

Recommendations for a financially sustainable post-2027 EOSC

Final Report of the Financial Sustainability Task Force of the EOSC
Association

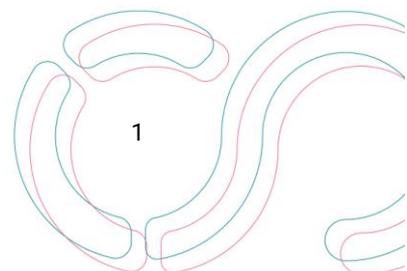
April 2024

Abstract

This Final Report presents the main findings of the Financial Sustainability Task Force. It scopes EOSC in a financial sustainability context, outlines 8 key principles for sustainably funding EOSC, provides rough cost estimates for EOSC's main components, stipulates financial sustainability requirements on EOSC's future legal entity and provides important further issues of relevance for financial sustainability. It concludes with recommendations for future work.

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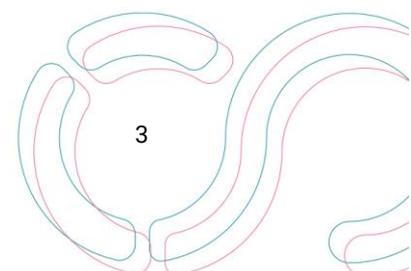
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Acknowledgements

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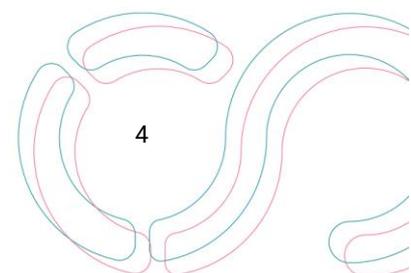
Executive summary

This report presents the findings and recommendations of the Financial Sustainability Task Force for the European Open Science Cloud (EOSC) post-2027. Its conclusions reflect the discussions among the Task Force's heterogeneous membership and expertise, covering relevant knowledge of EOSC-related national and European policies, international infrastructure landscape and data management as well as legal aspects and business processes.

EOSC is evolving at pace, with decisions expected during 2024 on its future legal form and governance, and rapid development of the concept of EOSC Nodes. The Task Force identified several challenges related to the long-term financial sustainability of EOSC which need to be overcome. These include the highly fragmented research data landscape, widely varying levels of "FAIRness" and the lack of overall coherence of the funding mechanisms when considered on a European scale, resulting in suboptimal use of Member States' investments in research resources; and the greater ease of creating new resources than sustaining existing ones. To address these challenges the Task Force has developed 8 key principles about the financial sustainability of EOSC, elaborated in chapter 3:

1. Joint funding by the EC and Member States/Associated Countries of the collective EOSC components is essential to ensure national engagement and strategic relevance
2. Long-term, stable political and financial commitment from the EC and Member States/Associated Countries is essential
3. EOSC is part of the rich ecosystem of RIs created by investment by MS/AC, and the EC, and should build on, complement and enhance, but not duplicate, it
4. The EOSC Exchange needs to provide straightforward access to the European research community's services and platforms for data utilisation and analytics, to support realisation of the full potential of research data
5. Federating data and services through EOSC involve additional costs for providers, which should be paid for primarily by Member States/Associated Countries
6. Coordination of EOSC strategy and funding between Member States and with the EC is required and should be assured as part of the EOSC governance
7. The sustainability of research services must be addressed for efficient use of investment
8. Inclusiveness: Whatever legal and governance model is adopted, the division of costs within its funding model should not act as a barrier for countries to participate.

The Task Force presents very broad estimates for the likely costs of EOSC (see chapter 4). The main observation which should be drawn is that the costs of the operation, maintenance and development of the EOSC EU Node and the expansion of the EOSC Federation are modest in relation to the estimated cost of FAIRification, which is an order of magnitude more expensive and will be primarily incurred at national and institutional level. However, in order to achieve



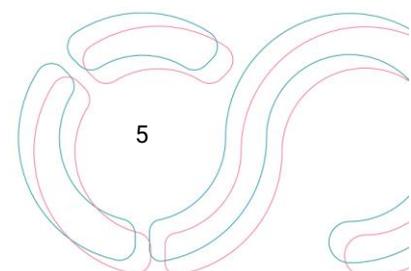
increased secondary use of research data, this data and its federation are the most important and most valuable assets for EOSC.

We have identified requirements relating to financial sustainability which should be satisfied by the legal entity chosen for EOSC in future (see chapter 5). These include the need for long-term sustainability; presence of MS/AC as stakeholders making a long-term financial commitment; participation by different legal forms of research entities such as ERICs and European Intergovernmental Research Organisations; stakeholder influence over the EOSC work programme; and the potential for participation of private companies as users of EOSC.

In addition, the Task Force highlights other issues of relevance to financial sustainability, including:

- the choice of cost-recovery mechanisms for the EOSC Exchange, the vast majority of whose contents (services) is assumed to be financed using national or institutional funds
- assessment of the potential role of commercial services in the EOSC Exchange
- the importance of stakeholder involvement and representation, in particular that of the research community, in EOSC governance, and of dialogue between key stakeholders
- the challenges relating to procurement and VAT, in the context of the EOSC Exchange
- the need to recognise non-technical EOSC costs, such as communications, training, research support, governance-related activities (e.g. RoP and access policy enforcement and evolution, service selection, quality assurance, regulatory compliance), and EOSC performance and usage monitoring
- the need for access policies for EOSC resources to consider inclusivity of MS/AC and the global context in which RIs operate.

The report concludes by presenting 15 recommendations for future work, notably to analyse and recommend strategies for the cost of federating data through EOSC; further explore models to achieve inclusiveness of the EOSC funding model(s); detailed assessment of the cost of operating and developing the EOSC EU node post-2027; analysis of the financial sustainability implications of EOSC as a federation of nodes; and activities to ensure a well-functioning EOSC Exchange.



1. Introduction

The ERA policy agenda 2022-2024 states “The ambition of the European Open Science Cloud (EOSC) is to provide European researchers, innovators, companies and citizens with a federated and open multi-disciplinary environment where they can publish, find and re-use data, tools and services for research, innovation and educational purposes. The EOSC ultimately aims to develop a ‘Web of FAIR Data and services’ for science in Europe, upon which a wide range of value-added services can be built. These range from visualisation and analytics to long-term information preservation or the monitoring of the uptake of open science practices”.¹

The mandate of the Financial Sustainability Task Force of the EOSC Association (TF FinSust) was to develop scenarios for the long-term financial sustainability of the main components of EOSC, i.e. the Core, Exchange and Data Federation, for the period from 2027 onwards². This was an ambitious mandate, given the lack of clarity in the definition and scope of EOSC and its components, which limited our ability to go beyond principles to specify funding models, and made it very challenging to estimate costs with any accuracy. After two years of work, the TF FinSust presents its conclusions in this final report, in which we

- summarise EOSC’s financial sustainability context and the Task Force’s assumptions underpinning this report (chapter 2)
- describe eight key principles relating to the funding of EOSC (chapter 3)
- present estimates of the possible future costs of EOSC (chapter 4)
- highlight key considerations including financial sustainability requirements for the future legal entity (chapter 5)
- list recommendations for future work relating to the financial sustainability of EOSC (chapter 6)

The Task Force published a first sketch of potential financial scenarios for the EOSC Core, Exchange and Data Federation in its interim report *Towards Sustainable Funding Models for the EOSC*³ in November 2022⁴. After a consultation⁵ in early 2023 targeting the Steering Board, RIs and e-Infrastructures, the Task Force consolidated and refined its proposals during 2023.

Discussion of the future EOSC legal entity and governance post-2027 is taking place within the current EOSC governing bodies⁶. To provide timely input to this evolving context, the Task

¹ European Research Area (ERA) Policy Agenda 2022-2024, <https://bit.ly/ERA-policy-agenda-2021>.

² The TF FinSust charter, https://bit.ly/EOSC-A_TF-FinSust_Charter.

³ Dale Robertson & Jan Meijer. (2022). *Towards Sustainable Funding Models for the EOSC (Version 1)*. <https://doi.org/10.5281/zenodo.7318481>

⁴ The report was presented at the EOSC Symposium 2022, at an EOSC Steering Board webinar on 16 January 2023, and at an Irish EOSC workshop on 7 February 2023.

