



# The Vivus Study

Ensuring that EOSC-Core & Minimum Viable EOSC are sustainable through a study on their costings, potential business models and funding schemes

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## Contents:

Executive Summary .....	3
1. Scope of the Study.....	5
Overall Methodology .....	5
Iterative Document Development Plan .....	6
2. EOSC Core Components.....	8
Introduction .....	8
Service Costings .....	8
Re-mapping of Services onto Iron Lady.....	14
Pricing Model .....	15
3. Funding Mechanisms that could be of interest to EOSC CORE + MVE components .....	20
European Level Public Funding Schemes .....	21
National Level Public Funding Schemes .....	22
Private Funding Schemes (European / National).....	25
Case studies of European Level entities that successfully mobilized national funds.....	28
4. Business Model taking into account MVE .....	30
5. Use Cases Taking into Account MVE.....	45
General Insights from the Business Models Study.....	48
6. Conclusions and Final Recommendations .....	52
Annex A: Minutes of Discussions with EOSC WGs .....	57
Annex B: Original Document Answers from Service Providers.....	70
Annex C: Detailed Costings Workings.....	71
Annex D: EOSC Core Iron Lady Service Mappings.....	72
Annex E: EOSC Core Service Pricing .....	74
Annex F: Details on the Platform Design Approach to Study EOSC Ecosystem .....	75



**Figures:**

- Figure 1: EOSC Core Iron Lady Service Mapping
- Figure 2: Service Pricing Feedback from Service Aggregators
- Figure 3: ESIF Implementation by Country
- Figure 4: Summary of Funding Scheme Dimensions
- Figure 5: Initial Map of EOSC Ecosystem
- Figure 6: Updated Map of EOSC Ecosystem
- Figure 7: The Two Families of Sustainability Model



# Executive Summary

The Vivus study was initially commissioned to examine EOSC components in relation to the mapping between EOSC Core Services and the technical e-infrastructure services that would deliver them and to explore business models that would support EOSC Core. The scope of the study then grew to include MVE, service pricing and funding sources.

The method employed mixed stakeholder interviews and desk research to model various aspects of EOSC Core and MVE. Four reports were produced, of which, this is the final report.

e-infrastructure services were mapped initially onto the Tinman Core service structure. The e-infrastructure services were subsequently mapped onto the Iron Lady version of the EOSC Core service structure. In both cases, it was discovered that some Core service requirements have no corresponding e-infrastructure service offerings, while other Core services have an abundance of e-infrastructure services competing to supply the EOSC demand. Notably, the Metadata framework is missing in both Tinman and Iron Lady mappings. In addition to the interviews several meetings were organised by the Sustainability WG where the study personnel were able to interact with several other WGs in order to broaden the range of views and to collect a wider range of comments. Notably, many obstacles to EOSC success were raised during these meetings, the common denominator of which was the fact that none of them could be solved from within EOSC, e.g. cross-border operations and taxation, procurement and micro-payments. It is clear that EOSC needs to start lobbying for a single market for EU research and for incentives to encourage national entities to participate more fully in international activities.

Upon investigating the EOSC Core costs, the e-infrastructure service providers were interviewed in order to understand their cost profiles. However, it was discovered that institutional accounting practices did not focus individually on service costs and we were unable to develop any confidence in the relevance of the data being collected. For this reason, simple project-based resourcing costs were collected and plotted in a matrix against the relevant (Tinman) Core services. When totalled these costs revealed a total cost (approximately €7M) that seems insufficient to adequately deliver a sustainable service, given the complexity of EOSC. On top of this we calculate that service pricing will be found to be in the region of an additional 25% to 50% on top of service costs.

Another finding related to the EOSC Core costs study was that the existing e-infrastructures offered a great advantage to EOSC, in that they not only simplify the relationship that EOSC will maintain with its service providers but that they also embody a great deal of knowledge important to EOSC. The existing e-infrastructures were re-branded as Service Aggregators. In this new role, it was clear that these entities also need to be examined in relation to their sustainability. The four main e-infrastructures were interviewed in order to understand their running costs (which would become a service delivery premium for EOSC.) Again, there was a lack of detailed understanding of the income needed to sustain their operations at a level required by EOSC. However, it was also noted that during these interviews competitive thinking and entrepreneurial behaviour was beginning to emerge. This was viewed as a positive indicator.

Understanding that there was no appetite within the EOSC community for a funding model that embraces pay-per-use by individual, or collectives of, researchers, a study was also undertaken to catalogue likely candidate sources of EOSC funding, these ranged from EU level funds down to national and regional funds. It also included support from business and charitable sources.



EOSC is not a technology and has a role that is strategic as well as operational. As such, it needs to build trust in its user communities and a way of achieving this goal is for EOSC to become independent of project funds. To do this it needs to migrate towards longer-term business-like income streams. A business viable model is required. The business modelling activity considered EOSC from an ecosystem perspective and investigated relationships and dependencies. Two models were identified as being suitable, the Learning Engine and the Transaction Engine, with a final conclusion being that a hybrid model would be initially required. Insights regarding how it might be possible to capitalise upon these engines are revealed in the recommendations.

EOSC is a federation of discipline-oriented research data infrastructures, with a superimposed service infrastructure connecting them, producing a seamless European research data infrastructure capable of enabling high quality cross-disciplinary and transnational research. EOSC-Core is a cost-centre and must be supported by income generated elsewhere. The MVE may be able to offer end-users a “supporting and mentoring” role leading to the role of “cultural/technical/legal mediator and advisor”. These are commonly designed as part of the Learning Engine of a Platform strategy. These services can be put into the EOSC-Core but, if the policy guides to keep EOSC-Core the lightest possible, in any case they should be part of the MVE, with any income being able to (partially) support the Core. Funding bodies may also be attracted by the proposed monitoring and policy-maker support aspects of the MVE and may be prepared to pay for access to the data collected.

Continued public funding for EOSC-Core is felt to be acceptable in the short term, but in the medium-term actions should be taken to gain sustainability independent from the public funding. There are many examples of strategic platforms that have become independently sustainable, best practise should be collected from these sources and investigated for resources useful to EOSC.

After the collected data were analysed, modelled and reported, a comprehensive set of recommendations and suggestions for future work were developed. It may come as no surprise to learn that future studies in this area are recommended.



# 1. Scope of the Study

AcrossLimits in collaboration with Boundaryless has carried out a study in response to a Request for Proposals for the identification of EOSC Core Operational Costs, developing a scenario-based cost model, and suggesting potential usage and revenue models.

The study forms a part of the EOSC Executive Working Group on Sustainability activities to help examine suitable business models for EOSC post-2020 and the scope is to provide relevant output for one of the four key deliverables of the Working Group. This study will contribute to the definition of the Minimum Viable EOSC (MVE) and its associated cost and revenue model

The original scope of the study was further extended in order to ensure that funding mechanisms for the sustainability of operations of EOSC Core and the Minimum Viable EOSC are also investigated, and in order to move towards business models that look at not only EOSC Core components but also to the wider MVE. Relevant use cases are also given in order to ensure an understanding of potential scenarios that are enabled thanks to EOSC.

## Overall Methodology

The steps that were followed in order to deliver the required deliverables were as follows:

### 1. Identification of the Opportunity and nature of the Ecosystem through Background Information Gathering via Interviews and Document analysis

The first step of the process consisted of the thorough analysis of existing EOSC Core documentation and the performing of a number of interviews with stakeholders of EOSC Core related projects with the aim of collecting information on two essential aspects: the nature and classification of EOSC related services and components and the nature of all EOSC related ecosystem players in terms of their performance pressures, needs and their current relationship with the market.

Interviews have been targeted to both: internal EOSC members and players from the ecosystem, and the Business Models Task Force of the Sustainability WG that has helped the consulting team to identify main players.

### 2. Creation of ecosystem map, use cases, revenue models and scenarios

Models were created by the consulting experts to show visually how the existing market relationships and services provided can be bundled in a platform organization model and define the list of *ecosystem facing value propositions*, the related revenue models and the implied activities and resources. The models have covered both the so-called *transaction engine* and *learning engine* (subject to revenue model based on the consumption of centrally/EOSC Core provided services and modules).

### 3. Understanding the various cost structures that are underpinning the EOSC-core services to be provided

After studying the relevant documentation provided by the different EOSC projects and stakeholders, the experts have considered the core services as per the Tinman document that are already deployed. The various cost components have been split into their different cost categories including all types of fixed and variable costs that might be required to be





present in order for all the services to be delivered. These include amongst others - compute resources, data storage costs, bandwidth costs, human resources, equipment (depreciation or leasing), energy costs, maintenance costs etc

#### **4. Survey and Interviews with potential stakeholders, projects and experts for cost quantification**

The various service providers (e.g. those operating compute facilities, data centres, etc.) that together will form the technical building blocks of these core services have been contacted and asked to reply to a series of questions related to their costs. In-depth interviews with different service providers and stakeholders have been done iteratively in order to get a better understanding of all the issues with respect to costs. These costs have been collected and analysed and will form part of the cost model for EOSC-Core.

#### **5. Creation of a spreadsheet model with the ability to calculate various scenarios of costs**

The costs collected in the step above have been sorted and modelled in a spreadsheet that allows an estimation of the final costs for running EOSC-Core services

#### **6. Study of funding mechanisms in Europe**

Identification of the major public and private funding schemes that are available in Europe both at national and transnational levels which would match the needs of the EOSC Core +MVE components

#### **7. Moving from Costings to Pricing Models**

Additional interviews with e-infrastructure service providers in order to move away from simple costing to a more pricing scheme for services

#### **8. Discussions with several Working Groups (WG)**

A series of online meetings with WG Architecture and WG FAIR in order to present the initial findings of this study and also get their additional inputs to refine our results. Minutes of the Discussions can be found in Annex A.

#### **9. Delivering a final report with all findings**

All materials are collated in this final report that will also be presented in person to EOSC Secretariat partners and stakeholders

## **1.1 Iterative Document Development Plan**

The above methods were applied in an interactive fashion with 4 individual checkpoints resulting in 4 different delivery documents as follows. This is the fourth and final delivery document and encompasses in it all the important insights of the previous three.

### **First Delivery - May**

- Preliminary ecosystem model
- Definition of questions to be used in interviews for stakeholders
- Initial findings based on existing documentation from past projects / work



## Second Delivery - June

- Detailed and comprehensive model of the Ecosystem
- Scenarios and use cases - Models and diagrams
- Results from the interviews
- Updating of initial findings based on the first interviews done
- Structure of spreadsheet model to be used for the EOSC Core components

## Third Delivery - July

- Finalisation of all interviews
- Deep calibration and normalisation phase of costs given by service providers
- Review of costings/models based on inputs of Sustainability working group
- Spreadsheet filled in with normalised numbers
- Insights and conclusions by our experts on the "willingness to pay" on one side, and the "costings of the EOSC core" on the other side, and bridging (any) gaps

## Fourth and Final Delivery - October

- A finalised mapping of services and costs as per Tinman from the different service providers
- An overview of the typology of public funding instruments that could be used to fund the Minimum Viable EOSC
- A more comprehensive business model for the whole of EOSC including the input of the funders with national funding schemes identified
- Additional use cases for the Minimum Viable EOSC and not only for EOSC Core
- A pricing model that could be utilised for the delivery of EOSC Services





## 2. EOSC Core Components

### Introduction

In the initial part of this section (sub-section a)) we look into the costs of service provisioning from the candidate providers of the services that will become the EOSC Core. In this part of the study, we refer to the Tinman version of EOSC Core. In the subsequent section (sub-section b)), we remap the candidate services onto the Iron Lady version of the EOSC Core. Finally, in sub-section c, we consider how the costs associated with the provision of candidate services translate into the prices associated with the delivery of such services. In this final part of the study, the scope has expanded slightly to cover EOSC MVE, not only EOSC Core.

### Service Costings

In respect of the costs of service provisioning, we discriminate between different uses of the word **service/services** in the following manner:

- **Core Service:** The services defined by the EOSC Sustainability Working Group as a core requirement of a functional EOSC.
- **Candidate Service:** Those services that exist in the wider e-infrastructures community that may fully or partially map onto one, or more, of the Tinman services

### Services Included in the EOSC Core Costs Study

The investigation considered all EOSC Core services listed in the Tinman document:

- A shared **open science policy framework**, which effectively embeds a data compliance framework for open / FAIR data. It dictates and applies the rules of how the data elements are published, shared and re-used.
- An **Authentication and Authorization Interoperability (AAI)** framework, a trust and identity service for researchers to seamlessly access all EOSC resources.
- A **data access framework**, whose primary role is to offer data as a service. It enables open interfaces where data consumers are able to discover and use data.
- A **service management and access framework**, whose role it to provide a consistent and agreed upon understanding of e-science services: what they offer, which science problem they address, what is their operational capacity, how they are accessed, who pays for them.
- A **minimum legal metadata framework**, for ensuring openness and interoperability, privacy and security (copyright status, disclosure limitations, patents pending, other IPR on the datasets or workflows, the existence of personal data, designation of data as PSI, etc.)
- An **open metrics framework**, which sets the rules (usage, performance, value for money) for the assessment of EOSC elements, i.e., policies, access framework, services, data, business, funding and usage models. This should include elements to facilitate the incentives and awards mechanism for researchers, as recommended by the EC HLEG on Next Generation Metrics and the EOSC Pilot policy group.
- **PID:** Services to generate, resolve and validate persistent identifiers (PID)



- **Helpdesk:** framework for linking national/thematic/institutional service desks that can provide training/consultancy on EOSC-Core services.
- **Portal:** an EOSC Service implementing a web portal providing one form of accessing and using the EOSC Resources.

At the request of the EOSC Sustainability Working Group, two additional services were added to this list at the beginning of the study: A **procurement service** and an **operational security service**.

During the study, two further candidate (component) services were identified and were included for completeness: a **collaboration and communication service** (organisational) and a **messaging service** (technical). These services can be considered as connecting services which will be required to allow the Core services to interoperate.

## Service Provider Analysis

Potential candidate service providers were contacted in relation to the identification of candidate services. Initially, we contacted individuals nominated by the EOSC Sustainability Working Group. However, this resulted in us being redirected to other individuals nominated because of their superior understanding of costs. Furthermore, it became apparent during the study that some Core services were actually compositions of smaller services and for this reason the costs associated with a corresponding set of candidate services had to be considered. Please see Annex B for the actual responses discussed here.

Multiple engagements were made, initially by email with a proforma questionnaire to complete and return. The questionnaire was simple and contained only five questions. This initial phase resulted generally in low quality results. It was followed by a series of phone/AV calls and email dialogues and this process improved the quality of the results: but only to a limited extent. The limited nature of the results we were collecting highlighted a number of factors

- Scientists and operators are, unsurprisingly, not well aware of the detailed costs associated with their work and are disjoint from those parts of their host organisations which are set up to account for those same costs.
- Rather more surprisingly, many institutional accounting departments seem unable to provide detailed costings at the level of individual services. We assume this to be because full cost accounting is not practiced.
- The cost estimates provided by potential candidate service providers were noticeably variable; some over-estimated service costs, while many more under-estimated the service costs.
- The costs collected were calculated using a wide range of methods and reported in a variety of formats. During the many rounds of interactions with candidate service providers, it became apparent that there is insufficient knowledge of Tinman outside of the Sustainability working group. Some did not know about Tinman at all, while others who had heard of Tinman could not interpret Tinman requirements from the descriptions provided.
- It is absolutely clear that more time and effort, and possibly some training is going to be required to truly understand the costs that the EOSC Core service portfolio must cover.
  - This assessment is aimed at an accuracy to provide sufficient confidence that costs are in the right region, we are not aiming for a comprehensive and detailed view of all costs.



- The end result is that we are not confident that the costs we have been able to assemble to date reflect the actual costs of running EOSC Core. We would go further: given the total costs calculated in this study, we assess that the candidate service providers are underestimating true service costs and that EOSC Core will be unsustainable if it is funded at the level exposed in the current version of the costing model. Please see Annex B.

As a result of the difficulties discussed above, it became clear that the deep-dive into costings which had been originally planned was not going to be productive. Therefore, we instead decided to widen the scope of the study to consider other factors associated with costs. We considered the difficulty of managing many small candidate services, of which many Core services seem to be composed. We also considered the concept of using the existing legal entities (LE) within the e-infrastructure community as “Service Aggregators” (SA). We were especially interested to understand the legal relationship between an SA and its member community as this will have an impact on how EOSC core may be able to initiate and maintain operational relationships.

- If core services are to be contracted in by the EOSC LE it makes sense to keep procurement costs as low as possible and for this reason, the notion of using the existing e-Infrastructures as Service Aggregators has been developed.
- Taking this view from the pragmatic context of EOSC Core being easier to manage if it has only a few entities with which to contract.

During this part of the study an anomaly was detected. If a procurement service is to be contracted as part of EOSC Core, how will the procurement service itself be procured? This anomaly reveals that the EOSC LE should, ideally, contain a procurement capability as well as the planned administrative and management capabilities.

The candidate service providers engaged during the study took widely different approaches to nominating the candidate services. Some participants took a shotgun approach, mapping many candidate services against the Core services, whilst others took a much more conservative approach mapping very few of their candidate services against a single Core service.

Already noted above is the variable nature of under-estimating and over-estimating the candidate service costs. It is worth noting that a factor in the under-estimation of costs, is the belief that the Virtual Access (VA) model is a suitable means to reveal candidate service costs. The VA scheme is **not** a model to employ when determining services costs. VA relies on the fact that necessary additional costs are provided by the host project. Without a host project, any candidate service attempting to cover its costs using VA alone will quickly find that it is not independently sustainable.

## Final Spreadsheet Structure

Please see Annex C for the Detailed Costings presented in the spreadsheet described here. Given the shift in the study context from deep to wide, some columns were moved and removed from the existing tables, while an additional table was added. The simpler structure of the existing tables reflects the lack of depth in the costings we were able to discover. The structure of revised tables are now:

Table 1 (Overview Sheet): Addresses Qs 1 and 2 of the questionnaire.

- Name of Tinman EOSC-Core service



- Supplier Organisation (the name of the host infrastructure, e.g. EUDAT, OpenAIRE, etc.)
- Service (name of the service)
- Service Supplier (the actual supplier of the service, e.g. university, national node, etc.)
- Compliance with Tinman definition of EOCS-Core
- Cost Centres (which kinds of [headline] costs are considered). These heading as deliberately not titles as project costs are in order to avoid “project think”
  - Personnel
  - Equipment
  - Services (equipment needs electricity, data need comms, people need to travel, etc.)
  - Others (people need desks, buildings need drains, etc.)
- Costs Period (how the costs are reported to us (e.g. per week))
- Costs Units (e.g. Euro, CHF, Dollar, etc.)
- Normalised Costs (calculations on reported costs to convert them into Euros per month)

Monthly and Annual totals of the candidate service costings are calculated directly under Table 1.

Table 2 (Overview Sheet): Addresses Qs 3, 4 and 5 of the questionnaire.

- Scaling Factor required on costs to deliver services 24/7
- Scaling Factor required on costs to deliver increased service user volume
- Current Funding Sources
  - Membership
  - National
  - EC Projects
  - International
- Funding End Date

Table 3 (Aggregation Sheet): Addresses Service Delivery

The new table reflects the wider scope that now includes issues associated with costs: Service Aggregation and Legal representation. Two models of aggregation exist:

- IP is ceded to the LE by the candidate service providers and the LE provides the infrastructure to deliver the aggregated service on behalf of the community.
  - A binding delivery contract is agreed with the EOCS LE to provide the aggregated service
- IP is retained by the candidate service providers and the aggregator LE establishes:
  - A binding contractual delivery agreements with the candidate service providers
  - A binding contractual delivery agreement with the EOCS LE to provide the aggregated service.

The questions in this table are, therefore:

- Do the Aggregators possess their own IP or licence IP from third parties?
- Do the Aggregators possess their own infrastructure to deliver the service?
- Are the Aggregators able to legally sign a contract with external third parties?
- Do the Aggregators form legally binding contracts with their candidate service providers?



One Core service, the Metadata Framework, is clearly not addressed by any candidate service put forward by any service provider or service aggregator. This situation remains true after explicitly asking for candidate services to map onto this Core service during interviews.

Mappings to Tinman have been carried out on a preliminary basis but more work will be required to assess the degree of correctness of these mappings and to determine the suitability of each candidate service mapped against a Tinman service.



## Results

- Within the wider service provider community, there is a general lack of understanding about Tinman and the nature of the Core services it describes.
- Many candidate services map onto only a few Core services
- The Metadata Framework Core service is not addressed by any candidate service.
- Training is required to allow a more meaningful study to be conducted.
- VA is not a sustainable cost model when used outside of a project context.
- Despite best efforts and several calls, many participants were unable to currently provide data that build confidence in EOSC being able to sustain itself with income covering only the Core costs declared to date.
- The EOSC LE requires an internal Procurement capability. Anomalies arise if a procurement service is to be contracted in as a Core service.
- Individual responses to questionnaires can be found in Annex B
- The analysis source can be found at Annex C

## Insights

- Not all Core Services are covered by candidate services
- More time and training is required to allow the candidate service communities to gain sufficient understanding of their true service costs.
- More time and training is required to allow the candidate service communities to gain sufficient understanding of the Tinman Core services.
- A procurement Core service cannot be procured unless the EOSC LE contains a procurement capability.
- The use of procurement processes (such as pre-commercial procurement and others) should be explored.
- VA is not a sustainable costs model outside of project funding.
- Standard methods for counting costs of candidate services that reflect true costs and include margins and returns need to be created.
- Legally binding templates of Service Level Agreements (SLA) for EOSC candidates service providers should be created:
  - External SLAs between the EOSC LE and any service aggregator or directly to a candidate service provider.
  - Internal SLAs between service aggregators and the candidate service provider



## Re-mapping of Services onto Iron Lady

The figure below shows the mapping of services onto the Iron Lady core service profile.

