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Deliverable Abstract

This deliverable reports on the baseline values as of 2021 of the Key Performance Indicators (KPIs) of the Horizon Europe EOSC Partnership Monitoring Framework. The report aims to achieve three main objectives:

1. Report to the EC on the data collected from EOSC-A Members to establish the MF KPI baseline for the status of the EOSC Partnership in 2021, with respect to the goals identified in the EOSC SRIA. This report will be submitted to the EC for approval in the first half of 2023.
2. Provide the basis for a discussion between EOSC-A and the EC on the methodological approach to KPI monitoring. This will include suggestions for KPI phrasing, terminology clarification, and the inclusion of additional KPIs in the Monitoring Framework selected from the MF Companion document.
3. Provide reflections for the alignment of monitoring methodologies across initiatives from other bodies towards the establishment of the EOSC single joint monitoring system.

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Glossary

Terminology/Acronym	Definition
AAI	Authentication and Authorisation Infrastructure
AAP	Additional Activities Plan
AC	EU-Associated Country
DMP	Data Management Plan
EC	European Commission
EOSC	European Open Science Cloud
EOSC-A	European Open Science Cloud Association
EOSC-SB	Commission Expert group to act as European Open Science Cloud Steering Board
INFRAEOSC	EC Horizon Europe projects supporting an operational, open and FAIR EOSC ecosystem (Destination INFRAEOSC)
FAIR	Findable, Accessible, Interoperable, and Reusable
KPI	Key Performance Indicator
Member	An entity with the "Member" status in the EOSC-A (as distinguished from the "Observer" status)
MF	Monitoring Framework of the EOSC Partnership
MoU	Memorandum of Understanding of the EOSC Partnership
MS	EU Member State
OO	Operational Objective (from SRIA)
PID	Persistent Identifier
RFO	Research Funding Organisations
RI	Research Infrastructure
RPO	Research Performing Organisation
SO	Specific Objective (from SRIA)
SP	Service Provider
SRIA	Strategic Research and Innovation Agenda for EOSC

Table of Contents

List of Figures

List of Tables

Executive Summary

All Horizon Europe Partnerships must formulate a reference monitoring framework, based on the general, specific, and operational objectives of their strategic agendas, that allows their progress towards achieving the specific Partnership goals to be tracked. For the Horizon Europe co-programmed EOSC Partnership, progress towards EOSC-specific policy objectives and deliverables is tracked through a series of monitoring processes, including the Additional Activities planning (AAP Surveys) and reporting and the monitoring of the EOSC Partnership's Key Performance Indicators (KPIs) against their target values, as defined in the Horizon Europe EOSC Partnership Monitoring Framework (MF).

This deliverable reports the baseline values as of 2021 of the KPIs of the Horizon Europe EOSC Partnership and appraises the progress of the Partnership towards its objectives. The base values for KPIs were assessed via a survey among EOSC Association (EOSC-A) Members. The survey was implemented via the GDPR compliant EUSurvey platform by the European Commission. It was launched by the EOSC-A on 21st October and closed on 25th November 2022 after a two-week extension of the original deadline. The survey targeted the following member groups: Research Performing Organisations, Research Funding Organisations, Service Providers, Horizon Projects, and Research Infrastructures. In total, 63 EOSC-A Members completed the survey. In addition to that, part of the questionnaire was also filled via a desk study conducted by EOSC-A itself, who also reached out to the EOSC Steering Board Subgroup A for one question. A series of training workshops was provided to help respondents navigate the survey and answer questions.

Results from the survey were processed in anonymised form. After the survey assessment, some of the questions were evaluated considering the number of respondents and quantifying the number of

times a specific answer was given from a closed set of predefined answers. The results are presented and analysed with reference to the KPI target values indicated in the MF using the same format, e.g. as a number or a percentage, for ease of comparison. To visualise the current status of the KPIs against the target value, the monitored values were normalised to the target value set in the EOSC Partnership MF. Out of 34 KPIs, the target values of nine of them have been already 'achieved', i.e. they have reached the target values (100% or above). The target values of 12 KPIs are 'on track', i.e. they hold values within the range of 40-99% of their target values. The target values of 10 KPIs are 'well-below-the-target', i.e., they are below 40% of the defined target values. The evaluation of three KPI is 'in progress or not measurable'.

In order to facilitate future monitoring cycles, the authors reflected upon selected issues, considering the qualitative answers received from the respondents, which mostly refer to the methodology used to prepare the survey and to the presentation of the collected data. The attention was placed on the following areas of improvement: (re-)phrasing of some of the survey questions; detecting ambiguity in the terminology employed for KPIs and proposing alternative solutions for disambiguation; KPI wording. These were accompanied by recommendations for possible modifications, subject to further consultation.

Appropriate consideration was also given to the MF Companion document and rationale for the suggestion for inclusion of some of those indicators was provided; at the same time, two of MF KPIs utilised in this survey are suggested for exclusion from the next iteration of the survey, and to be included in the Companion document until the boundary condition of the EOSC is realised.

Finally, considering the methodology presented in the Monitoring Framework for the National Contributions to EOSC, deployed by the European Commission expert group EOSC Steering Board, and the need for the alignment of the different monitoring systems of the EOSC ecosystem towards a single joint monitoring system, the EOSC Partnership MF KPIs were assigned to the following categories: Publications, Data, Software, Services, Infrastructure, Skills/Training, Assessment, and Engagement in the three domains: Policies, Practices, and Impact. Suggestions for some adaptations of those categories are provided. The only category where KPIs are mostly 'well-below-target' is Software, considering the practices of sharing software source codes; the Data and the Publication categories are mainly represented by KPIs that are on track to reach their target value; the MF KPIs that could be related to the categories Infrastructure and Services appear to be in good progress overall, with some elements achieved and others still in the early-development stage; Skills/Training is mainly achieved; some further reflections are needed for the categories Assessment and Engagement, where the MF KPIs were only tentatively assigned.

1 Introduction

The European Open Science Cloud (EOSC) is the ever-growing environment that supports the Findability, Accessibility, Interoperability and Reusability of research data, software and methods (collectively known as "research digital objects"). In June 2021, the Horizon Europe co-programmed Partnership for EOSC was established by the signature of a Memorandum of Understanding (MoU)[1] between the European Union (EU) and the EOSC-A, to establish a coordinated approach in investments and initiatives for the realisation of EOSC. In this MoU, the EOSC-A and its Members commit to measuring the progress of the Partnership towards the objectives of the EOSC Strategic Research and Innovation agenda (SRIA)[2], a jointly owned document by the EC and EOSC-A, based on:

1. The evaluation of Key Performance Indicators (KPIs) of the Monitoring Framework (MF) (see Appendix 1); and
2. The reported in-kind contributions to Additional Activities (AAs) performed by the EOSC-A Members.

1.1 The EOSC Partnership Monitoring Framework

In line with the SRIA, the EOSC Partnership has three key general objectives: (1) to ensure that standards are defined, and services and tools developed, to enable researchers to find, access, reuse/combine and reproduce data from all areas of research—i.e. data that comply with the FAIR principles[3]; (2) to make Open Science practices and skills become the new normal and ensure they are rewarded and taught across Europe; and (3) to establish a sustainable and federated infrastructure enabling open sharing of scientific results.

These general objectives are articulated - in the MoU - into 9 specific and 14 operational objectives (Table 1). Progress against these objectives is to be monitored through the KPIs described in the Monitoring Framework (MF) of the EOSC Partnership (March 2022)[4]. The KPIs refer to target values to be achieved by certain timeframes (2023, 2025, or 2027). An early assessment of the baseline values of the KPIs was run by T4.2 of the EOSC Focus project, via a survey, in October 2022.

SO Short	SO Description
SO1	Increase the number of relevant research results that are made available as open as possible by researchers performing publicly funded research
SO2	Professional data stewards are increasingly available in research performing organisations in Europe to support Open Science
SO3	Development and adoption of incentives for researchers to perform Open Science
SO4	Increasing amounts of research data produced by publicly funded research in Europe are FAIR by design
SO5	The EOSC Interoperability Framework supports an increasing range and quantity of FAIR digital objects including data, software and other research artefacts
SO6	Provide an increased number of services and resources to ensure that European research is discovered and reused within and across disciplines to extract new knowledge
SO7	EOSC is operationalised and provides a stable and valuable infrastructure supporting researchers addressing societal challenges

[1] https://www.eosc.eu/sites/default/files/EOSC_Memorandum_30_July_2021.pdf
[2] https://eosc.eu/sites/default/files/SRIA%201.1%20final.pdf
[3] https://www.go-fair.org/fair-principles/
[4] https://eosc.eu/sites/default/files/2022-05/Monitoring%20Framework.pdf

SO Short	SO Description
SO8	Essential additional functionalities for end users, including from the public and private sectors, and citizen scientists, are implemented in EOSC (these developments are complementary to those of other European data spaces)
SO9	EOSC increasingly establishes ties with related initiatives from regions around the world and becomes a partner in global cooperation frameworks for Open Science
OO Short	**OO Description**
OO1	Deliver and operate all the necessary components of the MVE to share openly research data, publications, software, tools, and services while attracting increasing numbers and categories of users (public and private) (based on a governance structure representative of the various stakeholders and including domain-specific user environments supporting Open Science)
OO2	Make monitoring systems to gather data and evidence on best open science practices accessible through EOSC (including the development of a dashboard to monitor the evolving landscape of policies, infrastructures and open resources made accessible via EOSC)
OO3	Increasingly mainstream Open Science skills in European research performing organisations (RPOs) including through the uptake of curricula and training frameworks related to data stewardship through the lifespan of the Partnership
OO4	Co-develop domain-specific standards and adopt Open Science practices through the engagement with research communities during the lifespan of the Partnership
OO5	Provide the technical components of a FAIR ecosystem for uptake and customisation by the communities by 2023 (including open specifications, standards, schemas, application programming interfaces (APIs), metadata frameworks supporting FAIR digital objects and their automated processing)
OO6	Provide the metrics and tools to measure the adoption of the FAIR principles for research artefacts and provide frameworks to help in certifying that repository services enable FAIR in EOSC throughout the lifespan of the Partnership
OO7	Co-develop a first generation of a robust pan-European network of infrastructures for software source code (including incentives for the effective documentation and sharing of research software)
OO8	Co-design and adopt a rewards and recognition framework for FAIR and open data practices in research during the lifespan of the Partnership
OO9	Implement and evolve the EOSC Rules of participation and onboarding process for EOSC providers and increase the number of service providers and services offered progressively over the course of the Partnership
OO10	Deploy and operate an authentication and authorisation infrastructure (AAI) framework to manage user identity and access
OO11	Implement the EOSC persistent identifier (PID) policy and architecture
OO12	Co-develop a minimum metadata framework and provide a common search and access mechanism to EOSC resources across the EOSC federation
OO13	Continuously monitor and promote the increased uptake of core services and EOSC resources, access to EOSC Exchange tools and services and ensure a feedback loop with the users
OO14	Define models for availability and costing of services across borders

Table 1 - Articulation of the EOSC Partnership objectives, over specific objectives (SOs) and operational objectives (OOs)

1.2 Monitoring and Reporting of the EOSC Partnership

The activities of the Partnership are continuously monitored and periodically reported to the EC over the duration of the MoU. The periodic reporting framework consists of the annual and biennial reporting schemes, which differs in terms of the goals and scope:

- Annual Reporting Activity:
  - Report on the **Additional Activities Plan (AAP)** of contributions;
  - Report on the actually provided **Contributions to the Additional Activities**.