⁵ M. Rey Mazón, J. Klemeier, *Analysis of the Financial Sustainability Task Force Consultation Report* [10.5281/zenodo.8335178](https://doi.org/10.5281/zenodo.8335178)

⁶ See e.g. *EOSC governance meets to advance post-2027 planning*, <https://bit.ly/49kR5Rd>.

Force published a short *Statement on Funding EOSC*⁷ in November 2023, which synthesises the main outcomes of its work. The Statement's contents are included in this final report, together with additional information reflecting the evolution of our proposals during 2023 and based on EOSC's state of play up to January 2024. This document is, therefore, the result of numerous exchanges in the evolving context of European Open Science, conducted throughout more than two fruitful years.

The Task Force would like to thank all its past and current members for their engagement and hopes its work will advance the common understanding of how to achieve a financially sustainable and thriving EOSC.

⁷ *Financial Sustainability Task Force: Statement on Funding EOSC*: <https://zenodo.org/records/10125890>

2. Financial Sustainability Context and Assumptions

2.1. Context

EOSC is in a transition phase and continues to develop in a highly dynamic environment. Key decisions are expected during 2024 on the future legal form and governance of EOSC. In parallel, the contracts resulting from the EC's procurement to operate elements of the EOSC Core and centrally financed services - the "EOSC EU node" - began⁸ in early 2024. Closely related to this is the concept of EOSC nodes, introduced by the EC in March 2023 and now rapidly developing, which points towards a possible architecture of the EOSC Data Federation. How the EOSC EU Node operates, and how other stakeholders establish themselves as EOSC Nodes, will be crucial for the evolution of EOSC. While the Nodes discussion in and by itself does not appear to fundamentally alter the observations, analysis and conclusions presented in this report, implications may shortly emerge which the Task Force has been unable to take into account here. In a broader context, the interaction of EOSC with the other Common European Data Spaces⁹ and the future underlying middleware Simpl¹⁰, needs to be defined.

EOSC especially needs to overcome the challenges directly related to its long-term financial sustainability, including the highly fragmented research data landscape, with widely varying levels of "FAIRness"; the complexity, variety and lack of overall coherence of the funding mechanisms when considered on a European scale, resulting in suboptimal use of Member States' investments in research resources; and the greater ease of creating new resources than sustaining existing ones. For example, as the Task Force noted in its progress report in November 2022, national (MS/AC) contributions to the current *EOSC Partnership* are unclear:

"... it becomes evident that EOSC has challenges in aligning MS and EU strategic, operational, and financial commitments. It's about co-funding the same agreed activities, as opposed to funding separate activities, differently." [...] "The TF observes that AAP [Additional Activity Plan] national contributions at this time typically do not reflect genuine co-funding towards the implementation of a joint EOSC strategy but rather consist of already allocated national funding (often targeting the transition to Open Science), which is rebranded as supportive to EOSC deployment".¹¹

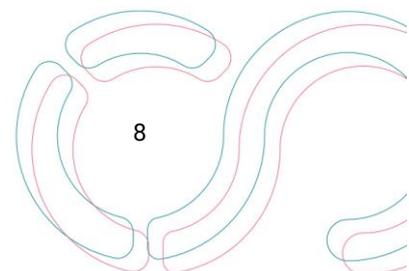
Last but not least, the wider political and economic climate in Europe and beyond in the coming years will determine the financial commitment for Open Science from EC and MS/AC. In a sense, the ambition of EOSC is to take a holistic approach in an ecosystem which has grown

⁸ <https://digital-strategy.ec.europa.eu/en/news/commission-announces-winners-eosc-procurement>

⁹ European Commission, Joint Research Centre, Farrell, E., Minghini, M., Kotsev, A. et al., European data spaces – Scientific insights into data sharing and utilisation at scale, Publications Office of the European Union, 2023, <https://data.europa.eu/doi/10.2760/400188>.

¹⁰ <https://digital-strategy.ec.europa.eu/en/policies/simpl>, accessed 2 January 2024

¹¹ Dale Robertson & Jan Meijer. (2022). Towards Sustainable Funding Models for the EOSC (Version 1), page 31. <https://doi.org/10.5281/zenodo.7318481>



organically, raising political, organisational and financial challenges. Such challenges are especially exhibited when it comes to cross-border financing and use of data and services.

2.2. Conceptual assumptions about EOSC

The following paragraphs provide a short summary of the main assumptions underpinning this report's recommendations, as presented in the Task Force's Progress Report. Readers are referred to the original report¹² for full details.

At the heart of the 'Web of FAIR Data and Services' lies the **EOSC Data Federation** (EOSC DF), which should enable the large-scale secondary use of research data across disciplines. Lacking a clear definition and architecture for the Data Federation, the Task Force envisaged it as the federation of existing (research) digital resources, repositories and archives, and other storage infrastructures, which enables researchers to have direct access to open and FAIR data from multiple sources across Europe, available at any of the levels of aggregation (local/institutional, national, thematic, European or international) through attribute-based discovery. This will result in additional visibility of data, stimulate collaboration across countries and disciplines in Europe, and increase Europe's competitiveness. The data and other resources will remain within the different research communities, i.e. EOSC itself will not "contain" or own data. Federation of data requires substantial preparation and adaptation of existing data and services. This carries significant costs, the majority of which arise in RIs and institutions. Hard decisions will be required in deciding what to prioritise - which resources are of most value for federation. Experience from various disciplines shows that to get the maximum use out of research data, it is key to ensure access to complementary scientific and analytical services.

The main role of **EOSC Exchange** will be to facilitate service findability, service transactions, and cost recovery mechanisms by providing a pan-European marketplace for such EOSC services. The Exchange enables the brokering of horizontal and thematic community services between providers and researchers and gives access to a range of services, be they commercial or not for profit services, following a range of different business models. The Task Force has identified three broad categories of service provisioning, each supported by a different financial model:

- Centrally financed consumption of services: access to a certain amount of usage of selected services will be available to EOSC users, centrally financed. This category is divided into two subsets:

¹² Dale Robertson & Jan Meijer. (2022). Towards Sustainable Funding Models for the EOSC (Version 1), page 31. <https://doi.org/10.5281/zenodo.7318481>

- A selective service portfolio of essential services (horizontal and thematic) which is 100% centrally funded and targets heterogeneous scientific domains and research communities.
- A small set of novel services which will receive temporary subsidies to initiate take-up in the research community.
- Access to commercial services: procurement-compliant access to contracts with research-relevant commercial services. Service usage is self-funded by the service consuming entity;
- Brokered not-for-profit services: community services brokered between the thousands of organisations in EOSC, with transactions facilitated by the Marketplace. This category constitutes the true marketplace of EOSC and includes both horizontal and thematic services. Service usage is self-funded by the service consuming entity with cost recovery / remuneration mechanisms facilitated by the Exchange Marketplace.

However, before EOSC Exchange can become the pan-European single market for research data and services, rather than just a platform for “window-shopping”, Member States need to enable national service providers and institutions to provide services to organisations in other countries, and to mandate organisations and researchers to consume services hosted in other countries by putting the appropriate legal mechanisms in place.

The **EOSC Core** will provide the basic functionalities required to enable the federation of research data repositories and the EOSC Exchange. As data ownership will remain with the respective Member States and communities, the EOSC Interoperability Framework, Rules of Participation, and usage and access policies, are key aspects that need to be developed as early as possible, to encourage federation with and usage of EOSC.

3. Key Principles for EOSC Financial Sustainability

The definitions and proposals originally presented in the Progress Report have evolved but not fundamentally changed as a result of the stakeholder consultation, other interactions, and developments in the landscape during 2023. As a result of the further evolution of the landscape in 2023, and of the Task Force’s further discussions, it has however been possible to identify eight principles which the Task Force proposes should be observed in relation to the funding of EOSC. These are presented and explained here.

Principle 1: Joint funding by the EC and Member States/Associated Countries of the collective EOSC components is essential to ensure real engagement of MS/AC in EOSC at European level. Funding should be in cash, not in-kind, to provide assurance of income, strong national engagement in securing strategic relevance, and quality control.