EOSC Core Service Groups as per Iron Lady	EOSC Core Service as per Iron Lady	Supplier Org	Service	Service Supplier	Complies with Iron Lady definition of EOSC Core
<b>Core Service Groups</b>	<b>Core Services</b>				
EOSC interoperability Framework	PID	DataCite	PID	DataCite	Yes
		EUDAT	B2HANDLE	EUDAT	Yes
Web Portal	Web Portal	EGI	Portal Front end	Cyfronet	Part
		EGI	Web Content	TrustIT +	Part
		EGI	Portal back end (provider portal)	ATHENA	Part
		EGI	Onboarding process	Trained personnel	Part
EOSC interoperability Framework	Data Access Framework	EUDAT	B2FIND	EUDAT	Yes
		OpenAIRE	EXPLORE	OpenAIRE	Yes
	AAI	GEANT	AAI	GEANT and Partners	Yes
		EGI	Check In	EGI GRNET	Yes
	Open Metrics Framework	OpenAIRE	Open APC	U o Bielefeld	Part
		OpenAIRE	OpenCitations	U o Bologna	Part
		OpenAIRE	Open Science Monitor	OpenAIRE	Part
		OpenAIRE	ScholExplorer	OpenAIRE	Part
		OpenAIRE	UsageCounts	OpenAIRE	Part
		EGI	Portal-based metrics	Cyfronet	Part
EGI		Accounting	EGI UKRI/STFC	Part	
EGI		Monitoring	EGI ARGO	Part	
A shared open science policy framework	A shared open science policy framework with data compliance framework for open / FAIR data	OpenAIRE	Open Science Helpdesk	U o Göttingen	Part
OpenAIRE	Provide	OpenAIRE	OpenAIRE	Part	
Security policies and procedures	Service request and problem management scheme	EGI	EGI xGUS	EGI	Yes
EOSC interoperability Framework	Service Access and Management Framework	EGI	GOCDB DPMT	EGI KIT	Part
		EGI	SOMBO Service order handling system (through Portal)	CNRS/IN2P3	Part
Security policies and procedures	Security policies and procedures	EGI	Operational Security	UKRI/STFC Nikhef	Yes
Interoperable metadata framework	Interoperable metadata framework				
Operational Support Service	Operational Support Service				
	<b>Tinman Core Additions</b>				
	Procurement	GEANT	Procurement	GEANT	Yes
	<b>Connection Components</b>				
	Collaboration and Communication Systems	EGI	JIRA Confluence	EGI	Component
	Messaging	EGI	GTM ARGO	EGI GRNET	Component

Figure 1: EOSC Core Iron Lady Service Mapping

**Please see Annex D: EOSC Core Iron Lady Service Mappings for clearer view**

Notably the metadata framework is still missing and a new Core Service, the Operational Support Service is missing a corresponding service. The Iron Lady still does not include a Procurement





service in EOSC Core. Given the difficulty in acquiring a traditionally derived metadata framework. It may be useful to adopt a bottom-up approach to addressing the metadata framework problem could be tried. New tools and services to achieve domain bridging in this manner are starting to appear.

## Pricing Model

This additional Service Pricing study follows on from the Core Costs study and attempts to gain insight into the area where services live or die: in the space between cost and price. Sustainability for EOSC Core relies heavily on it being able to rely on its own service providers; they in turn must, therefore, be independently stable. If they are not then the resulting service supply churn will undermine the sustainability of EOSC Core.

To be clear a cost is the input value to a system. A price is an output value of a system. The system adds value at a cost to itself and this cost must be covered alongside the input cost. These, and other, costs are summed to arrive at a total cost. Total cost forms part of the price of good or service offered by the system as an output. The other part of the price represents, amongst other things, the value the system adds to the good or service consumed by the customer. This value component is what guarantees sustainable operations. A corner shop selling corn flakes buys boxes in at a cost of the wholesale price and the cost of acquiring them. The corn flakes are then sold at a considerably higher retail price. The difference pays for the building the shop is situated in, the utilities it consumes to offer its sales services and the salaries of its members of staff. The residue is banked to pay for planned and unforeseen bills which ensures that the shop is able to continue trading under any circumstances. This naïve example highlights the way in which commerce is conducted and adds value. EOSC and its service aggregators are not corner shops but they do have costs and could use a pricing approach to ensure their respective sustainability.

We surveyed the four Service Aggregators<sup>1</sup> in order to understand the situation. We chose them for a number of reasons, mainly because they were previously identified as being valuable collaborators in the EOSC ecosystem and they are currently supported mainly through EC project funding and have varied approaches to maintaining the administrative core of their own community management systems.

Requests for interview were sent to our contacts in: EGI, EUDAT, GEANT, and OpenAIRE. Each participant in the survey received a small set of questions, which were designed to initiate a conversation rather than to collect hard data. This approach was taken because we felt confident that we would not be able to obtain the hard data without considerable time and effort being expended by the participating organisations. A more informal approach can often lead to the exposure of useful insights. The initiator questions were:

1. How much does it cost to run your central organisation?
2. How much do you need to contribute to the federated national/institutional entities you depend upon?
3. How much do any bought in services cost you to acquire?

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<sup>1</sup> In D3 we identified the value to EOSC of retaining the existing e-infrastructure organisations as service delivery partners as they contain valuable knowledge and also reduce the complexity of managing the national entities that are ultimately responsible for service delivery.



4. What kind of additional charge do you need to apply to ensure you can continue to develop as an organisation?
5. Do any national laws/regulations that you are aware of prevent or limit your national service providers selling services to a central EU entity? This question does not relate to the notion of common good, or quid pro quo relationships, we are interested in relationships based on actual financial transactions.

The conversations that took place around these questions were less confusing for the participants because we employed a different method. Instead of requesting the participants complete a questionnaire, we went straight to the interview and talked around the questions in some detail to explain ourselves. However, the fact that such extensive discussions were required indicates that confusion about EOSC still exists within the community.

The four service aggregators were asked to contribute to an investigation into the pricing model laying behind their ability to deliver the EOSC Core Services. Any costs behind these prices were to cover only the management, administration and helpdesk functions of the central organisation and were to exclude development costs for their services.

During the interviews conducted for this part of the study, it became clear that the service aggregators have started to take into account business modelling aspects in their work and recognise that they are moving into an environment where they face competition. Whether this is true or not is not really the point, it is the fact that they are thinking this way that is what is important. In fact, it is clear that entrepreneurial thinking is starting to occur. In the main, great comfort should be gained from this situation; however, in the short term it makes the job of those working in the Sustainability working group more difficult, as some information is not readily available. For example, in all of the interviews, the participants provided numbers in response to question 1. In all cases, when digging further into those numbers, it became increasingly difficult for the participants to provide further information.

The table below does not contain any confidential figures. This does not mean, however, that the table has no value.

The questions were answered as follows:



	1. How much does it cost to run your central organisation?	2. How much do you need to contribute to the federated national/institutional entities you depend upon?	3. How much do you bought in services cost you to acquire?	4. What kind of additional charge do you need to apply to ensure you can continue to develop as an organisation?	5. Do any national laws/regulations prevent or limit your national service providers selling services to a central EU entity? <small>This question does not relate to the notion of common good, in-kind services or quid pro quo relationships, we are interested in relationships based on actual transactions.</small>	6. Funding Sources
<b>EOSC Service Aggregators</b>						
<b>EGL</b>	EGL.eu head count varies, depending on income and need for posts. EGL.eu head count is partly supported by membership fee. EGL membership is not restricted to national entities but also network entities	Part of the membership fee is redistributed back to our members to pay for EGL specialised services. However, for end user services we experience a vicious feedback loop. EGL services are seen as being of low criticality to EGL members, so if the barrier to entry for end users is too high, they won't use EGL services and they look elsewhere. This means that the national centres will then discard the EU work (and staff) to focus on national service	S/W licenses and use fees Most costs are in member labour fees for setting up services etc.	We have adopted a strategic approach to participation in research projects. We do not need to charge for development. We do need to charge for capacity availability because we have no ability to build this into our business model.	Yes. Managing our exposure to VAT is a huge problem for us in this respect. We can be exempt on very specific items but our exposure is binary, if one item becomes subject to VAT then everything becomes exposed to VAT. We have considered setting up a dedicated commercial arm to deal with this but our low margins mean this is not a viable option for us	H2020 Projects Member fees
<b>EUDAT</b>	6 people 3 FTE but only for managing community. Need to double this to face EOSC 3-5% of income is for secretariat, rest is distributed to members	Costs are incurred but their calculation is complex. Shared national and EC services already run on same machine. So EOSC could be sharing services that are already shared in the same physical infrastructure	None	Double the size of the current team for EOSC as stated. Do not want to grow further and no growth plans currently exist. But could grow if required.	Partners are limited in this area because of funding organisation rules, those that can have very limited resources for reselling. EUDAT allows member reselling of services but direct selling is not allowed in many member states. Budget practices are part of the problem as they do not allow for responsive behaviour. Funds are allocated on an annual basis. So the data centres cannot respond to any additional unmet need within any financial period and have to make the case for such a need to be addressed in the next financial period. The case may be rejected. Growth cannot take place until/if next budget is agreed and even then, only if growth is supported by the funder. Currently, the overheads are limited and are able to satisfy only current needs for	H2020 Projects Member fees Selling services
<b>GEANT</b>	<b>NO RESPONSE</b>	<b>NO RESPONSE</b>	<b>NO RESPONSE</b>	<b>NO RESPONSE</b>	<b>NO RESPONSE</b>	Selling services
<b>OpenAIRE</b>	6-7 people in office	Only Zenodo and Graph are required as contributors. Both run independently of the management function	€1000 pa for MS service fees Approx €20K p/a for other general fees	???	Not an issue, maybe maintaining long-term access to Zenodo is a potential hazard but luckily CERN is special case in this respect, being an international organisation itself.	H2020 projects (as partner); EU (consumers) Private companies (small) Member States -> self-value-add service Worlwide connections e.g. South Korea

Figure 2 Service Pricing Feedback from Service Aggregators

See Annex E: EOSC Core Service Pricing, for a more detailed view.

We were expecting to uncover margins of between 25% and 50% of service coast as a baseline service delivery price. The responses suggest that there is not yet a full understanding by all the service operators of the true costs of running a service in a manner that ensures the organisation is able to cover its costs and retain sufficient funds that enable it to grow or seize opportunities when they arise. Without this kind of understanding, viable business modelling cannot be carried out successfully and, correspondingly, it is difficult to foresee some of these entities achieving true sustainability without acquiring additional skills. However, there is evidence of entrepreneurial activity taking place on a small scale. In summary, things are starting to move in the right direction but that movement is slow.

It is clear in the answers to question 1 that all of the service aggregators run a very lean team. Most keep the core team very small, to act as a community secretariat. EGL engages personnel to meet its needs which extend beyond community organisation. Such behaviour is probably the result of insufficient income to enable grow.

Question 2 reveals the complexity of the relationships that the service aggregators share with their national member organisations (note that OpenAIRE is different). EGL has a complex organisational relationship with its members, while EUDAT has a complex technical relationship to manage when it comes to managing services. It is likely that both organisations share organisational and technical complexity, it is merely a feature of the interview process that these two facets emerged from two contributors.

The answers to question 3 unfortunately reveal a limited understanding of detailed costs. There is a great need for the service aggregators and the wider EOSC community to be able to truly



understand costs. Costs underpin prices. Sustainability cannot be achieved without defining a pricing model for services that reflects reality. Getting this wrong results in two possible outcomes: either the model is insufficient to achieve sustainability or the model is too generous to be acceptable to funding agencies.

The answers to question 4 reveal further complexity. In all cases, there is a symbiotic relationship between the service aggregator and its service providers. In all cases, the membership fees paid by members to the service aggregator are at least partially returned to them. EGI retains funds that it uses to pay its members for capacity that is not accessed through project funds. EUDAT distributes the majority of its project income to its members.

The domain of question 5 is where the service aggregators experience most practical difficulty. They face difficulty dealing with national rules that discourage cross-border working and service reselling. In particular, the differences between national taxation (notably VAT) and public procurement rules are simply too difficult to tackle. The national members of the service aggregators operate with very low overheads and, therefore, have no ability to build the spare capacity needed to provide flexibility. It is not clear within the member organisations how spare capacity can be paid for, in order to cater for peak demands and unpredictable loads.

Question 6 reveals that H2020 is the most common source of funding for the service aggregators, with membership fees covering some aspects of central organisation. Entrepreneurial activity is emerging, with both EUDAT and OpenAIRE selling services.

It was originally foreseen in this part of the study to determine what charges needed to be applied to the basic service costs in order to determine the likelihood of their long-term survivability in relation to their forming components of EOSC service delivery. As can be seen from the table above, this has not been possible and not only because of insufficient information about charges but also because it is clear that not all aspects of achieving truly sustainable operations are considered. In the first part of this study, we were able to estimate (through simple summing of individual service costs) an annual cost of the EOSC Core services as being around €7M per year. Given the organisational complexity of EOSC and the way that most of its components are funded, we estimate that this annual cost is too low. During the more recent service pricing discussions the numbers that were revealed to us are also considered to be too low.

The EOSC landscape is still not fixed and even experienced people remain confused about EOSC.

Some Tinman core services are still missing: notably, the interoperable metadata framework. A new, Iron Lady core service is missing: the Operational support services. However, this may be because the description of this core service in the Iron Lady is unclear. Procurement is still not considered as a Core Service, this could prove to be a mistake. An additional service, the Explore service from OpenAIRE, has been mapped to the Data Access Framework in the Iron Lady core service list.

Core costs and pricings are likely underestimated. This view is based on the incomplete data collected against service costings and the incomplete service aggregator pricing models.

The finding that some skill-sets are not adequately represented has been reconfirmed in this part of the study, in particular:

- Business modelling, planning and development



- Financial modelling and planning, including micro-payments
- Market modelling and understanding
- Regulatory and tax compliance
- International service provisions

The need to retain the service aggregators is re-emphasised as the nature of their relationships with the national memberships are byzantine in their complexity. Managing these kinds of relationships at the EOSC level will be untenable.

Practically, EOSC should not try to be ambitious in its early phases. It needs to be pragmatic: starting with what is possible, only moving on when circumstances have stabilised.

EOSC is trying to assemble a set of cloud services to benefit European scientists. It is assembling services that it does not own and which are operated with very low overheads, with funds being allocated on an annual basis. The services are designed to service prescribed communities of interest, which are often national communities. There is little to no interest for the operators of these services to broaden access because there is no incentive to do so: funding is one problem with the constraints of their rules and regulations being another. Everything that needs to be done in order to achieve EOSC ambitions is (rightly) seen as a problem because the lack of overheads undermines operational flexibility. Activities such as cross-border service delivery, VAT payments, procurement and micro-payments represent severe obstacles to service integration.

Compare this with, for example, Amazon Web Services. Amazon owns all of the services it operates along with the hardware they run on and the facilities they run in. Amazon operates globally, delivering services across borders, handling VAT (and other forms of sales tax) in many different jurisdictions. It meets all procurement regulations also in many different jurisdictions. It is able to handle micro-payments for services, like the many other kinds of services run by on-line gaming companies. Consequently, we see that none of the obstacles faced by EOSC prevent Amazon from succeeding.

Amazon is a profit-making business but this is not the reason why it does not struggle with the same obstacles that hinder EOSC. The difference is that Amazon chooses to fund the resources it requires to address these obstacles from the profits it makes. EOSC cannot do this because of the tight overheads within which it has to operate. It seems logical, therefore, that EOSC should be funded centrally by the EC to a degree sufficient to allow its partners to address these obstacles. Moreover, if the EC were to engage with national governments to reduce some of the cross-border service delivery and procurement frictions (maybe through the provision of incentives), along with addressing the community-specific rules that the national centres operate under, then the level of the funding requirement would reduce. If successful, this approach could be thought of as the creation of a Single Market for EU research products and services. The handling of micro-payments is considered a technical and operational problem.

Amazon built its infrastructure using massive investments and spent many years suffering losses before it broke even and started making profits. It is now one of the most valuable companies globally. The EC should perceive its funding of EOSC in the same way as Amazon investors - as a long-term commitment with a considerable payoff when it is successful. As EOSC is a publicly funded entity, that payoff will be measured in a massively declining requirement to fund EOSC in perpetuity and in the increased quantity, quality and diversity of EU research outputs, it will not be measured in dividends, valuations or profits.





However, as stakeholders in EOSC ecosystem, the EC and the member states are unlikely to make such moves unilaterally, so EOSC should begin lobbying, now, for the changes it requires to be implemented in order to achieve its objectives.

Furthermore, VAT and procurement are only part of a bigger problem. The risk around these activities also has to be taken into consideration. Risk also has a cost associated with it, as risk increases so does the financial cost of addressing it in a satisfactory manner. Consequently, procurement, VAT (and other taxation issues) and risk management are all funded through overheads (or profits). Again, such problems cannot be solved from within EOSC alone and will require external support.

Lobbying is required to establish either a single market for research or gain permission to operate with greater overheads. EOSC and its underpinning service aggregators need to find a way of fitting the approach associated with commercial spending thresholds into a public finance model. This will involve the leadership in long and complex negotiations with the funding bodies at national and EU levels as well as with policy-makers in order to explore the removal or relaxation of the current barriers to EOSC sustainability and that of its underpinning service aggregators. Such negotiations will first require the EOSC community to gain expertise in these domains.

In summary, the tight overheads and lack of ability to build up reserves to improve service flexibility or fund service expansion is an important problem. There are two possible solutions:

- either the EC creates a single market for research in Europe AND provides incentives for national resources to deliver across borders,
- OR participating national and international entities are funded in a manner that allows increased levels of overhead to acquire expertise and resources to deal with the varied VAT and public procurement regimes and to build up of financial reserves to allow operational flexibility.

### 3. Funding Mechanisms that could be of interest to EOSC CORE + MVE components

Apart from revenues that could be possible should the EOSC MVE users be willing to pay for its services as per the business models already described, this section will investigate and list different types of funding mechanisms available in Europe in order to give the financial / other resources to the operators of the various components of the MVE to keep working.

We will consider different levels of funding, both public and private and explain the different conditions that need to be met for each to become available.

We are aware that an initial overview of funding schemes was also documented in the draft EOSC partnership proposal (May 2020, section 2.2.6 Investments needed for EOSC<sup>2</sup>) however our

<sup>2</sup> [https://ec.europa.eu/info/sites/info/files/research\\_and\\_innovation/funding/documents/ec\\_rtd\\_he-partnership-open-science-cloud-eosc.pdf](https://ec.europa.eu/info/sites/info/files/research_and_innovation/funding/documents/ec_rtd_he-partnership-open-science-cloud-eosc.pdf)



search went wider and also into national and private levels, thus augmenting the number of funding opportunities that could be used.

## European Level Public Funding Schemes

This is the first and most obvious level of funding schemes and what has been used to date in order to build the various components and also fund a certain level of operations / pilots. However this can be further split into different types of funds according to the programmes, and on whether one will consider Project Level funding or Operational Support Funding. The following are the programmes of potential interest

- **Horizon Europe<sup>3</sup>**

This is a continuation of Horizon 2020 and therefore offers primarily **Project Level** types of funds for eInfrastructure Projects, research communities, piloting projects but also **Operational Level** types of funds similar to the Virtual Access ones that have been started in the last few years.

The complexity of having multiple projects with a complete variety of consortium partners is however stifling and is the main reason why there is clear lack of harmonisation or even communication sometimes between different actors in the EOSC multiverse to date.

Therefore continuing in this vein might be detrimental in the long term although clearly an advantage from a financial point of view to the different actors in the short term.

- **Digital Europe<sup>4</sup>**

This is a completely new programme that will be launched in the next Multiannual Financial Framework (MFF) and has promised to be more about implementation rather than research and development. The policy sectors addressed by this programme clearly match those that are in EOSC, however this once more promises to be **Project Level** type of funds and therefore might suffer from the same fragmentation issues seen above in Horizon2020

- **CEF2<sup>5</sup>**

The Connecting Europe Facility Digital Programme is a continuation of CEF in the current MFF however in the next financial period it will take on board more of the digital infrastructure areas (similar to broadband connectivity). Therefore this could also be a potential candidate for some of the work to be done by EOSC since one could argue that after all EOSC is going to be ensuring digital connectivity infrastructures.

CEF2 projects however require the **blessing of the member state** in question, and therefore in this respect one would need to look at the country where the applicant of the funds will be based. If the EOSC legal entity is in **Belgium**, but however the operators and the EOSC Core service aggregators are in **Netherlands, Finland and Greece** (as per our Delivery 3 Annex 2), then it is unclear how the other member states will be involved (see also below in National Funding). One needs to note that there are some limitations in who

<sup>3</sup> [https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme\\_en](https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme_en)

<sup>4</sup> <https://ec.europa.eu/digital-single-market/en/europe-investing-digital-digital-europe-programme>

<sup>5</sup> <https://ec.europa.eu/digital-single-market/en/connecting-europe-facility-cef2-digital>





can get access to CEF2 funds (for example not all European associated countries can be partners)

- **Eureka / Eurostars**

<https://www.eurostars-eureka.eu/>

This is a programme for commercial entities that would be creating innovative services, and therefore as such it might be available for the creation of some of the EOSC Marketplace services that will then be sold through the EOSC Exchange. However a clear commercialisation route needs to be present, and also only the entities that are clearly commercial (for example, the aggregators that are a Limited Company) might be able to apply. Once more this would be however a **Project level** funding with all the complications that it entails coupled with the requirement of a more **commercial** offering that needs to be developed

- **European Institute of Innovation and Technology (EIT)**

<https://eit.europa.eu/>

This is a different European legal entity which is separate from the European Commission and works with a variety of technology topics that are however closer to market rather than heavy research. However even here thanks to the various sub-areas in the EIT Innovation Communities, there could be space for working together with EOSC components, although once more this would be **Project Level** funding and again more **commercial** offering oriented. As such this would therefore be better for the individual service providers that want to offer a clear and succinct business like service, however lots of these communities within EIT could definitely also benefit from EOSC so a bridge could be built here that might also mean some funding possibilities.