  EOSC-A Members have committed to contribute €500 million in kind to the objectives of the EOSC Partnership over the lifetime of the MoU (2021-2030). This is measured by the AAP, which is an ex-ante plan along nine high-level categories, which has to be approved by the EOSC Partnership Board, prior to its implementation.

  The final AAP 2023, with a total value of €383 million, was approved during the 4th Partnership Board meeting on 19th December 2022. This adds to the €312 million detailed in the AAP 2022, approved during the 3rd Partnership Board meeting on 7th April 2022. The sum of these plans already exceeds the goal established for this Partnership at last in terms of planning, and it should be noted that the AAP 2021, although already approved, has not been included due to the uncertainty about how much of it would be eligible, since it was approved in October 2021. The AAP 2024 survey and AAP 2022 report are scheduled for Q3 of 2023, and will be submitted to the Partnership Board in the last quarter of 2023.

  More information about the AAPs and the progress on budget provisions commissioned by EOSC-A Members can be found on the EOSC-A website[5].
- Biennial Reporting Activity (2021, 2023, 2025, 2027):
  - **Biennial Monitoring Report (BMR)** including indicators common to all Horizon Europe partnerships;
  - **Full Report** covering the following aspects:
    - The progress of the partnership towards its objectives and the expected impacts (**Monitoring Framework KPIs**);
    - Functioning of the Partnership (additionality, directionality, international visibility and positioning, transparency and openness, coherence, and synergies);
    - Agreed and actual contributions;
    - Investments in operational activities;
    - Structured and representative 'impact case studies' (success stories).

1.3 Scope of this deliverable

This deliverable presents a report of the KPI baseline, which assesses the initial value for all the KPIs of the EOSC Partnership Monitoring Framework as reported in 2022.

This deliverable pursues three main objectives:

[5] https://eosc.eu/additional-activities-planning-and-reporting

- To report on the data collected in 2022 from EOSC-A Members to establish the MF KPI baseline of the status of the EOSC Partnership, in 2021, with respect to the goals identified in the EOSC SRIA. This report will be delivered to the EC in the spring of 2023, for approval;
- To provide the basis for a discussion between EOSC-A and the EC on the methodological approach to KPI monitoring, including suggestions for KPI phrasing, clarification of terminology, and inclusion of additional KPIs in the Monitoring Framework, selected from the MF Companion document;
- To reflect on the alignment of monitoring methodologies across initiatives from different bodies, i.e. EOSC-SB, towards the establishment of a 'single joint monitoring system' for EOSC.

2 Methodology

2.1 The Monitoring Framework KPI Baseline Survey

The assessment of base values for KPIs has been carried out via a survey among EOSC-A Members in November 2022. The aim of this survey was to establish the baseline for all the KPIs of the EOSC Partnership MF for 2021.

The survey questionnaire is provided in Appendix 1. Each question of the survey carried a particular code (e.g. OO1_01; SO3_02), corresponding to the code of the KPI (Appendix 1).

All questions, phrased following an iterative process of revisions, inquired about figures from the year 2021. Some figures arising from desk study correspond to 2022. When this happens, this is indicated in the table of results (Table 3).

In order to minimise the burden of the survey, we developed a methodology to limit the number of questions that each Member received. Only a subset of the questions was sent to all the EOSC-A Members, while the rest of the survey questionnaire was structured around several target groups of information providers previously identified in the MF. The following target groups were identified:

- Research Performing Organisations (RPOs);
- Research Funding Organisations (RFOs);
- Service Providers (SPs);
- Horizon Europe Projects;
- Research Infrastructures (RIs).

Each target group would thus have to respond to a different set of questions, composed of the general questions, plus the specific set of questions for that target group. In addition to that, part of the questionnaire was also filled via a desk study conducted by the EOSC-A itself, who also reached out to the EOSC Steering Board Subgroup A for one question. A matrix of the target groups and the KPIs directed to them is provided in Table 2.

		Target group							
SRIA Objective	KPI code	RPOs	RFOs	SPs	EOSC-A Members	EOSC-A	Horizon Projects	RIs	SB-A
SO1	SO1_01	X							
SO2	SO2_01								X
	SO2_02	X							
SO3	SO3_01		X						
SO4	SO4_01	X		X					
	SO4_02							X	
	SO4_03				X				
	SO4_04				X				
SO5	SO5_01							X	
SO6	SO6_01						X		
SO7	SO7_01							X	
SO8	SO8_01			X					
	SO8_03					X			
SO9	SO9_01					X			
	SO9_02					X		X	
OO1	OO1_01					X			
	OO1_02					X			
OO2	OO2_01					X			
OO3	OO3_01	X							
OO4	OO4_01					X			
OO5	OO5_01				X				
OO6	OO6_01	X					X		
OO7	OO7_01		X						

		Target group							
	OO7_03					X		X	
OO8	OO8_01				X	X			
	OO8_02	X							
OO9	OO9_01					X			
OO10	OO10_01					X			
OO11	OO11_01	X							
OO12	OO12_01				X				
	OO12_02					X	X		
OO13	OO13_01					X	X		
	OO13_02					X			
OO14	OO14_01			X				X	

Table 2 - Target Groups per SRIA's Operational Objectives (OO) and Specific Objectives (SO)

For disambiguation of the terminology used in the MF, and hence in the survey questions, we provided a link to the EOSC MF Glossary[6], available on all the pages of the questionnaire for ease of reference.

The survey was implemented via the GDPR compliant EUSurvey platform[7] by the EC. It was launched by the EOSC-A on 21 October, with an initial closing date set on 11 November, which was then extended by two weeks. A series of training workshops were also held as soon as the survey was available online to help respondents navigate the survey and answer all their questions. The training sessions, as well as the actual survey, were communicated to the EOSC-A Members via direct e-mailing by the Association. There were six sessions held between 25 October and 8 November 2022, most of which were also attended by the EOSC-A President. The survey questionnaire could be downloaded by the respondents, in order to facilitate representatives of all target groups to become familiar with it. In total, around 25 representatives of the EOSC-A Members participated in the training sessions.

2.2 Methodology for the analysis of the survey results

Results from the survey were processed in anonymised form. Questions were evaluated considering the number of respondents and quantifying the number of times a specific answer was given within a predefined answering category, according to the following options:

[6] https://eosc.eu/sites/default/files/2022-10/EOSCPartnershipMF_Glossary.pdf
[7] https://ec.europa.eu/eusurvey/

- Nominal closed questions: Questions that could be answered by the respondent as 'Yes', or 'Applicable', or 'No', or 'Not applicable'.
- Numeric questions, including absolute numbers, ranges, percentages, ratios: questions that could be answered by the respondent by providing a certain number.
- Ordinal or ranked questions: questions that could be answered by the respondent as Yes/Applicable, 'In planning' or 'Partly', or No/Not Applicable and provide a ranking within their answers on how far a respondent exercises the listed activity.
- Free-text entries directed to a specific answer: Questions that could be answered by respondents as a specific textual answer that cannot be categorised in numerical values, but do provide a list of initiatives. These questions gave respondents the possibility to clarify or expand on their answers, through an open text field, into two main forms:
    - An open text questions asking to clarify or expand information, considering a specific KPI: these questions were meant to provide a deeper insight into the activities of the respondents;
    - An optional open-text box was given at the end of each survey section, enabling respondents to convey impressions on the questionnaire, point out unclarities or difficulties, and provide their own valuable input on the given information.

Results of the KPI 2021 baseline survey are always presented in comparison with the target values indicated by the MF KPIs, and with the same format as the target value, e.g. as a number or a percentage, for ease of comparison:

- For the closed nominal questions and the ordinal/ranked questions, the main results are calculated as a percentage between answer categories, for example: the number of 'Yes' or 'Applicable' is divided by the total number of answers. Results are presented against the target value indicated in the Monitoring Framework. It should be noted that the number of total responses varied throughout the survey for each KPI, due to different numbers of respondents in the target groups selected.
- Free-text questions were analysed qualitatively, mining for recurring answers or overarching themes, like initiatives or tools mentioned by more of one party, as well as to identify requests for clarification around certain aspects/terms of the questionnaire.

The results are accompanied by a standard traffic-light colour coding, showing at a glance the status of each indicator with respect to its target value. The colour green stands for target value reached; yellow represents values between 40 to 100% of target values; values below 40% of the defined target values are coloured in red (Fig. 1).

For the full description of the KPIs, we refer to Appendix 1.

3 Results of the KPI baseline survey for the Horizon Europe EOSC Partnership Monitoring Framework

3.1 The MF KPI Baseline

The survey was responded to by 63 Members of the EOSC-A (40% of the total number of Members, which at the time of survey was equal to 159; it does not include the number of Observers) and complemented by the results of the desk study conducted by the EOSC-A itself. The results are summarised in Table 3: the first and second column report the coded name and description of the MF KPI; while the survey results, i.e. the value of the indicator in 2021, are in the third column (Baseline 2021). The table also reports the target values for the KPIs according to the Monitoring Framework in the years of the Biennial Reporting Activity (2023, 2025 or 2027). All entries are accompanied by a descriptive comment on the baseline result.

KPI code	KPI Description	Baseline (2021)	2023	2025	2027
SO1_01	The percentage of publications from EOSC Association Research Performing members that have been available in immediate open access in the last 12 months	49%	70% of the publications from the target year from the EOSC Association research-performing members become immediate open access		
		A total of 196 396 publications have been indicated by 34 respondents, a sum of 123 664 OA publications among 33 of them, and 96 754 immediate OA publications by 28 respondents.			
SO2_01	The number of countries where the national education system recognises curricula for data stewards	No answer.		5 national education systems recognise curricula for data stewards	
		This question was presented to MS representatives through the EOSC-SB survey of Q1 2023; responses are not available yet.			
SO2_02	The percentage of EOSC Association members whose research is supported by professional data stewards	21%		50% of the RPOs that are EOSC Association members have data stewards to support their research	
		7 out of 34 respondents answered 'yes', an additional 17 out of those 34 respondents answered 'partly'.			
SO3_01	Percentage of research-funding members of EOSC-A that require data sharing and incentivise data re-use	67% data sharing, 50% data re-use		70% of research-funding members of the EOSC Association require data sharing and incentivise reuse	
		4 and 3, respectively, out of 6 respondents answered 'yes'			
SO4_01	The number of repositories in EOSC that have a certification (e.g. CoreTrustSeal)	24%		30% of the repositories in the EOSC will have a certification (e.g. CoreTrustSeal)	
		12 out of 50 respondents answered 'yes', 1 'partly'			
SO4_02	The number of thematic European research	83%	60% of research disciplines have		

KPI code	KPI Description	Baseline (2021)	2023	2025	2027
	infrastructures (as a proxy for all major scientific disciplines) with documented standards and protocols for data sharing and re-use		documented standards and protocols for data sharing and reuse		
		All 6 respondents answered 'yes'. They correspond to the following disciplines defined by Frascati: 40% account for (1) natural sciences, 10% (2) engineering and technology, 30% (3) medical and health sciences, none to (4) agricultural sciences, 10% (5) social sciences, 10% (6) arts and humanities. Compare Figure 5 in section 2.4.			
SO4_03	Percentage of members of the EOSC Association that have policies which require FAIR to be implemented in project design via Data Management Plans	41%	70% of the members of the EOSC Association have policies which require FAIR to be implemented in project design via Data Management Plans		
		24 out of 58 respondents responded 'yes'.			
SO4_04	The percentage/ the estimated number of research data-sets from EOSC-A members that are deposited in repositories and made open and FAIR	16%		50% of research data-sets from EOSC Association members that is deposited in repositories is made FAIR and 'as open as possible', i.e.: at least the metadata are available	
		9 out of 58 respondents answered 'yes'.			
SO5_01	Number of major research infrastructures which adopt the EOSC Interoperability Framework, enabling their data to be federated into EOSC	1	The EOSC Interoperability Framework is adopted by at least 5 major research infrastructures in Europe, enabling their data to be federated into EOSC		
		1 out of 5 respondents answered 'yes'.			
SO6_01	The number of inter and cross-disciplinary use	60		Five use cases have	

