action line, identifying the key findings arising from the survey, key messages and an assessment of the potential for each of the milestones to be delivered by December 2020.

**Section 3:        Overview**

The analysis is based on 35 survey responses, representing 29 projects plus individual members of the EOSC Executive Board and EOSC Secretariat. The survey responses offer balanced representation across a range of project types.
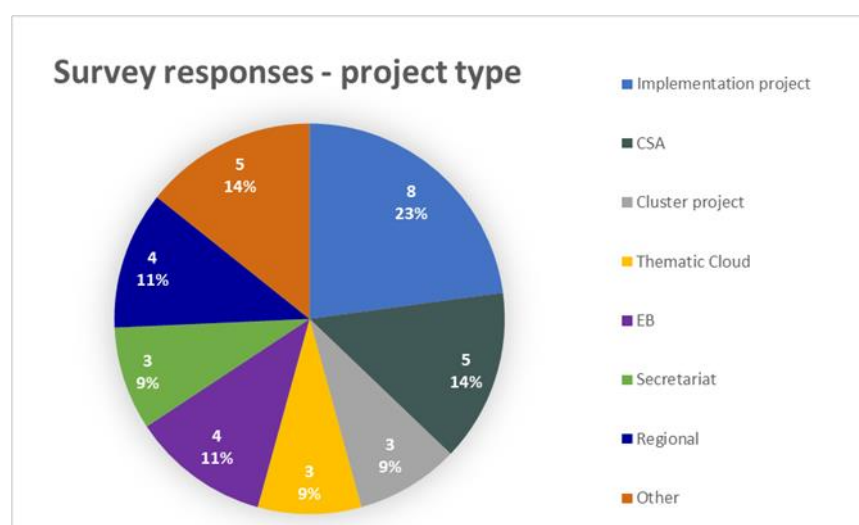


For each milestone (with exceptions noted in the analysis), respondents were asked to identify how far they considered the milestone had been reached (fully, partially, minimally, or don't know). Respondents were also asked to provide examples of where the work of their projects had contributed to the delivery of the milestone.

Overall, at the time the survey was conducted (May - June 2020), the survey responses show clear recognition that progress towards many of the milestones is being made, though the advance of progress varies, evidenced by a majority of respondents selecting either partially or fully reached at this stage. Notable exceptions include:

▪   Architecture: Initial registry of data infrastructures of the EOSC (26% minimally reached, 29% unknown);

▪   Architecture: Preliminary connection of most infrastructures and services to the EOSC (29% minimally reached, 23% unknown);

▪   Services: Initial EOSC catalogue of datasets accessible (54% minimally, 17% unknown).

A summary of responses for each milestone is shown in the following figure.

## Overall, do you think that this milestone has been satisfactorily reached?

● Fully ● Partially ● No or minimally ● Don't know

| | Fully | Partially | No or minimally | Don't know | Milestone |
|---|---|---|---|---|---|
| A1 | 6% | 66% | 20% | 9% | A1: Initial EOSC federating core in place |
| A2 | 6% | 40% | 26% | 29% | A2: Registry of data infrastructures of the EOSC (initial) |
| A3 | | 49% | 29% | 23% | A3: Preliminary connection of most infrastructures and services to the EOSC |
| D2 | 6% | 66% | 11% | 17% | D2: European Framework for FAIR data agreed |
| D3 | 20% | 51% | 11% | 17% | D3: FAIR Persistent Unique Identifier policy defined |
| D4 | 9% | 54% | 14% | 23% | D4: FAIR certification scheme available |
| S1&2 | 17% | 71% | | 9% | S1&2: Initial/updated EOSC Catalogue of Services and EOSC Portal |
| S3 | 26% | | 54% | 17% | S3: Initial EOSC catalogue of datasets accessible |
| R1&2 | | 71% | 14% | 11% | R1&2: Initial/Final RoP |

The remainder of this section summarises the progress within each action line, and then sections 4 to 8 review the evidence from the survey in greater depth.

**Architecture:** The Architecture action line is composed of three milestones:

A1.  Q4 2019: Initial EOSC federating core in place.

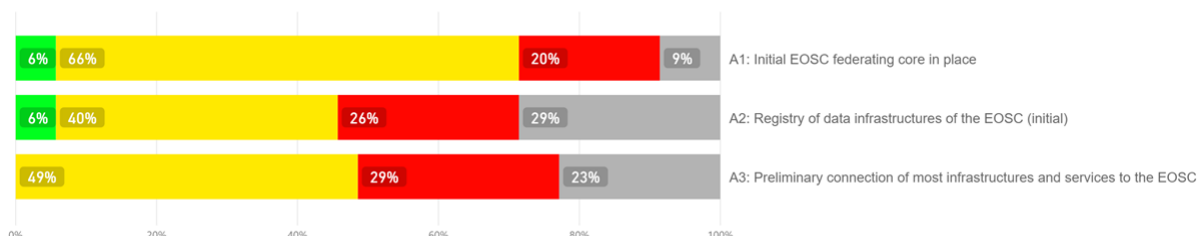A2.  Q4 2019: Registry of data infrastructures of the EOSC (initial).

A3.  Q2 2020: Preliminary connection of most infrastructures and services to the EOSC.

Overall, do you think that this milestone has been satisfactorily reached?

● Fully  ● Partially  ● No or minimally  ● Don't know



**Key findings**

Significant progress has been achieved within the Architecture action line, particularly with the first milestone, **the implementation of the initial EOSC federating core**, where the vast majority of respondents considered it to be at least **partially implemented**. This is supported by a number of the KPIs provided by the projects, especially from EOSC-hub. For example, EOSC-hub report that for their KPI1 (number of integrated service providers on-boarded), as of December 2019, 329 providers have been on-boarded, against a target of 325 by December 2020. Significant work has been performed towards the definition of the "federating core", in particular towards the "EOSC catalogue and portal", the "Shared Resources" and the "Compliance Framework"; still, **further consolidation work is required within 2020**, in particular among projects and in close cooperation with the EB and its WGs, to agree on the exact definition and architecture of the core, given also the evolving and sometimes diverging requirements, e.g. between horizontal and thematic infrastructures.

The majority opinion is that the second and third milestones are **partially implemented**, although there was more diversity of opinion, with significant numbers of respondents considering it was either minimally met, or not knowing. **Within the project community, the survey responses indicate a lack of clear understanding of what the second milestone refers to (initial registry of data infrastructures)**. Although in the Roadmap the milestone is well-defined, referring to a catalogue of interested and eligible (per Rules of Participation) data infrastructures to be federated into the EOSC (mainly through EOSC-Pilot and CatRIS), the interpretation by the respondents varies, several of them referring to EOSC-hub portal and marketplace. The EOSC catalogues currently feature a number of both generic and thematic data infrastructure services and data catalogues. However, a lot of the thematic data infrastructures services and artefacts, such as the ones from the Regional (5b), the Cluster and other Thematic Cloud projects, in particular datasets, are not yet on-boarded, on one hand due to different timelines of the projects, and on the other due to manual and multifaceted compliance and registration processes. In other words, although the ESOC Pilot project, EOSC-hub, CatRIS and later on, in 2020, the EB WG on Rules of Participation have provided a first set of guidelines for data infrastructures services and data registration and on-boarding, the assessment of compliance with these guidelines may not always be straightforward or at least well understood/accepted. Validation and monitoring tools have not been developed yet, which is also due to the fact that the final RoP have not been approved yet. Further work is required to automate and allow bulk service on-boarding. Overall, **the current status of the catalogue(s) does not fully reflect the diversity of services provided by the different thematic projects**.

On the other hand, the third milestone referring to the "preliminary connection" of most infrastructures and services is not well-defined in the Roadmap. If the preliminary connection implies the federation of infrastructures in EOSC, in particular of cluster projects responsible for the milestone, this is not yet achieved. **As one of the cluster projects is declaring, *"the connection itself has been established", but "it has to be formalized, intensified and made permanent".*** Thus, the cluster projects' engagement with EOSC is "work in progress", and more results are expected towards the end of the year. **In summary, although a number of thematic RIs have started registering their services within the EOSC catalogue, a clear model to federate and on-board thematic communities' services into EOSC has not been devised.** Furthermore, **the data component is still inadequately federated,** as only a small number of thematic data catalogues are registered in the EOSC portal. As many RI projects operate their own thematic portals or data catalogues, the need for such a federation model is becoming even more important. **Furthermore, on-boarding currently requires manual efforts** (filling out application forms and iterating through a human feedback process)**. Significant work is required to define machine-actionable interfaces for connecting services in an automated fashion.**

### Key messages

- Coordination among projects, and between projects and the EOSC EB/WGs, is required to align and consolidate related efforts on the federating core architecture and agree on its composition by the end of the year.  Post-2020, the federating core will need further deployment and adaptation to meet the evolving user needs, and such work is expected to take place as part of the INFRAEOSC-03 awarded project.

- Improved community engagement is needed to derive a common understanding of the registry of data infrastructures, in particular the Rules of Participation and processes, and the nature and the added value of EOSC registry.

- Further development of both policy and process issues, including models/templates, streamlining/simplification and automation, are required to facilitate the federation of data infrastructures and their services. Further effort is also required on the thematic data infrastructures services and artefacts, in particular datasets, inside 2020, but also beyond, in line with the timeline of the Cluster projects.

### Potential for milestones to be met by December 2020

Although progress has been made in all three milestones of the Architecture area, the timeline is challenging for some of them to be met by December 2020. Besides the first one on the federated core that can be concluded with appropriate coordination among related stakeholders, the other two (initial registry of data infrastructures and preliminary connection of most infrastructures to EOSC) may need to carry over beyond 2020, depending also on the exact interpretation, especially of the third one.

| Milestone | Expected position by end of 2020 | Comments (based on the key messages above) |
|---|---|---|
| A1 - Initial EOSC federating core in place | Fully | Provided that the coordination/alignment/ consolidation efforts mentioned above are |

undertaken.

| A2 - Initial registry of data infrastructures | Partially to fully | Depends on the interpretation of the level of "initial" registration of data infrastructures. |
| | | An initial registry will be available, but it is unlikely to be complete. |
| | | Resources models, validation tools and processes automation in line with the final Rules of participation need to be concluded by the end of 2020. |
| | | Registration of data infrastructures will carry forward into 2021 based on the agreed principles and rules defined and validation tools developed. |
| | | Key projects that are expected to register their infrastructures in 2021 are the Cluster, the Regional and some Thematic Cloud projects. |
| A3 - Preliminary connection of most infrastructures to EOSC | Partially to Fully | This depends on the interpretation of the "preliminary" connection of most infrastructures to EOSC and is strongly connected with A2. If this refers to the federation of most infrastructures and registration in EOSC, similar actions are required as mentioned in A2. |

**Data:** The FAIR data action line is composed of four milestones:

D1.  Q3 2018: FAIR data Action Plan published. *[Not consulted on in survey]*
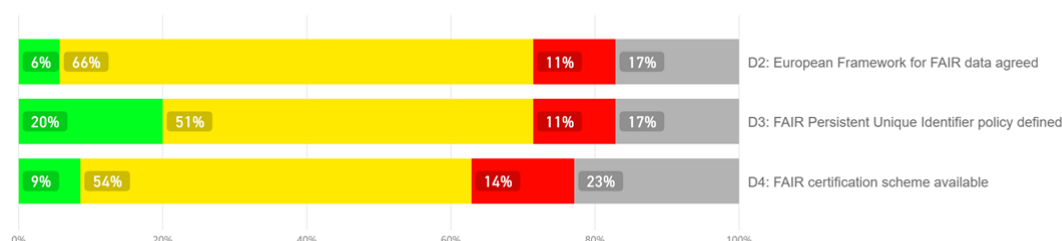
D2.  Q2 2019: European Framework for FAIR data agreed.

D3.  Q4 2019: FAIR Persistent Unique Identifier policy defined.

D4.  Q4 2019: FAIR certification scheme available.

Overall, do you think that this milestone has been satisfactorily reached?

● Fully ● Partially ● No or minimally ● Don't know



**Key findings**

Milestone *Q3 2018: FAIR data Action Plan published*, **is met** with the publication of the final report and action plan from the European Commission Expert Group on FAIR Data (Turning FAIR into Reality, November 2018). Therefore, progress on implementation of this milestone has not been consulted on in the survey.

Significant progress has been achieved in the area of FAIR data in relation to the other three milestones, with the majority of respondents agreeing that all three had been at least **partially implemented**.

For milestone *Q2 2019: European Framework for FAIR data agreed*, agreement on if the milestone has been met depends on its interpretation. **If the milestone intends a theoretical framework and high-level guidelines, this is already in place** by means of the FAIR Data Action Plan and corresponding Expert Group report, which provides guidelines and recommendations to research communities and countries to develop specific plans on implementing FAIR data. However, **if an operational implementation framework is expected**, such as the existing European framework for interoperability of public services, this has not been delivered yet, and **the current position would be represented as "partially implemented"**. Outstanding work in this area includes the finalisation of the RDA Data Maturity Model (*currently in the approval process*) and the EOSC interoperability framework documents, which are currently in consultation and are expected to be finalised later in the year. The EOSC FAIR WG will also propose FAIR metrics and certification by the end of 2020.

For milestone *Q4 2019: FAIR Persistent Unique Identifier policy defined*, the Roadmap document requires the definition of such a policy, with "Accessibility" in FAIR being supported through PIDs. The Task Force on PID policies, a sub-group of the EOSC Architecture WG, FAIR WG and FREYA project, **released the "draft Persistent Identifier (PID) policy for the European Open Science Cloud (EOSC)", initially in December 2019, with a second version in May 2020**. The document constitutes a good policy framework, defining a number of concepts, however **it does not recommend concrete implementation approaches**. Furthermore, it is noted that PIDs require a global approach, so more work is needed to improve interoperability among existing PID providers and related technical implementations. **The finalisation of the PID policy document is planned for Q4 2020 with the concrete implementation guidelines.** In general, this area is less dispersed (in terms of multiple projects

working in the same area) and it may be easier to converge. On the other hand, the implementation guidelines, including technical solutions and interoperability among them, may be technically more demanding.

For milestone *Q4 2019: FAIR certification scheme available*, **the FAIRsFAIR project is supporting the uptake of the CoreTrustSeal certification for repositories, and is working with the CoreTrustSeal organisation to align its criteria with the FAIR principles.** The Metrics and Certification Task Force of the EOSC FAIR Working Group has released two interim documents for consultation, providing an overview of ongoing global and European activities and preliminary discussion of key issues. In particular, the FAIRsFAIR Deliverable D4.2 "Repository Certification Mechanism: a Recommendation on the Extended Requirements and Procedures" has worked in aligning the CoreTrustSeal Requirements with an assessment of repositories' ability to enable FAIR data, and presents the first draft of mapping between requirements and principles. Feedback is expected on this work. Similarly, the Metrics and Certification Task Force of the EOSC FAIR Working Group has released two interim documents for consultation and after a cycle of feedback, **the final recommendations for implementing FAIR metrics and certifying services within EOSC will be released in fall 2020**. In essence, what is currently being developed is the alignment of the CoreTrustSeal requirements/metrics with the FAIR ones.