- **Other DGs / EU Agencies**

One could continue listing several different types of funds and calls that come up sometimes ad hoc and sometimes on a clear annual calendar from different European Agencies similar to the INEA (<https://ec.europa.eu/inea/en>) - Innovation and Networks Executive Agency or even the Joint Research Centres JRCs (<https://ec.europa.eu/jrc/en>). Even on a short cursory visit to anyone of these sites one can see a lot of potential overlap and details that would be there with EOSC, and as such, there seems to be little outreach to some of these other “funds” or potential supporting agencies. The full list of these can be found here: [https://ec.europa.eu/info/departments\\_en](https://ec.europa.eu/info/departments_en)

## National Level Public Funding Schemes

On the National level, it is clear that the situation becomes a bit more challenging since, if one has to go to the different Member States (MS) for them to financially support the operations of the EOSC Core / MVE. There need to be clear “wins” for the different MS so that they accept to do this, and therefore it might be a long road that would require a certain level of diplomacy. However, in the short term, there are already funding mechanisms at National levels that could be directly targeted by the different legal entities that are either service providers or aggregators and somehow already are part of the EOSC/Core MVE provision. Supporting a legal entity from their



own member state would be a smaller “sell” to each MS, although this might create an additional level of complexity since different components of EOSC would be funded with different strings attached. However in this overview we wanted to highlight the following schemes

- **European Regional Development Fund (ERDF<sup>6</sup>)**

The ERDF funding is a type of funding instrument that is available in all MS but with a different co-financing percentage according to the Gross Domestic Product (GDP) level of the country in question. This instrument is normally used to improve the infrastructure of a country, and to ensure that there is clear investment in areas related to the following thematic areas:

- **Innovation and research;**
- **The digital agenda;**
- Support for small and medium-sized enterprises (SMEs);
- The low-carbon economy.

The first 2 areas are clearly ideal for supporting EOSC and thus, such an instrument could be used by the legal entities that are registered in a particular Member State to not only go for **Project Level** funding, but in some cases also take care of **Operational Level** support. However each MS has its own national authority that decides on local rules and regulations and thus it is difficult to give a homogenous overview. What is definitely clear however, is that the components of EOSC Core / MVE would need to **coordinate internally** and then individually ask their own ‘host’ Member State to support with such funding.

- **European Social Fund (ESF<sup>7</sup>)**

ESF Funding is also another type of Cohesion funding that is administered at MS level with different co-financing requirements from each state according to their GDP. In this case however the emphasis is more on **human resources** rather than infrastructures and therefore this might make it a bit more difficult to access for the EOSC Core / MVE Service components. With regards to the importance that we highlighted in Delivery 3 of our study, of the training, expertise and support elements when it comes to implementing EOSC in practice, ESF funding would however be a good fit and thus could be also part of the suite of funding schemes to be considered. Once more **internal coordination** with the ‘host’ Member States of the various legal entities that are part of the service providers of EOSC CORE / MVE would therefore be vital to ensure a proper coverage of funds and support service.

- **Interreg Europe**

<https://www.interregeurope.eu/>

Interreg focuses on cross border and macro-regional (as in parts of Europe, and not parts of a country) types of funding, and in this case has different Managing Authorities that administer the funds on behalf of Brussels but for projects emanating from a particular macro-region. As an example Interreg Baltic contains in it some regions from Sweden, Finland, Estonia, Latvia, Lithuania, Poland, Germany and Denmark, although not the whole countries in some cases, but only those parts that are around the Baltic Sea. One of the top priorities of Interreg is “**Research and Innovation**” and therefore this is also of potential interest to EOSC Core / MVE. However this would add the usual complication of Project Level funding coupled this time with checking in which regions are the legal entities that make up some of the components of EOSC Core / MVE located.

<sup>6</sup> [https://ec.europa.eu/regional\\_policy/en/funding/erdf/](https://ec.europa.eu/regional_policy/en/funding/erdf/)

<sup>7</sup> <https://ec.europa.eu/esf/home.jsp>



### Note: Underspending in Cohesion funds is an opportunity!

In our research in the Cohesion National funds area, it became increasingly clear that some countries are underspending the cohesion funds, and therefore this could be a good opportunity for EOSC to move in and discuss in detail with these Member States and create a win-win where the funds are spent and the country improves on the KPIs that it had originally agreed to. The following image is taken from

<https://cohesiondata.ec.europa.eu/overview> which is the open data about the current spending situation for each country.

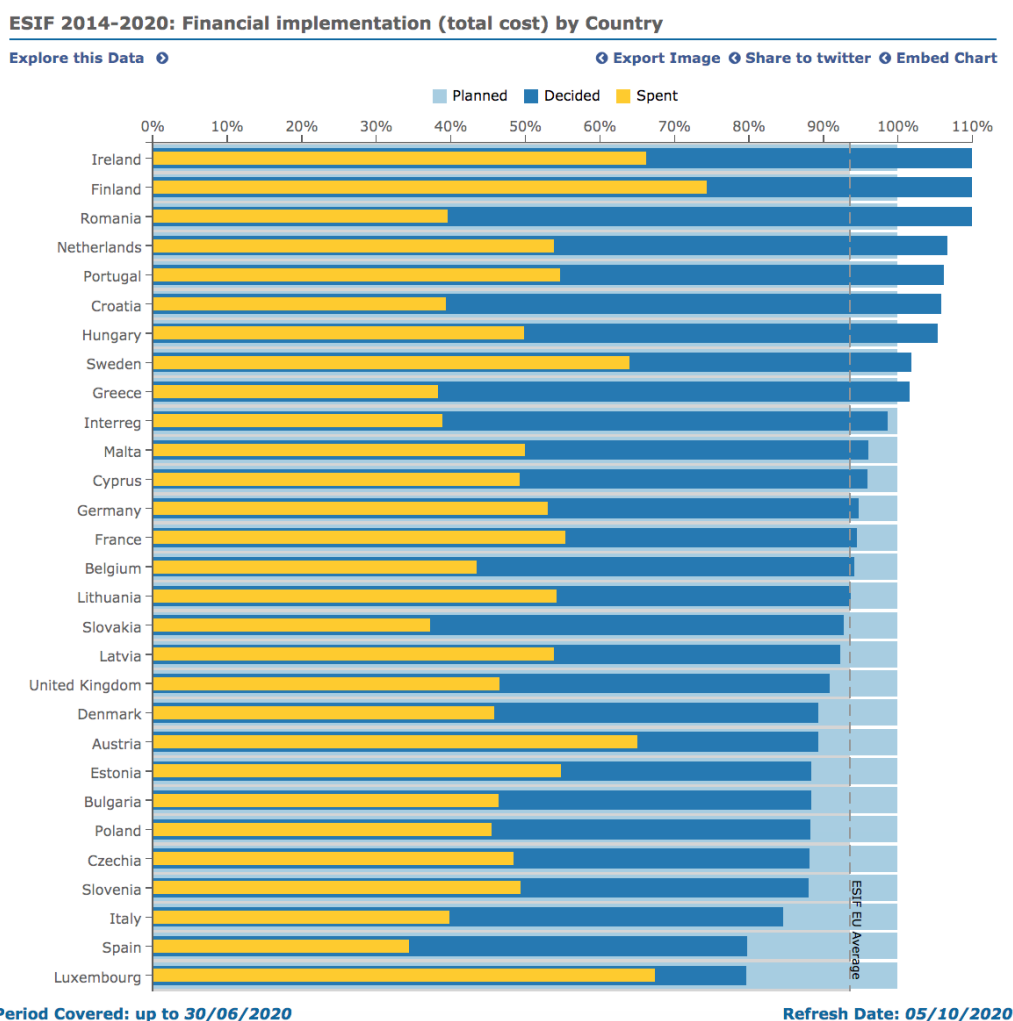


Figure 3: ESIF Implementation by Country

#### - National Research Funds<sup>8</sup>

Apart from the previously mentioned nationally administered funds which are still somehow linked to the European Union, however many of the European countries, have their own national research programmes which also have a healthy budget when it comes to funding research. Going through the list of the different individual countries is quite cumbersome since many of these are in their own national language, however all of the

<sup>8</sup> [https://www.scienceeurope.org/about-us/members/?type=Research%20Funding%20Organisation%20\(RFO\)](https://www.scienceeurope.org/about-us/members/?type=Research%20Funding%20Organisation%20(RFO))



research funding organisations have an international dimension, and therefore they should (in principle) be in line with the mission and vision of EOSC.

Once more here we however hit the diplomatic route requirement, since each European country would need to somehow be convinced that through supporting EOSC they would be actually supporting their own researchers better, and this might be in stark competition to local research organisations that need the state support to survive.

However it could be argued that support does not have to be “**in cash**” but also “**in kind**” and this would widen the possibilities of support from various member states, if they would be able to **pledge either compute, data storage, support staff or any other type** of help to EOSC. A mechanism for counting such support would have to be put in place in order to ensure that tabs are kept on who is supporting and who is not, and this might be similar to a ‘naming and praising / shaming’ situation which could (hopefully) help nations to come forward and give to the common EOSC cause.

## Private Funding Schemes (European / National)

In our hope to be as open and as wide ranging as possible, we also would like to consider a completely different type of funding mechanism that might potentially be applied to EOSC. This would be coming from the private sector, where we see large international foundations and corporations that for their own reasons (Macchiavellian or philanthropic) might want to support EOSC Core/MVE either with cash or as mentioned above with in kind contributions.

### - **Private National & International Charitable Foundations**<sup>9</sup>

Many of the European countries have different philanthropic foundations that operate within their borders and who promote development in Europe and the world through a variety of means. Research and Innovation is definitely important and a key to many of these foundations that would consider supporting different causes if a clear and direct positive impact can be proven. With this in mind, it would appear that EOSC Core/ MVE might be a candidate for such foundations, although in this case it might be easier for those different service providers and aggregator legal entities that have a non-profit NGO type of registration. Again, here it would mean that a **coordination effort** needs to be done by the different components of EOSC Core / MVE to ensure that they would apply in parallel to ensure that different aspects are covered. However the Corona crisis might at the moment divert the attention of such foundations towards more pressing needs like food and health. It would be a complex solution, but definitely one to be investigated.

### - **Corporate Social Responsibility (CSR) Foundations**<sup>10</sup>

Whether it is the large multinational or the original wealthy founder, recent years have seen the proliferation of CSR activities by a variety of large corporates like Microsoft (and Bill & Melinda Gates), Google, BBVA, Volkswagen and many others. The main reason behind such activities is both improving the public image of the companies and in the

<sup>9</sup> <https://dafne-online.eu/country-profiles/>

<sup>10</sup> <https://www.csreurope.org/>



meantime get some potential tax breaks. Within Europe there are many national networks of CSR companies, and each one of these would have its own particular focus and position of what and how to support research and innovation. To our understanding the aims of many of those corporates that somehow either hail from the digital world or are interested in particular research areas, might be in line also with the vision of EOSC. The issue here would be that engaging with such CSR entities might take time and it could also potentially alienate some of the main stakeholders of EOSC, so this needs to be approached in a very delicate and targeted way. However it is a clear source of funding and as such should not be ignored.

- **Joint European Disruptive Initiative (JEDI<sup>11</sup>)**

The Joint European Disruptive Initiative (JEDI) is a private entity whose purpose is to bring Europe in a leadership position in breakthrough technologies. It is powered by 3.700 leaders of Europe's deep tech ecosystem in 23 countries including many entrepreneurs. Since JEDI is launching Tech GrandChallenges to push the frontiers of innovation, with a radical method based on excellence, no geographical return, speed, high expectations & bold risk-taking, then it makes it a potential candidate for funding for EOSC since this would be an enabler for all research within Europe. There will be future funding calls that are loosely modeled on the American DARPA programme, although it's not yet clear how these will function.

## Summary and overview of funding mechanisms

It is therefore apparent that there are many potential funding schemes and mechanisms that could be used in order to fund the different components of EOSC Core / MVE, however some of these create additional complications that are not trivial.

A strong recommendation for this chapter only, is that there needs to be a **centralised fund/financing hunting team** (that could maybe sit in the newly formed EOSC Association), that is made up of entrepreneurial individuals whose aim is to ensure that no stone is left unturned when it comes to sourcing funds for EOSC. This team would need to **liaise with the diplomatic representations** of the various Member States to garner financial support for the ongoing existence of EOSC. This might mean for example, that **ERDF national authorities might start to see that support to EOSC would become an acceptable use of funds.**

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<sup>11</sup> <https://jedi.group/#intro>



The following figure summarises the different dimensions of the discussed funding schemes.

	Good Fit	Partial Fit	Project Based	Operations Based	Existing Scheme	Requires Discussion	Joint Application	Individual Entity Application	Simple / Known	Complex / New	Cash	In Kind	Time Window	Size of Funding
<b>European Level Schemes</b>														
Horizon Europe	X		X	X	X		X		X		X		Short	Large
Digital Europe	X		X		X	X	X			X	X		Short	Medium
CEF2	X		X	X	X	X		X		X	X		Medium	Large
Eureka / Eurostars		X	X		X		X		X		X		Short	Small
EIT		X	X			X	X			X	X		Medium	Small
Other Dcs / Agencies	X	X	X		X	X	X			X	X		Medium	Medium
<b>National Level Schemes</b>														
ERDF	X		X	X	X			X		X	X		Short	Large
ESF		X	X		X			X		X	X		Short	Medium
Interreg		X	X		X			X		X	X		Short	Medium
National Research Funds	X			X		X		X		X	X	X	Medium	Medium
<b>Private Funding Schemes</b>														
Charitable Foundations	X	X	X	X		X	X	X		X	X		Short	Medium
CSR / Corporate Foundations	X	X	X	X		X	X	X		X	X	X	Short	Medium

Figure 4: Summary of Funding Scheme Dimensions

Notes:

- **Good vs Partial fit** refers to whether a funding scheme is targeted towards infrastructures or not since we were primarily looking to fund the service components of EOSC Core / MVE. Those with partial fit have elements that are either looking more at human resources or else they might be more challenging since they look at geographical areas that are tougher to adhere to clearly (eg, specific regions of specific European countries)
- **Simple / Known vs Complex / New** refer to those instruments that have been so far clearly used by the entities behind the service providers and aggregators, and therefore there is already knowledge in the entities of how to address them



## Case studies of European Level entities that successfully mobilized national funds

Through our studies and work with different individuals within the research infrastructures and communities of Europe, and also in the joint meetings with the Working Groups of the EOSC Executive Board, several examples of entities that have successfully mobilised member states funding to provide services or access to resources to a large number of countries and users were identified. We are mentioning them here, in order to inspire EOSC that such an endeavour is possible, however in all cases we were strongly reminded of the need for **deep and wide lobbying**.

A common feature in the 3 examples detailed below, is that they are **relatively narrow and finite in scope**, in such a way that is easy also for policymakers to understand and therefore support. **EOSC is more transversal and horizontal and thus suffers from being quite complex** for many to understand its added benefits.

### - Elixir

Elixir<sup>12</sup> is an intergovernmental organisation with a mission to unite Europe's leading life science organisations in managing and safeguarding the increasing volume of data generated by publicly funded research. ELIXIR coordinates, integrates and sustains bioinformatics resources – such as databases, computational services, applications and training – across its member states and enables users in academia and industry to access what is vital for their research.

Member States support Elixir by payments in cash, calculated as a fraction of their GNP. In 2020 the member states provided around **7 million Euro in annual subscriptions**. In addition, to varying degrees, the Member States also fund their local node. The local nodes contribute and donate in-kind efforts participating in pan-node activities, joint projects and performing ELIXIR related activities locally. In addition, ELIXIR and the nodes compete for grants, nationally and at the European level. Such grants include EOSC-Life, ELIXIR-CONVERGE, FAIRplus and B1MG.

ELIXIR also operates a number of funding schemes that nodes can apply to (as the nodes do the work) so money flows back to the nodes<sup>13</sup>.

### - EMBL-EBI

EMBL-EBI<sup>14</sup> makes the world's public biological data freely available to the scientific community via a range of services and tools, performs basic research and provides professional training in bioinformatics. EMBL-EBI is part of the European Molecular Biology Laboratory (EMBL), an international, innovative and interdisciplinary research organisation (EIRO) funded by 27 member states, 2 prospective member states and 2 associate member states.

<sup>12</sup> [www.elixir-europe.org](http://www.elixir-europe.org)

<sup>13</sup> <https://elixir-europe.org/how-we-work>

<sup>14</sup> <https://www.ebi.ac.uk/>





The largest part of EMBL's funding comes from the governments of its member states. EMBL also attracts significant funds from external sources, including some beyond Europe. Other major funders include the UK Research and Innovation (UKRI), via the UK's Biotechnology and Biological Sciences Research Council (BBSRC) and Medical Research Council, as well as the European Commission, the US National Institutes of Health, the Wellcome Trust, and members of EMBL-EBI's subscription-based Industry Programme primarily representing the pharmaceutical sector.

According to their most recently published annual report<sup>15</sup>, the total operating expenditure of EMBL-EBI in 2018 was €79.3 million with 57% coming directly from the member states.

## - EuroHPC

The European High-Performance Computing Joint Undertaking (EuroHPC<sup>16</sup> JU) is a legal and funding entity, created in 2018 and located in Luxembourg. The EuroHPC Joint Undertaking allows the EU and EuroHPC participating countries to coordinate their efforts and pool their resources with the objective of deploying in Europe world-class exascale supercomputers, able to perform more than one trillion operations per second and developing innovative supercomputing technologies and applications. EuroHPC brings together co-funding by member states and the EC for the next generation of HPC resources with agreements for access rights.

The EuroHPC Joint Undertaking is jointly funded by its public members with a current budget of around **EUR 1.1 billion for the period 2019-2020**. Most of the funding comes from the current EU long-term budget, the Multiannual Financial Framework (MFF) with a contribution of EUR 536 million. This sum is expected to be matched by a similar amount from the participating countries. Private members will also provide additional contributions to the value of over EUR 420 million, through participation in the Joint Undertaking's activities. The Joint Undertaking provides financial support in the form of procurement or research and innovation grants to participants following open and competitive calls<sup>17</sup>.

HPC sites (and the national networks managed by NRENs) do not compete among themselves. The HPC access mechanisms are based on scientific excellence using peer reviews but are not considered to be very flexible (e.g. the allocation process cannot react to urgent changes in needs).

EuroHPC considered whether the desired coordinated HPC funding contributions from member states would fall foul of state aid rules. Proactive action was taken to address this risk, in the form of an update to the interpretation of the state aids rules as they apply to Important Projects of Common European Interest (IPCEIs), published as a Communication<sup>18</sup> from the EC in June 2014.

<sup>15</sup> [https://www.embl.org/files/wp-content/uploads/EMBL-EBI\\_Scientific\\_Report-2018.pdf](https://www.embl.org/files/wp-content/uploads/EMBL-EBI_Scientific_Report-2018.pdf)

<sup>16</sup> <https://eurohpc-ju.europa.eu/>

<sup>17</sup> <https://eurohpc-ju.europa.eu/discover-eurohpc#ecl-inpage-163>

<sup>18</sup> [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0620\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0620(01)&from=EN). The Communication is valid until 31 Dec 2020.



## 4. Business Model taking into account MVE

In the analysis we performed, we followed the Platform Design Toolkit framework approach, which has been consolidated over several years. Please see Annex F. for more details. The Platform Design Toolkit framework approach starts with the analysis of the ecosystem under observation, by clustering the organisations involved in roles that they perform when interacting among each other and then consolidating them into a manageable number of Key Relationships that highlight the connection and the value exchanges between the most important roles in the ecosystem.

Platform Design always *designs for* an existing ecosystem, and never tries to design a new ecosystem. This is because a Platform strategy always needs to resonate with the expectations of the entities and roles active in the given ecosystem and offer services to support and leverage (hidden or unexpressed) potential exchanges. Nevertheless, platforms can scale up or across (i.e. horizontally, in adjacent contexts) very fast and they can't afford to pay for its adoption by the user. Users need to be pulled on-board by the platform, and this is accomplished by resonating with their expectations and providing them identifiable and well perceived value gains.

As the final outcome of the earlier part of this study, which aimed to define the sustainability model of the EOSC Core segment of the EOSC platform, we identified the ecosystem of reference for the European Open Science Cloud initiative as you can see in figure 5 below. Our purpose in the mapping of the Ecosystem phase is always to look at the whole ecosystem and identify all the potential contributors to value creation in it. As a second step we proceed, following the open source methodology "Platform Design Toolkit", to investigate the expectations in terms of needs, objectives, value gains and capabilities to provide value to others for all the key role/entities that belong to that ecosystem and are already exchanging value among each other, even if these value streams are not efficient or there still is so much hidden or unexpressed.

So, the ecosystem that we've mapped is already considering EOSC as a whole, thus including the EOSC Core and the EOSC Exchange segments. As previously stated, in the first part of the study, we focussed on the EOSC Core in terms of services that EOSC as a platform should provide to the ecosystem in order to enable the Platform strategy and support entities to leverage their potential.

In this final phase of the study we widened the scope of the previous outcome, giving recommendations and suggestions on how the different parts of the EOSC ecosystem could contribute to the global sustainability of the Platform strategy.