KPI code	KPI Description	Baseline (2021)	2023	2025	2027
	cases conducted, on data sharing practices, using EOSC services			demonstrated engaging diverse research communities in cross-disciplinary data sharing using services onboarded into EOSC	
		9 different respondents indicated to have conducted use cases, with individual numbers between 2 and 60, In sum 74 use cases were counted with possible overlaps			
SO7_01	The number of major Research Infrastructures (as a proxy for all major scientific disciplines) that have relevant data and services indexed through EOSC	5 from the 6 major disciplines			All major scientific disciplines (Frascati Nomenclature -Level 1) have relevant data and services indexed through EOSC
		5 out of 6 respondents answered 'yes'. The respondents who answered 'yes' correspond to the following disciplines, defined by Frascati: 33% for (1) natural sciences, 11% for (2) engineering and technology, 33% for (3) medical and health sciences, none to (4) agricultural sciences, 11% for (5) social sciences, 11% for (6) arts and humanities. Additionally, there is 1 answer 'in planning' corresponding to category (1). At present, as recognised by the EC, EOSC is not in place yet. When this KPI was set, it was expected that EOSC (at least Minimum Viable EOSC) would be present at the time of start measuring these indicators. The EC in its 'Helicopter View on EOSC' currently mentions as a priority task for the future: 'Deploying and operating the EOSC EU node (Core, Exchange, FAIR Data Federation)' and has published an EC procurement for this action. The progress reported by the survey respondents is the result of a misconception of what EOSC is, while it is undebatable that this KPI is not measurable now.			
SO8_01	The number of services dedicated to end users requirements, including from public sector and citizen scientists, that are made available through the EOSC Core and EOSC Exchange	9		Ten additional functionalities and services dedicated to end users requirements, incl. from public sector and citizen scientists, are made available through the EOSC Core and EOSC Exchange	

KPI code	KPI Description	Baseline (2021)	2023	2025	2027
		9 out of 21 answered 'yes', additional 4 out of 21 are 'in planning' At present, as recognised by the EC, EOSC is not in place yet. When this KPI was set, it was expected that EOSC (at least Minimum Viable EOSC) would be present at the time of start measuring these indicators. The EC in its 'Helicopter View on EOSC' currently mentions as a priority task for the future: 'Deploying and operating the EOSC EU node (Core, Exchange, FAIR Data Federation)' and has published an EC procurement for this action. The progress reported by the survey respondents is the result of a misconception of what EOSC is, while it is undebatable that this KPI is not measurable now.			
SO8_03	The number of active data spaces that take up FAIR data management principles and practices, and provide data to the EOSC ecosystem	0%			At least 50% of active data spaces take up data management practices, incl. FAIR data principles, and provide data to EOSC ecosystem
		Desk study: The meaning of 'Active', as phrased in the KPI, is unclear and has to be evaluated in future surveys. However, The Association understands data spaces as the EU DS. The foreseen eight EU Data Spaces are not active yet (in 2021) and therefore the value is 0%.			
SO9_01	The number of observers joining the Association from outside EU MS/AC	0		At least 10 geographically spread observer organisations have joined EOSC from outside EU MS/AC	
		Desk study: 16 Observers joined in 2021, all from EU MS/AC			
SO9_02	The number of formalised connections between EOSC and non-EU cloud and commons initiatives, which allow EOSC users to discover additional resources	1			EOSC establishes connections with at least 3 non-EU cloud and commons initiatives, which allow EOSC users to discover additional resources
		1 example indicated by 1 of the 3 respondents, namely the Worldwide LHC Computing Grid (WLCG).			

KPI code	KPI Description	Baseline (2021)	2023	2025	2027
OO1_01	The number of operational and discoverable MVE Core functions	0		4 core functions of the MVE are developed to make the EOSC ecosystem accessible to researchers across disciplines and countries	
		The MVE should be established with the EC procurement of the EOSC Platform (2023, DG Connect)			
OO1_02	Types and geographic spread (EU MS) of members in EOSC-A, and members of the Board of Directors (BoD), to represent the varied stakeholders' nature (RPOs, RFOs, Libraries, Service Providers, Mandated Organisations) and a varied EU MS representation	a) the EOSC-A grew by 21 members and 16 observers between 2020 and 2021. b) they come from more than 5 EU MS They represent all types of stakeholders, however we cannot resolve 'Libraries' c) types of members: RPOs: 137 RFOs: 21 Libraries:N/A Service Providers - other than ESFRI RIs: 92 ESFRI RIs:16 Mandated Organisations:26 d) EU MS representation the BoD: 7 (and 1 international organisation) e) Type of entities in the BoD: all represented but RFOs		The EOSC-A membership has grown by at least 25 new members representing different stakeholders in the EOSC Ecosystem (RPOs, RFOs, Libraries, Service Providers, Mandated Organisations) coming from at least 5 different EU MS. In addition, a balanced representation is also achieved in the Board of Directors	
		In 2020: 132 Members (including the MOs), 55 Observers; in total:187. In 2021: 153 Members (of which 26 MOs), 71 Observers; in total: 224. EU MS representation in the BoD: IT (1), NL (2), ES (1), FI (1), FR (1) SW (1), DE (1); Type of entity in the BoD: RPO (6), RFO (0), SP (3).			
OO2_01	A monitoring system (like a dashboard) to gather OS metrics of the evolving landscape of policies,	0	A monitoring system (like a dashboard) to gather OS data		

KPI code	KPI Description	Baseline (2021)	2023	2025	2027
	infrastructures and open resources can be accessed through		and feed metrics of the evolving landscape of policies, infrastructures and open resources can be accessed through EOSC		
		Desk study.			
OO3_01	Percentage of RPO members of the Association that provide training for the upskilling of their researchers in Open Science	82%		50% of EOSC-A RPOs across Europe offer training on Open Science for researchers and data stewards	
		28 out of 34 respondents answered 'yes'.			
OO4_01	Number of scientific disciplines for which EOSC Association TFs provide recommendations on standards and Open Science best practices	6	Each major scientific community (Level 1 of the Frascati Manual Nomenclature) has at least one initiative on standards and Open Science practices involving EOSC-members		
		Desk study.			
OO5_01	The following technical components supporting FAIR digital objects and their automated processing are operational: standards, schemas, APIs, metadata frameworks	45% standards, 40% schemas, 47% APIs, 40% metadata frameworks	Standards, schemas, APIs, metadata frameworks and other technical components supporting FAIR digital objects are specified by EOSC related communities and supported by the service providing organisations		
		Respectively 26,23, 27, 23 out of 58 respondents answered 'yes' for each category indicated above.			
OO6_01	Availability of FAIR assessment tools to measure the FAIRness of	22%		At least one type of FAIR assessment tool	

KPI code	KPI Description	Baseline (2021)	2023	2025	2027
	different research digital objects			exists to measure the FAIRness of datasets, software and DMPs, respectively	
		11 out of 50 respondents answered 'yes'. (Note: 21% out or RPOs and 25% out of projects answered 'yes' - the sum makes up for 22%)			
O07_01	Percentage of research funders who are members of the EOSC association that include software source code as a research output to be described and managed in their Data Management Plans (DMPs)	17%		50% of research funders across the members of the EOSC Association include software source code as a research output to be described and managed in their Data Management Plans (DMPs)	
		1 out of 6 respondents answered 'yes'.			
O07_03	The number of first-generation pan-European infrastructures for preservation, management and sharing of research software	1 *		A first generation of pan-European infrastructures for preservation, management and sharing of research software is available	
		*1 out of 5 respondents indicated Zenodo linked to Github.			
O08_01	Number of policy fora where rewards and recognition frameworks for FAIR and open data practices are co-designed, where the EOSC Association is represented	147 (corresponding to 81% of respondent)	The EOSC Association is represented and active in policy fora where rewards and recognition frameworks are co-designed		
		47 out of 58 respondents answered 'yes'. 147 examples of initiatives and fora have been indicated including EOSC task forces, >15 different EOSC-related projects, 51 international initiatives, 52 national working groups, 10 international and 3 national events, as well as various RDA involvement. For the additional information see section 3.3.			
O08_02	Number of Association members that recognise open science activities in research career	34%		50% of the EOSC association members	

KPI code	KPI Description	Baseline (2021)	2023	2025	2027
	assessments (i.e.: FAIR and open data practices are linked to researchers' online records, publications linked to a researcher; open data practices and FAIR data practices are linked back to the researcher who can get credit for this)			recognise Open Science activities in research career assessments	
		11 out of 32 respondents answered 'yes'.			
OO9_01	Establishment of an 'RoP Board' to monitor and report on the qualitative and quantitative compliance with the Rules of Participation	in planning	An 'RoP Board' is established to monitor and report on the qualitative and quantitative compliance with the Rules of Participation		
		The rules of participation are being prepared, with a Task Force dedicated to the topic, however these can only be finalised once the EOSC Platform is available.			
OO10_01	Number of federated frameworks that are deployed and operational allowing service providers to offer services to users	0		A federated AAI framework is deployed and operational allowing service providers to offer services to identified users, and allowing users to gain access to services	
		A federation of frameworks will be realised as part of the EC procurement (2023, DG Connect) for the EOSC Platform.			
OO11_01	The Number of RPO members of the EOSC Association that adopt and use the persistent identifier allocation practice	82%		Persistent identifier allocation and usage is the adopted practice by all RPO members of the EOSC Association	
		28 out of 34 respondents answered 'yes'.			
OO12_01	Number of members of the Association that participate in fora to agree on standards for	60% participate in fora, 43% with policies		Standards for minimum metadata requirements are	

KPI code	KPI Description	Baseline (2021)	2023	2025	2027
	minimum metadata requirements and number of members of the EOSC-A that have policies in place to enforce the adoption of standard minimum metadata			agreed and are progressively adopted by relevant EOSC Association members	
		Respectively, 34 out of 57, and 25 out of 58 respondents answered 'yes'.			
OO12_02	Percentage of metadata belonging to publicly funded research datasets, from EOSC Association members, which are defined as Open Data, that are discoverable through EOSC federated infrastructure	<44%		70% of the metadata related to publicly funded research datasets (from EOSC Association members) which are defined as Open Data are discoverable by a search mechanism through EOSC federated infrastructure	
		7 out of 16 respondents answered 'yes'. There were 6 indications on individual percentages, only 1 out of the respondents indicated that 100% of their metadata could be attributed to as defined above. The average answer counts to 61% which reduces the overall percentage indefinitely.			
OO13_01	Frequency of EOSC stakeholder fora that are organised by the EOSC Association or by INFRAEOSC projects	2	At least one EOSC stakeholder forum takes place, and plans exist for yearly events		
		This includes the EOSC-A General Assembly (twice a year) and the EOSC Symposium			
OO13_02	The number of EOSC-A Task Forces which are set up with representation of users and service providers from different disciplines that issue relevant recommendations and launch relevant consultations for the continued development of EOSC	13	The EOSC-A sets up five Task Forces with representation of users and service providers from different disciplines. The TFs issue relevant recommendations and launch relevant consultations for the continued development of EOSC		

KPI code	KPI Description	Baseline (2021)	2023	2025	2027
		13 TFs have been created by the EOSC-A, under five advisory group umbrellas (https://eosc.eu/advisory-groups): (1) Implementation of EOSC o PID policy and implementation: Researcher engagement and adoption, Rules of Participation (RoP) compliance monitoring; (2) Metadata and data quality: FAIR metrics and data quality, Semantic interoperability; (3) Research careers and curricula: Data stewardship curricula and career paths, Research careers, recognition and credit, Upskilling countries to engage in EOSC; (4) Technical challenges on EOSC: AAI Architecture, Infrastructures for quality research software, Technical interoperability of data and services; (5) Sustaining EOSC: Financial Sustainability, Long-term data preservation			
OO14_01	Percentage of service providers who are members of the Association that have developed, adopted or tested models for the availability and costing of transnational services	57%	At least 30% of the EOSC Association service provider members have developed, adopted or tested models for the availability and costing of their transnational services		
		13 out of 23 respondents answered 'yes'.			