**Key messages**

▪ It is crucial to have policies that will continuously support the implementation of FAIR data in Europe and provide incentives for stakeholders to consider this in their agenda of priorities.

▪ Extensive work and consultation are ongoing. Review and integration of feedback and consolidation of final documents will be critical to finalise the implementation of this action line. In particular, the RDA Data Maturity Model (currently in the approval process), the EOSC interoperability framework documents and FAIR metrics and certification are to be concluded by the end of the year.

▪ Pilot-testing of proposed policies and approaches **in practice**, across thematic and national communities, and subsequent integration of feedback into final documents is strongly recommended. In particular, implementation and interoperability approaches and guidelines, including evaluation of PID providers, are required towards the end of the year.

▪ Official endorsements of key frameworks, policies and associated documents by the EOSC appropriate elements within the current or new governance would be welcomed by the project community, depending on the exact issuance timelines (i.e. within 2020 or shortly after).

▪ Communication and dissemination activities should be improved to raise the level of understanding and address the lack of awareness which is apparent in some of the survey responses.


**Potential for milestones to be met by December 2020**

Progress has been made in all areas of the FAIR data milestones, and it is expected that all of them will be substantially met by December 2020.

| Milestone | Expected position by end of 2020 | Comments (based on the key messages above) |
|---|---|---|
| D2- European Framework for FAIR data agreed. | Fully | Depends on the interpretation. If the milestone intends a theoretical framework and high-level guidelines, this is already in place. If an operational implementation framework is expected, this is expected to be achieved by the end of the year. |
| D3 – FAIR Persistent Unique Identifier policy defined. | Partially to Fully | The finalisation of the PID policy document is planned for Q4 2020 with the concrete implementation guidelines. Technical solutions and interoperability among them may be demanding, still it is expected that they will be partially met by the end of the year. |
| D3 - FAIR certification scheme available | Fully | The final recommendations for implementing FAIR metrics and certifying services within EOSC will be released in fall 2020, aligning the CoreTrustSeal requirements/metrics with the FAIR ones. So the milestone is expected to be achieved by the end of the year, in particular with the collaboration between FAIRsFAIR and the Metrics and Certification Task Force of the EOSC FAIR Working Group. |

**Services, Access & Interface:** The Services action line is composed of three milestones:
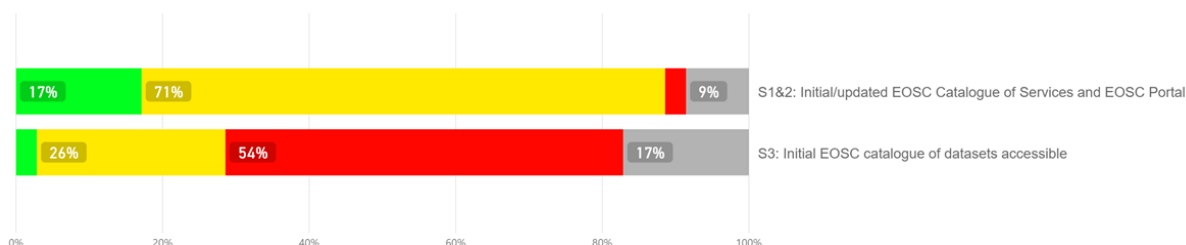
S1.    Q4 2018: Initial EOSC catalogue of services accessible and prototype EOSC Portal accessible.

S2.   Q4 2019: Updated EOSC Catalogue of Services and EOSC Portal.

S3.   Q2 2019: Initial EOSC catalogue of datasets accessible.

Overall, do you think that this milestone has been satisfactorily reached?

● Fully ● Partially ● No or minimally ● Don't know



**Key findings**

As **the first two milestones** are closely related, they were consulted on as one. Most respondents consider that these two milestones have either been **partially or fully met** (*of all milestones assessed, these had the highest proportion of respondents saying they were fully met*). Respondents responsible for building the catalogue/portal, tended to indicate that the milestone is fully met, by which they mean that the catalogue of services does exist at https://marketplace.eosc-portal.eu and contains a good number of entries.

▪   The reservations that have led respondents to indicate only partially met include:

▪   The catalogue is just a listing, or passive collection, that is not always usable and does not help to make a connection between supply and demand.

▪   The services are largely independent and lack interoperability.

▪   It is unclear how commercial services will be integrated.

▪   Future changes in the catalogue structure might cause problems.

▪   There seems to have been no evaluation of the services, with some not yet at 'production' level.

The third milestone is related to the **EOSC catalogue of datasets**. There is confusion amongst respondents over whether/how datasets are yet available through the portal, reflected in the majority of respondents indicating that this milestone **has not been achieved**. Overall, respondents consider that this milestone is the least achieved out of all within the survey.

Part of the confusion is because some dataset catalogues/repositories are available as services through the catalogue. There is concern about what are seen as 'competing datasets catalogues' (OpenAIRE, B2FIND), implying that a single point of entry would be preferable. EOSC-hub indicates that EOSC-Enhance will integrate a catalogue of datasets in EOSC Portal.

**Access and Interface:** The *Access and Interface* action line in the Roadmap does not have specific milestones associated with it, however there is a degree of overlap with the milestones for 'Services', for example the EOSC Portal is referenced in two of the Services milestones.

There is also reference to the outputs of the grant awarded under INFRAEOSC-06-2020 (EOSC Enhance), which started in December 2019, and it has yet to produce mature results.

Understanding the number and nature of access points currently provided or planned may be valuable in the assessment of the progress of the 'Access & Interface' action line.

Most survey respondents indicate that they are contributing to an entry point to accessing EOSC services. All the projects refer to their plans to produce some kind of entry point (regional e.g. EOSC-Nordic, thematic e.g. BE OPEN in transport research, PaNOSC portal for ExPaNDS), but there is a lack of a common view on the relation of this to the overall EOSC portal. **There is a tension between the EOSC Portal as the universal top-level point of access, or it being just one access point among many.** For example, the SSH Open Marketplace will include all services in EOSC Portal but will also extend to any available software or tool for researchers including those not suitable for the EOSC catalogue.

**Key messages**

- There needs to be consideration of what the aim is for the EOSC catalogue of services. It is currently considered to be just a listing, or passive collection, that is not always usable and does not help to make a connection between supply and demand.

- There should be a clear plan for increasing the utility of the catalogue of services, not just increasing the number of services within it. This would include some kind of evaluation of applicability and emphasis on interoperability.

- The benefits of the EOSC catalogue need to be made clear not only to potential end users but to national governments/ministries who will be assigning funding.

- A clear roadmap for on-boarding datasets in EOSC catalogues is desirable, to clear up the confusion that currently exists.

- The expectations for the EOSC Portal need to be clarified and justified. There is a tension between the EOSC Portal as the universal top-level point of access, or being just one among many.

**Potential for milestones to be met by December 2020**

Good progress has been made with the development of the EOSC Portal and the catalogue of services, and it is likely the milestones related to these will be met by December 2020. However, there are issues with developing a catalogue of data sets of utility to users, and it is likely that work required to meet this milestone will extend beyond December 2020.

| Milestone | Expected position by end of 2020 | Comments (based on the key messages above) |
|---|---|---|
| S1 - Initial EOSC catalogue of services accessible and prototype | Fully | An EOSC catalogue of services is in place, with 267 services available at the time of writing this report. |

EOSC Portal accessible.

| | | |
|---|---|---|
| S2 - Updated EOSC Catalogue of Services and EOSC Portal. | Partially | Depends on the interpretation. The portal is being updated (in sense that new services are continually being on-boarded). However, there are concerns from the community regarding the utility of the portal. These concerns will need to be taken on board, though, it is uncertain how developed the portal will be by the end of 2020. EOSC Enhance is expected to play a key role in further developments. |
| S3 - Initial EOSC catalogue of datasets accessible. | Partially | The evidence from the project community survey is that the catalogue of data sets is a substantial area of concern and that currently a meaningful catalogue is not in place. The EOSC Enhance project is committed to working with data providers to augment the catalogue of accessible datasets. |

**Rules of Participation:** The Rules of Participation action line is composed of two milestones:

R1.   Q1 2019: Initial EOSC Rules of Participation.

R2.   Q4 2019: Final EOSC Rules of Participation.

Overall, do you think that this milestone has been satisfactorily reached?

● Fully ● Partially ● No or minimally ● Don't know

| | | |
|---|---|---|
| 71% | 14% | 11% |

R1&2: Initial/Final RoP

0%      20%      40%      60%      80%      100%
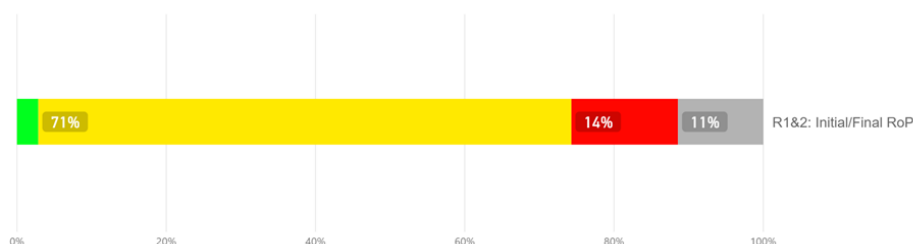
**Key findings**

As the two milestones are closely related, they were consulted on as one.

▪   It should be noted that the timeframes for delivery identified in the Roadmap are intended to refer to the minimal set of Rules of Participation[51] which were delivered by the EOSC Pilot project in August 2018. After the establishment of the EOSC interim governance, the Executive Board set up the Working Group on Rules for Participation, which delivered a further draft iteration of the Rules (EOSC RoP version 0.2[52]) in January 2020. This latest draft was the subject of a consultation during Feb-March 2020 and there is strong evidence of awareness of this amongst the survey respondents. The responses indicate that the project community largely consider milestone R1, the initial Rules, to relate to this most recent draft. In any event, when considering either the **initial Rules** delivered by EOSC Pilot this milestone, or the more advanced recent draft, this milestone can be confirmed as **fully met**.

Further progression towards full implementation of the second milestone, the **final Rules** of Participation, surrounds development of the content of the current draft, supporting a position of **partially met** at this time. Further iterations will be released over Summer 2020 with additions from the Architecture and FAIR Working Groups. A final version of the Rules is planned for release by the RoP Working Group in Q3 2020. A legal study to support the further development of the Rules has been commissioned through EOSCsecretariat, with specification of the study currently underway.

Overall, the survey responses suggest a strong level of stakeholder engagement and participation in the development of the Rules of Participation. A good level of knowledge and understanding of the current state of play, which is evident in the survey responses, reinforces this position. There appears to be a good degree of confidence that the milestones will be reached by the end of 2020, subject to the further development of the content of the current draft with respect to issues identified in the analysis, including:

▪   The current draft is too high level, providing guiding principles and definitions but requiring development of concrete implementation guidelines and standards, and details for accessing and providing services and data.

▪   Rules of Participation needed for different actors.

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[51] https://eoscpilot.eu/content/d25-recommendations-minimal-set-rules-participation

[52] https://repository.eoscsecretariat.eu/index.php/s/QWd7tZ7xSWJsesn#pdfviewer

- Model of compensation for service providers needs to be effectively clarified, also addressing the question of 'who pays for which services?'

- Clarification of issues relating to quality, monitoring and compliance of on-boarded services, including roles of stakeholders, enforcement, and sanctions.

- Input from other Working Groups, particularly FAIR need to be integrated to the Rules.

The recent consultation led by the Working Group on RoP will no doubt provide greater insight into these issues. Review of the consultation is underway.

One respondent to the survey (NEANIAS) also identified a need to refer to the EOSC legal entity in the final Rules. The project community view on overall responsibility for the Rules post-2020 was not a subject of the survey questions, nevertheless it was clear that Rules of Participation will remain a fundamental component of a successful EOSC in the longer term, and as such it is critical that they remain relevant in the evolving ecosystem.

The project community appears to be well-placed for contributing to the further development of the content in order to address the outstanding issues, and mechanisms exist (such as the recent consultation) to facilitate the flow of this input. The established participation rules for users and providers of developed infrastructures are highlighted in the survey as a potential source of inspiration for the final draft. A number of projects offer knowledge, experience or mechanisms which will support the development and validation of details to reinforce effective practical implementation, e.g. OpenAIRE cites concrete implementation standards (OpenAIRE on-boarding guidelines, CoreTrustSeal for data archives, RDA maturity model), NEANIAS offers practical validation and real-life applicability of the Rules through its on-boarding process, and RDA highlights that the ICT technical specifications for public procurement can be adopted by EOSC.

**Key messages**

- To ensure the successful delivery of the final EOSC Rules of Participation by December 2020, the Working Group on Rules of Participation should continue to gather and respond to feedback from the EOSC-related projects, recognising the project community as a valuable resource for addressing outstanding issues.

- The EOSC legal entity should be referenced in the final Rules of Participation, delivered at the end of the year.

- The project community has highlighted the need for further elaboration of the Rules in the following areas; concrete standards for practical implementation, Rules for different actors, compensation models, and quality (monitoring and compliance)

- There is significant experience in the community to inform the further development of the Rules to offer the practical and concrete details required for effective implementation that are lacking in the current draft

**Potential for milestones to be met by December 2020**

The initial milestone has been met, and it is likely that the on-going work to produce the final version of the Rules of Participation will be complete by December 2020.

| Milestone | Expected position by end of 2020 | Comments (based on the key messages above) |
|---|---|---|

| | |
|---|---|
| R1 – Initial Rules of Fully Participation | Delivered by EOSC Pilot in August 2018. Draft Rules of Participation released by EOSC Executive Board Working Group. |
| R2 – Final Rules of Fully Participation | Mechanisms are in place for continued engagement with stakeholders and there is significant expertise and knowledge within the community to support the further elaboration of the Rules. |

**Governance:** The Governance action line is composed of two milestones:

G1. Q4 2018: EOSC Governance established.

G2. Q3 2020: Recommendations on strategic and financing orientations and organisational settings for the future of the EOSC, post 2020.

These two milestones are well defined and relate to activities undertaken by the Commission, either directly or through the Executive Board. For these reasons, progress on implementation of these milestones was not consulted on in the survey.

The milestones relate to the first phase of the governance described in the Staff Working Document, which involves steering and oversight of the initial development of the EOSC, primarily led by the Member States and the Commission. This second phase is planned to become more stakeholder-driven, with Member States and Commission keeping a higher-level oversight role.

Milestone Q4, 2018: **EOSC Governance established, was reached within the required time-period**. The Executive Layer of governance is formed by the EOSC Executive Board. This was established by the Commission in Q4 2018, and it had its first meeting in January 2019. It is composed of eight community representatives and three independent experts selected via an open call. The Executive Board has convened and runs six working groups, supported by the EOSC Secretariat Project[53]. The Institutional Layer of governance is formed by the EOSC Governance Board, representing MS/ACs, which was also established in 2018, holding its first meeting in January 2019.