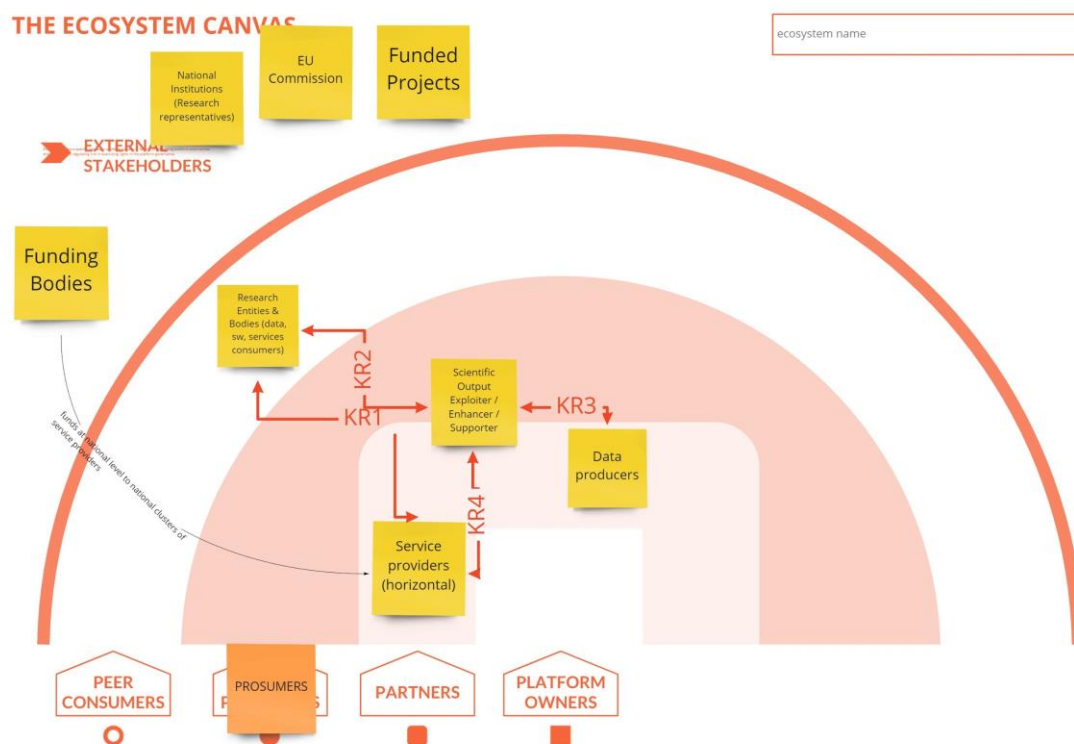


Figure 5: Initial Map of EOSC Ecosystem

In the ecosystem initial map, we have highlighted the following key roles. Please note that some of the Entities in the ecosystem can play different roles at the same time (or in different parts of the ecosystem, or when interacting with different other roles). Also, below you will find a brief description of the roles, for details please read the previous deliverable:

1. **Research Entities and Bodies (REBs)** are the **consumers of services, data and in general, of the value orchestrated** by the EOSC (Core) initiative.
2. **Scientific Output Exploiter / Enhancer / Supporter (SEEOS)**: They are context domain experts that can provide expertise on how to deal with data, services, resources in a specific domain, can provide consulting services on specific topics, help with experiments, data collection and elaboration, they can provide support in transforming datasets into FAIR open and interoperable datasets, help with data and resources exploitation, act as expert advisors and consultants for researchers and their tailor made special requests. The SEEOS can also act as a broker for the data resources that are not autonomously capable of managing the *exploitation of resources*. Example SEEOS entities are ELIXIR, OpenAire, Terradue srl, IN2P3 and ICOS RI.
3. **Horizontal Service Providers (HSPs)**: these entities provide general purpose services like storage, computational resources and consulting services on the services they offer. They can also provide consulting services around their offerings. They can be small providers or large horizontal EU e-infrastructures. Example HSPs include OpenAIRE, GEANT, EGI, XDC, CS3MESH, FREYA, ePIC, DOI/DataCite, FOSTER.
4. **Data Producers (DPs)**: these entities are mainly focused on providing Data that the Research Bodies are consuming. Research Infrastructures fall under this role when they are providing data to other parties. The data producer may be organized to permit the data to be exploited or consumed by the consumers. If the data producer needs help to prepare data for exploitation, it can ask for support and services from the SEEOS.



From the previous deliverable (the study on EOSC Core sustainability) there are no massive changes in the composition of the ecosystem map. However, it is important to highlight more features of some entities participating in EOSC especially as Horizontal Service Providers, and then we also added explicitly the role of the Platform Shaper and Governance body that will be covered by the new-born EOSC Association in the updated ecosystem map, seen below.

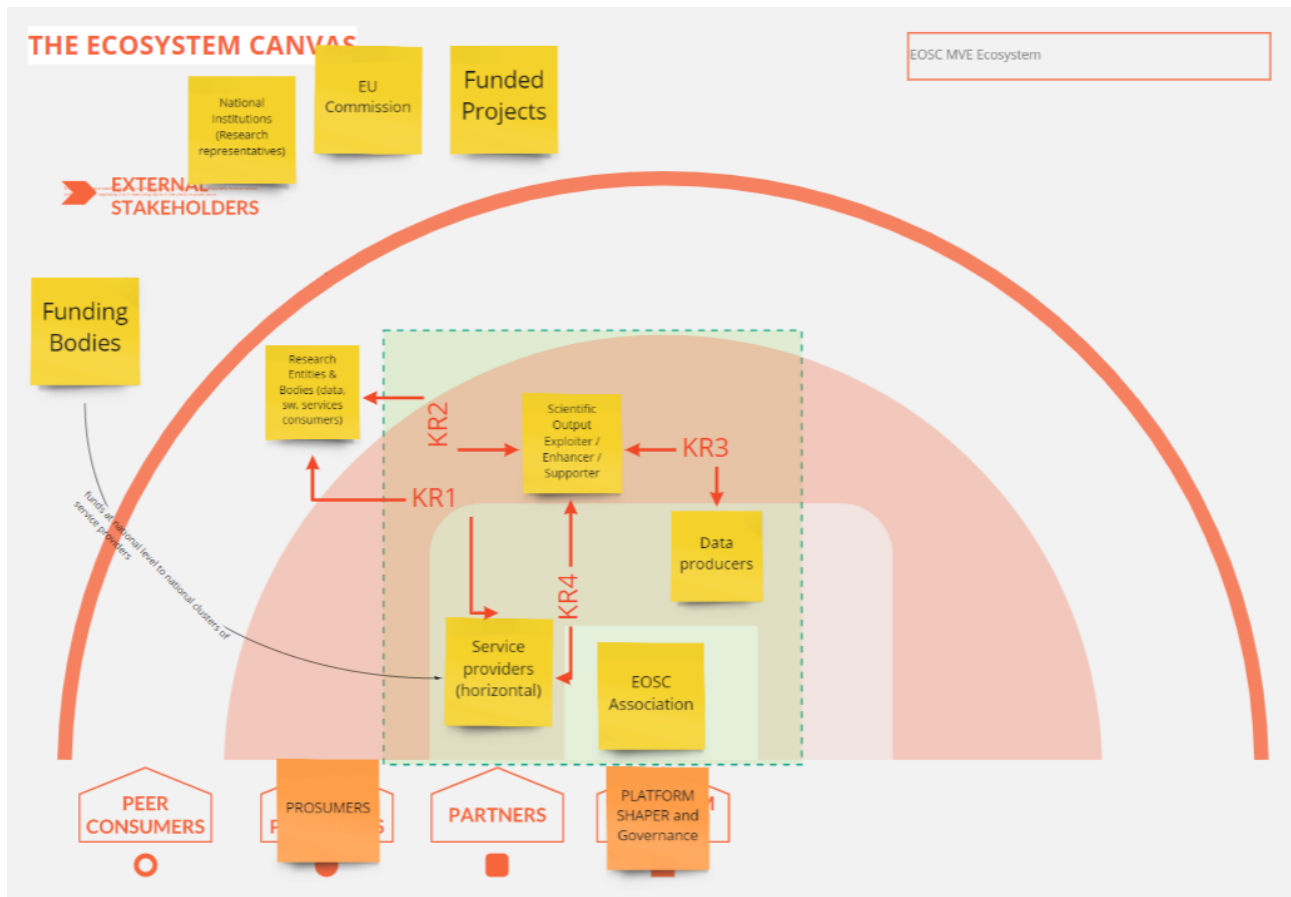


Figure 6: Updated Map of EOSC Ecosystem

Expanding on the Horizontal Service Providers (Géant, EGI, EUDAT, OpenAIRE), some of them are established organisations that provide the service backbone to researchers, since they represent existing e-infrastructures. Nevertheless, some of them have a strong platform potential because of their large networks of customers or communities, which means that the services they provide, like connectivity, can be the ground on which they can shape platform strategies and attract more users with network effects and becoming a platform themselves.

This has important implications on the “collaboration/competition” between same-scope HSPs and EOSC itself. As they change perspectives and they adapt their value chains to find synergies, EOSC strategy would be to approach them in a *coopetitive* way. This is a typical best practice in platform design. Every time it is possible to pick service providers from the ecosystem and enable them to provide their services through the platform to reach the final consumers, the Platform will help entities avoid direct competition. It will, instead, encourage all the impacted parties to find opportunities - through and thanks to the Platform orchestration capabilities - to work together in synergy, or to turn competitors into providers.



In the previous figure, we've also highlighted with the green box, what will be the recommended scope that EOSC should primarily focus on. This means that, even if the value will always flow from the supply side to the consuming side, the consumers of value - the research bodies - are requested to perform activities that go beyond their capabilities and competencies, when they need to access services and resources covered by the EOSC initiative. Purchasing cloud or computing services, configuring the architectures, dealing with international bureaucracies and international laws is something that goes beyond the scope of responsibilities of many researchers. So, EOSC in its role of organizing resources, should focus on the sub-system of entities/roles that can interact on behalf of the research bodies and offer to them its capabilities of coordination and orchestration of resources, to better serve them and release the pressure of unwanted administrative and technological chores.

To extend the scope of our initial study, from the focus on EOSC-Core to the entire EOSC, with the perspective of understanding what should be in the Minimum (or Minimal) Viable EOSC, we've invited to a series of workshops / interviews, as many representatives as we could contact, coming from different roles in the ecosystem, to validate our assumptions in the first part of the study and expand the knowledge we have on the real needs and behaviours of EOSC impacted entities.

## The harvest of information from the ecosystem

We have analysed the most recent documentation provided by the EOSC WGs, among which the SRIA survey, the Iron Lady draft, the EOSC-Hub report, the ESFRI Workshop minutes, and we also joined some meetings about the MVE steering groups (Sustainability, Architecture, FAIR Data WGs).

In addition to the desk study, we've organized three workshops and we invited representatives from the different stakeholders in the EOSC ecosystem. This activity has been performed through Miro, a collaborative software, whereby the invitees could add their insights dynamically and in real time. The workshop sessions were started with an introduction to our previous work and the fundamentals of platform design, only to give the invitees the room to start the discussion upon the design we made in the past studies and to add any critical information. To do so, we allowed them to modify our pre-compiled conceptual maps about the roles we found within the EOSC ecosystem. Then we reviewed and discussed the eventual modifications and moved on to illustrate the invitees the main outcomes of the previous study. We closed our workshops with open-ended questions such as the possible features that could be important to add to the Minimum Viable EOSC and the possibility of a pre-commercial procurement (PCP) service.

We have invited to the workshops / interviews sessions the following entities:

### E-INFRASTRUCTURES

- EGI
- EUDAT
- Géant
- OpenAire

### RIs

- AGINFRA
- CLARIN
- CNR-ISTI



- Dariah
- EURO Fusion
- European Molecular Biology Laboratory (EMBL)

#### Funding Bodies

- UKRI

#### HPC Centres of Excellence

- CompBioMed

#### SERVICE PROVIDERS

- Finnish IT Center for Science (CSC)
- STFC
- SURF

#### LARGE CORPS

- T-Systems

#### UNIVERSITIES

- University of London (UCL)
- University of Minho
- University of Utrecht
- University of Vienna (Univie)

Among these, the entities that joined the meetings have been:

- CNR-ISTI
- EGI
- EURO Fusion
- European Molecular Biology Laboratory (EMBL)
- Géant
- OpenAire
- STFC
- SURF

The response to our request for participation from the entities was relatively low but we put this down to the short notice periods we had to work with. Of those that we were able to engage with, many did not cover equally the spectrum of roles present in EOSC, with a clear lack of end-users (i.e. researchers).

Nevertheless, the interesting conversations we had during the workshops and the interviews led us to insightful elements for the study of the sustainability of EOSC “as a Platform”, that we are reporting in the following paragraphs.

## Transactional and Learning Engines, at EOSC Core level

In our understanding, any platform strategy is based on the creation of **two essential engines of value creation**. Designing, building and evolving these two engines (and finding a sustainable model to support them) is the most critical challenge.





The **Transactions Engine** consists of the set of **channels** and **contexts** specifically designed to facilitate interactions and exchanges between entities-roles. Transactions are—at least partially—already happening even before we deploy our strategy. This situation should improve as transaction channel design evolves, it is able to reduce the coordination/transaction costs and the friction associated with those transactions reduces over time.

**Creating and Improving channels to Reduce Transactions costs** (allowing more *niche* interactions) is the fundamental mission of this engine, since by making interactions easier, faster, reducing the cost of interaction between value producers and value consumers, platforms make it easier to interact in smaller niches: if the cost of coordinating with your consumer (as a producer) is lower, it will be easier to create a solution that fits exactly with the niche expectations. The purpose of this is to reduce entry barriers, remove frictions and asymmetric information, make small transactions sustainable and this invites more players to interact with their counterparts (on the supply or consumption sides) through the platform.

The **Learning Engine consists of** the set of support services (empowering, enabling) and contexts that the platform shaper provides and maintains for the participants so that they can learn, improve and evolve. The platform shaper helps entities-roles to cope with and adapt to the complexity of the networked age. As we live through a volatile, uncertain, complex and ambiguous world, the platform offers a huge promise of accelerated learning, ways to find new opportunities and hone new capabilities. The promise of a platform strategy is, essentially, that learning will happen faster by being “inside” than by staying “outside”. This engine is responsible for the attractiveness and the incentivizing of entities on both sides (providers and consumers of services, data, information, etc.) towards the platform itself, and it’s the internal growth engine of the adoption of the Platform services/aggregation in the ecosystem.

Both engines, that in practice will be unbundled in a series of atomic elements composing the supporting infrastructure that the Platform offers to the ecosystem, will be located in the EOSC Core, since they are the ground of the entire strategy to help the ecosystem evolve. With that we have all the services needed to run the basic infrastructure and they should be located at EOSC Core level, even if they will be more pertinent to other parts/sections. The Core will cover costs to provide the supporting services and infrastructure and will be also responsible for the management and the governance of these elements, while their use will be happening in the respective places of competence.

As a purely indicative and not exhaustive example, these services can be (taken from the Iron Lady document and extended as a result of our study):

- **A shared open science policy framework**, that is the inclusive sets of transparent rules shared with all the impacted players in the ecosystem, and represents the main (common and shared) value proposition that attracts the entities;
- **EOSC interoperability Framework**, that is the technical infrastructure fostering openness and collaboration;
- **Security policies and procedures**, protecting data and transactions since FAIR and interoperable need to deal with privacy at local and international level, as well;
- **Operational support services**;
- **Web-portal and interfaces**, towards entities

If we go back to the initial vision and mission of EOSC reported in the Strategic Implementation Plan, we read that *“the EOSC should be a federation of existing and planned research data*



*infrastructures, adding a soft overlay to connect them and making them operate as one seamless European research data infrastructure.”*

In the Iron Lady draft, we read that *“The main focus and value of EOSC is to connect such disciplinary infrastructures and research data to enhance disciplinary, cross-disciplinary and transnational research, leading to new scientific discoveries and new insights for society.”*

We all agree that EOSC is not a technology and has a role that is purely pertinent to the role of the Platform at strategic level. So, it’s a natural consequence that the initial or short-term focus of the MVE is as a “supporting and mentoring” role leading to a more continuous role as the “cultural/technical/legal mediator and advisor”.

Let’s broaden the scope of this reflection and consider the definition (and mission) of EOSC-Hub (as reported in the project's landing web-page):

*“EOSC-hub brings together multiple service providers to create the Hub: a single contact point for European researchers and innovators to discover, access, use and reuse a broad spectrum of resources for advanced data-driven research. For researchers, this will mean a broader access to services supporting their scientific discovery and collaboration across disciplinary and geographical boundaries. The project mobilises providers from the EGI Federation, EUDAT CDI, INDIGO-DataCloud and other major European research infrastructures to deliver a common catalogue of research data, services and software for research.”*

We also think that EOSC-Hub and subsequent implementation projects have an overlapping mission, that offers coaching and mentoring services. These are commonly designed as part of the Learning Engine of a Platform strategy. These services can be put into the EOSC-Core but, if the policy guides to keep EOSC-Core the lightest possible, in any case they should be part of the MVE.

Within our “platform design” approach, mentoring and coaching aspects are grouped into what we call a concierge service which is delivered through a “central concierge desk”, with the precise role of such a desk being agreed by the stakeholders. These desks should also be implemented in the approach of platforms, i.e. the platform itself will not try to re-implement and develop these services and capabilities from scratch, but it will invite and include the entities in the ecosystem that have this value to be provided, and offer them a proper channel (that is centralized) so that consumers can access those services and be put in touch with the providing entities.

EOSC Core could be then monitoring the global efficiency of these transactions and introduce services that are not available yet in the ecosystem, and can definitely offer a help desk function, limiting its scope to solving technical issues emerging in the interactions between ecosystem entities (i.e. the technical issues will not be probably “strictly technical”, most probably will be legal, or dealing with international regulations inconsistencies or contrasts).

If these “help and concierge” services can be freely accessed by ecosystem entities (looking at what they do to date) as a “marketplace” approach, they can continue to be offered through the marketplace, and the related costs will be left (in the funding and in the management of the process) to the single entities interacting. EOSC Core shall only cover structural costs related to



the new services (or “simply” to provide guidance when preparing and browsing a curated catalogue of resources).

The coaching/concierge support of the EOSC Core or MVE (depending on the strategic setup that is currently accepted by the founding entities) is needed to invite and guide entities in the first “interactions” with EOSC, since the EOSC Platform lacks a proper track record and is working on the definition of solid value propositions targeting the different clusters of users.

The recommendation here is to provide this supporting function with the dual purpose of supporting users and capture elements that will be new inputs for further refinements of the offering/value proposition of EOSC.

- In the first function of guiding entities in the accomplishment of their objectives we see, for example:
  - convert a dataset into a FAIR compatible format and publish it in an interoperable repository,
  - launch or join an international research project
  - publish the research outputs
  - increase the reputation of the contributing parties
- In the second function, this support capability will be able to detect the elements that can be useful to fine tune EOSC value propositions and to add, in an evolutionary and iterative way, more and more services and features that EOSC users value and demand.

This approach will have the effect of gradually increasing the number of EOSC users. Any associated success stories should be captured and used for marketing purposes through the correct and appropriate communication and dissemination channels.

The concierge function should not be confused with the “helpdesk” services. These services will be offered both at core level and in the exchange as a direct request for technical support from users, and the helpdesk will be provided directly by the service providers for what concerns their services offered through EOSC. A helpdesk can be provided at core level to support users in the management and use of the EOSC core services, but it will be covering the technical issues. The concierge service will have a broader ecosystemic scope, with the objective to foster the EOSC model adoption to all impacted entities.

In addition to this, and considering EOSC not as a “technology” but as a scalable collaborative agreement, we believe that the adoption of this common strategy towards cross-border research will grow constantly over time, and the value perceived will grow together with the number of users, so EOSC won’t suffer from the hype cycle ups and downs typical of “technologies”.

## Transactional Business Model vs Learning Business Model

Platforms do not have a unique sustainability model. They have a resulting, compound sustainability model, which is the union of different business models, each attached to an end-to-end, turnkey *experience* involving at least two different roles/entities. If we think of simple examples from existing platforms, the end-to-end experience can be “publish your personal data on your social network wall”, or “host someone at your home”, or “find the right service provider / consultant that can help you customize our software solution for your needs”.



Having said so, platforms' sustainability models substantially belong to two main families: transactional sustainability models, and learning sustainability models.

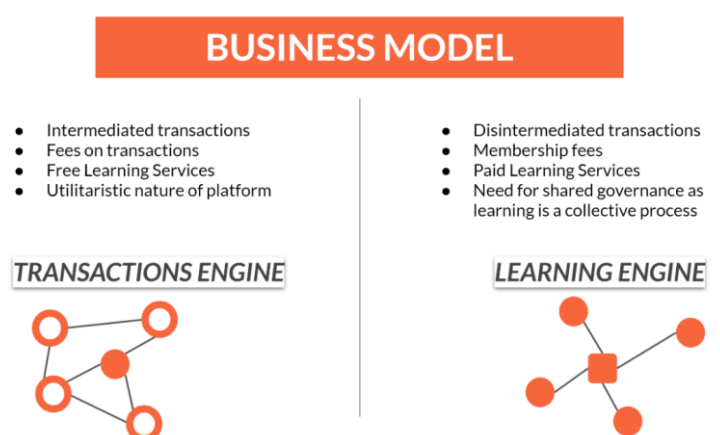


Figure 7: The Two Families of Sustainability Model

**Transactional models** (i.e. marketplaces) typically intermediate and manage transactions, capturing part of the transaction value through a transaction fee, and offer free “learning services” needed to attract entities and roles and nurture their capability and willingness to exchange value in the marketplace. The platform that is characterized by a transactional sustainability model is commonly a utilitarian platform.

**Learning sustainability models** are instead based on disintermediated transactions (that can happen also outside the platform) while they offer paid learning and membership services, where the perceived value is mainly on being part of a community and finding help and support or networking capabilities to improve the performances of the members. Learning is not intended only as educational, but also by having information and resources available to make decisions and act for the best options. These models typically enable a shared governance model, since *learning* is a collective and collaborative process.

It's important to pay attention to the (sometimes) subtle differences between the two families. Transactional models are typically based on pay per use/access/consume resources, on a single transaction basis. Learning business models on the contrary, do not charge single transactions (or they do not charge transactions at all) since the objectives of a platform based on the latter model is to hold the space for entities where these can find resources, guidance, support to accomplish their needs/goals in a more efficient and effective way: this implies a membership flat fee, or an indirect payment without strict monetization and profit objectives.

But if we pay for the access and consumption of services upfront, and then we consider to charge the transactions *ex post*, or with a retrospective evaluation of the services consumed, or if we give a flat free access with time or capacity limitations, we are presenting a transactional model *masked* as a learning model. The “payment” method or process used to fund the platform (or cover the costs for running the infrastructure) isn't the true discriminator.