Table 3 - Overview of EOSC Partnership Monitoring Framework KPI-baseline survey. The table contains: the KPIs' coded names (column one, from the left hand side), their description (column two, from the left hand side), their assessed baseline value in 2021 (column three, from the left hand side) and their target value to be achieved in specific years (last three columns, from the left hand side). Every baseline-value entry is accompanied by a descriptive comment on the result obtained.

3.2 The MF KPI status - Baseline against target values

To visualise the current status of the KPIs (Fig. 1 on page 28) against the target value set in the MF, the monitored values were normalised to the target value, and a classic traffic-light colour coding was applied, distinguishing between: 1) 'Achieved': KPIs that have already reached the target values set in the EOSC Partnership MF, coloured-coded in green; 2) 'On track': KPIs holding values within the range of 40-99% of their target values, coloured-coded in yellow; 3) 'Well-below-the-target': KPIs measuring below 40% of the defined target values, coloured-coded in red; 4) 'Evaluation in progress': KPIs to be monitored or evaluated from still on-going consultations with relevant information provider groups; coloured-coded in grey.

The list of the KPIs in each status category, either green, yellow or red, is reported in table 4 below, which also includes a description of their status. The target values of nine KPIs have already been 'achieved', i.e. they have already reached the target values (100% or above). The target values of 12 KPIs are 'on track', i.e. they hold values within the range of 40-99% of their target values. The target values of 10 KPIs are 'well-below-the-target', i.e. they are below 40% of the defined target values. The evaluation of the remaining three KPIs is in progress or they cannot be measured at the moment.

Achieved KPIs	• KPI OO1_02 defines that the number of EOSC-A Members should have grown by 25 new members from different stakeholders in the EOSC ecosystem, such as RPOs, RFOs, libraries, SPs, and mandated organisations, coming from at least 5 different MS. In addition, a balanced representation should also be achieved in the Board of Directors (BoD). While the latter has been achieved, at

	the time of writing EOSC-A had over 100 Members from various stakeholders, except libraries. This KPI is therefore achieved with the exception of a missing representation of RFOs in the EOSC-A BoD. • KPI OO3_01 defines that 50% of research performing organisations across Europe from EOSC-A Members offer training on Open Science for researchers and data stewards. This is already true for an even higher percentage of respondents. • KPI OO4_01 specifies that each major scientific community has at least one initiative from EOSC-A Task Forces on standards and Open Sciences best practices. The corresponding task forces involve participants from various disciplines and likewise work on generic recommendations. • KPI OO7_03 aims at the availability of a first generation of pan-European infrastructures for preservation, management and sharing of research software. This has been indicated by respondents to be Zenodo linked to Github. • KPI OO13_01describes at least one EOSC stakeholder forum to take place on a yearly basis. • KPI OO13_02 describes five EOSC Association Task Forces with representation of users and service providers from different disciplines. Task Forces issue relevant recommendations and launch consultations for the continued development of EOSC. Currently 13 Task Forces under five 'umbrella' advisory groups are in place. • KPI OO14_01 aims at minimum 30% of service providers from the EOSC-A Members to have developed, adopted or tested models for the availability and costing of their transnational services. This was indicated to be true by more than half of the respondents. • KPI SO4_02 defines 60% of research disciplines to have documented standards and protocols for data sharing and re-use. This point was affirmed by every respondent belonging to all but one major discipline, lacking only agricultural sciences so far. • KPI SO6_01 specifies five use cases demonstrating the engagement of diverse research communities in cross-disciplinary data sharing using services onboarded into EOSC. 60 distinct use cases have been indicated by respondents.
On track KPIs	• KPI OO5_01 describes standards, schemas, APIs, metadata frameworks and other technical components supporting FAIR digital objects specified by EOSC-related communities and supported by service providers to be operational. Almost half of the respondents have indicated examples of such frameworks. • KPI OO8_01 declares the EOSC-A should be represented and active in policy fora where rewards and recognition frameworks for FAIR and open data practices are co-designed. This has been indicated to be true by over 80% of respondents. Since no number is given for the target value, one could translate the KPI's definition as corresponding to the goal of participation in such fora by EOSC Association Members.

	• KPI OO8_02 defines that half of EOSC-A Members recognise Open Science activities in the assessment of research careers in 2023. Currently this is true for one third of the respondents. • KPI OO9_01 introduces an 'RoP Board' to monitor and report on the qualitative and quantitative compliance with the Rules of Participation (RoP). At the time of the survey this board was in planning. • KPI OO11_01 specifies that all Members of the EOSC-A have adopted the practice of persistent identifier allocation and usage. This was affirmed by 82% of respondents. • KPI OO12_01 says that standards for minimum metadata requirements are to be agreed and progressively adopted by relevant EOSC-A Members, given the participation in corresponding fora on standards for minimum metadata requirements and policies in place to enforce their adoption. While more than half of the survey participants are involved in such fora, less than half have policies in place. • KPI OO12_02 aims to have 70% of metadata related to publicly funded research datasets from EOSC-A Members defined as Open Data to be discoverable by a search mechanism through an EOSC federated infrastructure. Less than half of the respondents indicated this to be true, while similar percentages have not been specified in several cases. • KPI SO1_01 aims at 70% publications by RPOs from EOSC-A Members to become immediate open access in 2023. This has been achieved in nearly half of the publications in 2021. • KPI SO2_02 asks for the percentage of EOSC-A Members whose research is supported by professional data stewards in 2025, aiming to reach a value of 50%. This was affirmed by less than a quarter of respondents though some more answered that to be partly true for 2021. • KPI SO3_01 monitors the percentage of RFOs among EOSC-A Members that require data sharing and incentivise data re-use in 2025, aiming to reach 70%. While the first part is true for two thirds of the respondents, only half of respondents affirmed the latter for 2021. • KPI SO4_01 defines 30% of repositories in EOSC to be certified in 2025. About a quarter of respondents indicate to be running a certified repository in 2021. • KPI SO4_03 describes the percentage of EOSC-A Members that have policies which request FAIR to be implemented in project design via data management plans in 2023, aiming to reach 70%. In 2021 this was true for over 40%.
Well-below-the-target KPIs	• KPI OO1_01 specifies the target value 4 for core functions of the minimum viable EOSC for 2025. The corresponding progress to maturity is still under discussion and in absolute number it is represented by zero. • KPI OO2_01 envisions a monitoring system like a dashboard to gather Open Science metrics of the evolving landscape of policies, infrastructures and open resources accessible through EOSC for 2023. At the time of the survey, such a system was under development or in the testing phase. • KPI OO6_01 monitors the availability of FAIR assessment tools to measure the FAIRness of research digital objects. A target value was set to have at least one such a tool for measuring the FAIRness for datasets, software and data

	management plans for 2025. 22% of respondents affirmed the availability of such a tool without an indication of the type. This indicates the need of further development in this area. • KPI OO7_01 defines that half of RFOs across EOSC-A Members include software source code as a research output to be described and managed in their data management plans in 2025. This was affirmed by a sixth of respondents only for 2021. • KPI OO10_01 defines a federated AAI framework to be deployed and operational allowing service providers to offer services to identified users, and allowing users to gain access to services for 2025. At the moment such a system is still under development. • KPI SO4_04 measures the number and percentage of research datasets from EOSC-A Members deposited in repositories and made open and FAIR with 50% as target for 2025. About 16% of respondents affirmed to have deposited data in repositories and made FAIR and as open as possible in 2021, mostly without further indication of their individual ratio of such datasets in relation to non-published data, or to data that do not comply with this description. • KPI SO5_01 aims at the adoption of the EOSC Interoperability Framework by at least 5 major research infrastructures in Europe in 2023, enabling their data to be federated into EOSC. This has been achieved by only one research infrastructure as of 2021. • KPI SO8_03 aims at minimum 50% of the active data spaces to take up data management practices including the FAIR data principles and to provide data into the EOSC ecosystem. It is unclear whether the reference was supposed to be the EU Data Spaces (which are not active yet) or any data space. 78 data spaces have been named, with unknown information management practices. However, the Association understands data spaces as the EU DS. The foreseen eight EU Data Spaces are not active yet (in 2021) and therefore the value is 0%. The meaning of 'Active', as phrased in the KPI, is unclear and has to be agreed for future monitoring efforts. • KPI SO9_01 monitors EOSC-A Observers from outside EU Member States and Associated Countries and aims at a minimum of 10 geographically spread observer organisations to have joined EOSC-A from outside in 2025. In 2021, this condition was not met: there were no such Observers in the EOSC-A. • KPI SO9_02 measures formalised connections between EOSC and non-EU cloud and common initiatives which allow EOSC users to discover additional resources, aiming at three in 2027. One such example has been indicated with the Worldwide Large Hadron Collider Computing Grid.

Evaluation in progress / Not measurable	• KPI SO2_01 aims at a number of five national education systems that recognise curricula for data stewards in 2025. This question was managed through the EOSC Steering Board survey 2023: responses have yet to be collected, at the time of writing. • KPI SO7_01 aims at all major scientific disciplines to have relevant data and services indexed through EOSC. This is true for all but one discipline, the agricultural sciences. However, we have placed this indicator in the area of 'evaluation in progress/not measurable,' because EOSC is not in place yet, and while progress has been reported, this is clearly a mis-conception of what EOSC is. When this KPI was set, it was expected that EOSC (at least Minimum Viable EOSC) would be present at the time of start measuring these indicators. The EC in its 'Helicopter View on EOSC' currently mentions as a Task 1: 'Deploying and operating the EOSC EU node (Core, Exchange, FAIR Data Federation)' and has published an EC procurement for this action. We have left this KPI as in progress, as perceived by the community, while it is undebatable that this KPI is not measurable now. The situation should be addressed again at the next iteration of the survey. • KPI SO8_01 monitors services dedicated to the requirements of end users, including from the public sector and citizen scientists, that are made available through the EOSC Core and EOSC Exchange. A target value of 10 additional functionalities and services in 2025 was defined, with 9 indicated by respondents in 2021. However, for the same reason in the case of the KPI SO7_01, we have decided to place this indicator in the area of 'evaluation in progress/not measurable,' because - as already said - EOSC is not in place yet. KPI SO2_01 aims at a number of five national education systems that recognise curricula for data stewards in 2025. This question was managed through the EOSC Steering Board survey 2023: responses have yet to be collected, at the time of writing.

Table 4 - Status of the KPIs against the target value, classified in three (colour- coded) groups. 1) 'Achieved': KPIs that have already reached the target values set in the EOSC Partnership MF, coloured-coded with green light; 2) 'On track' KPIs holding values within the range of 40-99% of their target values, coloured-coded with a yellow light; 3) 'Well-below-the-target': KPIs measuring below 40% of the defined target values, coloured-coded in a red light; 4) "Evaluation in progress / Not measurable': KPIs to be derived from still on-going consultations with relevant information provider groups, coloured-coded in grey. For the full description of the KPI, please, refer to table 3 or Appendix one.