The Stakeholder Layer of governance predates the other two layers, having been established initially as part of the EOSCpilot programme (EOSC Stakeholders Forum held in 2017 & 2018). It is being continued by the EOSC Secretariat project (EOSC Symposium 2019 & 2020), and will then become the responsibility of the EOSC legal entity being formed as part of the development of the EOSC co-programme partnership.

Milestone Q3, 2020: **Recommendations on strategic and financing orientations and organisational settings for the future of the EOSC, post 2020, is currently on track to be met by the end of 2020**. An EOSC co-Programme Partnership proposal under Horizon Europe has been developed and has now been published by the Commission. To support the partnership proposal, a tripartite governance arrangement has been proposed, made up of the Commission, a Steering Board composed of MS/ACs, and an EOSC legal entity - The EOSC Association - that is currently being established as a Belgian AISBL. A Strategic Research and Innovation Agenda (SRIA) for EOSC is under development, to include a post-2020 multiannual work programme. All these activities are scheduled to be completed before the end of 2020.

The EOSC Secretariat has commissioned a number of studies contributing to the definition of the governance of EOSC post-2020. These studies will produce results by Q3 2020 that will influence the output of the working groups, notably FAIR, Sustainability and Landscaping , and these outputs will be published by the time of the EOSC symposium (Q4 2020). It is possible that such studies and working group outputs will identify areas that require further investigation.

The extension in time of the EOSC Secretariat project to Q2 2021 will assist the newly formed EOSC Association during this early period of its existence and the implementation of the post-2020 governance of EOSC.

**Potential for milestones to be met by December 2020**

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[53] See https://www.eoscsecretariat.eu/eosc-working-groups.

The initial milestone has been met, and given current activities, the second milestone will be met by December 2020.

| Milestone | Expected position by end of 2020 | Comments |
|---|---|---|
| G1 - EOSC Governance established. | Fully met | An interim governance structure has been established with four key components:<br><br>- A Governance Board with representatives from the European Commission, Member States and Associated Countries.<br><br>- An Executive Board of 8 community representatives and 3 independent experts selected via an open call.<br><br>- A broad-based and inclusive Stakeholder Community open to all.<br><br>- A series of Working Groups convened and run by the Executive Board. |
| G2 - Recommendations on strategic and financing orientations and organisational settings for the future of the EOSC, post 2020. | Fully met | An EOSC co-Programme Partnership proposal under Horizon Europe has been developed and has now been published by the Commission.<br><br>A tripartite governance arrangement has been proposed, made up of the Commission, a Steering Board composed of MS/ACs, and an EOSC legal entity - The EOSC Association - that is currently being established as a Belgian AISBL. A Strategic Research and Innovation Agenda for EOSC is under development, to include a post-2020 multiannual work programme.<br><br>All these activities are scheduled to be completed before the end of 2020. |

**Section 4:      Architecture**

-      **Action line overview**

**Scope:** Architecture of the federated infrastructures as the solution to the current fragmentation in research data infrastructures which are insufficiently interoperable.

**Actions and Milestones:** The Roadmap identified the following actions and milestones required to deliver the Architecture action line:

| Starting from | Committed resources (non-exhaustive) | Action | Milestones |
|---|---|---|---|
| 2018, Q1 | EOSC -hub project OpenAIRE-Advance project FREYA project | Develop the initial EOSC federating core including the EOSC shared resources | Q4 2019: Initial EOSC federating core in place |
| 2019, Q1 | EOSCpilot project **INFRASUPP-01-2018-2019 (b3)** (CatRIS project) | Develop a catalogue of interested and eligible (per Rules of Participation) data infrastructures and services to be federated into the EOSC and identify EOSC federate centres | Q4 2019: Registry of data infrastructures of the EOSC (initial) |
| 2018, Q4 | **INFRAEOSC-04-2018** (ENVRI-FAIR, ESCAPE, PANOSC, EOSC-Life, SSHOC) | Connection of the research infrastructures identified in the ESFRI Roadmap to the EOSC. Support to this activity will be provided through cluster projects. | Q2 2020: Preliminary connection of most infrastructures and services to the EOSC |

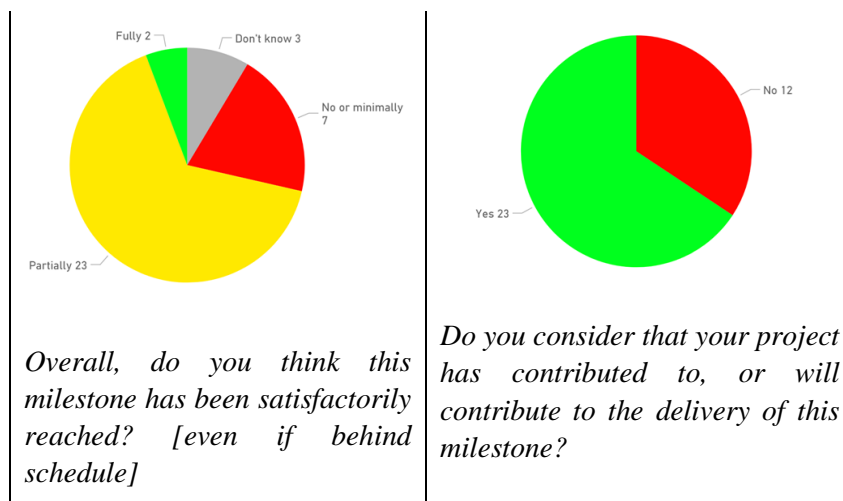- **Analysis of progress towards milestones**

4.2.1 Milestone: Initial EOSC federating core in place

**Action overview:** Develop initial EOSC federating core including the EOSC shared resources.

**Survey responses**

▪ Initial EOSC federating core in place

*Overall, do you think this milestone has been satisfactorily reached? [even if behind schedule]*

*Do you consider that your project has contributed to, or will contribute to the delivery of this milestone?*

**Response analysis overview**

▪ The majority of respondents indicate that the milestone is "Partially implemented".

▪ EOSC-hub, being one of the key owners of this milestone, claims that the federating core is "Fully implemented". Although it has indeed worked on the areas foreseen in the Roadmap doc, namely, the "Shared Resources" and the "Compliance Framework", along with the EOSC portal and catalogue, there is no clear definition and composition of the "federated core" architecture. The concept of and the expectations from the federating core have also evolved, especially after the introduction of the Tinman report by the EOSC sustainability group[54], in 2020, i.e. 2 years after setting the specific milestone, and **further consolidation is required.**

▪ On the other hand, there are respondents claiming that it is "No or minimally implemented", which may not be fully in-line with their own comments, stating that several components are up and running. Still, **it is clear that coordination among projects and between projects and the EOSC EB/WGs is required to agree on the what the federating core is, what is the progress in relation to the milestone set in 2018, what are the new requirements defined in 2020, and how this evolution will affect the development of the EOSC federating core in the coming years.**

**Key points from other projects/respondents**

o The **definition of the federating core** and its components is yet inconclusive; a clear definition has to be agreed across all projects/EOSC governance and **the architecture needs to be refined/consolidated**, starting from the EOSC-hub work (which includes computing/storage resources that are moved to the EOSC Exchange in the EOSC EB WGs documents). Such an agreed definition of the EOSC Core and a more detailed compliance framework including rules of participation and the interoperability framework, will also enable the faster **integration and on-boarding of regional EOSC projects and their services/outputs**.

o A framework including guidelines for **data/data infrastructures federation** should be developed, as well as the connection with the services provided by the thematic communities. The scientific outputs (data, applications, software, pipelines etc) are also missing.

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[54] https://drive.google.com/file/d/1vlsCj3D6XEmoRqw3m9_JlQ2hiv67wNXq/view

o Although several components have been implemented being in an advanced state (EOSC portal, catalogue of services, AAI, on-boarding process), **further integration effort across** these and other ones not sufficiently developed, especially around **data/data management**, is required, including concrete use cases/workflows, for a coherent and seamless EOSC environment.

o Further requirements concerning **security, privacy, access restrictions and data transfer**, especially for **thematic infrastructures**, need to be taken into account, including relevant workflows combining several of these.

o The **EOSC Interoperability Framework** is welcome as a key component for practical use of the EOSC and this should be developed and articulated further, made openly available for use, especially by thematic infrastructures.

o The **processes relating the core operations are sometimes heavy-handed** and should be simplified and streamlined.

o A higher level of **bottom-up** consultation and modification of the EOSC model to suit workflows established and trusted in the science community would accelerate adoption of EOSC services.

o Further architectural work including business models is required on how the **commercial services** can be on-boarded.

**Evidence in support of position**

**Main projects responsible for milestone (EOSC-hub, OpenAIRE-Advance, FREYA)**

**Key results, activities or outputs**

▪ **EOSC-hub** has been one of the main contributors on the definition **and** implementation of the initial Federating Core. The project defined a [first proposal](#) of the Federating Core in July 2019 and started a wide discussion with communities in the ERA including a consultation in Nov-Dec 2019 to further enhance this definition and find a large consensus. An [updated document](#) was produced in February 2020, taking into account the comments received. The following projects have provided feedback: FAIRsFAIR, FREYA, GÉANT, INCD and LIP, NI4OS-Europe and SSH Open Marketplace (DARIAH-ERIC), and the five EOSC cluster projects ENVRI-FAIR, EOSC-LIFE, ESCAPE, SSHOC and PaNOSC.

▪ In this briefing paper EOSC-hub defines and provides the main components of the EOSC Federating Core: (1) Services that implement the federating tier (the "Hub portfolio") including the EOSC Portal, the EOSC Portal AAI, a EOSC dedicated helpdesk, accounting and monitoring capabilities. (2) Shared resources including scientific outputs (e.g. data, applications, software, and data processing pipelines), and federated storage and compute facilities to deposit, share and process data. (3) The EOSC Compliance Framework, i.e. policies that define the EOSC "regulatory tier" including enforceable Rules of Participation, security policies, and federated Service Management processes, such as order management through the portal, EOSC service portfolio management, customer and provider relationship management, etc.

▪ The EOSC Sustainability and Architecture working groups have also worked on the concept of MVE, EOSC-Core and EOSC-Exchange, especially the first with its "Tinman" report. [An alignment and consolidation of the EOSC federating core is however required](#).

▪ EOSC-hub also delivered various components of the EOSC Portal like the website, the AAI, the service catalogue & marketplace, the helpdesk and the monitoring. Federation tools

operated by EOSC (AAI, accounting, monitoring, etc) are also offered for integration to the service providers joining the EOSC.

▪ **OpenAIRE** has developed the [OpenAIRE Research Graph](), offering discovery and monitoring functionalities over all research products (literature, dataset, software). The graph is built by collecting metadata records from trusted scholarly communication sources that adhere to an agreed set of guidelines.

▪ OpenAIRE-Advance also refers to the eInfraCentral work on the catalogue of services (harvesting related e-Infrastructures and RI catalogues), along with the Open Access subset of research products collected from the OpenAIRE catalogue.

▪ **FREYA** provided PID-related services that will be integrated in federating core, such as PID Services Registry and Common DOI search

▪ **Regional projects and clusters**

▪ **EOSC-Synergy** is building an integration layer for Cloud resources based on the current operational tools of the EGI Federated Cloud, extending the concept to resources other than cloud, i.e. including access to HPC resources and data repositories. All the services deployed for the project are using a common AAI layer, and are integrated with a global monitoring and accounting system also based on EGI components following EOSC-hub architecture.

**Quantitative indicators of progress (e.g. KPIs)**

▪ EOSC-Hub KPIs based on Roadmap document:

- KPI1 (# integrated service providers) - **providers on-boarded**, including formal documentation related to level of service offered. Status December 2019: 329 (base target 325 by Dec 2020)

- KPI2 (# entries of the EOSC-hub service portfolio) **number of services listed**. Status December 2019: 95 (base target 49 by Dec 2020)

- KPI11 (# **new communities that become thematic service providers**) thematic services that reached maturity to be added in EOSC-hub marketplace. Status December 2019: 101 (base target 9 by Dec 2020).

▪ OpenAIRE-Advance lists related KPIs such as number of repositories and other content providers on-boarded, number of content providers providing usage data, or number of open/FAIR datasets or other research products deposited in Zenodo or aggregated in OpenAIRE catalogue. However, the current values are not provided.

- 1450 content providers are registered in OpenAIRE from Europe and around the world.

- The OpenAIRE catalogue provides a list of KPIs with their values, although target values were not always defined. (As of June 2020, OpenAIRE Explore lists 35mi OA publications, 975K OA data objects, 136 OA software, 3.3mi OA other type research objects).

▪ EOSC regional (5b) projects are working on a set of indicators for monitoring country readiness levels for EOSC (implementation status of EOSC at country level- National Open Science Clouds).

- FREYA reports KPIs on PID graph and PID Commons, stating that these may not be directly regarded as EOSC core ones.

- PANOSC provides their full list of KPIs which is more relevant to the next milestones.

- Other projects either provide KPIs not directly relevant, or do not provide relevant information.

**Outstanding work required by end of 2020**

- The **definition of the federating core** needs to be agreed across EOSC Hub/all projects and EOSC governance/WGs and **the architecture needs to be refined/consolidated/made compound**, having as basis the EOSC-hub work, adding a framework for **data/data infrastructures federation,** including guidelines/schemata at metadata level, following the FAIR principles. The connection/federation with the services provided by the **thematic communities, along with their outputs** (**data**, applications, software, workflows, etc.) need to be also planned and interfaced.

- The Compliance framework needs to be further refined, including the Rules of Participation, in particular focusing on the projects' outputs on-boarding process.

- Further **integration/consolidation effort** across the developed federating core components and the compliance framework is required, towards **automated procedures** and **concrete use cases/workflows** for a coherent and seamless EOSC environment.

- An agreed definition of the EOSC Core and a more detailed compliance framework including rules of participation and the interoperability framework, will also enable the faster **integration and on-boarding of regional EOSC projects and their services/outputs**. Automated on-boarding/federation from compliant national/regional/thematic services/artefacts into the European EOSC portal needs to be implemented. The on-going **PID mechanism**/policies for naming data and services need to be concluded. The discovery mechanisms for data and services in the portal need to be further refined, along with user identity and access mechanisms (although the latter is already advanced).

- Further requirements concerning **security, privacy, access restrictions and data transfer**, especially for **thematic infrastructures**, need to be taken into account, including relevant workflows combining several of these. The paper from the cluster projects and related use cases should be also taken into account and tested.

- The **EOSC Interoperability Framework** should be further articulated, developed, and documented, to be widely and easily usable, especially by thematic infrastructures.

- Work on-boarding commercial services.

- The processes relating the federating core operations are sometimes heavy-handed and should be simplified and streamlined.

**Project answers on outstanding work**

- EOSC-hub will continue and evolve the activities and services.