More on this point. Transactions are not to be strictly intended as “buy/sell” something. This “commercial” aspect can be pertinent to EOSC Exchange for the services coming from the private sector (i.e. Cloud Providers) but it's applicable also in the public research sector, where we don't monetize services directly, but we manage access and the use of resources on a project by project



basis and in terms of components/modules/items. We are considering the transactional business model if the focus is on punctual and granular exchanges, while the learning and lobbying services are given free of charge. A platform like this has typically a utilitarian approach.

Learning models are focused on offering a “safe” or efficient space where entities can find a true support to their needs, and we think that EOSC-Core and the infrastructure that is supporting the MVE should be considered as a learning model, since the “conciierge”, guidance, translation services, curation of catalogues and users orienteering services are falling under the label “learning services”.

A couple of examples of what is a learning-based model of sustainability. The first is Apolitical (apolitical.co) that is supporting a community of citizens and public servants together that are willing to contribute to the policy-making process of the State. This initiative offers tools to exchange ideas and opinions, and offers micro-courses so that everyone can share the same language and could have the same opportunities to contribute. The pricing model is a freemium one, with free access for some, and a paid subscription for those who want to have access to all resources.

Another example is the community of organisations, institutions and professionals around the design of national ict solutions, like design-system.service.gov.uk or designers.italia.it. These projects are born to offer a space for the impacted entities where they can learn how to make software, web applications, apps that are sharing the same best practices (and the approved ones by law, taking into account usability, accessibility, rights, etc.) and they can also share and reuse parts of code, icons, UI kits, or offer and request consulting services. The pricing model is a free access model since both UK and Italy examples are paid by respective governments aiming at spreading the culture towards best practices, but both are technically ready to launch a marketplace of paid services that can sustain the whole initiative in the long term.

In addition, the primary mission of EOSC is to coordinate and monitor the usage of resources coming from the EC and member states thus contributing to the sustainability of publicly funded research. Offering the space where this research (at an international level) can thrive, where Member States can meet and create/join shared projects, where the researchers can publish their outputs and make them interoperable and reusable/accessible by others, while giving it without access limitations for those who are entitled to be members, is a typical behaviour of the learning model.

Another important aspect is that the platform, by orchestrating the interactions, is also monitoring what happens and where the ecosystem is evolving. Such monitoring capabilities can offer the opportunity (at the technological level) to set up a data-driven policy-making process, driving the allocation of public resources and funds to valuable (and transparently assessed) projects and to operate dynamically according to geopolitical assets and objectives of the EU in relation to other regional players.

To perform in the most efficient manner this role of transparent, data driven policy informer, it is fundamental that the Platform catalyzes the interest in a shared governance model. EOSC can be the place where the processes insisting on the European cross border research processes are redesigned (and not only digitized as they are), and where members (representing all the entities and roles impacted by the Platform) can express their voices, and collaboratively work together to propose new policies. The establishment of the EOSC Association is an excellent initiative and



goes towards the best practices of platform governance, but there is an opportunity to do even more.

Platforms can, as an instance, benefit from some advanced practices falling under the name of Dynamic Governance, or Sociocracy<sup>19</sup> (similar to the more focused on private companies Holacracy<sup>20</sup>) and offer equal opportunities to all the members, to be part of circles of decision making with the purpose to define guidelines and policies that can be applied to the entire ecosystem, leaving at the same time total freedom to find the operational and factual solutions to all the responsible actors.

This shared and collaborative governance aspect is one of the most important enablers for EOSC. In the main role and responsibility to be a “scalable collaboration agreement”, it must be supported by all the entities involved, actively. Beyond the technical coordination role, aiming at “giving access to resources”, a collaborative capacity to emanate guidelines and principles is a value appraised by all members. We need a new way to do it, dismantling established routines that are preventing EOSC to be really inclusive for all the international members. Sociocracy can give this added value, by avoiding “position incomes”.

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<sup>19</sup> <http://www.socialenterprise.it/index.php/2020/04/05/sociocracy-on-the-human-organization-map/>

<sup>20</sup> <https://www.holacracy.org/explore/why-practice-holacracy>





## Hybrid Sustainability Models: “geographical and time” constraints

The two sustainability models, Transactional and Learning, will coexist in the EOSC MVE, being responsible for different aspects of sustainability.

Needless to say, the Exchange will lean towards the Transactional business model, while the EOSC Core and the Federated Data part (together with other entities supporting EOSC functions) will lean towards the Learning model.

A pure transactional model, based on the unbundling of all the transactions and on charging them punctually, is probably not viable for MVE since the overhead due to the management of such a fine granularity can easily outweigh the advantages of having control on each spending stream. We also need to take into account that to date, the entities that are already providing and consuming services that by their nature could be easily converted into a pay per use model, are not used to paying for them in such a way, since the most common model is the “prepaid flat access to resources”.

Forcing the conversion towards a pure commercial model is probably not a good move, since most of the entities in the “marketplace” are not capable of dealing with the huge administrative overhead required for that model.

Nevertheless, it would be important to track the usage and consumption of resources, for instance by offering a dashboard where every single user/consumer of resources can monitor their usage and become incentivised to make a wiser use of them.

At a central level (EU/EC) this aggregated monitoring can be really useful to set up a data driven policy making approach, for instance to make decisions on where to allocate funds, in order to match EU common objectives in terms of competitiveness.

The pure transactional model can be applied to the new services listed on the exchange in a later moment, for instance, coming from the new players attracted by the platform. Or, the platform can push the adoption of the transactional model for the resources that are already accessed on a pay per use basis, like datasets ready for the exploitation, or specific consulting services.

Access to open resources or to professional services that are exchanged to date without a proper payment or through a payment in-kind, could be monitored and registered for a further business analysis, but with a very light and low overhead approach.

On the other side, if we focus on the sustainability of the Learning model-based parts, we imagine that they will be funded mainly as happens today, through EC public funding. This is acceptable in the short term, but in the medium-term actions must be put in place to gain an independent sustainability from the public funding / patronage model. Possible options, which remain to be validated, include:

- a virtual accounting and “reimbursement” fee coming from other parts of the MVE (i.e. the Exchange?);



- to setup mechanisms that support the technological transfer of the research outputs towards the private market, and foster the creation of spinoffs that can put the research outcomes to the ground and reserve part of the profit to sustain the EOSC platform;
- provide a way to let the bi-directionality of value streams attached to the shared resources, and consider them not only as pay per access, but setup exploitation processes for the higher value resources re-inserted in circulation;
- explore PPI (public private partnerships for innovation) approaches and follow a model similar to the EIC Pilot European funding schemes, where the EC is aiming to obtain return on its investments in innovation and new ventures through equity ownership.

On the last point, in the current study we considered that

*“EOSC and its underpinning service aggregators need to find a way of somehow fitting the approach associated with commercial spending thresholds into a public finance model. This will involve the leadership in long and complex talks with the funding bodies at national and EU level and also with the policy-makers in order to explore the removal or relaxation of the current rules that will harm EOSC sustainability and that of its underpinning service aggregators”.*

This consideration resonates with the approach the EC is taking to allocate funds in support of the private ventures. They trust domain experts to evaluate the performance (or the expected ones) or growth plans (startups as well) of private businesses and then they co-invest together with financial institutions and professionals.

EOSC strategic objective to make the most efficient use of funds to support and leverage the research in the EU, to keep the competitiveness with other regions, can be heavily inspired by a similar approach. By having all the funding requests and processes passing through the platform, the EC can choose to co-invest/co-fund initiatives funded at member state level for instance, or help to coordinate larger scale and larger impact research, by putting together similar needs, objectives, topics and capacities. This will be a strong motivation and incentive for all the impacted entities and stakeholders, to join the platform and contribute to its growth.

The power of attractiveness of a platform is really fundamental for the success of the entire initiative, since Platforms can't push or force the adoption of its services “by law”, but they need to attract (pull) entities, that clearly and transparently understand and perceive the advantage for them, to interact through the platform instead of staying outside. The EOSC platform will offer this capability to:

- Be the place where research funds are vehicled and funding requests are filed;
- Involve/find peers and entitled/competent entities, that can help the EC in the research projects evaluation (in the viability, or in the performances) that can thus support the EC in the selection of fundable projects, also in a consortium with other funding bodies, at member state level or at international level;
- Be the place where the research outcomes are filed and made searchable, available and interoperable, together with an augmented capability (peer based, or ecosystem entity leveraged) to identify the right resources and transform them in exploitable formats



Can be all interesting ideas to empower the EOSC initiative and support it in the design of ecosystem pull incentives. It is also important to consider that the compound business model (Transactional and Learning) can also be dynamically changing its composition over time.

At the initial stage of MVE, the infrastructural aspects are prevailing, since the Exchange is not populated yet, and the entities are not used (or incentivized) to interact through the platform. The “catalogue” needs to be populated, the concierge desks need to be set up and initiated, the knowledge base of technical, legal and cross-border related issues needs to be populated. This will ensure that the learning model will sustain initially the EOSC-Core and the Federated Data component of the platform. These services and channels are not profitable by design, since they are making it possible for the entire platform to exist, and a proper “membership” funding needs to be planned and secured.

After the initial boot up of the MVE, the platform invites all the players to adopt the platform services (through proper incentives) and this will contribute to push up to speed the Exchange. In this stage, EOSC can start moving (virtual or fiat) resources through the different providers of services/data/value in general and monitor the consumption of available resources with a transactional model.

We are not suggesting that every single access to resources is managed individually, with a marketplace approach and a single procurement process, unless the resources exchanged are already set for this approach (i.e. if they are already purchased on the market, or sold publicly). In any case, the monitoring of the usage is a nice-to-have metric and can help research bodies to be aware of project performances.

Resources available in the commons, open source, FAIR, free of charge, can be exchanged through the Exchange as well. The value of doing this lies in a deeper monitoring of what resources are used and which not, leading to the evaluation of Underutilized Fixed Assets for instance, that can be later “monetized” and become side streams of sustainability.

The final stage, when the EOSC-Core is sustained, thanks to the routine transaction monitoring carried out in the Exchange use, it will be possible, once again to consider the deployment of a learning sustainability model in order to enable and support higher value streams through EOSC, for instance:

- Holding the space to foster the technological transfer of research outcomes into viable solutions (with a scheme, as already mentioned, of grant + equity + in-kind contribution by the EC, either through EOSC or by involving other initiatives, like EIC);
- Leverage the long tail of science;
- Holding the “space” where research bodies can “store” and promote the benefits associated with their outputs, thus increasing their reputation, which will, in turn, reinforce the benefits of participating in the EOSC ecosystem;
- Enable the citizen scientists, since they will identify a unique point of contact for all the distributed research activities;
- Other streams.

A final scenario, corresponding with the long-term vision in the EOSC Strategy Landscape, resonates with the possibility to access crowdfunding resources, or to find alternative sources by



interacting with the private sector. The current roadmap of EOSC puts this scenario far in the future, so we placed no focus on these sources for the current study.



## 5. Use Cases Taking into Account MVE

### Use case A

**TITLE:** I want to access and find appropriate and useful services along with general resources in an international research activity because my research organisation does not hold the resources I need in my research, and/or I want to join/launch a European research project.

**MAIN ACTIVITIES:** Finding the right services, datasets, resources I need, accessing and using them, understanding how and how much I should pay for these resources. On the supply side, this use case implies the registration of the supplier and the enlistment of the services they provide through the catalogue.

**DESCRIPTION:** accessing resources internationally and setting up an international research activity are still laborious tasks to be performed at the European level, as well as the process of finding the right or specific resources at European level among the many organisations. On the supply side, this translates in the problem for Service Providers to find users of their services.

**INSIGHTS and CONSIDERATIONS:** granting access to resources, monitoring their usage and real time consumption and dealing with the procurement processes, with virtual accounting and with funding streams can represent one of the most important impacts of EOSC for the ecosystem. As it will be also described in the next use case, it's a good practice to include and delegate to ecosystem entities these services and responsibilities. This is making the MVE more sustainable (asset light, nimbler since fewer services are under direct responsibility) and more scalable, i.e. more flexible in offering the right services to the right needs (capturing the unexpected requests, impossible to be designed exhaustively with a top-down approach).

### Use case B

**TITLE:** I want to access the right research resource (dataset, outcome, publication) or a supporting service in a specific domain (i.e. vertical scientific research support, think about Haddock, Climate Change, Earth Observation data, etc.), finding the right and useful datasets or services that can support my research activity, and finding exploitation services that can help me publish my research outcomes in an interoperable format (i.e. Elixir, OpenAIRE, etc.).

**MAIN ACTIVITIES:** focus on data stewardship and management, find the right dataset and resources, or publish and exploit the dataset properly, data analysis and scientific expertise support (algorithms, AI, simulation models etc)

**DESCRIPTION:** It is often complicated to find and access relevant datasets in a timely manner and let them be manipulated by vertical service providers that own specific AI models, algorithms and software, etc.

**INSIGHTS and CONSIDERATIONS:** reviewing this use case under the point of view offered by the Minimum Viable EOSC, leads us to stress the importance of behaving "like an ecosystem". This



means that the infrastructural services necessary to support the “list/catalog of services”, the metadata to organise services in the right ontologies and let them be sought and found by the right consumers will be located and funded by EOSC Core and the Federated Data, and this part will be also responsible for the development and maintenance of the “database and its accessing services”. But when possible, it’s a good practice that the platform will give the possibility to contribute and provide these basic services to all the entities in the ecosystem that are capable of doing it, and that are already providing similar services to date. Scientific Supporting entities can for instance provide guidance and mentoring services in the search or customization or access or procurement of resources when research bodies are not equipped with internal departments that can serve them with the same level of performances.

## Use case C

**TITLE:** ESCAPE Work Programme

**MAIN ACTIVITIES:** Improving resource sharing, management, hosting, access frameworks, interoperability and metadata management at the international level

**DESCRIPTION:** The association of the ESCAPE project with EOSC is of utmost importance for a series of reasons. The project functions as a vertical platform that enables connections to compute and storage resources, while applying the FAIR data principles. Additionally, it aims to implement a community-based approach for the development of shared resources and for training of researchers and data scientists.

**INSIGHTS and CONSIDERATIONS:** The association of the ESCAPE project with EOSC will enhance the possibility to broaden the EOSC and ESCAPE user bases, and will enrich EOSC offerings. In this win-win situation EOSC could accelerate the advances of projects such as ESCAPE by giving them the possibility to address their offering to a pan-European audience, while providing an architecture by which ESCAPE’s niche could be connected to other niches in the ecosystem. For example, ESCAPE could attract interested users while providing its services through EOSC. It could help EOSC’s platform to open up other vertical communities and to Citizen Scientists, while providing and receiving training for researchers.

This example makes an extensive use of most of the services available at MVE level, it can be (together with similar “schemes”, apart from the contextual application to a specific research vertical) one of the basic Platform Experiences to be implemented as MVE initial value proposition. It’s also an example of the integration of services and overlapping purpose for a “platform in the platform” or “platform as an entity” interaction scheme. Basic or technological components can be merged together, or the final recipients of both platforms’ services can indifferently use services provided by service providers coming from one platform or the other. The interaction between the two platforms is de facto extending the space (i.e. the ecosystem) of reference where services/value/information are exchanged.

## Use case D





This use case doesn't come from EOSC directly, but it is important for many reasons. First of all, it is a proven success case of a platform working at international and public level, with specific focus on the policymaking support functions. Second, it is a case that has a relevant technologic focus, with a lens on data and dataset exchanges. Third, it's an example of potential uses of the value generated in the EOSC platform at the service of institutions and member states, and prepares the ground for further sustainability streams.

The United Nation Global Platform<sup>21</sup> is a policy, technical and business infrastructure that provides a worldwide collaboration initiative meant to harness the ethical use of data to improve people's lives. It enables the access to data safely and locally, nationally and globally. It is sustained by organisations worldwide to provide trusted data, services and applications. Great emphasis is given to the high value of data to provide insights on the numerous challenges we face right now, including the evolving human need, the preservation of the environment and sustainable development. The UN Global Platform focuses on the 17 Sustainable Development Goals (SDGs).

One implication of the use of the UN Global Platform would be that, as the library of available algorithms grows, the effort needed to adopt cutting edge methodology will be substantially reduced everywhere in the world. Currently, the active services available in the platform are the following:

- Earth Observation Service (distil the underlying data from the visual imagery)
- Location Analytics Service (storing, indexing, querying, transforming and visualizing spatio-temporal data, offering the capability to animate millions of entities in the browser)
- Platform Authentication Service (secure, flexible, easy to use, central authentication)
- Global Billing Intelligence (advanced financial auditing for cloud-based projects)
- Security and Compliance Service (Cloud Providers: Amazon Web Services, Google Cloud Platform, Microsoft Azure and Alibaba – facilitate the exchange of open data)

The platform is already delivering results. Through it, it is possible to co-create new and innovative outputs; some examples are: the acquisition of faster indicators of economic activity, using new data sources (economic activity: shipping), the production of a vegetation-cover index from cloud-based data sources, (through which it is possible to assess the level of vegetation coverage along the roads, using an algorithm and images from Google street-view), the development of techniques to preserve the privacy of sensitive data, and the Automatic Identification System (AIS – through which data are gathered for faster economic indicators and experimental data)

We believe that the UN Global Platform can be considered a best practice that the EOSC Working Groups can refer to, as it provides some services that are overlapping with the EOSC strategy at its core and not only, from the access to the standardization of data.

Both EOSC and the UN Global Platform have strategic commonalities. For example, the UN Global Platform provides a Marketplace for the global platform, through which they will promote and encourage international collaboration. Through the Methods Service for the platform, they let the sharing and reuse of trusted algorithms and methodologies take place. Finally, through the Global Platform it is possible to access and analyse the big datasets in a cloud-native environment while exploring data, developing analytics and building applications securely on the Global Platform (giving the possibility to programmers and data scientists worldwide to collaborate on projects).

<sup>21</sup> [http://publications.officialstatistics.org/assets/pdf/UNGlobalPlatform\\_Brochure.pdf](http://publications.officialstatistics.org/assets/pdf/UNGlobalPlatform_Brochure.pdf)



A further exploration of commonalities and best practices that can be replicated or borrowed is thus highly encouraged, as well as the exploration of possible synergies with the UN Global Platform.

## General Insights from the Business Models Study

Here follows a series of insights and suggestions that we extracted from the study and by talking to representatives of the EOSC ecosystem and participating in various chances to deepen the knowledge of the ecosystem.

- EOSC as a whole is a complex and highly regulated ecosystem, EOSC cannot be over-simplified and reconstructed into silos, enabling the design of a strategy for each of them. The European Open Science Cloud ecosystem should be considered as a whole, considering the compound strategy and including all the impacted stakeholders. Some of the subparts can be a cost center, some can be a “free access” part useful to generate traction, some will act at a political level sustaining the EU goals, while some subsystems will be responsible for the sustainability of the whole Platform. We suggest that the capacity<sup>22</sup> to support the operation of EOSC-Exchange be considered an EOSC Core service and add the valorisation of research outputs and of research bodies/entities, taking into consideration the fundamental entities/roles identified: Research Units and Data providers/exploiters, Infrastructural Service Providers, Specific Domain services providers. As a different option, even if we don't include the Exchange into the EOSC Core services, the sustainability of the latter should be virtually sought in the “marginality” or value captured by the Exchange.
- Platforms scale their impact thanks to the “pull strength” towards entities and roles. If the value proposition of the Platform (EOSC as a whole) is not clear towards all the relevant actors, the probability of success of the whole initiative is at risk. Also, even if the Platform will be the only way to access funds for the research, looking for the independence of sustainability implies to start with the value driven approach, and then the rules will follow in resonance with the value.
- Matchmaking, peer to peer relationships. Every new research project is different from each other, and yet there are common aspects and approaches, or needs. It would be very difficult for the EOSC Platform to deal with each request and provide the right level of personalisation. The win-win approach in this case is to put directly in touch who is expressing the need with who can help, guide and support the decision making and the planning and accessing of the right resources. We can call these roles “expert advisors”, or ambassadors, or supporters, and they can be both peers and partners in the ecosystem. The platform can encourage the sharing of best practices and success cases, or provide a matchmaking channel to help the two sides negotiate the level of service needed.
- Quality issues in Platforms. Platforms do not control the quality of the services exchanged through their channels. The Service Level Agreements are left to each interaction, but the platform itself has a strong interest in keeping the quality high, otherwise the players are not incentivized to interact through it. So, the Platform typically contributes to setup a reputation and feedback engine, that helps building a reputation for all the entities and roles involved. As a second step, the recent trend is to have a “managed marketplace” where the Platform tries in a certain way to assign some “qualified” or “certified” badges to high quality transactions. This is also something that EOSC Core can provide: a service or a channel

<sup>22</sup> Technical environment, managerial and operational support, regulations, rules, policies, etc.



used to assess the level of service and takes the responsibility of the quality assurance of the service provided or exchanged.