The collective EOSC components anticipated at this point in time are the EOSC Core¹³ and support, centrally financed EOSC Exchange services¹⁴ and EU level data federation components. The Task Force calls for joint ownership of the future implementations of these collective components to go hand-in-hand with joint funding, based on joint commitment. The presence of the EC as co-funder ensures inclusiveness and balance among the countries, and funding from MS/AC will ensure they remain co-responsible for keeping EOSC strategically relevant, and for its uptake and sustainability. MS/AC and EC should jointly decide the strategic direction of EOSC, and align it with the wider European vision and priorities. The Task Force emphasises the need for the Core to remain lean, to limit unnecessary costs and to ensure the Core can remain flexible and agile. Especially at the current very early stage of operationalising the Minimum Viable EOSC the focus should be on adoption and providing tangible benefits, which build upon and complement the work of the science clusters, research communities and e-Infrastructures.

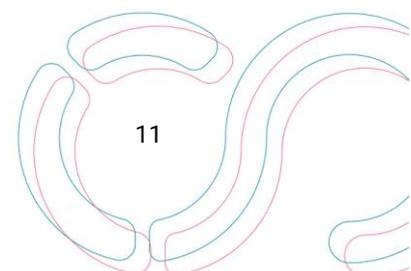
We recommend that MS/AC contribute fees, independently of any contribution in-kind¹⁵: in-kind provision of services for collective EOSC components should not in any way interfere with the fees for and commitment to EOSC to be sustainable, as it is important for adequate funding of these components to be anchored in national priorities.

The Task Force also proposes that the centrally financed EOSC Exchange services and any required EU-level data federation components are jointly funded by the EC and MS/AC. The scale, and therefore cost, of the latter two items remains to be determined, a point which is of

¹³ I.e. Lot 1 of the EC’s 2023 procurement for the EOSC-EU Node.

¹⁴ Currently instantiated through Lot 2 and Lot 3 of the EOSC-EU Node procurement, compute, sync ‘n share storage, data and file transfer services

¹⁵ In-kind contribution with or without cost reimbursement.



relevance to considerations about the future funding of the EOSC EU Node. Other costs¹⁶ relating to the governance of EOSC, connecting and integrating different EOSC Nodes into the EOSC Federation as well as training need to be funded too, some of which are also likely to be best-suited to joint EC/MS funding.

Principle 2: Long-term, stable political and financial commitment (at least 10 years) from the EC and the EU Member States and Associated Countries is essential to ensure users and infrastructures can rely on, and are willing to integrate with, the EOSC infrastructure.

For EOSC to become a success it needs both content and usage. Long-term commitment from the funding parties - ideally 10-15 years - is a necessary condition to establish and develop trust in EOSC within research communities so stakeholders provide resources to, use, and rely on EOSC to the extent required to justify MS and EC investment in EOSC. E.g. only if there is a long-term commitment for EOSC and stable long-term provision of Core services available to a wide scope of users, RIs could consider replacing their local instances of such services.

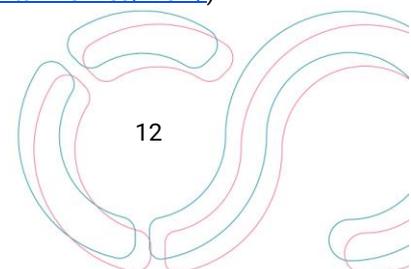
Principle 3: EOSC should build on, complement and enhance the landscape. EOSC is part of the rich ecosystem of research infrastructures at local, national and European levels which has been created by investment by the MS and AC, and the EC, over many years. EOSC has an important role to play in ensuring the maximum value is derived from investments already made (e.g. in the research infrastructure cluster projects).

The EOSC Data Federation must build on existing infrastructures and thematic ecosystems and avoid duplicating efforts. The introduction of the EOSC Nodes concept in the landscape helps to progress the debate around the architecture of the EOSC Data Federation but also raises the possibility of new constructs being created which duplicate what is already available. This should be avoided, both in the interests of deriving the maximum benefit from investments already made in other infrastructures, and also to ensure EOSC complements those investments and adds - and is seen to add - genuine value. There should be a focus on maximising interoperability whilst avoiding redundancy.

This does not mean that there is no need for additional efforts or developments, however. There are already many thematic RIs in operation with long-term funding from MS/AC and a clear mandate to provide FAIR and open research data for their communities. Examples¹⁷ of

¹⁶ Such as technical integration support, governance-related activities such as RoP and access policy evolution and enforcement, service selection and quality assurance, and compliance with ethics, data protection, copyright and other regulatory requirements.

¹⁷ For a more detailed picture of RIs in the EU, readers can consult the ESFRI Landscape analysis <https://roadmap2021.esfri.eu/landscape-analysis/section-2/>, or the MERIL project (<https://portal.meril.eu/meril/>).



established RIs include the members of the EIROforum¹⁸ and the ERICs¹⁹ that are actively collaborating to advance EOSC via the science clusters²⁰. The mandates and the financial resources of existing RIs do not cover the additional costs for them to create links to each other, however, or for establishing interoperability at EOSC level.

Federation across communities is a good starting point providing value as demonstrated by ESFRI, ERIC, and the cluster projects. Interoperability towards EOSC integration is the next step, but it takes time and considerable effort - which has a significant cost. Indeed, the achievements of the cluster projects should be continued, with the focus on enhancing interoperability and increasing their collaboration with EOSC²¹. The value-add of the EOSC EU Node (for example in reducing costs and/or duplication, or in enhancing findability or accessibility of research resources), and its role in establishing the EOSC Data Federation need to be determined as part of the implementation of the EC EOSC procurement and the further definition of the EOSC nodes concept. Wide-scale federation is a non-trivial development which requires a clear vision for the long-term architecture of the EOSC Data Federation.

Principle 4: The EOSC Exchange needs to provide straightforward access to the European research community's services and platforms for data utilisation and analytics, to support realisation of the full potential of research data. This requires viable cross-border cost recovery (remuneration) mechanisms, evolving mandates of existing RIs and (national) e-Infrastructures, and ensuring procurement-free service consumption. Any centrally financed components need to have user-driven selection and governance to ensure they match the needs of the users.

Increased cross-disciplinary research and secondary use of research data may entail increased demand for data compute and analytics resources, including demand from outside of established national or disciplinary community boundaries²². The EC's EOSC procurement includes simple compute and storage services to cater for some such anticipated demand, but development of viable purchase and remuneration mechanisms for cross-border consumption of research services, many of which are publicly funded, would help to boost innovative research. Cross-border provision of services is currently done either via the RI model

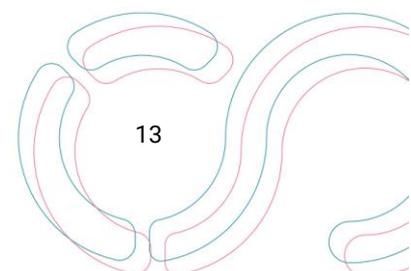
¹⁸ <https://www.eiroforum.org/>

¹⁹ https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/european-research-infrastructures/eric_en

²⁰ <https://science-clusters.eu/>

²¹ The collaboration continues through OSCARS (2024-2028), together with European RIs to carry out lasting interdisciplinary services and drive the uptake of FAIR data-intensive research throughout the European Research Area (ERA). See <https://oscars-project.eu/>.

²² Such cases were studied in work conducted in the EOSC-hub project. See <https://www.eosc-hub.eu/publications/briefing-paper-provision-cross-border-services>



of in-kind contributions, e-Infrastructure cost-sharing models or within EC-funded projects. The EOSC Exchange is intended to facilitate cross-border provision to a far larger extent.

Based on its analysis of the intent behind the EOSC Exchange, the Task Force envisages that brokered not-for-profit services, including horizontal and thematic services, will constitute the majority of services and the true marketplace of EOSC, where hundreds or thousands of public sector EOSC participants offer services to each other. To enable this, the EOSC Marketplace has to be designed to facilitate service findability and transactions, and include suitable cost recovery mechanisms that allow researchers to seamlessly access the resources they need and the proper reimbursement to the provider of the costs incurred, both for services that are “free at the point of use” for researchers as well as for those that require researchers to pay. The mechanisms should encourage service providers to join the marketplace and provide the best-quality service possible at the best price. The usage of these services will not be centrally financed on European level but via national or institutional funds. Therefore, the available cost-recovery mechanisms, e.g. virtual access, vouchers/tokens or subscriptions with invoiced payments, need to be available that are simple enough, transparent, and compatible with the nature and constraints of the public sector. Although deemed important, some doubts remain regarding the feasibility of implementing virtual access because of its many restrictions and its incomplete suitability for cost-based accounting²³. Provisions to address appropriate IPR and license agreements should be included in the transaction process.