- OpenAIRE will deliver a full EOSC resources catalogue, inclusive of EOSC services and EOSC research products, with relationships to other key research entities, such as: funders, organizations, communities, and authors. It also has an international perspective via an

internationalisation roadmap for the guidelines which was a milestone in the OpenAIRE Advance.

▪ **EOSC Enhance** is working on developing and improving the functionalities of the EOSC Portal. By end of 2020 a new version of the EOSC Portal will be operational including a single registry, a single on-boarding process and an upgraded version of the user interface for both users and providers.

▪ **Regional projects**

▪ **EOSC-Synergy** is building an integration layer for Cloud resources based on the current operational tools of the EGI Federated Cloud, extending the concept to resources other than cloud, i.e. including access to HPC resources and data repositories. All the services deployed for the project are using a common AAI layer, and are integrated with a global monitoring and accounting system also based on EGI components following EOSC-hub architecture.

▪ **EOSC-Pillar** is implementing a model for national catalogues that can be used for testing the on-boarding of national services.

▪ **NI4OS-Europe** will build a functional building block aiming to simplify and increase the integration of resources with the operational tools from the EOSC-core layer.

▪ **EOSC-Nordic** will work on integration of its services with the federating core, in collaboration with EOSC-hub and EOSC Enhance.

4.2.2   Milestone: Registry of data infrastructures of the EOSC (initial)

**Action overview:**  Develop a catalogue of interested and eligible (per Rules of Participation) data infrastructures and services to be federated into the EOSC and identify EOSC federated centres.

**Survey responses**

▪ Registry of data infrastructures of the EOSC (initial)
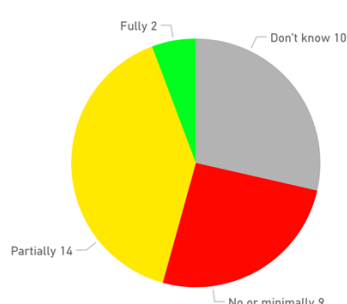


*Overall, do you think this milestone has been satisfactorily reached? [even if behind schedule]*

*Do you consider that your project has contributed to, or will contribute to the delivery of this milestone?*

**Response analysis overview**

▪ Although the highest number opted for "Partially implemented", there is a high number of "No or minimally" and of "Don't know's", and only few fully implemented. Despite the fact

that the Roadmap is clear on what this point refers to, i.e. catalogue of interested and eligible (per Rules of Participation) data infrastructures to be federated into the EOSC  it appears that **there is no clear understanding/interpretation of this point by all the respondents**. There are responses saying that "we do not know what it refers to", "such registry doesn't exist" and others referring to the Landscape WG report. So, from the answers it is evident that there is **a lack of information**, especially compared to the previous architecture milestone on the federated core**.**

- **The summary answer is that although the EOSC service catalogue features a number of both generic and thematic data infrastructure services and data catalogues, still a lot of thematic data infrastructures services and artefacts, such as the ones from the Cluster projects, in particular datasets, are not yet on-boarded.** In more detail:

    o Although there are individual thematic/data catalogues listed in the EOSC catalogue and marketplace, the following key ones are not yet or insufficiently federated:

        - **EOSC/ESFRI cluster projects**

        - **CatRIS** (Catalogue of RI Services) catalogue

        - **Other thematic projects** currently on-going which are at early stage

        - **EOSC Enhance project**

        - Although EOSC-Pilot, EOSC-Hub, CatRIS, and later on the WG on RoP have provided a first set of guidelines for on-boarding, **the assessment of compliance with these guidelines may not always be straightforward** or at least well understood/ accepted by other projects. Validation and monitoring tools need to be developed to ease the on-boarding validation process.

    a. **Marketplace/Catalogue operation under the FAIR principles** is not yet sufficiently achieved, as several points need to be improved:

o **Lack of service PIDs** limits referencing and attribution

o **Further discoverability/cataloguing features**, in particular for scholarly communications artefacts **including datasets** are required.

o A common set of **interoperability guidelines** need to be agreed across all the above projects, including **resource description templates/metadata, etc.** Automatic interfaces/APIs for automatic on-boarding after interoperability is achieved are required.

    o **A set of examples/workflows/use cases easing the uptake of services/data use** are insufficiently developed. Furthermore, **connecting/interlinking related services/data is needed.**

**Evidence in support of position**

**Main projects responsible for milestone (EOSCPilot and CatRIS)**

**Key results, activities or outputs**

- CatRIS responded that the catalogue of data infrastructures and services is partially implemented and seems to be in a rather initial phase of development, as it includes a small part of resources available in Europe.

- EOSC-hub and eInfraCentral have agreed on the EOSC portal **service on-boarding process**, and the EOSC service catalogue exposes **a growing number of thematic and generic data-related services** that can be discovered and used by European researchers. EOSC-hub defined a basic set of rules of participation that are currently used to validate the services before the on-boarding, in particular to verify their maturity (TRL8 or TRL9).

- **EOSC-hub has published 34 thematic services in the EOSC portal** by communities participating in the project (GEOSS, CLARIN, CMS, ENES, OPENCoastS, WeNMR, etc.) or in competence centers (ELIXIR, EPOS, Fusion, etc.) The EGI, EUDAT e-infrastructures and the INDIGO-DataCloud initiative, core members of EOSC-hub have published their whole service catalogue in the EOSC portal, including services to support the whole data lifecycle (access & sharing, discovery & re-use, process & analysis, data curation & preservation).

- The PaNOSC data portals have been registered with OpenAIRE and r3data.org, but data is not appearing in B2FIND.

- NI4OS-Europe declares that its service catalogue is compatible with the EOSC service catalogue and feedback will be provided to EOSC on the overall on-boarding and cataloguing process. Other regional projects are also working on interoperable catalogues/registries.

- NEANIAS also declares compatibility of its thematic catalogue with EOSC catalogue (e.g. EOSC Pillar).

- *Evidence of outstanding/not fully developed features is given above but also in the corresponding section below.*

**Quantitative indicators of progress (e.g. KPIs)**

- **EOSC-Hub** KPIs based on Roadmap document:

    - KPI1 (# integrated service providers) - **providers on-boarded**, including formal documentation related to level of service offered. Status December 2019: 329 (base target 325 by Dec 2020)

    - KPI2 (# entries of the EOSC-hub service portfolio) **number of services listed**. Status December 2019: 95 (base target 49 by Dec 2020)

    - KPI11 (# **new communities that become thematic service providers**) thematic services that reached maturity to be added in EOSC-hub marketplace. Status December 2019: 101 (base target 9 by Dec 2020).

    - KPI12 (# order for services part of the EOSC-hub catalogue) **total number of service requests received via the marketplace**. Status December 2019: 186 recorded, 118 fulfilled (base target 70 by Dec 2020)

    - KPI16 (**# countries having users consuming Virtual access EOSC-hub services**). December 2019 status being assessed, status December 2018: 107 (base target 30 by December 2020)

- KPI9 (**# new communities reaching pilot use of EOSC-hub services**) supported communities that can run successful pilots using EOSC-hub. Status December 2019: 8 (base target 8 by Dec 2020); and

- and KPI10 (**# new communities reaching production use of EOSC-hub services**) communities using EOSC services in production mode (covered by SLAs). Status December 2019 value 5 (base target 5 by Dec 2020).

▪ OpenAIRE-Advance lists related KPIs such as number of repositories and other content providers on-boarded, number of content providers providing usage data, or number of open/FAIR datasets or other research products deposited in Zenodo or aggregated in OpenAIRE catalogue. The current values are provided in the OpenAIRE catalogue, however not always having previously set target values.

- o 1450 content providers are registered in OpenAIRE from Europe and around the world.

- o OpenAIRE also offers research impact service monitoring tools to research communities, often intended to research infrastructures, in order to deliver numbers on their scientific impact.

▪ PANOSC provides their full list of KPIs, yet their services and data are not yet federated or integrated to the EOSC and CatRIS portals.

▪ Other projects either provide KPIs not directly relevant, or do not provide relevant information.

**Outstanding work required by end of 2020**

▪ The **following key data infrastructures will be federated** via an automatic interface (API) after a common set of interoperability guidelines are agreed, including a **resource description template with a common or an interoperable metadata schema**:

- **EOSC/ESFRI cluster projects**

- **CatRIS** (Catalogue of RI Services) catalogue

- **Other thematic clouds/projects** currently on-going which are at early stage and EOSC Enhance (if not directly worked out inside the EOSC portal)

- **Such a federated registry with authoritative records for the majority of EU data infrastructures is required.** Focus must be put on **harmonisation of records and reusability** through abiding to the FAIR principles including interoperability. However, this may not be ready by the end 2020.

▪ Validation and monitoring **tools for the assessment of compliance with the Rules of Participation/on-boarding guidelines** need to be developed, as soon as the RoP are finalised (EOSC Governance having different timelines from the Roadmap ones).

▪ A set of features that will make the EOSC portal **attractive to users** is required, **including workflows/use cases**/examples easing the uptake of services/data use (respective grant launched only in December 2019)
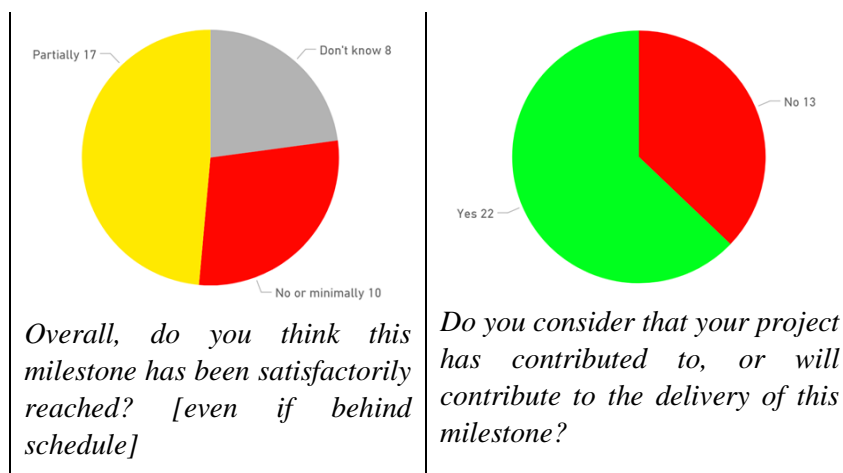
▪ The **OpenAIRE Research Impact Service** monitoring tools to research communities will be updated to facilitate monitoring of the outputs in the future, cross-linking services, research products, and research infrastructures (more generally data infrastructures). The timeframe though is not specified.

4.2.3 Milestone: Preliminary connection of most infrastructures & services to the EOSC

**Action overview:** Connection of the research infrastructures identified in the ESFRI Roadmap to the EOSC. Support to this activity will be provided through cluster projects.

**Survey responses**

▪ Preliminary connection of most infrastructures & services to the EOSC



*Overall, do you think this milestone has been satisfactorily reached? [even if behind schedule]*



*Do you consider that your project has contributed to, or will contribute to the delivery of this milestone?*

**Response analysis overview**

▪ Although the highest number opted for "Partially implemented", there is a high number of "No or minimally" and of "Don't know's", with no respondents indicating that they consider the milestone fully implemented. **All Cluster projects** who are responsible for the milestone **declare that this as "Partially implemented", however the term "preliminary connection" is not well-defined. If this implies the federation of cluster projects in EOSC, this is not yet achieved. As one of the cluster projects is saying, "*the connection itself has been established*", but "*it has to be formalized, intensified and permanentized*". Thus, the cluster projects' engagement with EOSC is "work in progress", and more results are expected towards the end of the year.**

▪ **In summary, although a few thematic RIs have started registering their services within the EOSC catalogue, a clear model to federate and on-board thematic communities into EOSC has not been devised.** Furthermore, **the data component is still inadequately federated,** as only a few thematic data catalogues are registered in the EOSC portal. As many RI projects operate their own thematic portals or data catalogues, the need for such a federation model is becoming even more important. **Furthermore, on-boarding currently requires manual effort** (filling out application forms and iterating through a human feedback process)**. Significant work is required to define machine-actionable interfaces for connecting services in an automated fashion**. As already identified in the previous milestone, a common (or interoperable) resource description template with a common (or an interoperable) metadata schema is required for bulk automated on-boarding for services/data.

- **The EOSC clusters position paper** has contributed towards raising awareness on the clusters expectations and priorities, in particular enabling the accessibility and re-use of research data, increasing scientific value of research data, and delivering an interoperable environment of data infrastructures. Such an added value, along with long-term commitment by EOSC, contributes to the closer engagement of the clusters and thematic RIs.

- Finally, not all clusters and in particular not all RI projects are in the same level of advancement or maturity. In particular, the EXPANDS project (the only thematic project of the EOSC-5b projects that is in essence a cluster project) declares that they don't see a consistent connection to EOSC, although some initial steps have been taken.

**Evidence in support of position**

**Key results, activities or outputs**

- Multiple individual activities of collaboration between cluster or RI projects with EOSC implementation projects, reflects the current **"work-in-progress" level of engagement**. Some examples are provided below:

  o PANOSC has been working with EGI in using some of the EOSC-hub services. Also, there is a preliminary connection at Authentication, Authorisation Infrastructure (AAI) level.

  o SSHOC has already submitted a small number of services for inclusion in the EOSC Portal and plans to submit a large number of services over the course of the project runtime.

  o EOSC-hub engaged with several clusters and ESFRI RIs through different channels to promote the integration with EOSC, which resulted in the publication of an initial set of EOSC cluster services in the EOSC Portal.

  o GEANT is providing Trust and Identity services (AAI) to a number of clusters, which supports access to their services in a more secure manner.

  o EOSC-Nordic has been working with ARIADNE RI project on discovery and re-use of research data in EOSC.

  o FREYA has been working with cluster projects on the adoption of their (FREYA) services.

  o NI4OS-Europe quotes three relevant to the clusters thematic areas on which it has been working on.

**Quantitative indicators of progress (e.g. KPIs)**

- **PANOSC KPIs**

  o Service Providers connected to eduTeams Umbrella - Status May 2020: 2

  o Services connected and accessible through eduTeams Umbrella - Status May 2020: 1

- **EXPANDS** has provided related KPIs, such as "Number of users accessing ExPaNDS data catalogues through the EOSC", however most of them will be collected in 2021.

- **EOSC-Hub** KPIs based on Roadmap document:

  ○ KPI11 (# new communities that become thematic service providers) thematic services that reached maturity to be added in EOSC hub marketplace. Status December 2019: 101 (base target 9 by Dec 2020).

  ○ KPI9 (# new communities reaching pilot use of EOSC-hub services) supported communities that can run successful pilots using EOSC-hub. Status December 2019: 8 (base target 8 by Dec 2020); and

  ○ KPI10 (# new communities reaching production use of EOSC-hub services) communities using EOSC services in production mode (covered by SLAs). Status December 2019 value 5 (base target 5 by Dec 2020).