- Procurement (streamlined). Procurement rules are complex, while the research projects can request a certain amount of flexibility. At the international level, EOSC can intermediate the payment for and purchase of resources and put channels in place to help redistributing the return of these investments to more or different bodies or institutions. Moreover, a central procurement function offered by EOSC can provide better efficiency and optimized use of the underutilized fixed assets, or contribute to calm down prices, monitoring the usage and request of resources and plan in advance the increase in the offered capacity, contributing to speed up the competitiveness of the EU research ecosystem in regards of other continents.
- Access to credit and resources, indirect monetization and value sharing. Being in a highly regulated environment, with international laws and regulations to be respected, of course we need to take into account that the system is slow in the response to the value driven attitude of the Platform strategy. Indeed, the Platform has the opportunity to become the ally and the testbed for new approaches that can experiment how the “new regulatory asset” could look like. As an example, since one of the strongest blocking points is the EU regulatory framework on procurement, EOSC could conduct an experiment to understand how the various researching bodies can transfer resources and access services among them. To proceed with a value accounting in retrospective after any project has been completed. This experiment will be a valuable input for the regulatory bodies, aiming for a modification of the rules. Token or virtual vouchers design can be considered for this experimental approach.
- Value of the Researchers, the EOSC (hidden?) resource. The researchers (Research Bodies and Units, generalised) are the true value of the EOSC ecosystem. The current design of the platform partly recognizes this. Currently, the consumer of services is burdened with the responsibility of managing the procurement, the planning and architecting and the deployment and management of the resources and services. These are not roles that fall within their capabilities and competencies. Researchers are looking for different values: the learning model tells us that they seek a better reputation, they need a place to publish their outputs and be recognized and paid back (also virtually), finding opportunities for a career, or to become expert in a specific field and guide others with similar needs or issues. Training and co-research opportunities are also perceived as strong value gains, EOSC platform should capture this potentiality and provide services to support these needs.
- Training and support (both on the horizontal services, and on data exploitation or vertical scientific services) is left to the organisations in the ecosystems and not yet incorporated in EOSC. Yet, oftentimes there is the need to access training that helps organisations to get better. For example, by conducting our analysis, we discovered that there is little understanding about what FAIR data actually are, why they are so useful and, also important, There little understanding of how to FAIRify data and how much this will cost, the consequence of this is that the entities we interviewed did not see FAIR data as a priority for EOSC in the foreseeable future. Why does EOSC not provide a dynamic, common learning area to improve understanding through use cases (also provided by real users?). Moreover, there are many SEEOS across Europe that provide different training and support activities, especially context-specific activities. These could be linked to that “common area” and let themselves be known, so that the organisations could have the possibility to get in touch with the SEEOS operating in different parts of Europe.



- A project-based approach is not long-lasting. The project-based approach presents some shortcomings. Throughout our analysis, and especially during the presentation of the second deliverable, we noticed that most of the organisations were funded via a project-based system. The lack of rigorous accounting principles accepted Europe-wide is one of the causes of the impossibility to make reliable observations of the organisations costing\payments on our side; however, this might be the symptom of a bigger problem, namely the impossibility for funders to hold organisations accountable with a cascading effect down to the single researcher\procurement division and hence to assess the efficiency of the given organisation, and the difficulty for international funders to understand the difference in accounting procedures. The risk that emerged is dual: first, entities don't know how to deal with the accounting of resources for a project at the level of detail required to completely understand EOSC as a sustainable entity. Accounting inconsistencies also undermine basic functions (e.g. data retrieval). Second, projects are meant to end, while research activities are not always "expiring", or the new iteration is a continuation of the previous one, so the risk is every time to reinvent the wheel.
- As the analysis unfolded, it is possible that EOSC as a platform should not target the research bodies as its first priority; by solely focusing on them (and taking for granted that they are the target) there is a risk that it is not properly understood how other organisations interact within the ecosystem. Maybe it would be beneficial to analyse whether the primary target would be the "proxies" that retrieve, manipulate and\or supply data(sets), in addition to other products and services. Have the researchers the capability to use profitably and autonomously consume resources aggregated by EOSC? (i.e. B2B2C?)
- An incidental impact associated with EOSC is that it possesses the important elements of a programme that may transform the way research in the EU is funded and managed. New methods for funding research may be discovered; we believe that, by changing the accountability scheme, funders can count on a more efficient use of funds and gain the capability to consume research services on a value-driven basis. This is obviously not going to be a quick and easy change, since the complexity of EU systems and the necessity to deal with different national rules and laws is a barrier to the success of the EOSC initiative. There is room, however, for smaller niches (in a lean and agile approach) of value to start interacting in a different and more efficient way through the EOSC platform. We think of private service providers that can partner with other peers to provide services to support international research, and that can be nimbler in using resources and funding streams. Also, some of the most advanced public service providers are already acting as a proxy (towards internationalisation of research initiatives) for the smaller/less equipped research units and can support them in this journey to access EU resources. EOSC can support this Transaction Engine by helping to lower the costs (in terms of effort and resources needed) for these transactions. The key question to be understood and validated is how much freedom to change the rock-hard procurement rules the design team is entitled to, and if there will be a political buy-in to reorganize this context to give back competitiveness to the European service providers in competition with the extra-EU large service providers (commodity services).
- Funding agencies may choose to have their funds managed in a more structured way and not on a per-project basis anymore; by managing the flow of funds (especially international ones), EOSC would enable organisations to be more aware about the costs of services. In this framework, a solution can be found in the role of funders, that can play a major role in the ecosystem. By giving them the tools to better assess the "health" of an organisation (e.g. through metrics), the funders may require the organisation to adhere to EOSC policies and to its standards (e.g. accounting, FAIRification of data, etc.). Funders could also act



and think not on a project basis, but aim to have returns in terms of research output and research reputation

- Validation of the Platform strategy designed. The whole strategy needs to be validated and the assumptions need to be confirmed or changed by involving the ecosystem entities and roles in a new iteration of the design process. This assures that the needs and gains are directly expressed and “certified” by the real representatives, maximizing the probability of success of the platform initiative in the ecosystem.



## 6. Conclusions and Final Recommendations

The following list of recommendations are presented as suggestions based on the experience in carrying out this exercise, and might be helpful also to other Working Groups and to the future EOSC Legal Entity to take into account.

- a) **Awareness raising within the research communities of what is EOSC Core and clear mapping of services** - There seems to be a difficulty of some Service Providers (SPs) in understanding how to map their services leading to divergent understanding of what is included in EOSC Core as defined in the Tinman document. Additionally, there still seems to be some confusion on what EOSC actually is and its purpose. We understand that the Architecture Working Group of the EOSC Executive Board is working on clarifying this situation, and this would be a welcome addition to all Service Providers to establish a common understanding.
- b) **Clear explanation of what constitutes cost based accounting and engagement of the right individuals within the relevant stakeholders** - Sharing of helpful examples and documents (similar to the description of cost types in Appendix F) since many technical experts working at service providers still think of “Project”-based costings and not the real accounting method of counting costs. This means that they prefer to work in “person-months” and with an average rate which is not an appropriate representation since there are different people with different wages / skill sets even within the same organisation, and it is too ‘simplistic’ to think that human resources are the only cost to be considered. Indeed it could be possible to ‘bridge this gap’ using percentages for indirect costs, however this would only be an interim solution and eventually real actual accounting / admin personnel should be engaged in this exercise from the service providers side in order to give a proper financial foundation.
- c) **Virtual Access a step in the right direction but needs improvement** - The Virtual Access funding scheme that the European Commission has introduced seems helpful for Service Providers to develop a better understanding of service costs. We saw a higher-level of maturity in costing information provided by those SPs that had already determined Virtual Access unit costs. However, it is important to note that even this scheme leaves a lot of potential costs out and the risk is that therefore just basing on the smaller set of costs could put the whole organisation and delivery of EOSC Core Services at jeopardy. For real sustainability one needs to have a margin on top of costs as this will allow the entities providing the service to do this without risking their other operations. So future procurement-style calls should take this into account
- d) **EOSC requires Service Provider Aggregation** at least in the interim - Ideally when the EOSC Legal Entity will be created, it should be able to procure services directly from the operators. However, at the present time, the provider community is fragmented. Fortunately, there are 4 large aggregators (GEANT, EGI, EUDAT and OpenAIRE) that are serving as a confluence and support for these individual operators. They also contain a vast amount of embodied knowledge that is essential to EOSC. Without them there is a risk that all the EOSC Core services will not be effectively provided. At the moment there are projects like EOSC Hub and EOSC Enhance that are ensuring that this happens, however when the actual final services are procured, if there is no aggregator support, and no joint





support towards the service operators, then the EOSC Legal entity will need to take on the role that is currently being carried out by these afore-mentioned projects.

- e) **Pre-commercial Procurement** - EOSC could coordinate and help purchase resources by implementing the more suitable norms and tools provided by the EU Procurement Code. As an example, the PPP (Public Private Partnership) and the PCP (Pre-Commercial Procurement) may be the right tools, in different contexts, to deal with the high expectations and strong flexibility required by the Research context.
- f) **Consider EOSC as a whole** - Going beyond the focus on EOSC-Core is needed to assess how the funded EOSC related projects will be interacting with each other and to understand how these projects will contribute to the sustainability of EOSC. EOSC CORE is focusing on commodity services, which are typically a pure cost for the platforms. They are fundamental since the entire operational model relies on those components and modules to be executed, but the marginality is leaning towards zero. So, a platform strategy should cover their cost with other sustainability streams, coming from the transactional or from the “learning” sustainability models. If EOSC core is siloed on the basic services only, sustainability will be difficult to accomplish. The risk is that, if the platform is laid out as intended, it is possible that there are too few single-value services which would neither guarantee that the user-base reaches critical mass nor that the Core achieves the long-term sustainability of EOSC as a whole. There seems to be some confusion and overlap between various EOSC elements, the platform elements are highly interconnected and, for each functionality added by EOSC as a platform (or removed), there could be potentially huge differences. Users need training about the use and functionality of EOSC.
- g) **EOSC as a “super” platform** - EOSC can easily become a “super-platform”, with the possibility of coordinating and connecting other existing platforms (e.g. Géant) in a way that both they and EOSC would benefit by this strategy. Namely, EOSC would benefit by the fact that it can gather data<sup>23</sup> about users behaviour (intended as everyone signed up in the platform, irrespective of the role played in the ecosystem) that can become a source of revenue and has the control of what is actually happening in the ecosystem and taking advantage of that. The risk is that researchers’ rankings based on different platforms can require time to make the reputation to be portable and it can be complicated, and that the (inter)national platforms are not easy to coordinate. However, by coordinating the existing platform, EOSC would have access to important data flows that can be reused to provide better services, and shared with the coordinated platforms and other third-parties (and potentially monetising them). At the initial stage, the EOSC platform should relay, include and aggregate the already existing service aggregators and give them more chances to improve and scale across the national borders. In a second stage, the platform can work on the optimization of the resources and promote a re-bundling of the aggregators on a better value driven rule.
- h) **Data Stewardship and Data Driven policy making** - Data is king, needless to say, in the research context. Even if the FAIR data framework and the Open Science Policy Framework are obviously the top priority for the platform shapers, most of the entities are not aware of their recommendations and rules. There is space to set up a data stewardship support service and also to use data in a real time policy making decision process,

<sup>23</sup> In a GDPR compliant manner



monitoring the metrics of success of the research initiatives in terms of open outputs generated by the unit of funding.

- i) **Centralised EOSC Funding Support Team** - It is apparent that many of the service or data providers or even the Service Aggregators, do not yet understand where and how to look for funding to support their operations notably for cross border delivery of services. To-date they have mainly relied on e-infrastructure calls published by DG CNECT under Horizon 2020 but as seen in the previous chapter, this is just one of many funding avenues that are available. Thus, a centralised EOSC Funding Support Team should be set up within the legal entity or independently in order to ensure that no funding opportunities are left unexplored and to guide the individual entities that provide EOSC services or data on how to be more “entrepreneurial” in order to ensure their own continued existence.
- j) **National Political Support for usage of ERDF Funds for EOSC** - Many Member States find it difficult to spend their European Regional Development Funds. The decision of what is eligible for ERDF funding is taken at local and national levels. Consequently, EOSC should work to convince Member States to make costs related to the operations of EOSC Core +MVE eligible under such funding programmes.
- k) **Local Political Support for national entities to deliver cross border services** - Pursuing the recommendation on ERDF above, the national EOSC should persuade their national governments to allow their national entities to provide services to other member states as long as these are part of the wider EOSC spectrum of joint activities.
- l) **Enhancing the skillset present in the EOSC community.** There is an abundance of highly skilled and motivated people working hard in the EOSC community to ensure it is a success. However, they are struggling with some of the more business-like skills, such as accounting, market analysis and business planning. It would benefit the community and help to more efficiently achieve sustainable operations, if such skills could be engaged.
- m) **Lobbying is required** Building on recommendation k) above some of the problems faced by EOSC cannot be addressed from within the community, they can only be solved by engaging with several external actors: funding bodies, policy makers, regulators, lawyers, etc. as well as tolerant national policies that encourage and support cross-border working, either a single market for EU research is required or the entities comprising EOSC as well as EOSC itself must be allowed to retain sufficient income to be able to afford to address the legal and regulatory complexity associated with VAT, procurement, commercial risk and micropayments.
- n) **Coexistence of different sustainability models in EOSC and their evolution over time.** Different parts of EOSC can be based on different models. CORE and Federated data sections will benefit from a membership-based learning business model, partly funded by the EC and partly by the member states. The mission of this part will be to provide support to the entire ecosystem to learn collectively how to allocate resources, how to manage cross-border research projects, and to provide shared cultural elements to spread best practices and seamless integration approaches. The Exchange section will benefit from a transactional model, pre-paid with *monitoring usage of resources purpose* for the commons, FAIR resources, open access resources free of charge but with strong guiding and orienteering services. These sustainability models will dynamically change weights



over time, following lean thinking, start-small best practices. Once the Exchange will be able to host services coming from the private sector and have them being accessible by the final consumers, a pay per use pure transactional model will be advised. This will help to absorb peaks in resources demand and to include state of the art innovative services in the system.

- o) **Shared and collaborative governance and decision-making processes have to be designed and established.** The primary impact of EOOSC initiative is not commercial (i.e. sell or buy services) but is definitely about offering a different and seamless mode to organise international research projects. Since the gamut of possible “issues” can’t be thoroughly identified and solved upfront, EOOSC management may benefit from engaging dynamically with its governance body and with the policy making process as part of its activities.
- p) **Obstacles to successful EOOSC operations need to be overcome.** In the meetings with the various WGs many obstacles were described. The obstacles are common in the business context but in the EOOSC context they are severely limiting due to the way that the components of EOOSC are currently funded. Given that solutions to all of the obstacles revealed so far are available in the business context, measures should be taken to examine how they can be adapted for deployment in EOOSC.

## Next Steps: Future Studies

It has become increasingly clear that there is still a lot of research and studies to be undertaken in order to be able to steer EOOSC towards a sustainable future. Thanks to our interactions with the different stakeholders, as an expert team we would like to suggest areas for future focus and work:

- 1) **Creating standard ways of calculating costs** for services that also include margins and returns for service aggregators and other ‘intermediaries’ that are needed to de-risk the quality of EOOSC services and cohesion between operators.
- 2) **Awareness raising of what is in EOOSC and what is NOT in EOOSC** at all levels of research, politics and even technical service provision. So far it seems there is no common vision and many have their own ideas which are often in conflict with the (relatively) small group taking decisions.
- 3) **Procurement processes** (like pre-commercial procurement and others) that could be used in order to eventually ensure that EOOSC itself is able to buy all administration (and not only technical) services that it would need to survive.
- 4) **Service Level Agreements for EOOSC Services** and creation of EOOSC “label” ensuring that when one brands something as “EOOSC-compliant” or “EOOSC-ready” then it would actually mean something.
- 5) **Cross Border Delivery of Services for EOOSC MVE** that would look in detail at both the costings of entities to provide cross border services (including access to data), which barriers they might have in doing so (legal, financial, infrastructural, psychological) and what funding schemes and business models would help them to do so.



- 6) **Identify one pilot context/use case and design, validate and implement the vertical Minimum Viable Platform for that.** This demonstrator will be useful to generate practical inputs to iterate the design and will provide a success case to capture the attention of all players.
  
- 7) **Study the means by which the current obstacles faced by EOSC can be overcome.** We suggest introducing new skill sets into EOSC, integration of common business processes into EOSC and the introduction of lobbying as an EOSC Secretariat activity.



# Annex A: Minutes of Discussions with EOSC WGs

Meeting 09/09/2020.

Participants:

Sustainability WG:

Rupert Lueck (co-chair)  
Bob Jones (rapporteur)

Architecture WG:

Jean-François Abramatic (co-chair)  
Owen Appleton  
Leif Johansson

FAIR WG:

Sarah Jones (co-chair)  
Françoise Genova (co-chair)

EOSC core operational costs study:

Angele Giuliano (AcrossLimits)  
Steve Robertshaw (AcrossLimits)  
Luca Ruggieri (BoundaryLess)  
Andrea Valeri (BoundaryLess)

Dale Robertson (editor of EOSC-Hub Briefing Paper – Provision of Cross-Border Services)

Agenda:

The preparation of the forthcoming iron lady document and work on the 'EOSC core operationally costs' study by AcrossLimits & Boundaryless has highlighted a number of questions about the MVE for which the Sustainability WG would appreciate input from the Architecture and FAIR WGs. An initial set of questions about EOSC-Core were discussed (see below).

It was agreed to limit the scope of this meeting to EOSC-Core and organise a follow-up meeting about the larger MVE (EOSC-Core, federated data and EOSC-Exchange).

Shared Resources: The concept of Shared Resources as defined in the EOSC-Hub briefing paper fits better with the scope and funding model of EOSC-Exchange than EOSC-Core. EOSC-Hub defines Shared Resources as the storage and computing hosting platforms needed to deposit, share and process scientific output. The EOSC-Hub Briefing Paper – Provision of Cross-Border Services (1 Sept 2020, appendix I) came to the same conclusion and states "The comparison shows that the Shared



Resources as proposed by EOSC-hub form part of the EOSC-Exchange proposed by the Sustainability WG Tinman”

This point was agreed and it was noted that the Shared Resources is not yet a clearly defined element of EOSC-Exchange. It was also acknowledged the EOSC-Core on its own does not represent sufficient added value for EOSC to become sustainable.

Metadata framework: The EOSC core operational costs study highlighted that none of the EOSC related projects interviewed are proposing a solution for a metadata framework. The recently published RDA COVID-19 Recommendations and Guidelines on Data Sharing, 30 June 2020 (<https://doi.org/10.15497/rda00052>), stated the key to finding and using digital assets is metadata. Section 2.2.5 of the RDA document focuses on metadata standards. RDA noted the need for balance between achieving ‘perfectly’ FAIR outputs and timely sharing is necessary with the key goal of immediate and open sharing as a driver. This suggests an iterative approach that is consistent with the Sustainability WG approach to the development of EOSC.

The FAIR WG’s draft EOSC Interoperability Framework (v1.0) “aims to provide a set of recommendations on the components that need to be provided in the ecosystem and on the principles guiding digital object producers and/or consumers on their use”, provides a definition for metadata and section 4.2.2 explores metadata frameworks and elements to support interoperability.

It was agreed that a means of enabling interoperable metadata is a high priority for EOSC and is currently not addressed. The EOSC interoperability framework says “*A simple vocabulary should be proposed for allowing discovery over existing federated research data and metadata (extension of DCAT-AP, DDI 4 Core, or DataCite core schema). There should be some alignment among them, and maybe this should be layered/prioritized*”

Interoperable metadata should be highlighted as a target for Horizon Europe funding calls however it was noted that depending on such funding streams could cause delays to the early iterations of EOSC. The Architecture and FAIR WGs do not have the resources to address this issue themselves. In the meantime, a recently approved EOSCsecretariat co-creation proposal (‘Applying DDI-CDI to EOSC’) could contribute as well as the project to be funded under the INFRAEOSC-03-2020 call. Additional near-term funding activities should also be considered. The focus should be interoperability by engaging research communities to critically analyse the different options and converge on the definition of a minimal set of interoperable metadata taking into account their current usage and community standards.

AAI – the material presented during the architecture session of the EOSC consultation day in May suggests that the AAI has two broad components following the AARC blueprint architecture consisting of a core element that is integrated with community specific services. We suggest that the community specific services should not be considered as part of EOSC core.





It was agreed that, while community specific services would not be part of EOSC-Core, they must be interoperable with the federating AAI element. The Architecture WG task force on AAI is working to provide more precision in this domain.

It was also agreed that some resources which are openly accessible via EOSC may not require authentication (e.g. when datasets are completely open) but a non-intrusive means of monitoring their usage will be necessary to measure the impact of EOSC.

Help-desk: provides training/consultancy on use of EOSC-Core services and a means for linking national/thematic/institutional service desks that can provide local support. It will include a knowledge base of information and a ticketing system for handling queries and the management of issues concerning the core services. We propose the EOSC core funding will cover the production of training material in one language in various online formats (documents, videos, webinars etc.), operation of the ticketing system, on-boarding of service-desks and maintenance of the knowledge base. The operation of national/thematic/institutional service desks, local consultancy and training, and translation of material into other languages are foreseen to be funded outside of the EOSC core.

It was agreed that the help-desk functions, which need to be more precisely defined and renamed, should be limited to the scope of the EOSC-Core functionality and support those federating services connecting to the EOSC-Core. Helpdesks related to the individual services accessible via EOSC Exchange or related to disciplinary data centers should continue to operate as they do now.

The platform design approach being pursued by the EOSC core operational costs study and EOSC-hub highlight that the platform does not provide the solution itself but enables the participants to organise themselves to discover the best solutions. This approach takes into account scalability aspects and avoids the temptation to plan all possible usages at the platform design phase.

The EOSC-Core also includes a Portal and it was suggested that its definition should be renamed and expanded to include web-content as well as supply and demand facing services. It is recognised that the portal is not unique and should act as an exemplar. It was also highlighted that machine access, preferably in the form of open APIs, are essential for EOSC-Core.

A doodle will be distributed to arrange a follow-up meeting on the MVE with the same participants, preferably during the week of 21 September. The working groups are asked to propose questions, in the same manner as the Sustainability WG did for this meeting, in order to focus the agenda and limit the duration of the meeting to one hour.

Meeting 24/09/2020.



Participants:

## Sustainability WG:

- Rupert Lueck (co-chair)
- Jessica Klemeier
- Bob Jones (rapporteur)

## Architecture WG:

- Jean-François Abramatic (chair)
- Owen Appleton
- Leif Johansson
- Mark van de Sanden

## FAIR WG:

- Sarah Jones (co-chair)
- Françoise Genova (co-chair)
- Oscar Corcho

## EOSC core operational costs study:

- Angele Giuliano (AcrossLimits)
- Steve Robertshaw (AcrossLimits)
- Luca Ruggieri (BoundaryLess)
- Andrea Valeri (BoundaryLess)

Dale Robertson (editor of EOSC-Hub Briefing Paper – Provision of Cross-Border Services)

Agenda:

- Update from Arch WG on status of its MVE work

Jean-François shared slides (uploaded) summarising the status following the Architecture WG meeting that took place the day before.