Figure 1 - Overview of KPIs baseline and their target values. The colour scheme of traffic lights indicates the status to which extent a target value has been reached. The colour green stands for target value reached; the orange colour is for KPIs with values between 40 to 100% of target values; values below 40% of the defined target values are coloured red; the KPIs where evaluation is still in progress or are not measurable are in grey.

3.3 Insights into the analysis of non-numerical results

In order to gain more insight and an overview on examples, some open or qualitative formulations of questions were included in the survey.

For example, for KPI OO8_01, intended to indicate the participation of EOSC Association Members in policy fora for co-designing rewards and recognition frameworks for FAIR and open data practices, the survey question asked for examples of such initiatives, asking respondents to freely enter their name or some other reference.

We analysed the information received for KPI OO8_01, which indicated names, some repeated, of 43 international fora and 46 international projects, and further 50 national fora. In summary, there were 243 mentions of 140 distinct fora, outlined in the third column of Table 5 below.

Participation in national fora and initiatives:	APRE, Centre for Research & Development Monitoring, Data Vault Initiative in Flemish universities, DCC Implementation Network NL, DCC Implementation Network NL, Digital Curation Centre, ELIXIR-Belgium, EOSC Finnish Forum, EOSC Nordic, FAIR Data Spaces Fraunhofer, FAIR Data Spaces NFDI partner, FAIR Office Austria, Finnish Open Science and Research Coordination, Flemish Interuniversity council, Flemish open Science Board, Flemish Open Science Board, Flemish Research Data Network, Forum GDI, GAIA-X Austria, Gdansk Data Stewards Excellence Centre, German Office of the GO-FAIR initiative, Hellenic Open Science Initiative, Helmholtz Open Science Fora, Ibergrid, IOSGG, Italian Computing & Data Infrastructure, Italian Reproducibility Network, National Coordination Point Research Data Management, national Digital Competence Centres in NL, National Open Science Forum Hungary, National Platform Open Science NL, National Research Data Infrastructures Göttingen, NFDI, North-Rhine-Westphalien RDM initiative, ODISSEI, Open Data Advisory Group at the Ministry of Education and Science, Open science community Utrecht, Polish Data Stewards School, Polish Data Stewards Working Group, Polish Open Science Coordinators Working Group, RDA Austria Node, RDA interests groups and national contact point, RDA Node Romania, Research Data Netherlands, Romanian Open Science Cloud Initiative, Spanish open Science working group, Strategy for Open Science initiated by NRDIO, Swedish National Data Service, Swedish Research Council, Thematic Digital Competence Centre Social Sciences and Humanities, Warsaw Open Science Platform	Number of distinct fora: 50 Total number of entries: 65
International fora and initiatives:	One Million Genomes, CESAER, CESSDA, CLARIAH, Clarin, CODATA, Confederation of OA Repositories, CoreTrustSeal, Dariah, DATACITE, Dataverse, Digital Curation Centre, DigitalCSIC, ELAG, ELIXIR, Enlight Rise, EPIC, ESFRI, EUA, EUDAT, European Open Science Forum, FAIR Digital Objects Forum, FDO Forum, GA4GH, Go FAIR, Group on Earth Observations, IIF, International Neuroinformatics Coordinating Facility, JCDL, Knowledge-Exchange.info, LIBER, OpenAIRE, ORCID, PaNOSC, Research Data Alliance, Ro-Crate, SciCat, Science Europe Open Science, The Guild, UnaEuropa, World Data System	Number of distinct fora: 42 Total number of entries: 128
Related projects:	4CH, AI4Europe, AI4PublicPolicy, BD4NRG, BYCOVID, C-SCALE, Decido, DICE, EGI-ACE, EHRI, EOSC Focus, EOSC Future, EOSC Pillar, EOSC-Life, EUH4D, ExPaNDS, FAIRCORE4EOSC, FAIR-GNSS, FAIR-Impact, FAIRsFAIR, GREAT, HealthyCloud, iMagine, interTwin, LABPLAS, LETHE, NIO4S, OpenEO, PaNOSC, SSHOC, PATTERN, PITHIA-NRF, PolicyCloud, POLIFONIA, SKILLS4EOSC, SoBigData++, StairwAI, Tango, TIGER, Triple, Unlock CEI	Number of distinct fora: 41 Total number of entries: 50
Data Spaces (different from EU Data Spaces)	APM1, ASREN2, BCAM3, CRG4, CCCA5, CGE6, Crue Universidades Españolas7, CRef8, CSUC9, CLPU10, Couperin.org11, DESY12, DKRZ13, DLR e.V.14, The Alliance15, DSRSL16, ERINHA17, euroCRIS18, ECMWF19, EFMI20, EuroFIR AISBL21, EATRIS22, ESF23, ESS ERIC24, EUA25, FORTH26, IRD27, Frontiers28, SCAYLE29, GWDG30, GSSI31, IIAP32, FISEVI (IBiS)33, IG PAS34, Instruct-ERIC35, JHI36, Jisc37, JNP38, JKU39, LERU40, NCSRD41, NIB42, Nasertic43, NORDUnet44, os4os45, OpenNebula–ONEedge46, rasdaman47, RPIC RV48, RDA49, SE50, SU.FR51, SPARC52, FISEVI (IBiS)33, IG PAS34, TG55, ANR56, The Guild57, ISF58, Udice59, UKAEA60, UA61, UC.ES62, UCO63, UGR64, Universidad Isabel I65, URJC66, Univaq67, UNISOB68, UPO69, UniSR70, UL71, UN72, UGA73, UP1PS74, UNIBL75, UM.SI76, UoM77, VLIR78.	Number of data spaces reported (not EU Data Spaces): 78

Table 5 - Name and number of OS-related Fora/initiatives participated or organised by the respondents

From the analysis we could further extract:

i) The number and the geographic distribution of the reported national initiatives and fora, where the number of exemplified initiatives is provided under the assumption that the nationality of the event corresponds to the nationality of the respondent entity (Fig. 2a);

ii) The frequency of recurrent examples of international initiatives and fora (Fig. 2b).

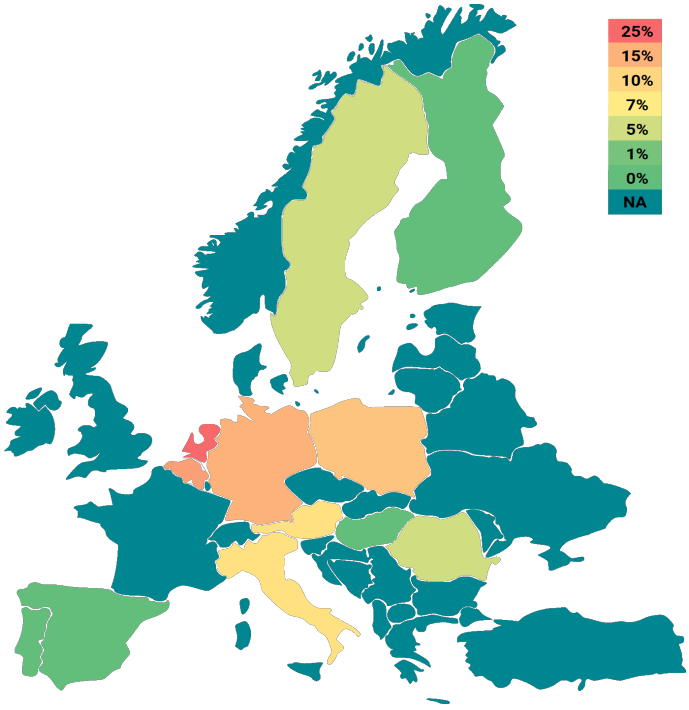

Figure 2a - Geographic distribution of reported national EOSC-related initiatives and fora, regarding rewards and recognition frameworks for OS practices adoption/implementation
The colour bar reflects the percentages of examples given per country with respect to the total number (50) of examples reported by the respondents.

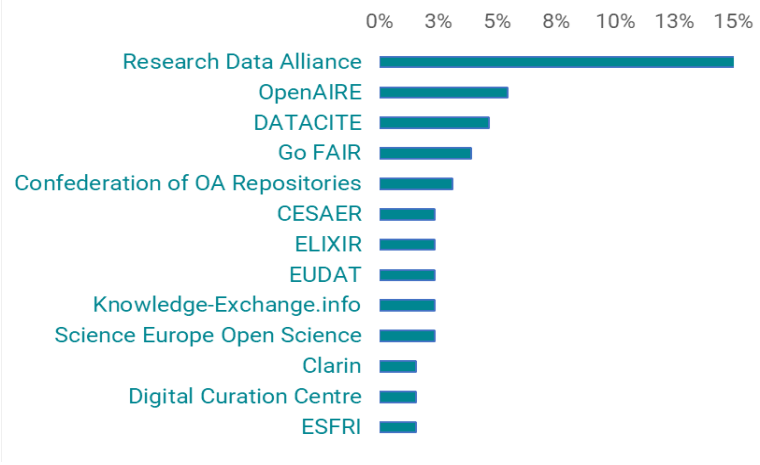

Figure 2b - Recurrence of OS-related International fora/initiatives examples as a % of the total given examples

EOSC aims to make digital scientific resources available across disciplines by including all major research communities. The main six 'fields of science and technology' are: Natural Sciences; Engineering and Technology; Medical and Health Sciences; Agricultural Sciences; Social Sciences; Arts and Humanities, according to 'level one' of the Frascati Nomenclature Manual[8].

[8] OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris, https://doi.org/10.1787/9789264239012-en.

Considering the ESFRI RIs as proxies for the reference fields of science and technology and related communities, the survey shows that five out of the six fields are represented within the ESFRI-RI pool that responded to the survey (Table 6), with the exception of Agricultural Sciences, and with Natural Sciences (40%) and Medical and Health Sciences (30%) as the most represented.

Frascati field of science and technology	Frequency of RI representation
1. Natural Sciences	40%
2. Engineering and Technology	10%
3. Medical and Health Sciences	30%
4. Agricultural Sciences	0%
5. Social Sciences	10%
6. Arts and Humanities	10%

Table 6 - Frequency of the representation of each field of science and technology (level 1 of the Frascati Nomenclature Manual), among the ESFRI research infrastructures that responded to the survey

4 Reflections on the methodology applied

In order to facilitate future reporting, the authors reflected upon selected issues, also considering the qualitative answers received from the respondents, mostly associated with the methodological aspects of the preparation of the survey and the presentation of the collected data. The attention was put on the following 'pain points' (developed in the sections below):

- General remarks
- Phrasing of the survey questions;
- Terminology ambiguity of KPIs and propositions for disambiguation;
- KPI wording

4.1 General remarks

Since the survey was intended to set the baseline for the EOSC Partnership MF KPIs, there is no benchmark available to compare with. The MF, however, indicates a target value to be reached and this allows for an evaluation of the KPI status. Trends and progress analyses will only be established with further surveys, held on the regular biennial basis set by the MF.

In order to shape understandable survey questions, the original wording of the MF KPIs may be adapted. Some KPIs could also not be put into single questions because they contained two or more topics; thus, in some cases, sub-questions were introduced. As for the questionnaire itself, it may, for further iterations, also be useful to provide an option for an answer like 'in preparation', instead of only the binary response option of yes/no (e.g. SO5_01 and OO12_01).

The representativity of the results of the first release of the report is limited. The first limitation is that the survey was only sent to the Members of the EOSC-A, and not to the Observers. The second limitation is the small size of representatives in some target groups (Table 7). In order to increase the number of responses in future releases of the survey it may be useful to include the Observers. More uptake could further be achieved through targeted communication to the whole membership, e.g. during the General Assembly in May 2023, to increase the awareness of the duty to report on the status of the Partnership.