How far the EOSC Exchange should go in facilitating transactions is a question that needs further investigation. Facilitation can range from service findability, basic contractual/financial transaction support (i.e. standard agreements and cost remuneration mechanisms) and more involved contractual/financial transaction brokering where the marketplace operator becomes part of the transaction, to full technical brokering i.e. involvement in the actual provisioning and deprovisioning of the service through standardised mechanisms.

However, a well-functioning marketplace that facilitates service findability and transactions is not enough in and by itself. To enable use of services outside currently established (national, thematic RI or institutional) boundaries, and/or against payment in the EOSC Exchange, the current mandate of (national) service providers and institutions needs to change to allow this. Moreover, there are political, legal, policy and cultural barriers to this in addition to the need to further research the transactions the marketplace could support. The legal-operational setup of EOSC from 2027 onward is also of relevance to the ownership of the EOSC Marketplace and catalogue and other EOSC components (see chapter 5 below).

The Task Force recommends a dedicated effort to firstly identify feasible cost-recovery mechanisms for the Exchange marketplace that can facilitate a broad range of services and which can be phased in from 2027 onward and secondly provide recommendations on where

²³ M. Rey Mazón, J. Klemeier, *Analysis of the Financial Sustainability Task Force Consultation Report* [10.5281/zenodo.8335178](https://doi.org/10.5281/zenodo.8335178)

the Exchange should sit on the sliding scale of possible service transaction facilitation.

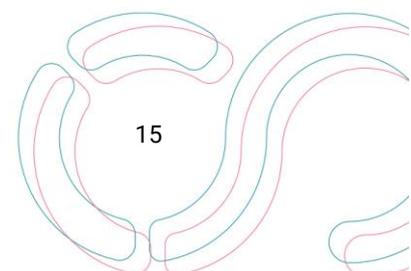
The selection and management of portfolios of centrally financed services requires a researcher-driven governance structure for which the Task Force proposes there should be a Scientific Advisory Committee (SAC), with representatives from the different research communities. More details can be found in chapter 5 under governance.

Access to commercial services via the EOSC Exchange allows researchers to benefit from innovations in the private sector but public sector entities cannot just buy commercial services, being required instead to follow public procurement rules. EOSC would add value by aggregating demand and procure on behalf of the entire EOSC community, offering research performing organisations a well-maintained portfolio of procurement-compliant agreements with research-relevant commercial service providers integrated with the technical EOSC infrastructure. Usage of these agreements is expected to be self-financed but can also be part of EOSC's portfolio of centrally financed services. The selection and management of this EOSC portfolio of agreements is again recommended to be the provenance of a Scientific Advisory Committee. Whilst the concept of large-scale joint European R&E procurement has been successfully developed and tested by a number of projects²⁴, further work is required to ensure ACs and intergovernmental organisations to whom the EU procurement directive does not apply can benefit from such a portfolio. Secondly a suitable framework needs to be developed to identify which demand across the whole EOSC community is sufficiently large to warrant a large-scale collective procurement. Scalable mechanisms for centrally funded consumption of commercial services need to be proposed, should such funded consumption be desirable. Lastly, suitable entities able to act as a central purchasing body for EOSC need to be identified.

Principle 5: Federating data and services through EOSC involves additional costs for providers, which should be identified with RIs and e-Infrastructures and paid for by Member States/Associated Countries. The benefits of federation may not be realised directly by those bearing the cost - (primary) data producers vs. (secondary) data consumers - or else may take considerable time to accrue (economies of scale for service providers).

Setting up the EOSC Data Federation in a way that provides a framework for the secondary use of data between different disciplines involves additional costs related to making data FAIR, making experiments reproducible, ensuring long-term access to data, and federating data to EOSC. The scale of these costs and how they are distributed across the different aggregation levels (European/international, thematic, national, or other) will depend to an extent on the architecture chosen for the Data Federation. The technical, financial, and legal structure of the EOSC Data Federation must be agreed on in the context of the EOSC Nodes, but achieving

²⁴ GÉANT GN4-2, GN4-3, GN5-1, OCRE, EOSC-Future.



clarity on these aspects seems likely to assist in securing funding commitment from MS/AC. The EC has procured an operational enabling infrastructure “EU Node” for EOSC²⁵, aiming for it to become a reference node for a proposed open federated system of EOSC Nodes²⁶. The extent and cost of any infrastructure for data federation at European level remains to be seen but in the opinion of the Task Force, (a) its funding should follow the model proposed for the EOSC Core and the centrally financed parts of the Exchange, and (b) the majority of the costs relating to data federation will be incurred in national and European RIs, and therefore funded for the main part by MS/AC. Some benefits of this latter investment - such as economies of scale in service provision - may be controversial (job losses) or take time to be recognised, whilst others - secondary research results produced using data made discoverable in EOSC - highlight the need for data re-use to lead to scientific credits for the data producer/owner, aggregator, or funding body, irrespective of how (i.e. through which workflow) a given set of data was included in EOSC. Moreover, due to their international and often distributed nature, the contribution of RIs to data curation and hosting cannot be easily positioned at the national or institutional level but should be seen as an overall thematic service.

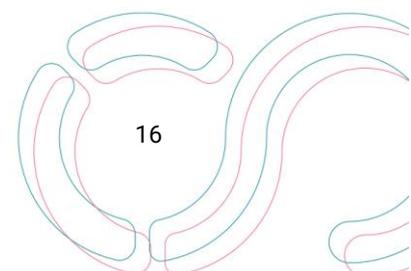
Financial sustainability issues arising in relation to federation of data, which are now bound up in the development of the EOSC nodes concept, include:

- the costs and consequences of harmonisation, i.e. alignment of metadata schemas and associated access procedures, certification and validation of repositories, harmonised APIs and services for data access and interoperability, and operation and maintenance costs, in particular what will happen to the current thematic data portals once a model for federating data into EOSC has been created;
- the costs incurred for providing data and services to researchers outside of the domain the data providers are currently funded for, e.g. workloads brought to the data;
- the financial and technical requirements to establish a federation of EOSC-interoperable trusted digital repositories and data infrastructures;
- the costs of legal and ethical issues, including those relating to sensitive data, in a federated data scenario.

Principle 6: Coordination of EOSC strategy and funding between Member States and with the EC is required and should be assured as part of the EOSC governance. The example provided by ESFRI could be followed. EOSC is a federated infrastructure whose content and users come from its participating entities. The activities of hundreds, if not thousands, of organisations need to collectively contribute to a thriving and rich EOSC. Investments in coordination at cross-disciplinary, national and European levels (e.g. EOSC Association, thematic clusters)

²⁵ <https://digital-strategy.ec.europa.eu/en/news/commission-announces-winners-eosc-procurement>, published on 24 November 2023 and accessed 21 December 2023.

²⁶ Peter Szegedi, “Launching and operating the EOSC EU Node”, presented at the 2024 EOSC Winterschool, Thessaloniki (Greece), 30 Jan 2024, <https://eosc.eu/wp-content/uploads/2024/02/Peter-Szegedi-European-Commission-Winter-school-2024.pdf>



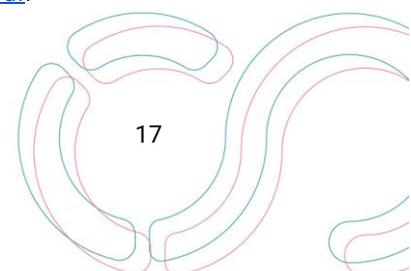
should be leveraged and maintained, as the “human factor” - building networks and common understanding - takes time. Increased MS investment in and commitment to combined European (i.e. cross-border) activities, rather than those with [effectively] only a national scope, is required, in order to fully realise the benefits of EOSC for the Open Science agenda.