These slides are based on Rupert's presentation of the Tinman presentation to the Executive Board.

Jean-François highlighted that the act of federating existing infrastructures has to bring added value for each contributor initially and that inter-disciplinary added value is essential but will come later.

The EOSC-Core must enable interoperability according to the EOSC interoperability framework.



He introduced the word 'element' rather than 'service' or 'framework' for the contents of the EOSC-Core and stated it is important that such elements map onto the EOSC interoperability framework.

A revised spreadsheet of the MVE contents has been prepared by the Architecture WG and will be shared with the participants on the understanding that it is on-going work.

- Finalise list of services in EOSC-Core

Bob presented one slide (uploaded) that summarized the contents of EOSC-Core as it appears in the draft of the iron lady document. Comparing this list to the slides presented by Jean-François it was agreed that the web-portal should not be considered as unique but rather an exemplar of such interfaces.

While it remains unclear if the contents of EOSC-Core are services, the list was agreed as well as the importance of EOSC-Core embodying the EOSC interoperability framework. Clarifying this point is important in order to establish a costing of the EOSC-Core. A spreadsheet from the EOSC core operational costs study identifies the potential providers consulted (uploaded)

- Do we agree to focus on the mature ESFRI cluster projects' services and datasets for high-priority federation via MVE?

It was agreed that RI cluster projects' services and datasets are a high-priority for federation via MVE because:

- They represent high-quality resources valued by the research communities
- The RI clusters are willing to federate their resources via EOSC
- There are established communication channels with the RI clusters

The engagement of RIs in EOSC is highlighted in the recent ESFRI white paper (section 2.5

[https://www.esfri.eu/sites/default/files/White\\_paper\\_ESFRI-final.pdf](https://www.esfri.eu/sites/default/files/White_paper_ESFRI-final.pdf) )

- What needs to change in the current EOSC Portal Catalogue and Marketplace (<https://marketplace.eosc-portal.eu/> ) for it to be part of the MVE?

It was noted that prioritizing the federation of RI cluster resources does not mean that the existing marketplace contents need to be removed. However, there are concerns that the limited information available about the existing entries in the marketplace and the inability for users to complete end-to-end negotiated access to such services. The low-level of usage of the marketplace is also an issue suggesting changes are required. 'Actionable' contents of the marketplace are required for popular services as well as those not available via other channels. Developments to the portal and marketplace are in-progress where the EOSC Enhance project (<https://www.eosc-portal.eu/enhance>) is active.



It is taken for granted that the existing prototype represents a correct approach but how will we know if we are building the right MVE? KPIs in monetary terms are difficult to define at this point but it was agreed that measuring the impact via the number of success stories for researchers that are made possible by EOSC is a worthwhile objective.

The motivations of the stakeholders to participate in EOSC are to be elaborated in the deliverable from the on-going EOSC core operational costs study.

- What shared resources should be prioritized?

Dale explained the definition of Shared Resources as presented in section 5.4 of the EOSC-Hub paper: <https://www.eosc-hub.eu/sites/default/files/EOSC-hub%20Briefing%20Paper%20-%20Provision%20of%20Cross-Border%20Services%20-%20For%20Consultation.pdf>

General IaaS capacity is emphasized in this document while it is recognized that higher-level added value services are also needed and the RI cluster projects have repeatedly called for EOSC to support long-term data preservation.

PaNOSC was cited as an example where the RIs have a mandate to produce the data but not the resources to exploit it. It was suggested that the shared resources should be viewed as a means of providing what is not available locally or via an RI.

The funding model for shared resources and the willingness to pay for services is a key question. The network community has found that policy free access to resources is not feasible if their cost is non-negligible. A representative with knowledge of this area will be invited by Sarah to the next meeting.

It was agreed that the funding model for shared resources to be made available via EOSC-Exchange will be the focus of the next meeting.

## Meeting 16/10/2020

### Participants:

#### Sustainability WG:

Rupert Lueck (co-chair)  
Jessica Klemeier  
Bob Jones (rapporteur)

#### Architecture WG:

Jean-François Abramatic (co-chair)  
Owen Appleton  
Leif Johansson



Mark van de Sanden

FAIR WG:

Sarah Jones (co-chair)  
 Françoise Genova (co-chair)  
 Oscar Corcho

RoP WG:

- Juan Bicarregui (co-chair)
- Rene Belsø

EOSC core operational costs study:

Angele Giuliano (AcrossLimits)  
 Steve Robertshaw (AcrossLimits)  
 Luca Ruggieri (BoundaryLess)  
 Andrea Valeri (BoundaryLess)

Invited:

- Dale Robertson (JISC, editor of EOSC-Hub Briefing Paper – Provision of Cross-Border Services)
- Matthew Scott (GEANT)

Agenda:

The focus of this meeting was on the funding model for shared resources.

The following background material was distributed before the meeting:

EOSC-hub briefing paper where a definition and explanation of shared resources is included:

<https://www.eosc-hub.eu/news/new-briefing-paper-cross-border-services>

Relevant extracts from the draft iron lady document:

- The scale and diversity of the services and resources to be federated implies that the operational and financial responsibility of federated services and data will remain with their existing operators and funders.
- Shared resources are considered part of EOSC-Exchange and should appear in an EOSC catalog.
- Funds for developing, operating and maintaining the services included in EOSC-Exchange is principally the responsibility of the service providers that operate them. There are many potential funding schemes and mechanisms that could fund the different components of the MVE but each comes with its own constraints and integrating them into a comprehensive funding plan will be a challenge requiring effort of an entrepreneurial nature to actively seek funding opportunities and secure them.



- Services made available via EOSC-Exchange may be available free of charge or against payment (but all remain free at the point of use). Where a service is available against payment, charges will be transparent and visible, including via the portal.
- A transaction for the use of a service will be an agreement between the service provider and user or their sponsor (i.e. the operator of EOSC-Exchange will not be involved in the transaction). To encourage the support for FAIR principles, the agencies and organisations (including European Regional Development Fund and national programmes) funding research in countries participating in EOSC, should consider making a policy decision to accept the use of services in EOSC-Exchange as an eligible cost in data management plans and grant requests submitted by publicly funded researchers.
- It is recognised that the services provided by publicly funded organisations frequently have a mandate and a budget to serve a well-defined set of users that may be delimited by research discipline or geographical boundaries, and that broadening access to those services may generate additional costs. As an incentive to encourage service providers to participate in EOSC-Exchange and open up their services to all publicly funded researchers, the projects to be funded via calls such as INFRAEOSC-07-2020 will offer an EC-funded means, based on the Horizon 2020 Virtual Access scheme, to compensate service providers for the additional operational costs they incur. Should a service provider request compensation (i.e. request Virtual Access funds) for providing a service via EOSC-Exchange, then it would be classed as a service available against payment.
- Participation by service providers in the EOSC-Exchange incentive schemes described above will be subject to their commitment to participate in monitoring and reporting schemes intended to gauge usage and uptake of the services.

The iron lady has an example of an incentive for service providers:

The National Science Foundation (NSF) in the USA has taken the process of aligning funding programmes a step further by allowing researchers to request funds to access centrally procured cloud services to support their e-needs while submitting research grant proposals. NSF has funded CloudBank as a 5M\$ pilot to enhance the research and education community's access to cloud computing resources through selected programs within the NSF Directorate for Computer and Information Science and Engineering (CISE). Grant applicants include a supplementary document that provides the cost details (which count toward the overall proposal limit), justification, and description of the cloud computing resources requested.

If such an approach were mapped onto EOSC, it would mean funding calls under Horizon Europe should allow applicants to request access to EOSC-Exchange resources as part of their proposals. Such a funding model would allow researchers to plan their e-needs by consulting the EOSC catalogues of services and could help





ensure the results of publicly funded research are made more widely available and accessible beyond the lifetime of the grants.

A similar model could also be used for research grants funded via the European Research Council (ERC) and Marie Skłodowska-Curie actions as well as national and regional funding programmes.

#### Discussion:

- Shared resources are not the only type of services to be included in EOSC-Exchange. Many data sets and services are not rivalrous in their nature. There may be technical constraints in accessing large datasets which could impact the underlying infrastructure of EOSC but research performing organisations, including EMBL and CERN, have found the means to make petabyte scale datasets openly available.
- Not all shared resources need to be internationally accessible in order to be considered for inclusion in EOSC-Exchange. EOSC-Exchange can add value by making shared resources more visible in their country of origin.
- Researchers adopt open access policies when it simplifies their research activities or when their funding agencies demand it.
- There are constraints on access to shared resources due to their rivalrous nature and the means by which they are funded. There are only a few examples of shared resources which are openly available internationally and their wider access is often made possible through EC funds while the majority of shared resources are funded by member states.
- Access to commercially operated shared resources (such as cloud services) is possible but, as discovered by the OCRE project, publicly managed procurement of such services at an international level needs to be carefully organised to comply with legislation, ensure value added tax can be recuperated and avoid excessive transaction costs for small-scale usage.
- In effect, the digital single market for shared research resources does not exist and better alignment of national research funding policies is necessary to bring it into existence. EOSC could provide the opportunity to bring about such a policy change but it will require EOSC to be able to exert influence at a political level in the member states. The success of the recently created European platform in response to COVID-19 provides an example of the advances that can be made if such a policy change happens.
- The European Cloud Federation (<https://ec.europa.eu/digital-single-market/en/news/commission-welcomes-member-states-declaration-eu-cloud-federation>) shows the member states appetite for the digital single market.
- PRACE is an example of shared HPC resources where access is possible internationally based on agreements that have been made between countries and sites. A fraction of a HPC sites' resources are available to international users. Those countries that do not fund and host HPC sites contribute to funding their operating expenses (and associate services) in order to access the resources. EuroHPC brings together co-funding by member states and the EC for the next generation of HPC resources with similar agreements for access rights.



- HPC sites (and the national networks managed by NRENs) do not compete among themselves. The HPC access mechanisms are based on scientific excellence using peer reviews and are not very flexible (e.g. the allocation process cannot react to urgent changes in needs).
- A form of national consortia, inspired by the HPC model, could provide a mechanism to corral member state funding into the EOSC partnership and simplify international access to shared resources.

It was agreed to hold a further meeting during the week of 26-30 October 2020 and participants will propose focused questions as input to the agenda.

## Meeting 29/10/2020

### Participants

#### Sustainability WG:

Jessica Klemeier  
Bob Jones (rapporteur)

#### Architecture WG:

Leif Johansson  
Mark van de Sanden

#### FAIR WG:

Sarah Jones (co-chair)  
Oscar Corcho

#### RoP WG:

- Dale Robertson
- Rene Belsø

#### EOSC core operational costs study:

Angele Giuliano (AcrossLimits)  
Steve Robertshaw (AcrossLimits)  
Luca Ruggieri (BoundaryLess)  
Andrea Valeri (BoundaryLess)

#### Invited:

- Matthew Scott (GEANT)

#### Agenda:



1) Which are the "low hanging fruit" that can be made available as services/data via the EOSC MVE that would be able to deliver cross-border services in 2021 without restrictions?

There are many datasets in repositories that are not yet included in the EOSC catalogues. There are also the datasets and services from the ESFRI clusters which are now part of the INFRAEOSC-03-2020 project.

There are also the services to be made available via the INFRAEOSC-07-2020 set of projects.

The INFRAEOSC-07-2020 set of projects will make use of the virtual access mechanism to extend access to the services to a wider audience.

The virtual access funds in the INFRAEOSC-07-2020 set of projects represents >50% of the EC funding, consequently >22M euros of funding for the period 2021-2023.

Even with the virtual access funding mechanism, many public sector providers have policy limitations on the fraction (e.g. 5%) of their capacity they can make available via such routes.

It was highlighted that all these examples are using EC funds as incentives to the service providers to make their services more widely available.

Some service providers, DataCite being one example, already have business models.

But does the absence of business models for the majority of the public sector service providers prohibit services from being shared across borders?

Does the virtual access mechanism provide an 'initial' business model for such service providers?

These questions highlighted that instead of trying to solve the problem (i.e. finding business models that support EOSC implementation), we should rather first point out that without a clear business model (or motivation) for cross borders usage of resources, EOSC cannot be realised.

This discussion gave rise to a number of key business model questions:

- Is EOSC only about EU funded services, data or infrastructures (i.e. not about opening/sharing national resources)?
- What might motivate a provider to offer any services/data/infrastructures across EU borders, within the EOSC framework? Which business model could motivate them to do this?



- In the absence of virtual access funding, is there no incentive for offering cross border resources via EOSC, in that it consumes labour and budget resources, without any compensation?
- Can one say that EOSC without a cross border business model for national resources is reduced to being (only) a vehicle for the narrow pursuit of attracting EC funding?

This led to the idea of a possible evolution of the virtual access funding mechanism that could be funded not only by the EC but also by the MS/AC.

One of the advantages of the virtual access mechanisms is that it is a form of demand-driven compensation for service providers that has very low transaction costs.

The virtual access mechanism is only suitable for not-for-profit service providers and a different provisioning mechanism would be required for services from private sector providers. Issues of state aid were evoked and it was highlighted that, in preparation for EuroHPC, a derogation from state aid rules was implemented in 2014 by the EC for Important Projects of Common European Interest (IPCEIs) [[https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0620\(01\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0620(01)&from=EN)]. Could something similar be envisaged for EOSC?

It was also noted that the criteria for selecting service providers eligible for virtual access funding was membership of successful INFRAEOSC-07-2020 consortia rather than adherence to a set of EOSC approved requirements for inclusion in EOSC Exchange.

2) Would a follow-up study focussing on funding models to enable cross border delivery of publicly operated services for EOSC MVE be interesting?

The question was not addressed directly but the discussion did focus around cross-border business models for not-for-profit service providers where more work is required.

As the Executive Board WGs are completing their work and publishing their final reports, it was agreed not to schedule another MVE meeting in the immediate future.

The notes from the MVE meetings are distributed to the participants and made available online. (<https://drive.google.com/drive/folders/1jE71vRv3Yj2OZ75PfkNdWra7O3QtStGt?usp=sharing>)

A draft of the iron lady document was distributed during the EOSC Governance Symposium last week.

The final version of the iron lady will be published in November as well the report from the EOSC core operational costs study.



The points discussed during the series of MVE meetings have contributed to these documents.



## Annex B: Original Document Answers from Service Providers

Not included in this report.





# Annex C: Detailed Costings Workings

Not included in this report.



# Annex D: EOSC Core Iron Lady Service Mappings



EOSC Core Service Groups as per Iron Lady	EOSC Core Service as per Iron Lady	Supplier Org	Service	Service Supplier	Complies with Iron Lady definition of EOSC Core
<b>Core Service Groups</b>	<b>Core Services</b>				
EOSC interoperability Framework	PID	DataCite	PID	DataCite	Yes
		EUDAT	B2HANDLE	EUDAT	Yes
Web Portal	Web Portal	EGI	Portal Front end	Cyfronet	Part
		EGI	Web Content	TrustIT +	Part
		EGI	Portal back end (provider portal)	ATHENA	Part
		EGI	Onboarding process	Trained personnel	Part
EOSC interoperability Framework	Data Access Framework	EUDAT	B2FIND	EUDAT	Yes
		OpenAIRE	EXPLORE	OpenAIRE	Yes
	AAI	GEANT	AAI	GEANT and Partners	Yes
		EGI	Check In	EGI GRNET	Yes
	Open Metrics Framework	OpenAIRE	Open APC	U o Bielefeld	Part
		OpenAIRE	OpenCitations	U o Bologna	Part
		OpenAIRE	Open Science Monitor	OpenAIRE	Part
		OpenAIRE	ScholExplorer	OpenAIRE	Part
		OpenAIRE	UsageCounts	OpenAIRE	Part
		EGI	Portal-based metrics	Cyfronet	Part
		EGI	Accounting	EGI UKRI/STFC	Part
	EGI	Monitoring	EGI ARGO	Part	
	A shared open science policy framework	A shared open science policy framework with data compliance framework for open / FAIR data	OpenAIRE	Open Science Helpdesk	U o Göttingen
OpenAIRE			Provide	OpenAIRE	Part
Security policies and procedures	Service request and problem management scheme	EGI	EGI xGUS	EGI	Yes
EOSC interoperability Framework	Service Access and Management Framework	EGI	GOCDDB DPMT	EGI KIT	Part
		EGI	SOMBO Service order handling system (through Portal)	CNRS/IN2P3	Part
Security policies and procedures	Security policies and procedures	EGI	Operational Security	UKRI/STFC Nikhaf	Yes
Interoperable metadata framework	Interoperable metadata framework				
Operational Support Service	Operational Support Service				
	<b>Tinman Core Additions</b>				
	Procurement	GEANT	Procurement	GEANT	Yes
	<b>Connection Components</b>				
	Collaboration and Communication Systems	EGI	JIRA Confluence GTM	EGI	Component
	Messaging	EGI	ARGO	GRNET	Component



# Annex E: EOSC Core Service Pricing

EOSC Service Aggregators	Q1. How much does it cost to run your central organisation?	Q2. How much do you need to contribute to the federated national/institutional entities you depend upon?	Q3. How much do any bought in services cost you to acquire?	Q4. What kind of additional charge do you need to apply to ensure you can continue to develop as an organisation?	Q5. Do any national laws/regulations prevent or limit your national service providers selling services to a central EU entity? <small>This question does not relate to the notion of common good, in-kind services or quid pro quo relationships, we are interested in relationships based on actual transactions.</small>	Q6. Funding Sources
EGI	EGI.eu head count varies, depending on income and need for posts. EGI.eu head count is partly supported by membership fee. EGI membership is not restricted to national entities but also network entities	Part of the membership fee is redistributed back to our members to pay for EGI specialised services. However, for end user services we experience a vicious feedback loop. EGI services are seen as being of low criticality to EGI members, so if the barrier to entry for end users is too high, they won't use EGI services and they look elsewhere. This means that the national centres will then discard the EU work (and staff) to focus on national service provision, if EGI income is insufficient	S/W licenses N/W access and use fees Most costs are in member labour fees for setting up services etc.	We have adopted a strategic approach to participation in research projects. We do not need to charge of for development. We do need to charge for capacity availability because we have no ability to build this into our business model.	Yes. Managing our exposure to VAT is a huge problem for us in this respect. We can be exempt on very specific items but our exposure is binary, if one item becomes subject to VAT then everything becomes exposed to VAT. We have considered setting up a dedicated commercial arm to deal with this but our low margins mean this is not a viable option for us	H2020 Projects Member fees
EUDAT	6 people 3 FTE but only for managing community Need to double this to face EOSC 3-5% of income is for secretariat, rest is distributed to members	Costs are incurred but their calculation is complex Shared national and EC services already run on same machine So EOSC could be sharing services that are already shared in the same physical infrastructure	None	Double the size of the current team for EOSC as stated Do not want to grow further and no growth plans currently exist But could grow if required .	Partners are limited in this area because of funding organisation rules, those that can have very limited resources for reselling. EUDAT allows member reselling of services but direct selling is not allowed in many member states. Budget practices are part of the problem as they do not allow for responsive behaviour. Funds are allocated on an annual basis. So the data centres cannot respond to any additional unmet need within any financial period and have to make the case for such a need to be addressed in the next financial period. The case may be rejected. Growth cannot take place until/if next budget is agreed and even then, only if growth is supported by the funder. Currently, the overheads are limited and are able to satisfy only current needs for existing demand. No wiggle room is available.	H2020 Projects Member fees Selling services
GÉANT	NO RESPONSE	NO RESPONSE	NO RESPONSE	NO RESPONSE	NO RESPONSE	Selling services
OpenAIRE	6-7 people in office	Only Zenodo and Graph are required as contributors. Both run independently of the management function	€1000 pa for MS service fees Approx €20K p/a for other general fees	???	Not an issue, maybe maintaining long-term access to Zenodo is a potential hazard but luckily CERN is special case in this respect, being an international organisation itself.	H2020 projects (as partners) (as consumers) Private companies (small) Member States-> sell value-add service. Worldwide connections e.g. South Korea



# Annex F: Details on the Platform Design Approach to Study EOSC Ecosystem

This Annex reports the initial model extracted from the EOSC ecosystem study as it was included in the 3rd deliverable. Here is reported to complete the final considerations included in this final document, where we extended the study to the whole MVE.

## Introduction

The current study of the EOSC ecosystem aims to define the most appropriate sustainability models for the EU international research context and specifically for the European Open Science Cloud, is strongly based on the open source methodology Platform Design Toolkit, available here for further reference: <https://platformdesigntoolkit.com/toolkit/>

The theoretical framework is also available with the [Creative Commons CC-BY-SA 4.0](#) license and described in this [User Guide](#), and included as Annex C to this report as well.

## The approach used

In the analysis we performed, we followed the Platform Design Toolkit framework approach, which has been consolidated over several years. It starts with the analysis of the ecosystem under observation, by clustering the organisations involved in roles that they perform when interacting among each other and then consolidating them into a manageable number of Key Relations that highlight the connection and the value exchanges between the most important roles in the ecosystem.

One of the main objectives when designing a platform strategy is to design the system of incentives and attractors that capture the attention of and resonate with the value expectations of the impacted and involved entities.