**Outstanding work required by end of 2020**

- EOSC-hub in collaboration with EOSC-Enhance, which incorporates in its consortium the coordinators of all cluster projects, **plans to design and implement the federation of the EOSC clusters service catalogues.** However, the timeline is a challenge and likely this milestone will be achieved after the end of 2020. Machine-actionable interfaces for connecting services in an automated fashion are required, along with a resource description template with a common or interoperable metadata schemata for bulk automated on-boarding for services/data.

- Particular emphasis should be given on the data catalogues and the data components, so that thematic datasets are accessible via the EOSC portal. However, again it is not clear whether such a milestone will be reached by the end of 2020.

## 4.3    Action line summary

**Significant progress has been achieved in the area of EOSC architecture**, in particular in the area of the EOSC federated core, and somewhat less in the areas of the registry of data infrastructures and EOSC clusters connection to EOSC. This is showcased by some of the KPIs, especially from EOSC-hub project, where the current values are much higher than the initially planned.

However, several steps are needed to be able to tick the milestones as completed. Less for the federated core and more for the registry of data infrastructures and clusters connection to EOSC.

**Regarding the federated core**, coordination among projects, and between projects and the EOSC EB/WGs is required to agree on the federating core composition and consolidate the relevant efforts by the end of the year.

- The **definition of the federating core** needs to be agreed across all projects/EOSC governance and **the architecture needs to be refined/consolidated**, starting from the EOSC-hub work (which includes computing/storage resources that are lacking from EOSC EB WGs documents). A framework including guidelines for **data/data infrastructures federation** is required, as well as the connection with the services provided by the thematic communities.

- The **Rules of Participation** which are part of the Compliance Framework are not detailed enough, especially for on-boarding project outputs. The **EOSC Interoperability Framework** should be developed and articulated further, made openly available for use, especially by thematic infrastructures. Such work will also

enable the faster **integration and on-boarding of regional EOSC projects and their services/outputs**.

▪ Further requirements concerning **security, privacy, access restrictions and data transfer**, especially for **thematic infrastructures**, need to be taken into account, including relevant workflows combining several of these.

▪ A higher level of **bottom-up** consultation and modification of the EOSC model to suit workflows established and trusted in the science community would accelerate adoption of EOSC services. The processes relating the core operations are sometimes heavy-handed and should be simplified and streamlined.

▪ More work is also needed on business models and other financial/legal areas for on-boarding **commercial services.**

**Regarding** *the* **registry of data infrastructures and EOSC clusters connection to EOSC,** only a number of both generic and thematic data infrastructure services and data catalogues is federated, and still a lot of thematic data infrastructures services and artefacts, such as the ones from the Cluster projects, in particular datasets, are not yet on-boarded. In these two areas there is higher uncertainty of whether some key developments can be concluded by the end of the year.

● The following key research data infrastructures are not yet or insufficiently federated:

▪ **EOSC/ESFRI cluster projects**

▪ **CatRIS** (Catalogue of RI Services) catalogue

▪ **Other thematic clouds/projects** currently on-going which are at early stage

▪ **EOSC Enhance project work** on EOSC portal in collaboration with EOSC Clusters.

▪ The initial RoP proposed by EOSC Pilot in 2018 (aligned with the Roadmap timeline) were not assessed by those responding in the questionnaire. The WG on RoP have provided a first set of guidelines for on-boarding, but **the assessment of compliance with these guidelines may not always be straightforward** or at least well understood/accepted. As soon as the RoP are finalised, validation and monitoring tools should be developed Further work is required, especially to automate and allow bulk service on-boarding.

▪ **Marketplace/Catalogue operation under the FAIR principles** is not yet sufficiently achieved, as several points need to be improved:

○ **Lack of service PIDs** limits referencing and attribution

○ **Further discoverability/cataloguing features**, in particular for scholarly communications artefacts **including datasets** are required.

○ A common set of **interoperability guidelines** need to be agreed across all the above projects, including **resource description templates/metadata, etc.** Automatic interfaces/APIs for automatic on-boarding after interoperability is achieved are required.

○ **A set of examples/workflows/use cases easing the uptake of services/data use** are insufficiently developed. Furthermore, **connecting/interlinking related services/data is needed**

○ **The Marketplace/Catalogues** should further evolve based on the recommendations of the EOSC Governance (WG Architecture, Sustainability).

▪ As outlined in the area of the federated core **a clear model to federate and on-board thematic communities into EOSC has not been devised, with emphasis on the data component and the thematic data catalogues**. As many RI projects operate their own thematic portals or data catalogues, the need for such a federation model is becoming even more important. **Such a model needs to foresee machine-actionable interfaces for connecting services in an automated fashion**, to move away from the current manual efforts (filling out application forms and iterating through a human feedback process)**.** As already identified in the federated core milestone, resource description templates with a common (or interoperable) metadata schemata are required for bulk automated on-boarding for services/data.

## Section 5: FAIR Data

### 5.1 Action line overview

**Scope:** FAIR data management and tools. A common data language to ensure data stewardship across borders/disciplines based on FAIR principles.

**Actions and Milestones:** The Roadmap identified the following actions and milestones required to deliver the FAIR Data action line:

| Starting from | Committed resource | Action | Milestones |
|---|---|---|---|
| 2018, Q3 | RDA Europe 4.0 **INFRAEOSC-05-2018-2019(b)** (EOSC-Pillar, NI40S, ExPaNDS, EOSC-synergy, EOSC-Nordic) | Define a European Framework for FAIR research data | Q2, 2019: European Framework for FAIR research data agreed |
| 2019, Q1 | FREYA Project RDA Europe 4.0 | Define a Persistent Unique Identifier policy for FAIR data | Q4, 2019: FAIR Persistent Unique Identifier policy defined |
| 2019, Q1 | **INFRAEOSC-05-2018-2019(c)** (FAIRsFAIR) | Develop FAIR data accreditation/certification scheme for repositories | Q4, 2019: FAIR certification scheme available |

### 5.2 Analysis of progress towards milestones

5.2.1 Milestone: European Framework for FAIR research data agreed

**Survey responses**

▪ European Framework for FAIR research data agreed
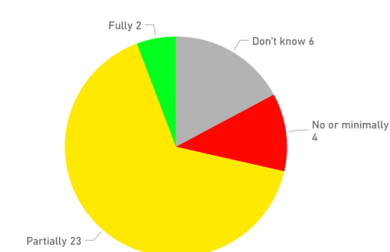


*Overall, do you think this milestone has been satisfactorily reached? [even if behind schedule]*
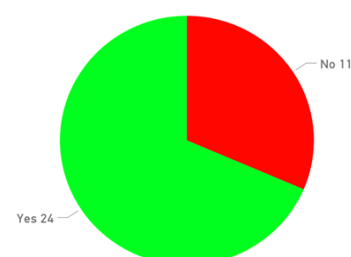


*Do you consider that your project has contributed to, or will contribute to the delivery of this*

**Response analysis overview**

▪ The majority (22) agrees on "Partially implemented", although **the interpretation of the "European Framework for FAIR research data" varies among respondents**. The Roadmap links this milestone with the" FAIR Data Action Plan" produced by the European Commission Expert Group on "Turning FAIR Data into reality". The Action Plan and the corresponding Expert Group report provide a set of guidelines, recommendations and actions to research communities and countries to develop specific plans on how to implement FAIR data in their contexts (i.e. research areas and countries). The Roadmap further specifies that the "outcome of the action plan would eventually constitute a new operational framework for FAIR research data", similar to the existing European framework for the interoperability of public services. So, although the Expert Group documents (along with several other documents produced that are mentioned below) already constitute a framework, it has not been clear whether the operational/implementation framework is required to tick the milestone as completed. **If the milestone is more linked to a theoretical framework and high-level guidelines, this is already in place, while if the operational implementation framework is required, the "partially implemented" represents the current state.** Note that *several respondents clearly raised this issue of what the framework refers to*, be it the general framework or a concrete implementation framework.

▪ A small number of respondents (2) answered that the milestone is fully implemented, while there is another small of "No or minimally" (4) and a bit higher number of "don't know's" (5).

**Evidence in support of position**

**Key results, activities or outcomes**

▪ RDA-Europe 4.0 and the regional EOSC-5b projects are referred to as responsible projects for this milestone, still other projects/initiatives and WGs have been reported by the respondents working on this milestone, namely:

▪ EC expert group "Turning FAIR into reality"" and its "FAIR Data Action Plan" as already reported above.

▪ A joint report by FAIRsFAIR, RDA Europe, OpenAIRE, EOSC-hub, FREYA, entitled "Recommendations for Services in a FAIR data ecosystem", highlighting common challenges and priorities, and proposing a set of initial recommendations on how existing data infrastructures can evolve to provide services that support the implementation of the FAIR data principles, in particular in the context of building the EOSC.

▪ The FAIR Evaluation services by University Polytechnic Madrid, Oxford eResearch center, Go-FAIR international office and Maastricht University, providing resources and guidelines to assess the FAIRness of digital resources.

▪ The "FAIR DATA Maturity Model" by an RDA Working Group, which provides guidelines and specifications in terms of a maturity model for FAIR assessment with assessment indicators, priorities and evaluation methods. This contributes to the normalisation of

assessment approaches to enable comparison of results. Note that this is in its last steps of endorsement as an RDA Recommendation.

▪ The "EOSC Interoperability Framework", by the EOSC Architecture and FAIR Working Groups, which is also part of a consultation process and a final version is expected in October 2020.

▪ The FAIRsFAIR efforts have been also referred to including:

- the FAIRsFAIR Synchronisation Task Force mapping activities which are contributing to Turning FAIR into Reality in the context of the EOSC.

- the upcoming FAIRsFAIR White Paper, which will provide a set of prospective recommendations for how to encourage alignment and synchronisation around FAIR, Open Science and EOSC, and also provide information about progress on turning FAIR into reality, taking input from the above task force and related workshops.

▪ So, all these initiatives and documents contribute to the implementation framework noted in the Roadmap by providing concrete steps for evaluation of data and services "FAIRness", taking the initial generic framework by the EC expert group several steps further.

▪ RDA Europe referred to the work of RDA "fostering the development of professional practices in Research Data Management (RDM) and stewardship", related to "*i) better culture and practical skills in research data management, ii) developing FAIR data tools, and iii) fostering demand for FAIR data through consistent FAIR data mandates and incentives*".

▪ Several other respondents, including some of the regional (5b) EOSC projects, the EOSC clusters'/EOSC thematic cloud projects, answered that **they work on tools for FAIR and metadata validation**, **promoting incentives and rewards on RDM and FAIR, and developing FAIR data spaces by aggregating/federating datasets** and other artefacts from multiple domains. OpenAIRE also referred to its **Open Science Observatory** (work in progress), where FAIRness per country and discipline will be reported.

**Outstanding challenges**

▪ Despite the good progress, there are also comments on the readiness level of the various actors to adopt the FAIR principles. RDA Europe based on a series of workshops states that there is a relatively **low level of maturity in the context of building the EOSC with regards to FAIR data,** quoting lack of information and good practices and evolving roles and responsibilities of actors in this area. Both the technical elements (such as PIDs, machine actionable metadata/DMPs) and the social elements (global collaborations, including FAIR in research assessments, sharing culture) are reported.

▪ The role of the thematic infrastructures was further highlighted, also in this area. In particular the participation of **thematic areas** in the **testing, adaptation and implementation of FAIR guidelines** would be beneficial for the advancement of this milestone, including specific actions, practices for PIDs, metadata, and policies for different thematic areas.

- More concrete work is needed furthering the high-level guidelines into more specific actions, such as **practices for PIDs, metadata guidelines, and related policies** that different thematic areas in EOSC should follow.

**Quantitative indicators of progress (e.g. KPIs)**

- There are scattered indicators by several projects, among others FAIRsFAIR, FREYA, NI4OS-Europe, OpenAIRE-Advance, PANOSC, however in many cases no current values are given to be able to quantify the progress. Two examples are given below:

- NI4OS-Europe:

  - 2 FAIR and ORDM tools

- PaNOSC:

  - number of metadata parameters defined

  - number of raw data DOIs

  - number of user defined DOIs

  - number of citations of DOIs

  - number of datasets

  - volume of data archived

  - number of datasets cited in publications

  - number of PANOSC facilities offering public metadata via OAI-PMH

  - number of facilities offering a PANOSC catalogue search endpoint

  - number of datasets with FAIR data leaving embargo period in the coming year

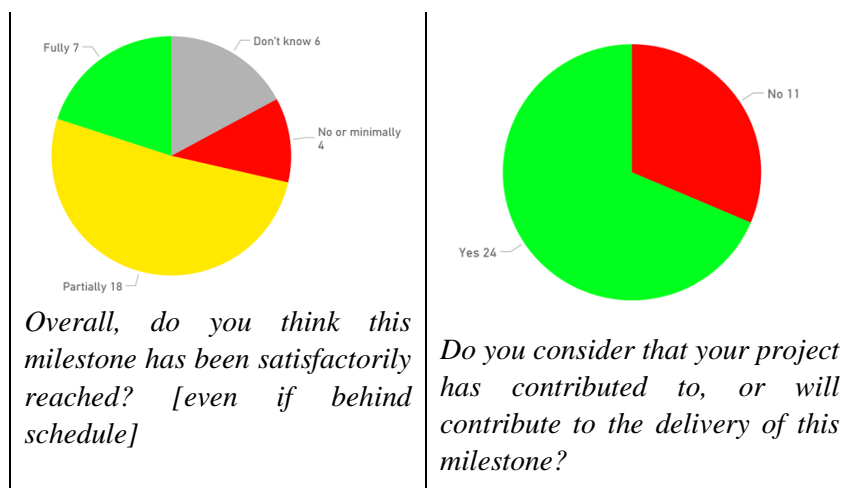**Outstanding work required by end of 2020**

- There are several documents from different entities (outlined above), some of which need to be finalised and then endorsed. In particular, the **RDA Data Maturity Model and the draft EOSC interoperability framework document**, which are currently in consultation are expected to be finalised later in the year. The FAIR WG will also propose FAIR metrics and certification by the end of 2020. Furthermore, the final EOSC interoperability document should be published under EOSC FAIR WG.

  - In particular the following points need to be concluded:

    - *the principles related to findability and accessibility require mostly technical expertise that can be addressed by **generic/horizontal services** (e.g. PIDs, cataloguing, discovery and storage)*

    - *the principles related to interoperability and reuse require services that cater to disciplinary needs which require specific **thematic/domain expertise** (e.g. ontologies, curation and stewardship provided by domain repositories).*

  - *Furthermore, **skills and services for data stewardship and preservation** are needed to maintain the FAIRness of research outputs over time.*

- An official endorsement of such an operational framework should be devised, possibly by the new EOSC legal entity (as the official view on FAIR compliance).

- The EOSC interoperability framework needs to be pilot tested, especially by thematic and national communities/repositories.

- It is crucial to have policies that will continuously support the implementation of FAIR in Europe and provide incentives for stakeholders to consider this in their agenda of priorities.

● Furthermore, the dissemination of related framework or guideline documents needs to be improved, because several respondents were not aware of all documents related to this milestone.