The development of EOSC has hitherto effectively been driven by the EC. While most MS have signed up to ERA Action 1²⁷ to develop an EOSC, they have yet to sign up to a coordinated strategy and corresponding funding, closely aligning national and EC funding towards joint and agreed goals. A case in point is the observed reluctance of MS to commit to jointly fund the EC-specified EU Node as long as the value for MS is considered unclear. The success of the ESFRI process that could serve as inspiration for the overall EOSC is based on the “Variable Geometry” principle, whereby the decisions on the priorities associated with the creation and development of Europe’s RIs integrate the views of all Member States and Associated Countries while respecting the cultural and geographical diversity of Europe and allowing flexible and inclusive solutions. While meeting pan-European needs, national RI policy priorities are systematically considered at the European level. EOSC as a federated infrastructure will not work if there is no content (services, data) federated through it, and this implies, similar to ESFRI-coordinated national RI investments, that the vast majority of the cost must be carried by the MS/AC, as the largest part of the content will be created using national funding. There needs to be better understanding of, and greater confidence in, the potential of EOSC (a) to add further value to research outputs produced from investments by MS, as well as to enhance the value of research in/for Europe as a whole, and (b) to support and achieve national and institutional Open Science policies. Coordinated strategy and funding can contribute positively towards this and be assured as part of the EOSC governance. On a national level, institutions and service providers will follow national policies and be incentivised by national funding. To ensure national- and European-level EOSC investments point towards the same goals, they need to be coordinated to ensure that we have a rising tide lifting all of the boats, not just some of the boats.

Principle 7: The sustainability of services must be addressed for efficient use of investment. At present, the development of scientific services heavily depends on short-term EC project funding, but the committed longer-term support for their stable operation and maintenance often does not materialise. This results in services whose income does not scale with usage (and cost), and which are too short-lived to encourage researchers to rely on them. This problem needs to be addressed by MS and the EC as part of their wider research strategy and planning.

The European research landscape abounds with examples of valuable services developed in

²⁷ See https://commission.europa.eu/system/files/2021-11/ec_rtd_era-policy-agenda-2021.pdf.

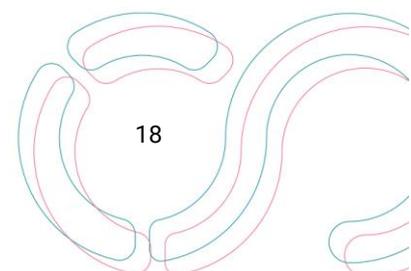


EC-funded projects, for which there is user demand but no sustainable medium- to long-term funding. This leads to another relatively common occurrence: “new” services being developed using project funding, which are basically duplicates of existing services which are not being sustained: it is easier to obtain funding to create (or duplicate) resources than for operations or maintenance, even for research infrastructures which have proven their value to research communities. This is a wasteful and inefficient situation which could be remedied by greater recognition of researchers’ need for stable services, aided by agile usage-driven service sustainability processes to ensure funding is accurately targeted in support of demand, and also by the increased funding advocated in principle 5 above. While this is not necessarily a problem for EOSC to solve, for the Exchange to support a rich and dynamic single European digital research service market it does need services that are well-sustained. A support framework or mechanism to better support the transition from short-term to long-term funding should be considered. This framework needs to be supported by national policies that allow national/institutional funding to be used for services outside their geographic remit, and it needs to acknowledge the effort by MS/AC to build national and thematic service provisioning for research over the past 30 years: servicing usage outside existing geographies and communities will require strong top-down commitment to remove protectionist barriers, as well as time for communities to buy in.

Principle 8: Inclusiveness: Whatever legal and governance model is adopted, the division of costs within its funding model should not act as a barrier for countries to participate: the costs should be shared in such a way that all Member States and Associated Countries can afford to be part of the governance.

All MS/AC should take responsibility for paying their fair share of the collective effort, but should also be able to take that responsibility according to their ability, e.g. using a GNI²⁸-based formula. All member states should be able to participate in EOSC’s governance to ensure alignment of national open science efforts across all MS/AC in benefit of the ERA.

²⁸ Gross National Income



4. Estimates and Considerations for Funding EOSC Post-2027

During 2023, the EC’s DG RTD presented a breakdown of the main EOSC tasks post-2027, which provided a basis for Tripartite discussions about future EOSC governance, operations and financing; this breakdown is shown below in Table 1, EOSC ‘helicopter view’:

EOSC ‘helicopter view’	
Main EOSC tasks for the future	Today (EOSC co-programmed partnership)
Task 1: Deploying and operating the EOSC EU node (Core, Exchange, FAIR Data Federation)	- EC procurement « EOSC managed services »
Task 2: Maintaining and updating the EOSC EU node and expanding the EOSC federation (with elements that are close to the ‘market’)	N/A
Task 3: Enabling a ‘web of FAIR data and service’ for science	- EU grants across HE - National & institutional additional activities
Task 4: Develop, prototype and test new elements supporting the evolution of the EOSC Core and Exchange and the tools enabling the federation (focus on elements that can be made ready for the ‘market’)	- EC grants resulting from Calls defined in the RI Work Programme
Task 5: Enabling Open Science policies and the uptake of Open Science practices	- Tripartite Governance activities (including with support of EU grants)

Table 1: EOSC ‘helicopter view’²⁹

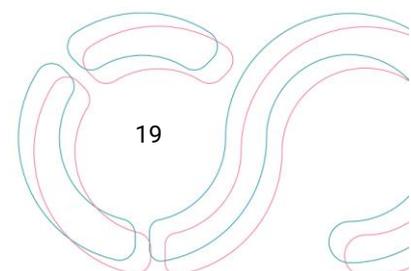
Based on the proposals and principles laid out in the previous sections, Table 2 at the end of this section summarises estimates from the Task Force of the required funding for Tasks 1-4³⁰, proposed in an attempt to help the discussion of the future funding and governance of EOSC. However, considerable guesswork is involved in interpretation of the five tasks in the table and hence the estimates given.

The five tasks still need to be fully defined to avoid misinterpretation: the architecture of the data federation is undefined, the EOSC nodes concept introduces uncertainty as to architecture and related costs, and the contents of the portfolio of centrally financed services is not defined, all of which create uncertainty about the size and scope to be financed; the EC procurement provides some of the few concrete numbers available, but its scope and scale have yet to be tested in practice; and our estimates have not been able to draw on a detailed

²⁹ Table 1, EOSC ‘helicopter view’, Michel Schoupe, ‘Where do we plan to be by 2027?’, presented at the 2023 EOSC Symposium, Madrid (Spain), Sep. 20, 2023.

<https://symposium23.eoscfuture.eu/wp-content/uploads/2023/09/1.-Michel-Schoupe-EOSC-post-2027-final-1.pdf>

³⁰ The tasks are defined in the “Helicopter View” slide. The Task Force has added the Required Funding and Funding Sources columns and the information in them.



analysis of the research landscape. The funding of EOSC is a very complex topic, and our proposals should be used only as an indication of the order of magnitude of the future costs involved.

The EC Procurement³¹ of the **EOSC Core and elements of the EOSC Exchange** (which we interpret as being represented by Task 1 in Table 2 below as the “EOSC EU node”, or “minimum viable EOSC”) for the period 2024-2026 has a total budget of €32 million, equivalent to approximately €11 million per year. Fifty percent of this amount is dedicated to EOSC Core services. The other half of this money is provided for data analytics and storage services. The Task Force interprets this as an experiment in the provision of a “selective service portfolio of centrally financed services (horizontal and thematic)”³².

Whilst EOSC Core should remain lean, allowance should be made for costs to increase to meet increased usage demands, e.g. for services such as AAI whose costs increase with usage (even if only at a relatively low rate). It should be considered however that **European-level data federation** will incur costs at the EU level, although it is difficult to predict an amount since the architecture is still unclear, and the scope and cost of the EOSC nodes have not yet been defined. Activities such as support and training, usage monitoring, service selection and quality assurance, Rules of Participation and access policy enforcement and evolution, and regulatory compliance also need to be funded.