KPI-specific remarks, drawn from the analysis of the results as well as from the feedback received from respondents, are reported in Appendix 2. **However, some of the KPIs may also be further discussed in broader terms, as it has been reported that there are divergent opinions in the community regarding the status of implementation of EOSC, where a part of the community considers the Marketplace and the EOSC Portal to be EOSC, whereas other authoritative representatives, including the EC and the EOSC Association, consider that EOSC will only exist after the EC procurement of the Minimum Viable EOSC (MVE).** The evaluation of the KPIs was affected by this issue in the following cases, among others: the availability of the services through the EOSC Core and EOSC Exchange against the very operation of the EOSC Core and EOSC Exchange (SO8_01); the availability of the services to EOSC (e.g. AAI) against the availability of resources available on the Marketplace or the EOSC Portal (OO1_01); and the indexing of services through EOSC against the full operation of EOSC (SO7_01). Because of the fact that this is an on-going discussion at the time of writing, these reflections are not covered in the Appendix, but they should be tackled strategically and be part of the future work towards forming the EOSC ecosystem; more so in view of the next iteration of the MF KPI, which should take place in 2024, and which will capture the KPI status related to 2023.

Target group	Number of responses	Total number of Members	Response rate (%)
RPO	34	145	23
RFO	6	21	29
SP	21	97	22
RI	6	17	35
Horizon Projects	16	54	30

Table 7 - The number of individual responses by the target group against the total number of EOSC-A Members by target group. Both the number of responses and the total number of Members do not sum up to the total of 63 respondents and 159 Members respectively, as it is possible one organisation (Member) belongs to more than one target group and, therefore, responded to the set of questions designed for these target groups.

4.2 Suggestions for KPI phrasing

In order to improve the process of data collection for future MF surveys, and to maximise the output of the information provided, based on the analysis of the results and of the feedback received from the respondents, on the difficulties met in answering the survey questions, we provide (Table 8) a list of possible modifications of the KPIs, followed by rationales for each change.

KPI code	KPI Description	Suggested modifications	Rationale
SO7_01	The number of major Research Infrastructures (as a proxy for all major scientific disciplines) that have relevant data and services indexed through EOSC.	Suggestion to insert these KPIs into the MF Companion, including the developed MF KPIs that cannot be measured yet. Either avoid measuring these KPIs until EOSC and its elements are developed or rephrase the KPIs and refer to the available intermediary solutions such as the EOSC Portal.	Misperception about the availability of EOSC and its elements. Respondents reported some progress in these areas, however EOSC, as well as its elements (Core, Exchange and FAIR Data Federation), are not developed yet. Progress therefore cannot in fact be measured.
SO8_01	The number of services dedicated to end users requirements, including from public sector and citizen scientists, that are made available through the EOSC Core and EOSC Exchange		

KPI code	KPI Description	Suggested modifications	Rationale
OO10_01	Number of federated frameworks that are deployed and operational allowing service providers to offer services to users		
SO3_01	Percentage of research-funding members of EOSC-A that require data sharing and incentivise data re-use.	Split into two KPIs: a) Percentage of research-funding members of EOSC-A that require data sharing and data re-use; b) Percentage of research-funding members of EOSC-A that incentivise data sharing and re-use.	Data sharing does not automatically entail incentives.
SO8_03	The number of active data spaces that take up FAIR data management principles and practices, and provide data into the EOSC ecosystem	The number of European Data Spaces that take up FAIR data management principles and practices, and provide data into the EOSC ecosystem.	It was unclear whether the reference was supposed to be the EU Data Spaces (which are not active yet) or any data space.
SO9_02	The number of formalised connections between EOSC and non-EU cloud and commons initiatives, which allow EOSC users to discover additional resources	The number of formalised [e.g. in the form of agreements as MoUs] connections between EOSC and non-EU cloud and commons initiatives, which allow EOSC users to discover additional resources.	Unclear meaning of 'formalised'.
OO1_02		Split into three Qs: a) Please indicate the types of members in EOSC-A; b) Please indicate the geographic spread of members in EOSC-A; c) Please indicate the geographic spread of EOSC-A Board of Directors.	OO1_02 is quite complex and has to be split into different questions in order to be evaluated.
OO7_01	Percentage of research funders who are members of the EOSC Association that include software source code as a research output to be described and managed in their Data Management Plans (DMPs)	Percentage of research funders who are members of the EOSC Association that require the description of software source code as a research output in their Data Management Plans (DMPs).	Meaning of 'managed in DMPs' is misleading.
OO7_03	The number of first-generation pan-European infrastructures for preservation, management and sharing of research software	The number of pan-European infrastructures for preservation, management and sharing of research software.	Unclear meaning of 'first generation'.
OO8_01	Number of policy fora where rewards and recognition frameworks for FAIR and open data practices are co-designed, where the EOSC Association is represented	Number of policy fora where rewards and recognition frameworks for FAIR and open [science] data practices are [e.g., developed, designed], where the EOSC Association is represented. Insert the target value for this KPI.	Unclear meaning of 'co-designed.' The target value is undefined. Perhaps it could indicate 'at least one EU-wide forum'.

KPI code	KPI Description	Suggested modifications	Rationale
OO12_02	Percentage of metadata belonging to publicly funded research datasets, from EOSC Association members, which are defined as Open Data, that are discoverable through EOSC federated infrastructure	KPI needs further elaboration.	Metadata(sets) are non-quantifiable. Open data sets are already monitored in SO4_04.
OO13_01	Frequency of EOSC stakeholder fora that are organised by the EOSC Association or by INFRAEOSC projects	Split into two KPIs: a) Frequency of EOSC stakeholder fora that are organised by the EOSC Association; b) Frequency of EOSC stakeholder fora that are organised by INFRAEOSC and other EOSC-related projects.	Inclusion of the fora that are organised by other projects.
SO4_02	The number of thematic European research infrastructures (as a proxy for all major scientific disciplines) with documented standards and protocols for data sharing and re-use	Replace 'scientific discipline' with 'fields of science and technology'.	The level of Frascati nomenclature adopted in the study to picture the status of the indicator on communities is the 'fields of science and technology' (level 1).
SO7_01	The number of major Research Infrastructures (as a proxy for all major scientific disciplines) that have relevant data and services indexed through EOSC		
OO4_01	Number of scientific disciplines for which EOSC Association TFs provide recommendations on standards and Open Science best practices		

Table 8 - Summary of the recommendations for the possible modifications of the KPIs

5 Broadening the Monitoring Framework

The EOSC Partnership Monitoring Framework, approved in April 2022, refers to a Companion document (Annex 1 of the Monitoring Framework), which is designed to extend the scope of the MF with additional KPIs. The EOSC Partnership agreed that this broadening would be applied if/when the conditions of the system are appropriate, at any given time.

Considering the boundary conditions emerged from the baseline survey: we provide a rationale for the potential inclusion of each 'companion KPI', in the next iteration of the MF KPI survey (Table 9); and: we suggest moving two KPIs (SO7_01 and SO8_01) of the current MF into the Companion document, on the grounds that these indicators are not measurable yet (Table 10).

In summary, eight additional KPIs (out of 13 total companion KPIs) are suggested for future inclusion: SO5_02, SO6_02, SO6_03, SO8_02, OO1_03 OO7_02, OO9_02, 0013_03; and: two KPIs (SO7_01 and SO8_01) may need to be added to the Companion document.

This analysis shall support the discussion between the EOSC-A and the EC for a potential modification of the Monitoring Framework.

KPI Short	KPI Description	Targets	Comments
SO1_02	Percentage of research data from EOSC Association members are made as FAIR as possible, ideally open	(2027) 70 % of research data from EOSC Association members are made as FAIR as possible, ideally open	KPI was already covered by another KPI, SO4_04. Changing the target value (from 50% to 70%) can be considered in the next survey.
SO3_02	Number of EOSC association members that recognise open science activities in research career assessments	(2025) 50% of the EOSC association members recognise open science activities in research career assessments	KPI was already covered by another KPI, OO8_02.
SO5_02	Percentage of research data produced in the last year by European RIs is made FAIR and can be accessed through EOSC	(2025) 70% of research data produced in the last year by European RIs is made FAIR and can be accessed through EOSC	KPI can be added in the next survey. KPI complements another KPI, SO5_01.
SO5_03	Percentage of research data and other digital objects produced yearly in Europe that is FAIR and available through EOSC	(2027) 50% of data and other digital objects produced yearly in Europe that is FAIR and available Through EOSC	KPI may seem redundant and beyond the scope (refers to a wider ecosystem not monitored at the moment).
SO6_02	Yearly increase of number of data and services available through EOSC	(2025) Increase of 30% of number of data and services available through EOSC compared to the previous year	KPI can be added in the future, without a defined time perspective at the moment.
SO6_03	Number of tools and services from national infrastructures available through EOSC	(2027) At least 30% of tools and services available through EOSC are from national infrastructures	KPI can be added in the future, without a defined time perspective at the moment.
SO8_02	Number of commercial providers that provide research related services through EOSC	(2027) At least 2 agreements with commercial providers are activated to enhance the EOSC resources at national or international level	KPI can be added in the future, without a defined time perspective at the moment.
OO1_03	An effective governance framework that coordinates activities and that directs the architectural development and the EOSC interoperability framework	(2024) An effective governance framework for architecture and interoperability framework of EOSC	KPI can be added in the next survey.
No code	Implementation of an infrastructure to gather OS metrics through EOSC	(2025) Infrastructure to gather OS metrics can be accessed through EOSC.	KPI was already covered by another KPI, OO2_01.
OO7_02	Number of services and infrastructures for software and source code (including repositories that opened up to host software) that are available through EOSC	(2025) 10% increase with respect to the previous year of services and infrastructures for software and source code (including repositories that opened-up to host software) are available through EOSC	KPI can be added in the next survey. KPI relates to another KPI, OO7_03.
OO9_02	Availability of detailed and comprehensive set of guidance	(2023) A detailed and comprehensive set of guidance documents are available.	KPI can be added in the next survey.

KPI Short	KPI Description	Targets	Comments
	documents to implement the Rules of Participation		
OO11	Services that resolve a wide variety of PIDs	(2025) A global PID resolver is developed to resolve all kinds of digital objects including services, for different kinds of PID (e.g. DOIs, ARKs, handles, etc.).	KPI may seem beyond the scope. KPI can be considered on certain conditions, i.e., if the target value was at the project or discipline or European level.
OO13_03	EOSC Exchange growth in number of domain-specific services	(2025) increase of 10% of the average number of domain-specific services available through EOSC Exchange	KPI can be added in the future, without a defined time perspective at the moment.

Table 9 - Considerations for inclusion or exclusion of the KPIs from the MF Companion, in the next iteration of the MF KPI survey. In the table, the KPIs suggested for inclusion (SO5_02, SO6_02, SO6_03, SO8_02, OO1_03 OO7_02, OO9_02, 0013_03) are highlighted

KPI Short	KPI Description	Targets	Comments
SO7_01	The number of major Research Infrastructures (as a proxy for all major scientific disciplines) that have relevant data and services indexed through EOSC.	All major scientific disciplines (Frascati Nomenclature-Level 1) have relevant data and services indexed through EOSC	This KPI refers to a moment in time when EOSC is deployed and available. This condition is not met now, and the KPI cannot be measured.
SO8_01	The number of services dedicated to end users requirements, including from public sector and citizen scientists, that are made available through the EOSC Core and EOSC Exchange	Ten additional functionalities and services dedicated to end users requirements, incl. from public sector and citizen scientists, are made available through the EOSC Core and EOSC Exchange	This KPI refers to a moment in time when EOSC is deployed and available. This condition is not met now, and the KPI cannot be measured.