### 5.2.2 Milestone: FAIR Persistent Unique Identifier policy defined

**Survey responses**

▪ FAIR Persistent Unique Identifier policy defined



*Overall, do you think this milestone has been satisfactorily reached? [even if behind schedule]*



*Do you consider that your project has contributed to, or will contribute to the delivery of this milestone?*

**Response analysis overview**

▪ 7 respondents answer that the MS was "fully implemented", 3 of which consider that their project has or will contribute to the delivery of the milestone, 4 do not

▪ 18 respondents answer that the MS was "partially implemented", 13 of these do consider that their project will contribute to the delivery of the milestone, 5 do not

▪ 4 respondents answer "no or minimally reached", 3 of these do consider that their project will contribute to the delivery of the milestone, 1 do not

▪ 6 respondents state that they "don't know", 3 of these respondents do consider that their project will contribute to the delivery of the milestone, 3 do not

▪ 22 respondents said that they consider that their project has contributed to or will contribute to the delivery of this milestone.

- The majority of respondents have selected either "Partially implemented" (18), or "Fully implemented" (7). A smaller number of respondents (4) answered "No or minimally" and there is also a number of "don't know's" (6).

- The Roamap document requires the definition of "a Persistent Unique Identifier policy for FAIR data", and a concrete example is given in the Roadmap document that "Accessibility" in FAIR can be supported through Persistent Unique Identifiers. **Such a policy, entitled "draft Persistent Identifier (PID) policy for the European Open Science Cloud (EOSC)" has been released** by the Task Force on PID policies, a sub-group of the EOSC Architecture WG, FAIR WG and FREYA, initially in December 2019[55], and a second version very recently, in May 2020[56]. The policy is broader than only FAIR data, rather all types of artefacts. **However, implementation guidelines are not yet sufficiently developed.**

- In more detail:

    - The majority of the respondents recognise these two policy drafts; on the other hand there is a number of the respondents (8) that were not aware of official documents and/or use domain-specific identifiers (e.g. in the health domain)

    - The document is characterised as generic, and that there was little intersection with research communities or industrial partners regarding data generation processes and workflows.

    - The document is considered as a good policy framework, defining a number of concepts, but **it does not recommend concrete implementation approaches**. Furthermore, it is noted that PIDs require a global approach, and more work is needed for the interoperability among existing PID providers and related technical implementations (e.g. even Crossref DOIs still cannot manage multiple DOIs by different providers for a single resource).


**Evidence in support of position**

**Key results, activities or outcomes**

- As outlined above the two main documents constitute the main results in this area.

    o "Initial Persistent Identifier (PID) policy for the European Open Science Cloud (EOSC)", https://zenodo.org/record/3574203

    o "Second draft Persistent Identifier (PID) policy for the European Open Science Cloud (EOSC)", https://zenodo.org/record/3780423

- Both RDA Europe 4.0 and FREYA who have been named as responsible have opted for "partially implemented" stating good progress (well-developed), both having contributed directly and indirectly.

- EOSC-hub referred to the B2HANDLE service work, covering a broad range of activities, from middleware applications and technical tools to establishment of workflows and policies.


**Outstanding challenges**

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[55] https://zenodo.org/record/3574203
[56] https://zenodo.org/record/3780423

- RDA Europe 4.0 highlights a series of recommendations, such as:

  ○ Implementation of PID services for a wide range of artefacts, including new types (e.g. instruments).

  ○ Domain-specific requirements have to be taken into account, including ontologies.

  ○ Machine-readable (besides human-readable) standards are needed, including agreed/standard metadata and licenses.

- As already highlighted above, several projects identified the lack of **concrete implementation approaches and interoperability among existing solutions;** still the first is currently planned in the third and **final version of the policy document to be released in the fall of 2020**.

**Quantitative indicators of progress (e.g. KPIs)**

- There are scattered indicators by several projects, among others FAIRsFAIR, FREYA, NI4OS-Europe, OpenAIRE-Advance, PANOSC, however in many cases no current values are given to be able to quantify the progress. A few examples are given below:

  - FREYA:

    - FREYA KPI on the development and growth of the PID graph

    - FREYA KPI on the sustainability of PID infrastructure (PID Commons)

  - PANOSC-EXPANDS

    - Number of data DOIs issued by ExPaNDS facilities - first measures in summer 2020

    - Number of ExPaNDS facilities offering a PaN catalogue search endpoint - first measures in 2021

    - Number of users accessing ExPaNDS data catalogues through the EOSC - first measures in 2021

    - Number of users processing data using PaN data analysis services through the EOSC - first measures in 2021

  o In addition, although not explicitly reported, the RDA Data Maturity model recommendation provides a list of metrics/indicators.
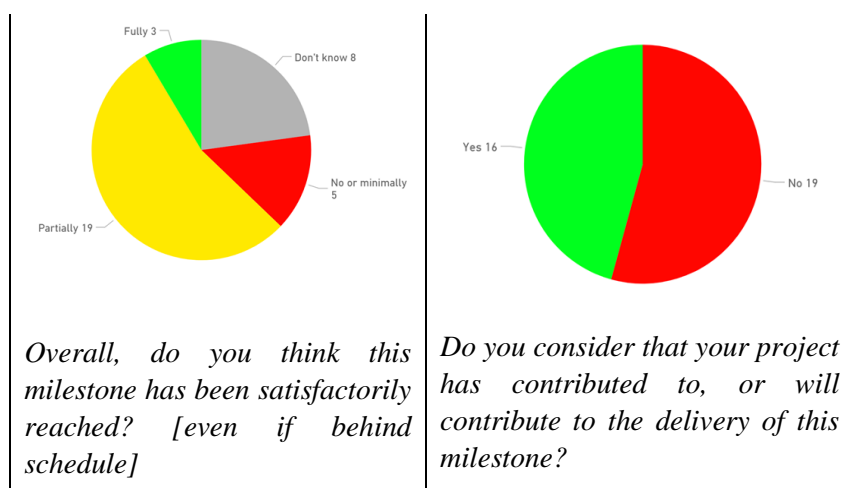
**Outstanding work required by end of 2020**

- As already analysed above the main outstanding points are the **finalisation of the PID policy document in the fall 2020 and the concrete implementation guidelines**. In more detail:

  o Finalise the Persistent Identifier (PID) policy for the European Open Science Cloud (EOSC), endorse it and publish it under the EOSC FAIR WG web presence as reference document.

  o Further work on details in the existing policy document is needed, as the following answers indicate:

- Take into account domain specific requirements and alignment with existing thematic/domain-specific standards (i.e. health sector)

- Work further on the workflow of the PID lifecycle and provide concrete implementation guidelines including interoperability assessments across solutions (e.g. implementation assessments of PID services, such as Archival Resource Key (ARK), Digital Object Identifier (DOI) or Handle system, maintain accurate Kernel Information for the PID, or be able to manage multiple DOIs by different providers for a single resource (e.g. CrossRef cannot still do this).

- Deal with PIDs across the various artefacts (not only data, like organizations, funders, services, infrastructure facilities, etc.)

- More dissemination activities for the PID documents seem appropriate.

### 5.2.3 Milestone: FAIR certification scheme available

**Survey responses**

- FAIR certification scheme available



| *Overall, do you think this milestone has been satisfactorily reached? [even if behind schedule]* | *Do you consider that your project has contributed to, or will contribute to the delivery of this milestone?* |

**Response analysis overview**

- 3 respondents answered that the MS was "fully" reached, 2 of which consider that their project has/will contribute(d) to the delivery of the milestone, 1 do not.

- 19 respondents answered that the MS was "partially implemented", 8 of which consider that their project has/will contribute(d) to the delivery of the milestone, 11 do not.

- 5 respondents answered that the MS was "not or minimally implemented", 1 of which considers that their project will contribute to the delivery of the milestone, 4 do not.

- 8 respondents answered that they "don't know", 3 of these respondents do consider that their project will contribute to the delivery of the milestone, 5 do not.

- 16 respondents said that they consider that their project has contributed to or will contribute to the delivery of this milestone.

  - The majority (19) agrees on "Partially implemented", while there are also a few respondents claiming that the milestone is "fully reached". The Roadmap requires

that a "**FAIR certification scheme for repositories**" is available, however, several respondents appear to have answered much more broadly, i.e. on the requirement of a "FAIR certification scheme" in general. This may be due to the fact that FAIRsFAIR which is responsible for the milestone (and which is referred to by the majority of respondents) is dealing much broadly with the "FAIRification" aspects. **In summary, the FAIRsFAIR project is supporting the uptake of the CoreTrustSeal certification for repositories and working with the CoreTrustSeal board to align its criteria to also address FAIR. The Metrics and Certification Task Force of the EOSC FAIR Working Group has released two interim documents for consultation, providing an overview of ongoing global and European activities and preliminary discussion of key issues. After feedback is integrated, new versions will be issued later in the summer for consultation and the final recommendations for implementing FAIR metrics and certifying services within EOSC will be released in fall 2020. In essence, what is currently being developed is the alignment of the CoreTrustSeal requirements/metrics with the FAIR ones. Thus, the "partially implemented" score is well justified, although a lot of work has been performed and a good basis for a FAIR certification scheme is available.**

- More than half of the respondents refer to the work of **FAIRsFAIR, RDA Data Maturity WG and of CoreTrustSeal,** which deals with repositories. CoreTrustSeal is an international non-profit organisation that offers a core-level certification to any interested data repository. The CoreTrustSeal seal of approval is based on a catalogue of core requirements constituting the characteristics of trustworthy data repositories, merging the Data Seal of Approval certification with the World Data System one under the umbrella of RDA.

- On the other hand, close to a quarter of the respondents, answered that they are not aware of a certification schema or related policy document, which hints to the fact that better dissemination of the current projects and efforts is required; still, one has to keep in mind that the EOSC developments are moving fast and in several areas, making it challenging to follow everything.

**Evidence in support of position**

**Key results, activities or outcomes**

**4   CoreTrustSeal/FAIRsFAIR achievements**

1. FAIRsFAIR Deliverable D4.1: Draft Recommendations on Requirements for **FAIR Datasets in Certified Repositories. This also deals with the core of the milestone**. This is the next step of the milestone, however, it needs to be tested in practice so that it can be improved (which is already part of the FAIRsFAIR plans).

2. FAIRsFAIR Milestone M4.1: **Evaluation of CoreTrustSeal, Implications for Maturity Modelling.** This document presents the first iterative step in **aligning the characteristics of FAIR digital objects with the repositories that 'enable' FAIRness, through the CoreTrustSeal Trustworthy Data Repository Requirements and the application of a maturity evaluation approach.** This is also in the core of the milestone and has been the first step of this milestone.

4.1 FAIRsFAIR Milestone M4.5: Evaluation of Procedures and Processes of Certification Mechanisms Provided. **This document addresses the issue of digital repositories trustworthiness. On the question how repositories can demonstrate their FAIRness,**

**an assessment process has to be designed. In order to do so, this document evaluates existing certification mechanisms and procedures. The recommendation from this deliverable is to consider the FAIR implications for CoreTrustSeal requirements by FAIR-aligning the extended requirements for the core certification of repositories.**

4.2 **D4.2 Repository Certification Mechanism: A Recommendation on the Extended Requirements and Procedures**. This deliverable is the next step in **aligning the CoreTrustSeal Requirements with an assessment of repositories' ability to enable FAIR data and presents the developing mapping between requirements and principles.** This is an important part of delivering an EOSC. The deliverable however has been only released at the end of May 2020, and thus has not been taken into account by the majority of the respondents.

## 5 RDA/RDA-Europe

1. **RDA WG on FAIR Data Maturity Models**, FAIR Data Maturity Model_ specification and guidelines_v1.00.pdf (already referenced above).

2. Report of FAIRsFAIR, RDA Europe, OpenAIRE, EOSC-hub, FREYA: Recommendations for Services in a FAIR data ecosystem (already referenced above),

## 6 EOSC WGs

1. **The Metrics and Certification Task Force of the EOSC FAIR Working Group has released two interim documents** for consultation, providing an overview of ongoing activities and preliminary discussion of key issues. After feedback is integrated, new versions will be issued later in the summer for consultation and the final recommendations for implementing FAIR metrics and certifying services within EOSC will be released in fall 2020.

    1.   FAIR metrics for EOSC

    2.   EOSC service certification

## 7 EOSC 5b (regional) projects task force on FAIR regarding FAIRsFAIR certification scheme

**Quantitative indicators of progress (e.g. KPIs)**

▪ There are only a few KPIs reported on repositories on-boarding (e.g. OpenAIRE, NI4OS-Europe on the number of repositories on-boarded), but there seems to be none on certification or any other to provide evidence of achieving this milestone.

▪ Although not reported, the RDA Data Maturity model recommendation provides a list of metrics/indicators.

**Outstanding work required by end of 2020**

▪ **As outlined above, a lot of work has been performed and a good basis for a FAIR certification scheme is available. Still, feedback is expected on the latest FAIRsFAIR deliverable (D4.2) on the alignment/mapping of CoreTrustSeal requirements with the FAIR principles. Similarly, the Metrics and Certification Task Force of the EOSC FAIR Working Group has released two interim documents for consultation and after a cycle of feedback, the final recommendations for implementing FAIR metrics and certifying services within EOSC will be released in fall 2020.**

- The **"FAIRified" certification requirements for repositories need to be tested in practice by different repositories, in particular thematic ones** and some feedback needs to be provided back to FAIRsFAIR and CoreTrustSeal, for their final documents.

- The **dissemination of related certification documents needs to be improved**, because several respondents were not aware of many documents related to this milestone.

## 5.3 Action line summary

**Significant progress has been achieved in the area of EOSC data** in all three areas of the milestones, namely the European Framework for FAIR research data, the FAIR Persistent Unique Identifier policy and the FAIR certification scheme for repositories, with the respondents agreeing on a partial implementation for all three.

Still, some more steps are needed to be able to tick the milestones as completed, in **particular receiving and integrating the feedback** (especially from the very recent documents) and consolidating the current documents. **Testing the proposed policies/approaches in practice for all milestones**, in some cases including testing in thematic (domain-specific) areas, which may have diverse requirements, would contribute to the understanding of their readiness level and answer the question of whether they are robust enough.

**a. Regarding the status of "European Framework for FAIR research data", this depends on interpretation of the action.** The Roadmap links this milestone with the" FAIR Data Action Plan" produced by the European Commission Expert Group on "Turning FAIR Data into reality". The Action Plan and the corresponding Expert Group report provide a set of guidelines, recommendations and actions to research communities and countries to develop specific plans on how to implement FAIR data in their contexts (i.e. research areas and countries). The Roadmap further specifies that the "*outcome of the action plan would eventually constitute a new operational framework for FAIR research data*", similar to the existing European framework for the interoperability of public services. So, although the Expert Group documents (along with several other documents produced that are mentioned below) already constitute a framework, it has not been clear whether the operational/implementation framework is required to tick the milestone as completed. **If the milestone is more linked to a theoretical framework and high-level guidelines, this is already in place, while if the operational implementation framework is required, the "partially implemented" represents the current state.**

Outstanding work in this area includes the finalisation of the **RDA Data Maturity Model and the EOSC interoperability framework documents**, which are currently in consultation are expected to be finalised later in the year. **The FAIR WG will also propose FAIR metrics and certification by the end of 2020. In essence, this is more on integrating the feedback that will be received and consolidating the final documents. An official endorsement of an operational FAIR framework** should be also planned.