On the other hand, the costs for **centrally financed services** may grow with usage, and are hard to predict as they depend on the type and scope of these services; a collaboration suite for 1 million researchers has a different price tag than providing a relatively small pool of European-level compute services for cross-border use cases. A conservative proposal would be to make provision of at least €10 million per annum³³, i.e. a doubling of the amount in the EC EOSC procurement, for the centrally financed services as part of Task 1 for several years (portfolio determined by a user-driven governance), whilst a harmonised European approach is developed to smooth service provisioning and consumption via the EOSC Exchange, as well as a good understanding of how much service consumption needs to be collectively funded to support effective use and reuse of research data.

We assume Task 2 in the table below to include staffing and running costs of the future EOSC legal entity, as well as costs relating to coordinating and developing the nodes concept³⁴.

Given these uncertainties, the Task Force feels unable to propose figures with any accuracy,

³¹ See <https://etendering.ted.europa.eu/cft/cft-display.html?cftId=12087> and <https://bit.ly/EOSC-platform-procurement>.

³² The concept of such a portfolio was discussed by the Task Force in the November 2022 progress report, but its contents were not defined.

³³ One comparison is provided by EGI-ACE, which served 43 use cases with compute and analytics services, with a budget of €4.8 million per year. See the EGI-ACE Impact Report at <https://zenodo.org/records/8119614>

³⁴ A draft position paper of the EOSC Association Board was published for comments in October 2023: <https://eosc.eu/wp-content/uploads/2023/11/20231112-Short-paper-on-the-EOSC-Federation-draft-v3.pdf>.

but to provide an idea of order of magnitude, we estimate that Tasks 1, 2 and 4 taken together may require funding of between €10 million and €50 million per year.

Please note that the Task Force assumes **the vast majority of services in the Exchange will not be centrally financed on European level** but via national or institutional funds and the cost for using these services are to be recovered using Exchange-facilitated cost remuneration methods.

The biggest cost factor concerns efforts for **making data and services FAIR and ensuring their integration with EOSC**, which the Task Force understands to broadly map to Task 3 of table 2. Already back in 2016, the first EOSC High-level Expert Group observed that about 5% of research expenditure should be spent on properly managing and stewarding data³⁵, and the Knowledge Exchange Research Data Expert Group and Science Europe Working Group on Research Data recommended a 5% “data overhead” as an additional budget for an individual RPO³⁶. Additionally, for its 2016 Roadmap, ESFRI recommended as much as 15-20% of the investments to go into the e-infrastructure³⁷. This is a cost each RI and institution needs to bear via its normal funding channels. (We assume costs relating to the EOSC Interoperability Framework are part of Task 1). The Task Force has provided a cost estimate for RIs in Table 2, but this is based on experience from one RI, EPOS³⁸, and is likely to underestimate the total because the costs for institutions (RPOs) are not included, so the estimate should be used only as an indicator of the order of magnitude of the expected costs.

The estimated costs in Table 2 should be considered against the estimated cost for the EU economy of *not* having FAIR data, estimated to be at least €10.2 billion per year, and possibly as much as €26 billion per year³⁹.

Overall, it may be observed from the suggested amounts in Table 2, that the costs of the operation, maintenance and development of the EOSC EU Node as the realisation of the Minimum Viable EOSC in Tasks 1 and 4, and the expansion of the EOSC Federation in Task 2, are very modest in relation to the overall estimated cost of FAIRification, represented at least in part by the figures in Task 3. And yet, to achieve the full potential of that FAIRification, the Minimal Viable EOSC is required: it provides the federating “glue” which ensures realisation of the value of the investment by MS in Open Science.

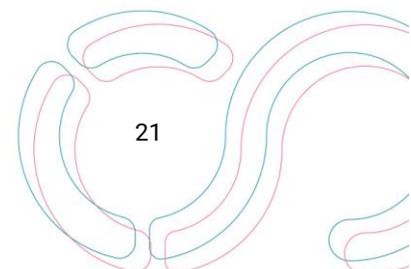
³⁵ *Realising the European Open Science Cloud*, <https://op.europa.eu/en/publication-detail/-/publication/2ec2eced-9ac5-11e6-868c-01aa75ed71a1>. See implementation recommendation I5

³⁶ Science Europe: Funding research data management and related infrastructures, May 2016. Accessible at: https://www.scienceeurope.org/media/uuqf0i03/se-ke_briefing_paper_funding_rdm.pdf. See page 23.

³⁷ *Supporting the transformative impact of research infrastructures on European research*, independent expert report for DG RTD, 2020, accessible at <https://bit.ly/Impact-of-research-infrastructures-on-EU-research>, page 51.

³⁸ <https://www.epos-eu.org/>. EPOS was chosen on the basis of its mission and services offered, at a smaller scale but similar to what is envisaged for EOSC.

³⁹ Cost-benefit analysis for FAIR research data conducted by PwC on behalf of the EC’s DG RTD, March 2018. Accessible at <https://bit.ly/Cost-benefit-analysis-of-FAIR-data>.



Main EOSC Tasks for the future (2027 onwards)	Estimated required Funding	Funding Sources
Task 1: Deploying and operating the EOSC EU node (Core, Exchange, FAIR Data Federation)	See estimate for Tasks 1, 2 and 4 in text above	MS/AC and European Commission (EC)
Task 2: Maintaining and updating the EOSC EU node and expanding the EOSC federation (with elements that are close to the 'market')	See estimate for Tasks 1, 2 and 4 in text above	MS/AC and EC
Task 3: Enabling a 'web of FAIR data and service' for science		MS/AC: coordinated national initiatives; and EC
Creating the data infrastructures and processes necessary to provide FAIR and open data	One-off investment of 10% of the investment already made in the RIs and infrastructures generating the data	National, regional, institutional (usual scheme funding the RI that provides the data), EC
Operating the data infrastructures and processes necessary to maintain FAIR and open data	Annual investment of 10% of the previous line - i.e. 1% investment per annum	National, regional, institutional (usual scheme funding the RI that provides the data).
Continuous development and upgrade of the data infrastructures and processes necessary to provide FAIR and open data	An increase of 33% in the annual operating costs of data-producing RIs and infrastructures	National, regional, institutional (usual scheme funding the RI that provides the data), EC
Task 4: Develop, prototype and test new elements supporting the evolution of the EOSC Core and Exchange and the tools enabling the federation (focus on elements that can be made ready for the 'market')	See estimate for Tasks 1, 2 and 4 in text above	Future EC Framework Programme (FP)
Task 5: Enabling Open Science policies and the uptake of Open Science practices		Future EC FP / national initiatives

Table 2: "Helicopter View" table with proposed funding requirements added

5. Important additional Issues of Relevance to Financial Sustainability

5.1. Stakeholder Involvement and Representation in Governance

The Task Force would like to strongly reaffirm that EOSC can only become successful if national stakeholders as well as national and thematic research communities, who have had and will have a significant part in building it, are closely involved in EOSC governance and have a strong voice in strategic decisions.

As stated above, the collective EOSC components should ideally be jointly co-funded by MS and EC. However, at the time of writing this report, the latest discussions have shown that there is still some reluctance amongst the Member States to wholeheartedly engage with the EOSC EU Node. It is likely this is partly due to a lack of understanding of what interaction between the EU Node and the different national landscapes will look like. **However, another likely reason is the lack of sufficient consultation, dialogue and coordination between the EC and the MS when preparing the procurement of the EU Node.** It is understandable that MS are reluctant to commit funding to something whose structure they had little say in shaping, and which may overlap with, or fail to bridge gaps in, their national structures.

A similar observation can be made in the research communities. **Strong representation of the research community in EOSC governance, e.g. through organisations such as ERICs and EIROs, is also required to ensure EOSC serves researchers' needs, including organisations such as ERICs and EIROs⁴⁰.** The voice of the research community, articulating requirements to create an interdisciplinary web of FAIR data and services, needs to be heard to avoid sustainability gaps arising and opportunities for further development being missed.

Therefore, the selection and management of the EOSC Core services and the collectively financed service portfolio requires a researcher-driven governance structure for which the Task Force proposes a Scientific Advisory Committee (SAC) with representatives from the different research communities. This SAC should select and evaluate these centrally financed services on a regular basis based on their usage, performance, usefulness, costs, etc. and compare them to other service offerings available. Having such a Committee in place is expected to lead to a high acceptance and usage rate among researchers as an additional advantage. The successful alignment processes among the different ESFRI cluster projects can serve as a basis for this committee.