Table 10 - Considerations for addition of two KPIs, from the current MF into the MF Companion, unless the boundary conditions will have changed

6 Towards alignment of the EOSC Partnership monitoring and evaluation practices

The need to align the monitoring and evaluation methodologies for the development of the EOSC ecosystem in the context of the tripartite collaboration was advocated during the first Tripartite Event in 2021. With the intent to move closer to the realisation of the 'Single Joint Monitoring System' for EOSC, this deliverable has applied the methodology developed by the EOSC-SB, for the evaluation of the indicators in the Monitoring Framework for the National Contributions to EOSC, to the KPIs of the EOSC Partnership MF.

6.1 Methodology of the Monitoring Framework for National Contributions to EOSC

The EOSC-SB Monitoring Framework for National Contributions to EOSC developed a methodology[9] for the evaluation of their indicators, categorised in nine different classes, in the three main dimensions of Policies, Practices and Impact. According to that methodology, those categories, are described as follows:

- Publications - research publications that are available in open access,
- Data - research data management and research data that is FAIR/open,
- Software - software that enables research and is available in open source,
- Services - services that enable research data discovery and exploitation,
- Infrastructure - data stewardship, data repositories, and data preservation,
- Skills/Training - skills and training for researchers to practise Open Science,
- Assessment - incentives and rewards for researchers to practise Open Science,
- Engagement - research that engages and involves citizens via citizen science.

6.2 Applying the EOSC-SB evaluation methodology to the MF KPIs

With the aim to support the establishment of an EOSC Single Joint Monitoring System, the MF KPIs were retro-fitted to the above-mentioned classification, as reported in Table 10.

Categories/dimensions	Policies	Practices	Impact
1. Publications			SO1_01
2. Data	SO4_03	OO11_01	SO4_04 SO6_01 OO12_02
3. Software			OO7_01
4. Services		SO8_01 OO6_01 OO10_01 OO14_01	OO1_01
5. Infrastructure		SO3_01 SO4_02 SO5_01 SO7_01 SO8_03 OO7_03 OO5_01	SO2_02
6. Skills/Training		SO2_01 OO3_01 OO4_01	
7. Assessment	SO3_01 OO2_01 OO8_01 OO8_02 OO9_01 OO12_01 OO13_02		

[9] The Monitoring Framework for National Contributions to EOSC. https://doi.org/10.5281/zenodo.7410760

Categories/dimensions	Policies	Practices	Impact
8. Engagement	SO9_01 SO9_02 OO1_02 OO13_01		

Table 11 - KPIs from the EOSC Partnership MF grouped into categories and dimensions, as defined by the EOSC-SB Monitoring Framework for National Contributions to EOSC

It is interesting to see how the KPIs are distributed in this matrix, with some of them only appearing along one of the dimensions: KPIs measuring actions taken as part of the infrastructure development, services, and skills and training categories, only show up under "Practices"; "Assessment" appears in the policy dimension; and KPIs in the "Data" category seem to be relevant across all three dimensions.

It can be useful to see the KPIs from the point of view of the Impact, as the areas they indicate may be where use-cases, success stories and good practices may be found, as examples of EOSC-related initiatives of benefit to the research community which could be 'mined' for reporting and story-telling.

We have further analysed the status of the various MF KPIs in each of the various categories of the EOSC-SB National Monitoring Framework, with the aim to see whether some areas were more advanced than others (Fig. 3).

The only category 'well-below-target' is 'Software', considering the practices of sharing software source codes; the Data and the Publication categories are mainly represented by KPIs that are on track to reach their target value; Training, on the other hand, looks like it is mainly achieved. The MF KPIs that could be related to the categories Infrastructure and Services appear to be in good progress overall, with some elements achieved and others still in the early-development stage. Some further reflections are needed for the categories Assessment and Engagement, where the MF KPIs were only tentatively assigned.

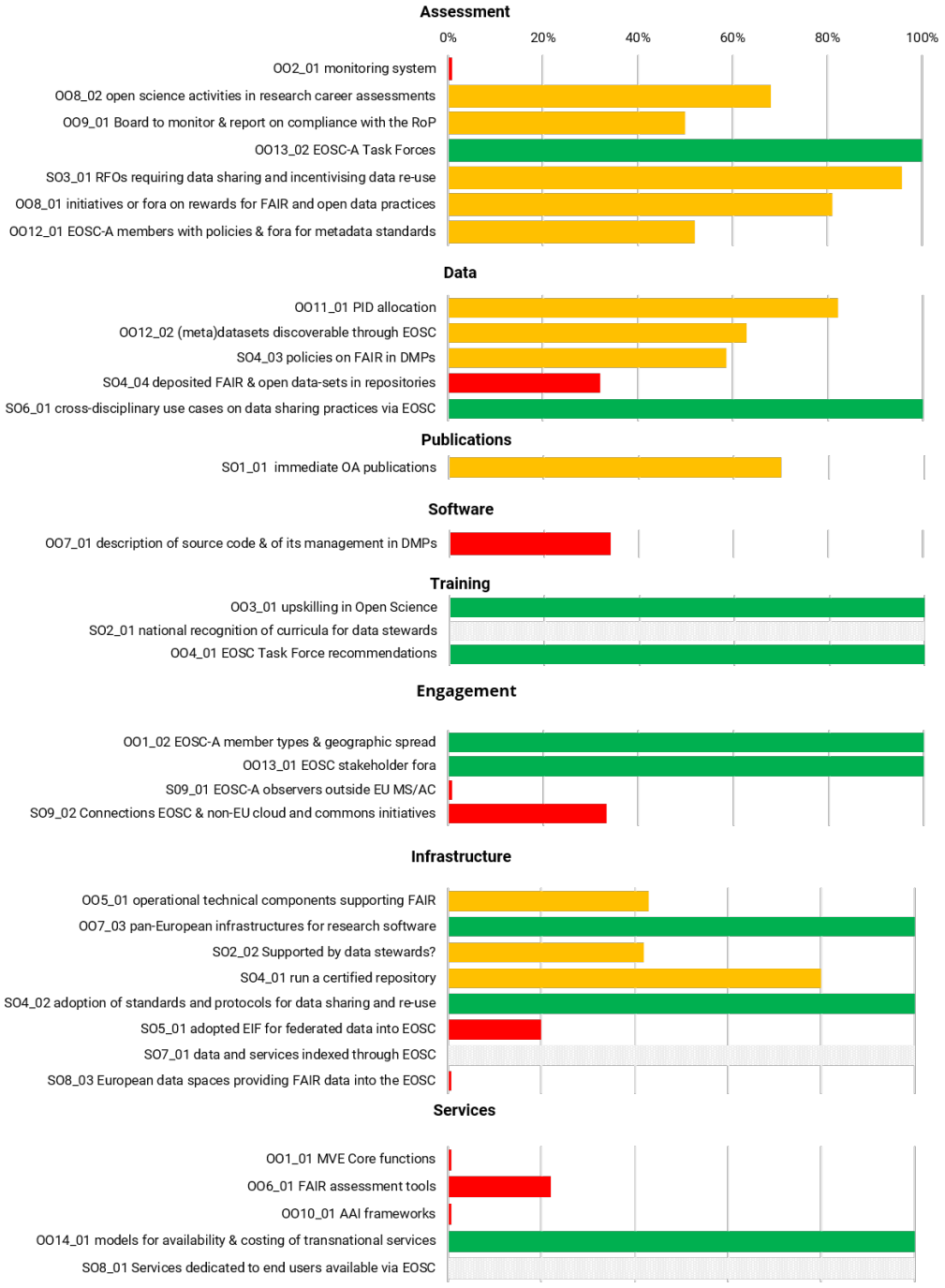

Figure 3 - Overview of KPIs baseline and target values, KPIs have been grouped into categories, reflecting the classification established by the EOSC-SB Monitoring Framework for National Contributions to EOSC

6.3 Discussion on the applicability of the EOSC-SB methodology for the evaluation of the MF KPIs

Retrofitting the MF KPIs to the above-mentioned classification exposed that the National MF category definitions may need broadening in order to allow all the MF KPIs to be captured; for example:

- Category 7 - 'Assessment' was broadened to include activities aiming at evaluation of actions taken by various stakeholders of the EOSC ecosystem; in addition to incentives and rewards for researchers;
- Category 8 - 'Engagement' was understood to encompass the engagement of all the actors, who create networks, collaborate and build knowledge fora, in addition to the context of citizen science

It is also unclear whether this categorisation allows for a key to narrate the EOSC development. As an alternative, a different mapping could be utilised, e.g. i) according to the areas covered by the EOSC Association Task Forces; and/or ii) against the components of the Minimum Viable EOSC (Core, Exchange, and FAIR Data Federation). However, the dimensions of policy, practices and impact could be useful with respect to the narrative, e.g. the impact dimension may be the area where use-cases, success stories and good practices may be found, as examples of EOSC-related initiatives of benefit to the research community.

7 References

No	Description/Link
R1	EOSC Association. (2022). Strategic Research and Innovation Agenda (SRIA) of the European Open Science Cloud (EOSC) (Version 1.1). https://eosc.eu/sites/default/files/SRIA%201.1%20final.pdf
R2	EOSC Association. (2022). The EOSC Partnership Monitoring Framework (Version 6.6.). https://eosc.eu/sites/default/files/2022-05/Monitoring%20Framework.pdf
R3	O'Neill. G. (2022). Monitoring Framework for National Contributions to EOSC (Version V1). Zenodo. https://doi.org/10.5281/zenodo.7410762
R4	OECD. (2015). Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities. Paris: OECD Publishing. http://dx.doi.org/10.1787/9789264239012-en

Appendix 1: Survey questionnaire

KPI Short	KPI Description	Question Asked in the Survey	Answer Options in the Survey
SO1_01	The percentage of publications from EOSC Association Research Performing members that have been available in immediate open access in the last 12 months	Please indicate the number of publications (e.g. articles, chapters, books, conference papers, policy papers, pre-prints, lecture notes) which your Research Performing Organisation released in 2021 and the number of them which were available in immediate (e.g. golden) open access	Free text answer: Number of publications in total Number of publications available in open access Number of publications available in immediate open access
SO2_01	The number of countries where the national education system recognises curricula for data stewards	Please indicate the countries where the national education system recognises curricula for data stewards	Free text answer
SO2_02	The percentage of EOSC Association members whose research is supported by professional data stewards	Is the research activity carried out by your organisation supported by professional data stewards?	Single choice answer: Yes: Across the whole organisation Partly across the organisation (in some centres, schools, departments) No
SO3_01	Percentage of research-funding members of EOSC-A that require data sharing and incentivise data re-use	Does your Research Funding Organisation require data sharing?	Single choice answer: Yes No
		Does your Research Funding Organisation incentivise data re-use?	
SO4_01	The number of repositories in EOSC that have a certification (e.g. CoreTrustSeal)	Does your organisation run a certified repository (e.g. CoreTrustSeal)?	Single choice answer: Yes In planning No
SO4_02	The number of thematic European research infrastructures (as a proxy for all major scientific disciplines) with documented standards and protocols for data sharing and re-use	Has your Research Infrastructure developed or adopted documented standards and protocols for data sharing and re-use? Please provide the names of standards/protocols	Single choice answer: Yes: Free text answer No
SO4_03	Percentage of members of the EOSC Association that have policies which require FAIR to be implemented in project design via Data Management Plans	Does your organisation have policies which require FAIR principles to be implemented in project design via Data Management Plans?	Single choice answer: Yes No
SO4_04	The percentage/ the estimated number of research data-sets from EOSC-A members that are deposited in repositories and made open and FAIR	Please provide an estimate of the percentage of research data-sets that your organisation deposits in repositories to make them open and FAIR	Free text answer