**The EOSC interoperability framework needs to be pilot tested, especially by thematic and national communities/repositories.** It is crucial to have **policies that will continuously support the implementation of FAIR in Europe and provide incentives for stakeholders to consider this in their agenda of priorities.** Furthermore, the **dissemination of related framework or guideline documents needs to be improved**, because several respondents were not aware of all documents related to this milestone.

**b. Regarding the milestone "Persistent Unique Identifier policy for FAIR data",** the Roadmap requires the definition of such a policy, and a concrete example is given in the Roadmap document that "Accessibility" in FAIR can be supported through PIDs. The Task Force on PID policies, a sub-group of the EOSC Architecture WG, FAIR WG and FREYA has

released such a policy, entitled **"draft Persistent Identifier (PID) policy for the European Open Science Cloud (EOSC)"**, initially in December 2019, with a second version coming out very recently, in May 2020. The policy is broader than only FAIR data, covering all types of artefacts/objects. However, **implementation guidelines are not yet sufficiently developed.** In other words, the document although constitutes a good policy framework, defining a number of concepts, it does not recommend concrete implementation approaches. Furthermore, it is noted that PIDs require a global approach, and more work is needed for the interoperability among existing PID providers and related technical implementations. **The finalisation of the PID policy document is planned for the fall 2020 with the concrete implementation guidelines**. In general, this area is less dispersed (in terms of multiple projects working in the same area) and it may be easier to converge. On the other hand, the implementation guidelines, including technical solutions and interoperability among them, may be technically more demanding. **The final document also needs to be endorsed by the EOSC stakeholders.** Finally, more dissemination activities for the PID documents deem appropriate to increase awareness and uptake.

**c. Regarding the "FAIR certification scheme for repositories"**, **the FAIRsFAIR project is supporting the uptake of the CoreTrustSeal certification for repositories and working with the CoreTrustSeal organisation to align its criteria with the FAIR principles. The Metrics and Certification Task Force of the EOSC FAIR Working Group has released two interim documents for consultation, providing an overview of ongoing global and European activities and preliminary discussion of key issues.**

In particular, the FAIRsFAIR Deliverable D4.2 "Repository Certification Mechanism: a Recommendation on the Extended Requirements and Procedures" has worked in aligning the CoreTrustSeal Requirements with an assessment of repositories' ability to enable FAIR data, and presents the first draft of mapping between requirements and principles. Still, feedback is expected on this work. Similarly, the Metrics and Certification Task Force of the EOSC FAIR Working Group has released two interim documents for consultation and after a cycle of feedback, **the final recommendations for implementing FAIR metrics and certifying services within EOSC will be released in fall 2020**. **In essence, what is currently being developed is the alignment of the CoreTrustSeal requirements/metrics with the FAIR ones.**

**The "FAIRified" certification requirements for repositories need to be tested in practice by different repositories, in particular thematic ones** and some feedback needs to be provided back to FAIRsFAIR and CoreTrustSeal, for these final documents. In this area it is more about reviewing, testing, and integrating feedback for the consolidated versions. **The final documents also need to be endorsed by the EOSC Governance, or EOSC stakeholders.** Finally, the dissemination of related certification documents needs to be improved, because several respondents were not aware of many documents related to this milestone.

**Section 6: Services, Access & Interface**

**6.1    Action line overview**

**Scope:** The 'Access and Interface' action line in the Staff Working Document does not have specific milestones associated with it, however there is a degree of overlap with the milestones for 'Services', for example the EOSC Portal is referenced in two of the Services milestones. There is also reference to the outputs of the grant awarded under INFRAEOSC-06-2020 (EOSC Enhance), which started in December 2019 and has yet to produce mature results.

As a result, these action lines were combined for the purpose of gathering the community view on progress and similarly, the following analysis addresses both the Services and Access & Interface lines.

**Services:** Available services from a user perspective. A rich environment offering a wide range of services covering the needs of users.

**Access & Interface:** Mechanisms/interfaces for accessing EOSC. A simple way for dealing with open data obligations or accessing research data across different disciplines

**Actions and Milestones:** The Roadmap identified the following actions and milestones required to deliver the Services action line and EOSC Portal.

| Starting from | Committed resources (non-exhaustive) | Action | Milestones |
|---|---|---|---|
| 2018, Q2 | EOSC-hub<br><br>eInfraCentral<br><br>OpenAIRE-Advance<br><br>**INFRAEOSC-01-2018** (OCRE)<br><br>**INFRAEOSC-04-2018** (ENVRI-FAIR, ESCAPE, PANOSC, EOSC-Life, SSHOC)<br><br>**INFRAEOSC-05-2018-2019(b)** (EOSC-Pillar, NI40S, ExPaNDS, EOSC-synergy, EOSC-Nordic)<br><br>**INFRAEOSC-02-2019** (COS4CLOUD, INODE, CS3MESH4EOSC, NEANIAS, TRIPLE)<br><br>INFRAEOSC-03-2020<br><br>**INFRAEOSC-06-2019-2020 (a and b)** (EOSC Enhance) | Develop initial catalogue of services to be provided via the EOSC (to be enriched periodically) and define delivery model(s) | Q4, 2018: Initial EOSC catalogue of services accessible and prototype EOSC Portal accessible<br><br>Q4, 2019: Updated EOSC Catalogue of Services and EOSC Portal |

| 2018, Q2 | EOSCpilot and EOSC-hub<br><br>**INFRAEOSC-04-2018** (ENVRI-FAIR, ESCAPE, PANOSC, EOSC-Life, SSHOC)<br><br>**INFRAEOSC-05-2018-2019(b)** (EOSC-Pillar, NI40S, ExPaNDS, EOSC-synergy, EOSC-Nordic) | Develop initial catalogue of datasets accessible via the EOSC (to be enriched periodically) | Q2, 2019: Initial EOSC catalogue of datasets accessible |

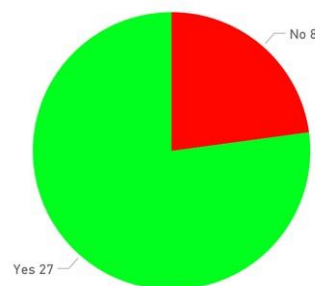## 6.2 Analysis of progress towards milestones

6.2.1 Milestone: Initial and Updated EOSC Catalogue of Services accessible, and EOSC Portal accessible

**Survey responses**

- Initial and Updated EOSC Catalogue of Services accessible, and EOSC Portal accessible
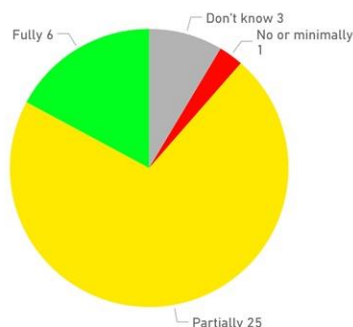


*Overall, do you think these milestones have been satisfactorily reached? [even if behind schedule]*



*Do you consider that your project has contributed to, or will contribute to the delivery of these milestones?*

**Response analysis overview**

- Most respondents consider the milestone has been partially achieved.

- A few indicate that it is fully achieved (especially those responsible for building the catalogue/portal), by which they mean that the catalogue of services does exist at https://marketplace.eosc-portal.eu and contains a good number of entries.

- Overall, respondents consider that this milestone has been the most successfully achieved out of all within the survey (31 of 35 respondents indicate either partially or fully met).

- The reservations that have led respondents to indicate only partially achieved include:

  - The catalogue is just a listing or passive collection that is not always usable and does not help to make a connection between supply and demand.

○ The services are largely independent and lack interoperability.

○ It is unclear how commercial services will be integrated.

○ There seems to have been no evaluation of the services, with some not yet at 'production' level.

▪ Future changes in the catalogue structure might cause problems, and it is not immediately obvious how the catalogue is being maintained and updated.

▪ The benefits need to be made clear not only to potential end users but to national governments/ministries who will be assigning funding.

**Evidence in support of position**

**Key results, activities or outcomes**

▪ All GEANT Services are available in the EOSC Catalogue; also, those of OpenAIRE

▪ Many regional projects and thematic projects plan to on-board services and datasets.

▪ The EOSC-synergy project singles out its rapid development of support for Covid-19 researchers connecting genomics data with federated computing resources and common authentication layer (https://covid19.eosc-synergy.eu)

▪ At the time of writing this report, a total of 267 services are available via the Catalogue.

**Qualitative indicators of progress (e.g. KPIs)**

● The only quantitative indicator is the number of services described in the catalogue—a figure of 250 is quoted, and constantly growing (see above).

**Outstanding work required by end of 2020**

▪ Many projects have plans to on-board resources to the catalogue during their lifetime, though none of these can really be interpreted as work that is absolutely required by the end of 2020.

▪ Examining the remarks made by the respondents, it is possible to identify a number of priorities for work:

o There should be a clear plan for increasing the utility of the catalogue of services, not just increasing the number of services within it. This would include some kind of evaluation of applicability and emphasis on interoperability.
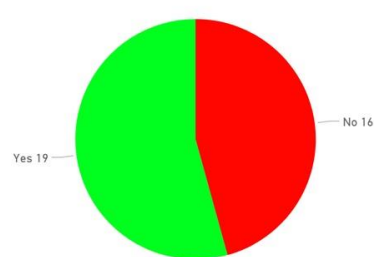
6.2.2 Milestone: Initial EOSC catalogue of datasets available

**Survey responses**

▪ Initial EOSC catalogue of datasets available
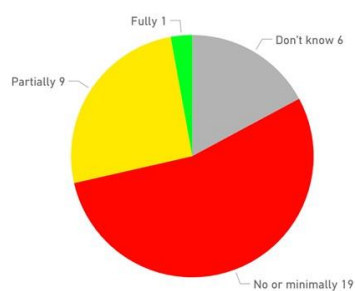


*Overall, do you think this milestone has been satisfactorily reached? [even if behind schedule]*



*Do you consider that your project has contributed to, or will contribute to the delivery of this milestone?*

**Response analysis overview**

▪ Overall, respondents consider that this milestone has been the least achieved out of all within the survey (19 of 35 respondents indicate either minimally or not met).

▪ Multiple respondents note that they are not aware of a catalogue of data sets, or that in their opinion there is no such catalogue exists.

▪ There is severe confusion over whether/how datasets are yet available through the portal.

  o EOSC-hub notes that EOSC-Enhance project will integrate a catalogue of datasets in EOSC Portal.

▪ Some dataset catalogues/repositories, such as Zenodo, are available as services through the catalogue, which adds to the confusion.

▪ There is concern about what are seen as "competing datasets catalogues" (OpenAIRE, B2FIND), implying that a single point of entry would be preferable.

▪ There is a view (Executive Board respondent) that the availability of datasets will be much more valuable than services.

**Evidence in support of position**

**Key results, activities or outcomes**

▪ EOSC-hub notes that it is only currently possible to publish services in the EOSC portal, so that an EOSC Catalogue listing datasets directly is not available yet. This is identified as a 'big gap' by one of the Executive Board respondents.

▪ EOSC portal has made available links to data discovery services, such as B2FIND, and data set repositories like B2SHARE, alongside a number of thematic repositories.

▪ OpenAIRE has developed a data catalogue as an interoperability overlay in EOSC by connecting all research outcomes (publications, data, software, methods, protocols) and linking them to people, organizations, funders, projects, research facilities.

▪ A number of projects have developed their own data catalogues, and this is providing useful insights on how the EOSC catalogues should be built and have made accessible metadata that can profitably become part of the EOSC Catalogue.

- EOSC Enhance is committed to working with data providers to augment the catalogue of accessible datasets.


**Qualitative indicators of progress (e.g. KPIs)**

- None reported.


**Outstanding work required by end of 2020**

- As for services, many projects promise to make available datasets in due course.

- FAIRsFAIR plans to deliver a "Proposal on integration of metadata catalogues to support cross-disciplinary FAIR uptake" by the end of 2020.

- OpenAIRE will roll out in production the new enriched OpenAIRE Open Research Graph and embed in the EOSC Portal to provide seamless access to datasets in context of the project and funding they were produced in.

- More generally, a clarification of the plans for datasets in EOSC catalogues would be very desirable, to clear up the confusion that currently exists.


6.2.3    Provision of access points


Note that this is not a formal milestone, however understanding the number and nature of access points currently provided or planned may be valuable in the assessment of the progress of the 'Access & Interface' action line.

- Most respondents say yes, they are contributing to an entry point to accessing EOSC services.

- All the projects refer to their plans to produce some kind of entry point (regional e.g. EOSC-Nordic, thematic e.g. BE OPEN in transport research, PaNOSC portal for ExPaNDS), but there is lack of common view on the relation of this to the overall EOSC portal.

- There is a tension between the EOSC Portal as the universal top-level point of access, or just one among many.

- .2 Example: the SSH Open Marketplace will include all services in EOSC Portal but extend to any available software or tool for researchers including those not suitable for the EOSC catalogue


**6.3    Action line summary**

- Most respondents consider that the first two milestones have either been partially or fully met. The majority of respondents indicate that the third milestone has not been achieved.

- The reservations that have led respondents to indicate this include:

    - The catalogue is just a listing, or passive collection, that is not always usable and does not help to make a connection between supply and demand.

    - The services are largely independent and lack interoperability.

- It is unclear how commercial services will be integrated.

- Future changes in the catalogue structure might cause problems.

- There seems to have been no evaluation of the services, with some not yet at 'production' level.

- There is confusion amongst respondents over whether/how datasets are yet available through the portal.

- Most survey respondents indicate that they are contributing to an entry point to accessing EOSC services. All the projects refer to their plans to produce some kind of entry point (regional e.g. EOSC-Nordic, thematic e.g. BE OPEN in transport research, PaNOSC portal for ExPaNDS), but there is a lack of a common view on the relation of this to the overall EOSC portal.

- Good progress has been made, with the development of the EOSC Portal and the catalogue of services and it is likely the milestones related to these will be met by December 2020. However, there are issues with developing a catalogue of data sets of utility to users, and it is likely that work required to meet this milestone will extend beyond December 2020.

**Section 7: Rules of Participation**

**7.1     Action line overview**

**Scope:** Rules of participation for different EOSC actors. An opportunity to comply with existing legal and technical frameworks and increase legal certainty and trust.

**Actions and Milestones:** The Roadmap identified the following actions and milestones required to deliver the Rules action line:

| Starting from | Committed resources (non-exhaustive) | Action | Milestones |
|---|---|---|---|
| 2018, Q2 | EOSCpilot<br><br>EOSC-hub<br><br>**INFRAEOSC-05-2018-2019 (a)** (EOSCsecretariat) | Develop Rules of Participation in consultation with stakeholders | Q1, 2019: Initial EOSC Rules of Participation<br><br>Q4, 2019 Final EOSC Rules of Participation |

**7.2     Analysis of progress towards milestones**

As the two milestones are closely related, they were consulted on as one.