⁴⁰ If the majority of the states member of an international organisation consists of EU countries - as is the case for ERICs and EIROs - it should be assumed that their financial contributions to the EOSC Core, similar to the national RIs, are covered by the respective contributions to EOSC from their member countries.

These points illustrate that a purely top-down approach will not work for EOSC. Instead, a close dialogue and more consultation on strategic and governance decisions are needed, involving the different research communities and MS/AC and ensuring that EOSC matches their needs.

Ideally, a closer, more interactive dialogue between MS/AC, research communities (ERICs, EIROs and EOSC projects) and the EC will already start now via the next round of EOSC Association Task Forces. While the impact of the current EOSC Association Task Forces' outputs is still being assessed, new Task Forces will shortly be set up with new mandates, presenting the opportunity to establish strong and clearly-defined links between them and the research communities and the EOSC Steering Board, for example through mandated memberships and regular meetings. Such links and opportunities for dialogue and discussion can contribute significantly to ensuring the quality, relevance and impact of Task Force outputs.

5.2. Requirements of the EOSC Legal Entity from a Financial Sustainability Perspective

With respect to the legal model, the Task Force has identified in the table below several requirements against which legal models under consideration for the future EOSC legal entity should be assessed.

Requirement for legal entity	Justification
The legal entity has a long term sustainable time horizon	Longevity of the EOSC governance and operating environment (10 years or more) is essential to provide sufficient assurance to users and providers, of the stability and sustainability of EOSC so they are willing to rely on and integrate with EOSC
Member States (MS) & Associated Countries (AC) are present in governance as stakeholders making a long-term financial commitment	When MS & AC commit and have a financial stake in EOSC, they will be motivated to ensure nationally relevant sound strategic direction and implementation of their investment
Different legal forms of research entities (e.g. ERICs, European Intergovernmental Research Organisations), can participate appropriately	Due to their significance in the European research landscape, such organisations should have the ability to contribute to and benefit from EOSC activities and strategic discussions, but not all forms of legal entity support this
The community of stakeholders can exercise influence within the legal entity over the EOSC work programme, including the selection of centrally financed services	The most sustainable EOSC is an EOSC that is actively used; users and service providers need a voice in the governance to ensure EOSC is fit-for-purpose

Research performing and public sector organisations can use services from the EOSC marketplace without going through a public procurement	A suitable choice of legal entity for EOSC could avoid the requirement for public procurement by service-consuming organisations for above-threshold purchases ⁴¹ , realising significant economies of effort and cost to cross-border and cross-discipline service sharing
There is a means to avoid paying VAT when users purchase services through the EOSC Exchange	A suitable choice of legal entity for EOSC can avoid VAT barriers and costs for cross-border and cross-discipline service sharing, supporting the creation of a well-functioning marketplace
Potential participation of private companies as users of EOSC is possible	Anticipating extension of the EOSC user base to industry and commerce, private companies should be able to benefit from EOSC

Table 3: Legal Entity Requirements from the Perspective of Financial Sustainability

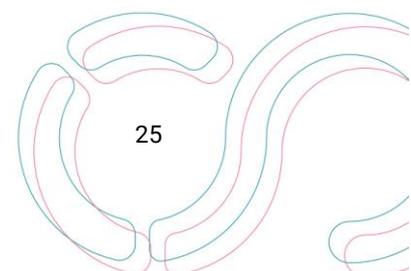
5.3. Challenges around Procurement and using the Exchange

Public sector entities should ideally be able to use services offered through the Exchange without having to conduct a public procurement process. As these entities are typically subject to public procurement rules, a public institution in country A cannot simply buy a service from a public institution in country B unless a long-term collaboration for provisioning of services is established. In the absence of this, cross-border service provisioning against payment between organisations will be hindered in practice. Ideally, the consumption of research services by public sector entities would be exempted from public procurement rules if these services are brokered through the EOSC Exchange. The details on how the EOSC Exchange can act as a procurement-free zone for public-sector EOSC participants should be the topic of a dedicated study as part of the decision-making process for the post-2027 governance and legal entity.

5.4. Challenges around VAT and using the Exchange

Cross-border VAT is a complex subject, with VAT due in the country of service consumption and service provisioning by public sector entities VAT-exempt in some cases/countries, while non-exempt in others. In an ideal situation, VAT would not be an issue for services brokered through the EOSC Exchange. In the absence of VAT-exemption, clear guidance for providers on how to deal with cross-border VAT, and practical facilitation of VAT-payments, should be part of the value-add by the Exchange for service providers.

⁴¹ Purchases by public sector entities above a certain monetary threshold generally need to be done through a public procurement. How big a challenge this would be in the context of the EOSC market place depends on how many purchases can be expected to be above-threshold.



Requirements imposed by VAT and procurement regulations, as outlined above, are persistent legal barriers hindering the cross-border provision of services.

5.5. Recognition of non-technical costs

In the past two years, the Task Force has focussed on the financial sustainability of EOSC's essential elements: data and services. However, the promotion thereof and the skills needed by the researchers to access and use them appropriately should not be underestimated. There should be recognition of non-technical costs relating to governance, and to connecting and integrating different EOSC Nodes into the EOSC Federation. These include costs related to marketing, training, technical research support, matchmaking assistance (helping researchers to identify appropriate services for their purposes), and governance-related activities such as RoP and access policy enforcement and evolution, service selection and quality assurance, compliance with ethics, data protection, copyright and other regulatory requirements, and EOSC performance and usage monitoring.

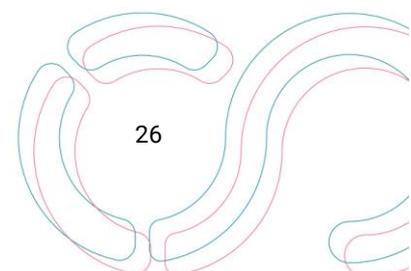
5.6 Use of Public Procurement for operational EOSC components

The EOSC governance bodies are considering the future legal entity/ies and governance structures which may be adopted for EOSC from 2027. It is unclear as yet how the EOSC EU Node will transition from a short-term procurement to a long-term, sustainable infrastructure. The Task Force would like to draw attention to the fact that some public entities cannot participate in procurement as this is precluded by EU competition rules; therefore, limiting the procurement to tenders may exclude some public entities from applying.

5.7 Access to EOSC

Access policies for data federated through EOSC cannot be more restrictive than access to that same data outside of EOSC e.g. through European or global research infrastructures. There are three main considerations. Firstly, in the scenario where not all MS/AC would join the future EOSC governance and joint funding scheme for European level EOSC components at the same time: nonetheless, all European research institutions should be able to federate their data and services through EOSC to allow others to benefit from them, and vice versa benefit from the data and services of others. This would not only support the ERA policy goals but also EOSC as a platform, as it exerts a greater pull to data and services when a wide community benefits. The more researchers and institutions benefit from EOSC, the more data and services the platform will attract. Effectively this means access to certain EOSC Core services without a MS/AC necessarily paying its part of the fee. This would be a small price to pay to ensure sufficient content in EOSC. On the other hand, access to centrally financed EOSC Exchange services should go hand-in-hand with financial commitment.

Secondly, as international RIs point out, European research is part of global collaborations that need to be able to access European data and services, and vice-versa. As a consequence,



EOSC will need to facilitate global access to certain services in EOSC Core. Further discussion on collaborative policies/funding models outside EOSC Governance with other countries or regions is required, to elucidate how and under which conditions this should and could be done.

Thirdly, EOSC must keep its direction aligned with that of user communities. Decisions on how to reach the right combination of widely accessible and local instances of services have to be discussed with research communities and service providers; there are RIs that do not have EOSC-compliant IT infrastructures in place or planned, be it for lack of IT or financial resources, or for strategic reasons. Specific strategies should be put in place to ensure ease of use and accessibility for a diverse user base, including those with less technical expertise.