KPI Short	KPI Description	Question Asked in the Survey	Answer Options in the Survey
SO5_01	Number of major research infrastructures which adopt the EOSC Interoperability Framework, enabling their data to be federated into EOSC	Does your Research Infrastructure adopt the EOSC Interoperability Framework, enabling their data to be federated into EOSC?	Single choice answer: Yes No
SO6_01	The number of inter and cross-disciplinary use cases conducted, on data sharing practices, using EOSC services	Has the project conducted inter and cross-disciplinary use cases on data sharing practices, using EOSC service? Please indicate the number of use cases	Single choice answer: Yes: Free text answer No
SO7_01	The number of major Research Infrastructures (as a proxy for all major scientific disciplines) that have relevant data and services indexed through EOSC	Does your Research Infrastructures have relevant data and services indexed through EOSC? Please provide a comment	Single choice answer: Yes: Free text answer In planning No
SO8_01	The number of services dedicated to the requirements of end users, including from the public sector and citizen scientists, that are made available through the EOSC Core and EOSC Exchange	Do you offer services dedicated to the requirements of end users, including from the public sector and citizen scientists, which are available via EOSC Core and EOSC Exchange? Please provide the name of each service; if available, provide links to these services	Single choice answer: Yes: Free text answer In planning No
SO8_03	The number of active data spaces that take up FAIR data management principles and practices, and provide data into the EOSC ecosystem	What is the number of active European data spaces that take up FAIR data management principles and practices, and provide data into the EOSC ecosystem? Please provide a comment	Free text answer: Free text answer
SO9_01	The number of observers joining the Association from outside EU MS/AC	Please list the names of new members with observer status who joined the Association from outside EU MS/AC, in the years 2020-2022	Free text answer
SO9_02	The number of formalised connections between EOSC and non-EU cloud and commons initiatives, which allow EOSC users to discover additional resources	Please indicate the number of formalised connections between EOSC and non-EU cloud and commons initiatives, which allow EOSC users to discover additional resources Please provide the names of initiatives	Free text answer: Free text answer
OO1_01	The number of operational and discoverable MVE Core functions	What is the number of operational and discoverable MVE Core functions?	Free text answer
OO1_02	Types and geographic spread (EU MS) of members in EOSC-A, and members of the Board of Directors (BoD), to represent the varied stakeholders' nature (RPOs, RFOs, Libraries, Service Providers, Mandated Organisations) and a varied EU MS representation	Please indicate the types of members in EOSC-A	Free text answer: Number of RPOs Number of RFOs Number of Libraries Number of Service Providers other than ESFRI RIs Number of ESFRI RIs Number of Mandated Organisations Number of International Organisations other than ESFRI RIs
		Please indicate the geographic spread of members in EOSC-A	Multiple choice answer: List of Ms/ACs countries

KPI Short	KPI Description	Question Asked in the Survey	Answer Options in the Survey
			Free text answer: Non-EU countries
		Please indicate the geographic spread of EOSC-A Board of Directors	
OO2_01	A monitoring system (like a dashboard) to gather OS metrics of the evolving landscape of policies, infrastructures and open resources can be accessed through	Does your organisation have access to a monitoring system (like a dashboard) to gather OS data and feed metrics of the evolving landscape of policies, infrastructures and open resources that can be accessed through EOSC? Please provide a comment	Single choice answer: Yes: Free text answer No: Free text answer
OO3_01	Percentage of RPO members of the Association that provide training for the upskilling of their researchers in Open Science	Does your Research Performing Organisation provide training for the upskilling of their researchers in Open Science?	Single choice answer: Yes No
OO4_01	Number of scientific disciplines for which EOSC Association TFs provide recommendations on standards and Open Science best practices	Please indicate in which disciplines your EOSC Task Force provides recommendations on standards and Open Science best practices	Multiple choice answer: Natural Sciences Engineering and Technology Medical and Health Sciences Agricultural Sciences Social Sciences Arts and Humanities
OO5_01	The following technical components supporting FAIR digital objects and their automated processing are operational: standards, schemas, APIs, metadata frameworks	Which of the following technical components of the systems supporting FAIR digital objects and their automated processing are operational in your organisation Please provide a short description of the component, optionally	Single choice answer Yes: Standards Schemas APIs Metadata framework In planning: Standards Schemas APIs Metadata framework No: Standards Schemas APIs Metadata framework Free text answer: Standards Schemas APIs Metadata framework
OO6_01	Availability of FAIR assessment tools to measure the FAIRness of different research digital objects	Are FAIR assessment tools available to measure the FAIRness of different research digital objects? Please indicate the name of the tool that has been developed/used during the project	Single choice answer: Yes: Free text answer In planning No

KPI Short	KPI Description	Question Asked in the Survey	Answer Options in the Survey
OO7_01	Percentage of research funders who are members of the EOSC association that include software source code as a research output to be described and managed in their Data Management Plans (DMPs)	Does your Research Funding Organisation require the description of the software source code and of its management in Data Management Plans (DMPs)?	Single choice answer: Yes No
OO7_03	The number of first-generation pan-European infrastructures for preservation, management and sharing of research software	Please indicate the number of first-generation pan-European infrastructures for preservation, management and sharing of research software Please indicate the name of the infrastructure	Free text answer: Free text answer
OO8_01	Number of policy fora where rewards and recognition frameworks for FAIR and open data practices are co-designed, where the EOSC Association is represented	Does your organisation participate in initiatives (such as discussion fora, conferences, symposia, workshops, etc..) where FAIR and open data practices are co-designed? Please provide the names of fora (optionally, please provide a reference to these initiatives, e.g. the framework under which it is carried out, a hyperlink)	Single choice answer: Yes: Free text answer No
OO8_02	Number of Association members that recognise open science activities in research career assessments (i.e.: FAIR and open data practices are linked to researchers' online records, publications linked to a researcher; open data practices and FAIR data practices are linked back to the researcher who can get credit for this)	Does your organisation recognise open science activities in research career assessments (i.e.: FAIR and open data practices linked to researchers' online records, publications linked to a researcher, open data practices and FAIR data practices linked back to the researcher who can get credit for this)?	Single choice answer: Yes No
OO9_01	Establishment of an 'RoP Board' to monitor and report on the qualitative and quantitative compliance with the Rules of Participation	Has the EOSC-A established an 'Rules of Participation (RoP) Board' to monitor and report on the qualitative and quantitative compliance with the Rules of Participation?	Single choice answer: Yes In planning No
OO10_01	Number of federated frameworks that are deployed and operational allowing service providers to offer services to users	Please indicate the number of federated authorisation and authentication infrastructure (AAI) frameworks that are deployed and operational allowing service providers to offer services to users Please provide a comment	Free text answer: Free text answer
OO11_01	The Number of RPO members of the EOSC Association that adopt and use the persistent identifier allocation practice	Does your organisation adopt and use a persistent identifier allocation practice to publications?	Single choice answer: Yes No
OO12_01	Number of members of the Association that participate in fora to agree on standards for minimum metadata requirements and number of members of the EOSC-A that have policies in place to enforce the adoption of standard minimum metadata	Does your organisation participate in fora to agree on standards for minimum metadata requirements?	Single choice answer: Yes No

KPI Short	KPI Description	Question Asked in the Survey	Answer Options in the Survey
		Does your organisation have policies in place to enforce the adoption of standard minimum metadata?	Single choice answer: Yes No
OO12_02	Percentage of metadata belonging to publicly funded research datasets, from EOSC Association members, which are defined as Open Data, that are discoverable through EOSC federated infrastructure	Please estimate the percentage of (meta)datasets deriving from publicly funded projects that have been published open access and comply with the FAIR principles and are discoverable through the EOSC federated infrastructure.	Free text answer
OO13_01	Frequency of EOSC stakeholder fora that are organised by the EOSC Association or by INFRAEOSC projects	Please indicate the number of EOSC stakeholder fora that were organised by the EOSC Association in 2021 Please provide the names of fora (optionally)	Free text answer: Free text answer
OO13_02	The number of EOSC-A Task Forces which are set up with representation of users and service providers from different disciplines that issue relevant recommendations and launch relevant consultations for the continued development of EOSC	Please indicate the number of EOSC-A Task Forces which are set up with representation of users and service providers from different disciplines that issue relevant recommendations and launch relevant consultations for the continued development of EOSC	Free text answer
OO14_01	Percentage of service providers who are members of the Association that have developed, adopted or tested models for the availability and costing of transnational services	Has your organisation either developed, adopted or tested models for the availability and costing of transnational (i.e. both in your country and outside) services?	Single choice answer: Yes No

Appendix 2: KPI-specific Remarks

KPI-specific remarks are drawn from the analysis of the results, as well as from the feedback received from the respondents

During the process of developing a survey questionnaire on the specific KPIs, the following issues had to be taken into account:

- OO1_02 is quite complex and has to be split into different questions
- OO3_01 targets a development towards 50% of EOSC-A RPOs across Europe offering training on Open Science for researchers and data stewards. We already exceeded this number, thus the KPI could be redefined or target values adjusted.
- OO5_01 does not consider an operational level.
- OO6_01 asks about the availability of FAIR assessment tools and sets a goal with the existence of at least one type of FAIR assessment tool. This phrasing is unclear and could be redefined, that for example all respondents know one or more tools, in particular for assessing not only datasets but also source code and DMPs.
- OO8_01 asks about 'fora', which could result in a variety of answers. In the questionnaire, examples to explain the term have been inserted, for clarification, such as 'discussion fora', 'conferences', 'symposia', 'workshops', etc. Still, when we tried to classify the examples provided by the respondents, we found out that the evaluation was not as straightforward as we envisioned. Moreover, the KPI-target value is missing.
- In the case of OO12_02, although the values of metadata are hard to determine even individually, it was possible to estimate percentages, which however did not allow a statistical evaluation. A handful of respondents indicated percentage estimations that could not be further assessed for the KPI. Metadata itself is hard to quantify, and would also have to be defined in more detail, since even affiliations will be counted as such. Additionally, the definition of 'being discoverable through EOSC federated infrastructure' remains vague, since 'EOSC federated infrastructure' could include EOSC portal resources as directly integrated research outputs, as well as results from a multi-level search process via resources offered by the marketplace, such as knowledge graph, BASE, and other integrated search engines that can answer queries using information outside of EOSC federated resources.
- OO13_01 does focus on fora organised by EOSC-A and INFRAEOSC projects, though EOSC-A members and other future respondents to surveys are also involved in additional projects and initiatives which could be a meaningful insight, too. This KPI should be split in two.
- SO8_01 The additional functionalities will have to be counted from the baseline value (i.e., 9, in 2021)
- SO8_03 asks for active data spaces feeding data into EOSC. It is hard to define activity, and it would be even more interesting to monitor also those data spaces, which are currently not part of the EOSC ecosystem but could be in future.

In addition, some respondents reported an unclear meaning of some terms, in specific KPIs, i.e.:

- 'recognise' or 'linked', in OO8_02;
- 'transnational services', in OO14_01;
- 'operational', in OO5_01

- 'first generation pan-European infrastructure', in OO7_03
- In OO1_01, which carries the question “What is the number of operational and discoverable MVE Core functions?” For the next iteration of the survey, it is suggested to provide a list of such functions, to choose from, if available.
- SO4_02, SO7_01, OO4_01: replace ‘scientific discipline’ with ‘fields of science and technology’, which is the level of Frascati nomenclature adopted in the study (level 1).