It should be noted that the timeframes for delivery identified in the ROADMAP are intended to refer to the minimal set of Rules of Participation[57] which were delivered by the EOSC Pilot project in August 2018. After the establishment of the EOSC interim governance, the Executive Board set up the Working Group on Rules for Participation, which delivered a further draft iteration of the Rules (EOSC RoP version 0.2[58]) in January 2020. This latest draft was the subject of a consultation during Feb-March 2020 and there is strong evidence of awareness of this amongst the survey respondents. The responses indicate that the project community largely consider milestone R1, the initial Rules, to relate to this most recent draft. In any event, when considering either the initial Rules delivered by EOSC Pilot this milestone, or the more advanced recent draft, this milestone can be confirmed as **fully met**.

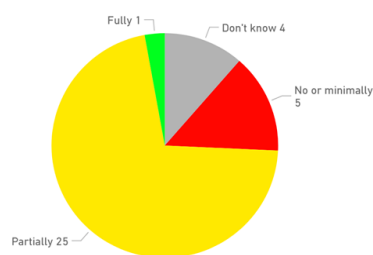7.2.1 Milestones:          Initial and Final EOSC Rules of Participation

**Survey responses**

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[57] https://eoscpilot.eu/content/d25-recommendations-minimal-set-rules-participation

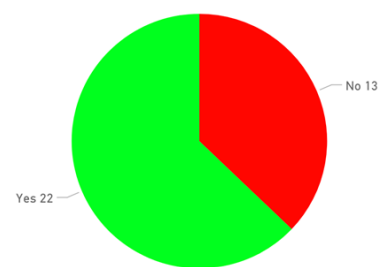[58] https://repository.eoscsecretariat.eu/index.php/s/QWd7tZ7xSWJsesn#pdfviewer

▪ Initial and final EOSC
  Rules of Participation



*Overall, do you think these milestones have been satisfactorily reached? [even if behind schedule]*



*Do you consider that your project has contributed to, or will contribute to the delivery of these milestones?*

**Response analysis overview**

▪ For the purposes of the survey questions, the milestones addressing both the 'initial' and 'final' versions of the EOSC Rules of Participation were combined.

▪ A significant majority agree that these milestones, in combination, have been '**partially reached**'.

▪ A single project, INODE, considers that the milestones have been fully met, though also notes that the project is in its first year with limited EOSC interaction at this time.

▪ Survey responses indicate broad acknowledgement that the *Initial EOSC Rules of Participation* have been delivered, with 19 responses directly referencing either the current draft version (EOSC Rules of Participation v 0.2[59]) or recent consultation, and others more generally describing an existing or earlier set of Rules. Therefore, we can consider this first milestone, initial EOSC Rules of Participation, to be '**fully reached**'.

▪ Justifications for partial or minimal delivery of these milestones surround key issues with respect to the **further development of content** of the current draft (further details below).

▪ Overall, the survey responses indicate a high level of awareness of the current draft and recent consultation, and there is a shared understanding that work in this area is in progress. Comments indicate an active engagement with the process, with some expressions of confidence that the Rules of Participation will be finalised and available by the end of the year.

▪ There were some concerns that the key elements do not appear to be being addressed, or uncertainty whether feedback is being taken on board (PaNOSC, TRIPLE)

▪ EB perception of progress is in line with that of the project community.

▪ A significant majority of projects identified that they had contributed or will contribute to the delivery of these milestones.

**Evidence in support of position**

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[59] https://repository.eoscsecretariat.eu/index.php/s/QWd7tZ7xSWJsesn#pdfviewer

The Staff Working Document identifies main projects responsible for milestones as EOSCpilot, EOSC-Hub, EOSCsecretariat, though it should be noted that the further development of the Rules beyond the initial version has been led by the EB Working Group on Rules of Participation.

**Key results, activities or outcomes**

- EOSCpilot: Recommendations for a minimal set of Rules of Participation[60]

- EOSC-Hub: Rules and policies for service providers to on-board services and make them discoverable and accessible through EOSC Portal[61]

- EOSC Rules of Participation version 0.2[62]


- An Executive Board presentation at the EOSC Symposium, Nov 2019 highlights that current version of Rules reflect the outcomes of wide consultation and stakeholder engagement

- .3 EOSC Summit: European Open Science Cloud from vision to implementation (June 2018)

- .4 High Level Expert Group Open Consultation (Launched June 2018)

- .5 EOSC Stakeholders Forum (Nov 2018)

- .6 Turning FAIR into Reality

- .7 Prompting an EOSC in practice

- .8 Realising the European Open Science Cloud


- IDCC Dublin, Feb 2020

- DANS workshop on Training in EOSC, Feb 2020

- Consultation on v0.2 Rules of Participation

- EOSC-Hub week, May 2020

- EOSC-Hub highlights that the basic rules of participation to on-board services are in daily use to increase the number of services offered by EOSC-Hub.

- 21 of the survey responses indicated that they had contributed, or expect to contribute, to the delivery of the Rules of Participation milestones.

- Survey responses reflect:

  - a high degree of engagement with consultation activities, and also several who actively participate in the RoP WG (EOSC-Hub, EOSC-Pillar)

  - the important role of the projects in engaging different stakeholders with the issues related to Rules, promoting best practice and feeding the needs of different actors back into the debate

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[60] https://eoscpilot.eu/sites/default/files/eoscpilot-d2.5.pdf
[61] https://wiki.eosc-hub.eu/display/EOSC/Service+Provider+Documentation
[62] https://repository.eoscsecretariat.eu/index.php/s/QWd7tZ7xSWJsesn#pdfviewer

**Quantitative indicators of progress**

- 24 responses received to consultation survey on initial draft, including major EOSC projects and infrastructures

- OpenAIRE provide details of providers in OpenAIRE/EOSC validated to OpenAIRE Guidelines (Journal (16,047), Institutional Repository (929), Data Repository (170), Journal Aggregator/Publisher (142), Publication Repository (76), Thematic Repository (66), Publication Repository Aggregator (10), Publication Catalogue (13), Institutional Repository Aggregator (10), Data Repository Aggregator (3), Software repository (2), Other (32))

**Outstanding work required by end of 2020**

As mentioned above, the survey illustrates that further work in the coming months needs to focus on the development of content of the current draft. Specific issues highlighted include:

- **Current draft is too high level:** A significant number of responses (7) indicated a view the current draft is too high-level, and that further work is required to develop a concrete set of Rules of Participation which can be practically implemented.

A number of projects expect to contribute to the development of the detail of the rules to add a practical dimension to the existing high-level principles, for example:

  - RDA offers ICT Technical specifications for public procurement[63]

  - OpenAIRE offers a concrete mechanism for implementation of key aspects of FAIR through its provision of metadata schemata and validation for literature-data-software repositories, OA Journals and CRIS systems (KPIs provided)

  - FAIRsFAIR has a dedicated work package which focuses on technical and practical aspects (Persistence, Interoperability, Semantics, Software and services)

  - NI4OS-Europe and NEANIAS will practically try to validate rules and access their real-life applicability through their on-boarding process

- **Rules of Participation for different EOSC participants need to be defined:** Several responses highlighted that different rules still need to be defined for different actors (ExPaNDS, EOSC-Pillar, RDA, and FAIRsFAIR). EOSC-Pillar suggested that this would improve the usability of the Rules, and this would therefore contribute to practical implementation. There is a clear role for the projects to inform the further development of the Rules in this area.

- **Quality and compliance:** The need for more concrete definition of quality criteria and implementation standards is identified, along with a need to further develop the approach to monitoring, compliance, enforcement and sanctions (ExPaNDS, OpenAIRE, EOSC-Pillar).

FAIRsFAIR, EOSC-Synergy, OpenAIRE all offer contributions to this work.

- **Rules for accessing and providing services and data,** including practical aspects of service and data integration need to be made more concrete (PRIMAGE, OpenAIRE).

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[63] RDA tech spec.

- **Compensation and charging models** were raised as a significant point in require of attention by a number of projects, including an ongoing confusion about the meaning of the wording "free at the point of use", the model of compensation for service providers, the fundamental issues of who pays for what.

## 7.3    Action line summary

- There is agreement, and indeed evidence, that the initial version of the Rules of Participation have been delivered.    Further progression towards full implementation surrounds development of the content of the current draft.

- Overall, the survey responses suggest a strong level of stakeholder engagement and participation in the development of the Rules of Participation.    A good knowledge and understanding of the current state of play, which is evident in the survey responses, reinforces this position.

- There appears to be a high degree of confidence that the milestones will be reached by the end of 2020, subject to the further development of the content of the current draft with respect to issues identified in the analysis.  The recent consultation led by the Working Group on RoP will no doubt provide greater insight into these issues.

- The community appears to be well placed for contributing to the further development of the content in order to address the outstanding issues, and mechanisms exist (such as the recent consultation) to facilitate the flow of this input.

- The Working Group on Rules of Participation should continue to recognise the value of the many connections projects have in the EOSC ecosystem as a valuable resource for addressing the further development of the Rules, including an understanding of the needs of different actors and as a route for promoting best practice and uptake.

**Section 8: Governance**

**8.1     Action line overview**

**Scope:** Governance of the EOSC, aiming at ensuring EU leadership in data-driven science but requiring new governance frameworks.

**Actions and Milestones:** The Roadmap identified the following actions and milestones required to deliver the Governance action line:

| Starting from | Committed resources (non-exhaustive) | Action | Milestones |
|---|---|---|---|
| 2018, Q1 | EC, with support of EOSCpilot project, High Level Expert Group EOSC, OSPP and other sources | Set up the EOSC governance framework in consultation with MS | Q4 2018: EOSC Governance established |
| 2019, Q1 | INFRAEOSC-05-2018-2019 (a) (EOSCsecretariat) | Prepare legacy for 2nd implementation phase (post 2020) | Q3 2020: Recommendations on strategic and financing orientations and organisational settings for the future of the EOSC, post 2020 |

**8.2     Analysis of progress towards milestones**
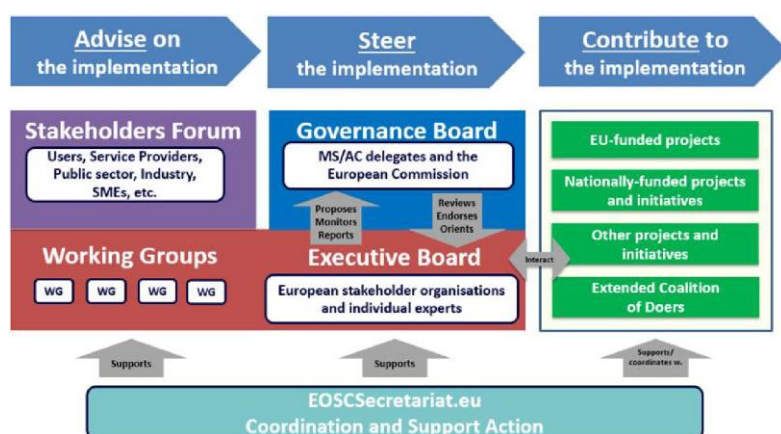
8.2.1    Milestone: EOSC Governance established

▪    This milestone was reached by the required date of Q4, 2018.

▪    The Roadmap foresaw a three-part Governance structure of executive layer, institutional layer and stakeholder layer.

▪    In August 2018 the Commission decided to establish an Expert Group – the Executive Board of the EOSC [Decision C(2018) 5552 final, 27.8.2018]. A call for applications for membership of the board was issued on 11.9.2018, with a deadline for applications of 10.10.2018. Members were appointed in November 2018 and the Executive Board first met (informally) in January 2019, with its first formal meeting in March 2019.

▪    The institutional layer was formed by the EOSC Governance Board, which was established by the Commission in 2018 and had its first meeting in January 2019.

▪    The stakeholder layer was established by EOSCpilot project (EOSC Stakeholders Forum held in 2017 & 2018) and is being continued by the EOSC Secretariat project (EOSC Symposium 2019 & 2020).

8.2.2    Milestone: Recommendations on strategic and financing orientations and organisational settings for the future of the EOSC, post 2020

- The activities in support of reaching this milestone are currently in progress, and it is currently on track to be reached by the end of 2020.

- Activities are being led jointly by the Commission and the EOSC Executive Board, in conjunction with the EOSC Secretariat project and the EOSC Governance Board.

- A co-Programme Partnership proposal has been developed (led by the EB) and has now been published by the Commission. This outlines the EOSC related activities planned for post-2020 (Horizon Europe). In support of this a Strategic Research and Innovation Agenda (SRIA) for EOSC is under development, which will include a post-2020 multiannual work programme.

- To support the partnership proposal, a tripartite governance arrangement has been proposed, made up of the Commission, a Steering Group composed of MS/ACs, and an EOSC legal entity (currently being established as a Belgian AISBL).

## 8.3 Action line summary

*Milestone Q4, 2018: EOSC Governance established*, was reached within the required time period. The Executive Layer of governance is formed by the EOSC Executive Board. This was established by the Commission in Q4 2018, and it had its first (informal) meeting in January 2019. There have been 13 formal meetings of the EB to date (June 2020). The Institutional Layer of governance is formed by the EOSC Governance Board, representing MS/ACs, which was also established in 2018, and also held its first meeting in January 2019. The Stakeholder Layer of governance predates the other two layers, having been established initially as part of the EOSCpilot programme (EOSC Stakeholders Forum held in 2017 & 2018). It is being continued by the EOSC Secretariat project (EOSC Symposium 2019 & 2020), and will then become the responsibility of the EOSC legal entity being formed as part of the development of the EOSC co-programme partnership.



*Milestone Q3, 2020: Recommendations on strategic and financing orientations and organisational settings for the future of the EOSC, post 2020*, is currently on track to be met by the end of 2020. A co-Programme Partnership proposal has been developed and has now been published by the Commission. This outlines the EOSC related activities planned for post-2020 (Horizon Europe). To support the partnership proposal, a tripartite governance arrangement has been proposed, made up of the Commission, a Steering Group composed of MS/ACs, and an EOSC legal entity (currently being established as a Belgian AISBL). A Strategic Research and Innovation Agenda (SRIA) for EOSC is under development, and it will include a post-2020 multiannual work programme.

The EOSC Secretariat has commissioned a number of studies contributing to the definition the governance of EOSC post-2020. These studies will produce results by Q3 2020 that will influence the output of the working groups, notably FAIR, Sustainability and Landscaping , and these outputs will be published by the time of the EOSC symposium (Q4 2020). It is possible that such studies and working group outputs will identify areas that require further investigation.

The extension in time of the EOSC Secretariat project to Q2 2020 will assist the newly formed EOSC Association during this early period of its existence and the implementation of the post-2020 governance of EOSC.