6. Recommendations For Future Work

The Task Force recommends the following areas for further work pertaining to the financial sustainability of EOSC:

1. **Analyse and recommend strategies for the cost of federating data through EOSC:** The requirements, characteristics and costs associated with federating data through the EOSC Data Federation need to be identified, clearly differentiating which cost categories are considered to be at the European level and which require financing of investments and operations at national and institutional level, with the latter two expected to bear the brunt of the (substantial) cost. To develop a long-term funding strategy, it is necessary to develop a consistent budget plan that assigns the necessary funds for data interoperability, curation and preservation. This requires cooperation between EC and MS/AC to find suitable contribution models that ensure the required long-term co-funding commitment. Important in this work is to recognise that those that carry the cost for sharing the data (i.e. data infrastructures) are not necessarily the ones reaping the benefits. Further work should be conducted to identify the financial requirements imposed by the envisaged federation of EOSC-interoperable trusted digital repositories and data infrastructures, and to propose appropriate incentives and measures that stimulate community-wide commitment for federating data.
2. **Inclusiveness of the funding model(s):** Ensuring inclusiveness in the funding model(s) is crucial. They should be structured to accommodate the varied economic capabilities of different Member States and Associated Countries. Exploring sliding scale models based on the financial capabilities of other Member States and Associated Countries could be a way to achieve this.
3. **Cost of operating and developing the EU Node:** a more detailed assessment should be made of the operational costs and investments required for, on the one hand, deploying and operating the EOSC EU Node after 2027 and, on the other hand, maintaining and updating the EOSC EU node. However, an accurate and informed cost evaluation is only possible in a stabilised environment where the roles and commitment of the various stakeholders are more clearly defined. An ongoing dialogue between implementers, funders and the decision-making bodies (like the Tripartite Governance) is essential to clarify the scenarios to be worked on. Execution of the current contract for the EU Node should produce real-life data on demand and related costs in the next few years.
4. **Financial sustainability considerations of the developing Nodes architecture:** an analysis of the financial sustainability implications of EOSC as a federation of nodes should be made as part of the developing EOSC Nodes concept.
5. **EOSC Exchange procurement and VAT challenges:** as part of the selection of the future governance and legal entity, a sufficiently detailed study should be undertaken into critical aspects to support scenarios, particularly relating to VAT and procurement,

ensuring services in the Exchange can be accessed without necessitating a public procurement, including identifying the size of the challenge i.e. by estimating how much service consumption can be expected to be above the monetary procurement threshold value for national or European procurements⁴².

6. **EOSC Exchange centrally financed services:** an analysis should be conducted on the potential value proposition(s) of the portfolio of centrally financed services to assist the recommended Scientific Advisory Committee (see Chapter 5) in its task.
7. **EOSC Exchange remuneration mechanisms and depth of transaction support:** The Task Force recommends a dedicated effort to develop recommendations for feasible cost-recovery mechanisms for the Exchange marketplace that can facilitate the brokered cross-border service delivery and consumption of a broad range of services and which can be phased in from 2027 onward and secondly provide recommendations on where the Exchange should sit on the sliding scale of possible service transaction facilitation.
8. **To facilitate easy access to commercial services and further develop EOSC's portfolio of agreements with commercial services, four key topics need to be further investigated:** Firstly, further work is required to ensure ACs and intergovernmental organisations to whom the EU procurement directive does not apply can benefit from such a portfolio. Secondly a suitable framework needs to be developed to identify which demand across the whole EOSC community is sufficiently large to warrant a large-scale collective procurement and thirdly, scalable mechanisms for centrally funded consumption of commercial services need to be proposed, should such funded consumption be desirable. Lastly, suitable entities able to act as a central purchasing body for EOSC need to be identified.
9. **A support framework or mechanism to better support the transition from short-term to long-term funding for services** exposed through the Exchange should be investigated. This framework needs to be supported by national policies that allow national/institutional funding to be used for services outside their geographic remit. As a first priority a brief problem statement should be produced, e.g. by a future task force.
10. **Legal and Ethical Considerations:** Legal and ethical considerations and requirements also drive costs for sharing research data and managing the associated risks. It is especially challenging for smaller institutions—which often lack the necessary resources—to properly assess how to conform to the additional layer of EU legislation and best practices, resulting in them being left out of data federations and associated services. While EOSC obviously advocates Open Science, there are many legal barriers

⁴² Thresholds requiring national procurement vary per country, in the case of European procurement, it is generally at €221 000 for the contract period (https://single-market-economy.ec.europa.eu/single-market/public-procurement/legal-rules-and-implementation/thresholds_en)

and ethical issues to deal with, such as those posed by the General Data Protection Regulation (GDPR), new EU data legislation and by intellectual property rights and copyright, among other regulation. The cost this entails must be considered for the overall sustainability of EOSC. The Task Force recommends creating a federated group of experts for the EOSC and to investigate setting up a risk management contingency fund.

11. **EOSC in a global context:** European research is part of global collaborations that need to be able to access European data and services and vice-versa. As a consequence, EOSC will need to facilitate global access to certain services in EOSC Core. Further discussion is required to elucidate how and under which conditions this could be done.
12. **Relation with the other Data Spaces.** For sustainability and efficiency, it will be important to clarify how EOSC fits and positions itself among the data spaces and what the synergies will be. The alignment and its associated costs of EOSC with the European Common Data Spaces, the Simpl middleware, and other initiatives such as other European Partnerships, or other initiatives of relevance to the web of FAIR data and services, should be explored.
13. **Involvement of the private sector in EOSC should be investigated, sketching possible scenarios and their pros and cons;** e.g. public-private partnership for co-financing pieces of EOSC, e.g. large centrally financed pools of services, or fee-based access to resources. Digital sovereignty, big tech considerations and potential loss of control of what is essentially a public-sector infrastructure should be taken into account. Strengthening the collaboration with private sector-oriented data spaces and systems may be a constructive path forward.
14. **Address support for citizen science;** citizens are being involved in many research activities alongside professionals. Numerous tools and platforms have been developed for citizens to collect data that are fed into data repositories and federations next to professionally gathered data. In this regard it is important for EOSC to take citizen sciences into account in its activities, in particular how to grant citizens access to services and data when they are not affiliated to any institutions, and how to deal with the resulting potential costs and liabilities.
15. **Address costs of environmental impacts:** The generation of yet more data, and enabling their long term preservation and processing, generates a significant impact on the environment, that is expected to be addressed for example via the Green Deal. The increase of AI applications to make them more and more reliable and meaningful will yet increase the huge amount of data to be made available and to process. In order to mitigate this environmental impact and take appropriate measures, EOSC should be in future even more attentive to the costs linked to fulfilling these requirements.

7. Conclusions

Over the two years during which the Task Force has been active, the shape and scope of the EOSC have evolved considerably as a result of the reflections and outputs provided by the numerous stakeholders involved, including the European Commission, Member States, EOSC Association (including its Task Forces) and EOSC-related projects. Reflecting on the financial sustainability of a whole infrastructure in the making is a complex and challenging process. It wasn't always easy to know whether our reflections and hypotheses were heading in the right direction, and while we are well aware of the difficulties of providing clear guidelines in a rapidly changing environment, a more sustained dialogue with and regular feedback from all components of the current EOSC governance would have been beneficial to our work. Given these points, we considered it useful to provide in this report:

- a simple model of EOSC as seen through the lens of financial sustainability
- a set of 8 principles which should guide decision-making for a financially sustainable EOSC after 2027
- cost estimates of the main identified EOSC tasks after 2027, bearing in mind that the architecture and organisation of the EU-node and the data federation remain largely undefined, which creates uncertainty about the size and scope of their costs
- observations about financial sustainability requirements to the outcome of the post-2027 discussion, including funding-related requirements of the future EOSC legal entity
- recommendations for further work relating to the financial sustainability of EOSC.

EOSC continues to evolve at a rapid pace. In recognition of that, the Task Force published a short Statement in November 2023 summarising the main findings of our work, as input to the deliberations of the EOSC Tripartite governance. This final report elaborates on that Statement as described above. The membership of the Financial Sustainability Task Force reflects the EOSC stakeholder community. We therefore hope our views and recommendations for achieving a fair, inclusive and sustainable EOSC which adds value for the research community, can be taken on board as the consideration of the legal model and governance of EOSC reaches its conclusion and the definition of the EOSC nodes concept develops.