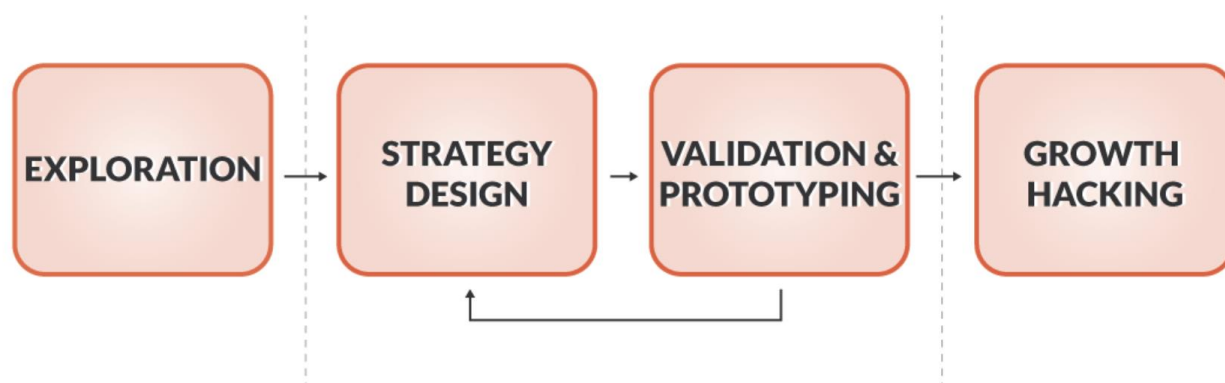
We study various strategic aspects of a range of Platform Experiences, extracting from them the most significant use case. Significance is associated with factors such as: frequency, importance and value. So, we are able to determine that issues arising frequently, matters that are described as important in the community and services that the community values are significant and, therefore, worthy of being reflected in use cases. The various aspects themselves, revealed through the Platform Experience, include:

- Candidate sustainability models.
- The different pull factors associated with various platform strategies.
- Nominal incentives systems that may attract more users.

Typically, we extract the use cases by directly involving in the design process the representatives of different entities and roles from the ecosystem. In this case, we could not act in this way, and we opted to interview the representatives and ask them to express their point of view. The reader can find the results in the following sections.



Platform Design always *designs for* an ecosystem, and never tries to design a new ecosystem. This is because a Platform strategy always needs to resonate with the expectations of the entities and roles active in the given ecosystem and offer services to support and leverage (hidden or unexpressed) potential exchanges. Nevertheless, Platforms can scale up or across (i.e. horizontally, in adjacent contexts) very fast and they can't afford to pay for its adoption by the user. Users need to be pulled onboard by the platform, and this is accomplished by resonating with their expectations and providing them identifiable and well perceived value gains.

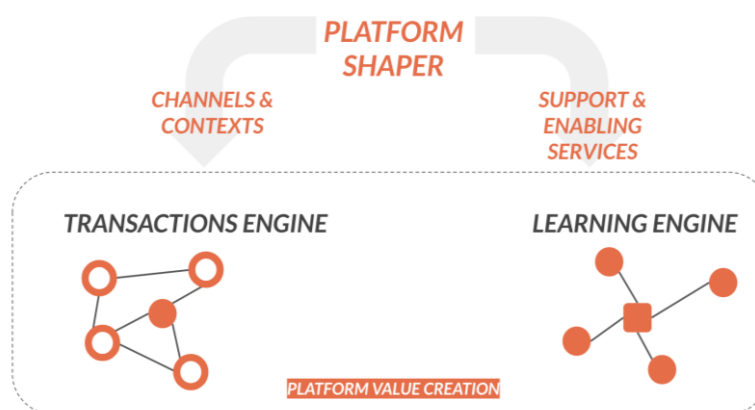


The platform design process is never “standardized” but it normally proceeds through a series of iterative aspect-phases. We talk about aspect-phases to emphasize the fact that they’re not supposed to be seen as “separated” phases, but more as continuously overlapped flows of work. For the sake of framing, we tend to break them down into three main blocks:

- **EXPLORATION:** leverages on *Platform Opportunity Exploration Guide*<sup>24</sup> and its *three canvases*. Venture practitioners into how to map an ecosystem that already interacts to identify what platform opportunities exist in a certain industry or context, and what strategic gameplay makes sense to adopt in a certain value chain to transform it through a platform strategy and possibly create an aggregation process.
- **STRATEGY DESIGN and VALIDATION & PROTOTYPING:** based on the *Platform Design Toolkit 2.2* framework, made of seven canvases and its *User Guide*. The strategy design phase allows practitioners or platform shapers to connect the exploration of opportunities in a context with the understanding of the entities and the expression of their potential. After researching and **mapping the entities’ individual context** –in terms of potential, pressures, gains, and goals– the design process focuses on the definition of the two **major platform value engines** which are the two main pillars of the platform strategic vision.
  - The **TRANSACTION ENGINE** is concerned with providing channels and contexts to enable and simplify value exchanges between entities, whereas the **LEARNING ENGINE** is concerned with providing services, tools, and context to foster the learning and evolution of participants.
  - The output from the design of the two engines is then condensed into a new phase which attempts at defining a set of **platform experiences** with specific value propositions and whose value & business model can be assessed, prototyped and validated using preliminary interviews and MVPs. This phase entails a series of iterative steps that allow the shaper to change and adjust the experiences after confronting reality.

<sup>24</sup> *Platform Opportunity Exploration Guide* is available at <http://bit.ly/POE-PDT>





- **GROWTH HACKING:** Once the assumptions of an existing potential-platform fit are validated, the platform shapers can focus on several tactics and approaches to leverage **network effects** in order to grow and scale the impact of this initiative up and across context.

The study of the sustainability models for the EOSC Core platform focused on the Design phase, and we performed two light iterations based on documents and interviews with ecosystem entities. Throughout our iterations, we focused on the value brought about and shared by the organisations that, depending on their ability to consume, provide, exchange or a combination of the three, by tracking their main motivations and transacting activities.

Finally, we consolidated the model by trying to understand how the organisations\roles studied can harness EOSC to produce a superior value by listening to their currently unsatisfied needs and figuring out, (through meetings with the Working Groups and the EOSC Consultation Days and interviews), how the organisations may evolve over time, as EOSC-as-a-Platform consolidates itself.

We highlight the contribution of the Sustainability Working Group to select the most suitable questions and for the meetings whose discussions helped us to shape the questions and gather responses. In addition, we underline our participation to the EOSC Consultation Days, held in May, where we gathered insights and data produced by their online forms. We continuously collected insights coming from the meetings with the Working Groups, the Consultation Days and the interaction with other Working Groups (e.g. EOSC-HUB), which we used to reiterate, when necessary, to provide an accurate picture of the ecosystem studied.

We gathered further information to validate our iteration through the interviews with the organisations of the ecosystem we studied. The people we approached spanned most of the roles we mapped, from the Research Funders to Horizontal Service Providers, but we lacked insights from the role we called Data Producer and the emerging role of the “Research Support entity”. The answers we gathered are listed in the Annex D.

## Ecosystem Diagram: Core entities and relationships

We started the study with an initial analysis of the most relevant entities and roles in the EOSC broad ecosystem, that is the fundamental first step we make to identify the entities and their roles towards the ecosystem and in relation to other entities-roles. This mapping helps us identify the



“Core System”, i.e. the most relevant roles and relationships that are exchanging the highest value (in terms of frequency, numerosity, size of the transactions, etc.).

Among these roles and entities that we represented on the Ecosystem map we have identified the following *role clusters*:

1. **Research Entities and Bodies (REBs)** are the **consumers of services, data and generally speaking of value organized** by the EOSC (Core) initiative. This role includes RPOs, Universities, Researchers, etc. This role can be taken by national or international bodies.
2. **Scientific Output Exploiter / Enhancer / Supporter (SEEOS)**: they comprise a wide range of Research Performing Organisations (RPOs) like universities, research institutes, government labs, Research and Technology Organisations (RTOs), Large-scale Research Facilities (LRFs). They are context domain experts that can provide for instance AI algorithms, expertise on how to deal with data in a specific domain, can provide consulting services on specific topics, help with experiments, data collection and elaboration, they can provide support in transforming datasets into FAIR open and interoperable datasets, etc. Under this role, there are specific service providers that can help with data and resources exploitation, i.e. help with frameworks to use and exchange data across different entities. In addition, all the University IT departments that are supporting the research units fall into this role, and they act as expert advisors and consultants for researchers and their tailor made special requests. The SEEOS can also act as a broker for the data resources that are not autonomously capable of managing the *exploitation of resources*. Example SEEOS entities are ELIXIR, OpenAire, UKRI, STFC, Terradue srl, IN2P3 and ICOS RI.
3. **Horizontal Service Providers (HSPs)**: these entities provide general purpose services like storage, computational resources and consulting services on the services they offer. They are Partners in the platform since they are providing value in terms of services as their main interest, hence monetising their products and services. They can also provide consulting services around their offerings. They can be small providers or large horizontal EU e-infrastructures. Example HSPs include OpenAIRE, GEANT, EGI, XDC, EOSC-Hub, CS3MESH, EOSC-hub, FREYA, ePIC, DOI/DataCite, FOSTER, EOSC-Enhance<sup>25</sup>.
4. **Data Producers (DPs)**: these entities are mainly focused on providing Data that the Research Bodies are consuming. Research Infrastructures fall under this role when they are providing data to other parties. The data producer may be organized to permit the data to be exploited or consumed by the consumers. If the data producer needs help to prepare data for exploitation, it can ask for support and services from the SEEOS.
5. **Funding Bodies** are the main **stakeholders** in EOSC since they support the research in all its stages, and they are mainly identified with the ones at national and EU level. Other entities are mainly identified with the European Commission and research representatives from National Institutions. **Normally, we don't design for the stakeholders**, because the Platform focus is on the "relationships with high frequency and high potential", but in this ecosystem the Funding bodies are relevant since they are the main financial contributors and the funding model is similar to a patronage/membership in a 'learning' business model approach.

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<sup>25</sup> Many of these entities are projects that have known end dates. The fact that they are listed here represents a strategic risk to EOSC Core. This risk is the main reason why both service aggregators and "operating margins" are required to cover convergence, as is highlighted in the final recommendations / insights of this report



The roles described above are a keystone in the Platform Design. If we can generalize entities in loose roles, we are preparing the Platform for capturing and supporting a broader set of organisations seeking and exchanging value in the ecosystem, while keeping the design simpler, more scalable and efficient, since it is designed for manageable roles but allows any evolution kicking in.

So, the purpose of this divergent analysis is to identify the ROLES that are relevant to the ecosystem, and later map the existing and acting entities into those roles. The impact of the platform strategy to the ecosystem, later in time, will preserve the roles and will support the same or new entities to provide their value in the “channels or contexts” of transactions, leading the process to streamline and efficientise these exchanges: some entities will get opportunities to change roles, while some new entities will be attracted.

The initial map of the roles, assigned to their main type (Consumer of value, Prosumers, Partners or professional suppliers, and stakeholders) can be found in the picture below.

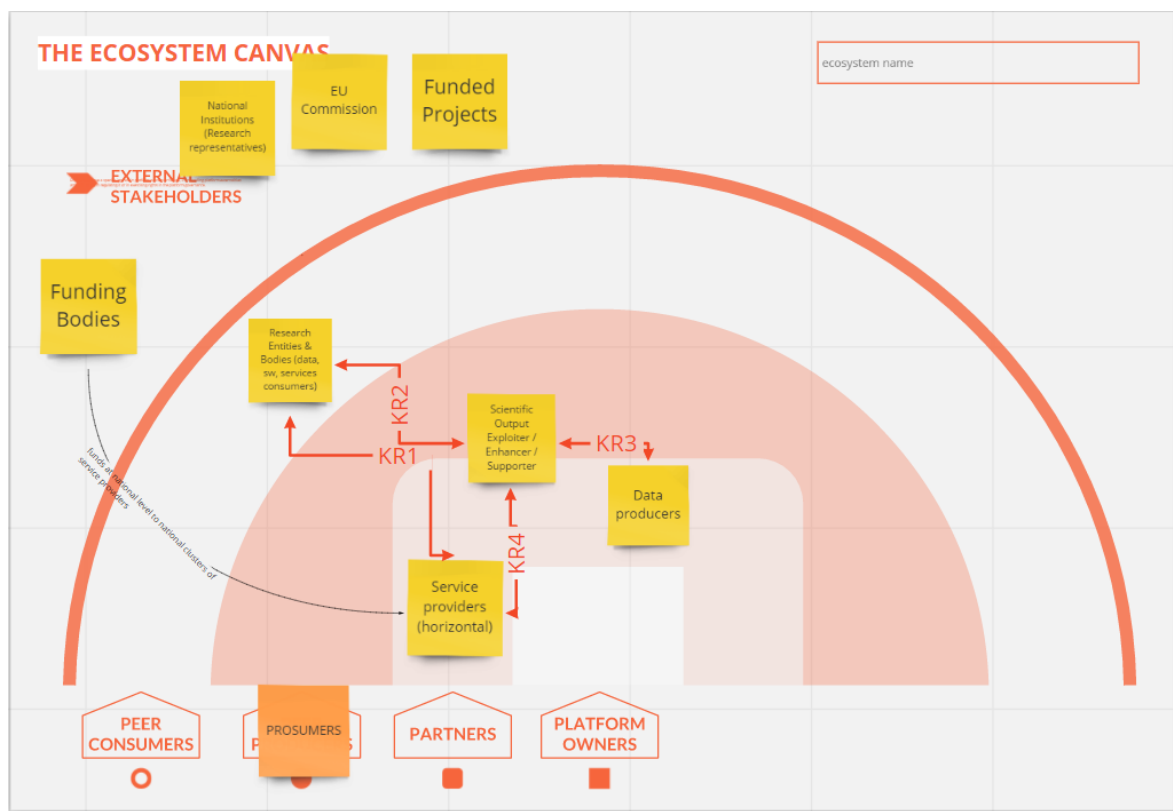


Fig.1 - By using the Ecosystem Canvas, we reflected on the ecosystem that EOSC is looking to shape. We clustered the entities present in this ecosystem, understanding what roles they might play.

In Platform Design terms, while Peer Consumers are the consumers of products and services generated by the other roles, Peer Producers and Partners are essentially the same in terms of providing products and services to the other roles. However, the scope is different: the Partners are professional value creators that tend to specialize in a niche or advanced/premium product/service and become better over time. Partners sometimes also facilitate, cater and enhance the value production by acting as brokers, facilitators or connectors. On the other hand, Peer Producers produce value occasionally and not systematically. Often the same *peer* may behave as both consumer and producer in different phases of its relationship with the brand-platform. As an example, consider a traveller that also rents her house when she's not at home,



such a user may sometimes contribute to the value and other times consume it, depending on lifetime phases, contexts and more. Peer producers can as well be Small/Medium Enterprises or individuals.

In the EOSC context, Peer Consumers are the Research Entities & Bodies, which access services and resources. Examples are researchers, Research Performing Organisations and Research Institutes. Examples of these organisations already present in EOSC can be found in the UK Research and Innovation (UKRI) and the Dutch National Institute for Subatomic Physics (NIKHEF). However, they can either consume services or provide some sort of services and products, especially when submitting their research and datasets. This implies that they can either fit into the role performed by the Research Entities & Bodies or in the Scientific Output Exploiter / Enhancer / Supporter (SEEOS), or other roles. The organisations falling in the latter role, like the Large-Scale Research Facilities, act more as the domain-experts that can provide a series of domain-specific products or services (e.g. Artificial Intelligence algorithms). Examples are given by the French National Institute for Nuclear Physics and Molecular Physics (IN2P3) and BonvinLab, the latter providing software based on AI algorithms. Note that Organisations can either decide to offer their services to the community or having an entrenched interest in selling products and services. This leads to the Partners of the ecosystem: the Data Producers and the Horizontal Service Providers. Organisations that fall in the former role are Copernicus, GEO and Italian ISTAT, while in the former we can find Géant, EGI, EUDAT, Cyfronet and OpenAire.

The Key Relationships drawn in the diagram (KRs) describe the importance and the frequency of the interactions between the roles, that we found through the discussions with our reviewers and the interviews. It seems that the most important relationship (KR1) would be between the Horizontal Services Providers and the Research Entities & Bodies, probably because the latter seek basic services, spanning from connectivity to identifications to authentication and authorisation infrastructures, as foreseen by EOSC Core. Another important relationship (KR2) would be between the Scientific Output Exploiter / Enhancer / Supporters and the Research Entities & Bodies, where we would expect frequent interactions to seek\provide services. Other Key Relationships (KR3 and KR4) link the Scientific Output Exploiter / Enhancer / Supporters to Horizontal Services Providers and Data Producers.

Based on the Ecosystem mapping phase, we have extracted the following information:

- Some entities, such as the Research Performing Organisations (RPOs) and Research Infrastructures (RI), can have a dual **ROLE**, both as consumers and as providers of value. So, they can be considered under the Researchers Units when they consume, and under the SEEOS when they provide specific services to the researchers; different entities - RIs for instance - fall into this role when they are consuming resources for their daily activities. When the research unit starts producing value instead of purely consuming it, it can fall under the SEEOS if it's offering services and expertise, or under the data producers if it's mainly providing research outputs.
- The SEEOS role is considered as a "prosumer", since even if it's mainly based on professional support (and based on that, it should be defined as Partner), there are cases where the service is provided without a monetization purpose, to contribute to research impact. Examples drawn could be the availability of software and the revision of research and data.
- Even if the target entity of the entire initiative is the Research Body (i.e. the research organisation, the researcher, the university) and the highest value proposition of EOSC



should be attracting them, we understood that whoever is purely involved in the research activities is not competent on the technical and administrative processes to select and access the right services (thinking specifically to the horizontal services, the “commodity” services, but also to the specific software or computational architectures needed). So, by forcing them into the role of choosing and implementing IT services for their research activities, EOOSC is not supporting the ecosystem to optimize resources and the use of funds.

- There are some roles in the ecosystem that are acting as service aggregators and as supporters to entities for the researchers (the final name should be found, we referred to them as “Research Supporters”, e.g. some departments in a University helping researchers to manage IT services and resources). Their main duty is to assist them in the identification of the right services and resources needed, in dimensioning and designing the software, hardware, and/or data architecture, and in purchasing, accessing and configuring the test/research environment. We suggest to focus the strategy to attract with a clear value proposition these subjects, and help them be the “ambassadors” or the “mentors/solution architects” for the researchers, offering them the guidance and technical or administrative support when they need to access and exploit resources.

## THE TWO ENGINES OF THE EOOSC PLATFORM STRATEGY

Our analysis finally revolved around the two engines that compose of the EOOSC platform strategy, that indicate on one hand how the organisations organised in roles exchange value among themselves and how they are onboarded into the platform, while harnessing EOOSC to reinforce existing interactions while new ones and catch new “**market**” opportunities, such as products, services, alliances and collaborations across Europe.

We analysed the two engines that are part of the EOOSC platform strategy: the transaction engine and the learning engine.

Through the **transaction engine** we explored how both the tangible and intangible values flow and the frequency of their exchange among the organisations; a sketch of the most important value flows that we found can be found in the appendix (through the Motivation Matrix and the Transaction Boards that can be retrieved in the Annex E). EOOSC would have a transactional component through the marketplace mainly represented by the current EOOSC-Exchange which may allow EOOSC to reach long-term sustainability. By understanding the transactions occurring within the ecosystem, EOOSC will be able to lower the existing friction that deters the organisations from interacting between themselves and hence generate an added value, in addition to reducing the difficulties connected to the retrieval, usage and sharing of resources.

On the commodity side, EOOSC could work on the standardisation of transactions, such as centralised buying and procurement, in order to find the right combination of the services while overcoming the European differences.

Emerging insights from the study of the “transactions” in the ecosystem of EOOSC reduce the entry barriers to access resources and services and to waive frictions or zero-sum games. On the former, the key approach is to help the players on the supply and demand sides to navigate the offer and find the right/best/more efficient solutions to accomplish a need, or to provide channels of interactions where the two sides can negotiate a tailor-made solution and level of quality. Curated lists, a better presentation and differentiation among the catalogues in the portal, or directly putting





in touch the players through the Platform or through a “proxy” or an “expert advisor” that can help find the optimal solution, are all good services that EOOSC should provide.

In addition, given that the EOOSC core services will be offered mainly by a wide variety of partners in the Platform, a strong attention to transparency and reducing friction should be put, to avoid risks of cheating or avoidance of platform offered services.

Through the **learning engine** we aimed to unearth the most feasible strategies to onboard the different roles by individuating the values, products and services that are the most important for them. Then, how the organisations can harness the platform to extract more value while becoming more efficient thanks to the platform. In this sense, we found that patronage funding seems to be the most feasible strategy because of EOOSC's unique, complex environment, in which the main source of funds comes from governmental entities at the national and European level. However, the risk connected to the patronage funding scheme is that, by itself, it does not allow EOOSC, and specifically EOOSC-Core, to be sustainable in the long-term because the latter does not allow for high margins when onboarding the organisations for basic service levels.

As general insights from the analysis performed through the study of the two “engines”, we extracted:

- The peer to peer relationship between entities and roles that can be of mutual benefit and support when they need to identify, access and exploit resources should be encouraged;
- The re-design of the procurement processes, also including some edge ideas and technologies (smart contracts, tokens) to take into account the possibility for a Country to fund an international research project and benefit from the “return of image” or generally speaking from an indirect and intangible return on investment should be further carried out, since it’s a common case emerging from the ecosystem. In general, a second-order layer of management for the purchase and management of resources can be valuable, since the procurement processes are long and complex and have not been designed primarily for the edgy needs of research and science applications;
- Smoothing the process by centralising all the different activities, gathering data and insights about **quotations** (e.g. accepted\refused, benchmark, etc).
- The **centralized procurement** is forecast in EOOSC Core but not yet operating. **It could be important to manage** the different levels of contributions from researchers in different Countries, and finetune the national and international contributions.
- On the learning engine side, this is mostly about supporting the entities and roles to perform at their best through the platform. The relationship between Research bodies and all the roles that can help them to make a better use or exploitation of data and dataset, or research outputs, is perceived as a strong value by the EOOSC ecosystem;
- Funding of initiatives and the value (re)distribution among the various clusters of players is something that EOOSC in general should take into account and EOOSC Core should support at infrastructural level, since it’s the basis of the “pull factor” of the entire platform strategy;
- Some possible funding solutions have been outlined in the Tinman document. Some of these funding models assume direct payments from researchers. However, such an approach to funding needs to be weighted to address the variety of GDP across Europe, service volume consumed and service subscription level, etc. These weights can be compiled into a single ratio and this should be "tied" to the EOOSC objectives and values. Funding is only one metric and it is very likely that other metrics exist.
  - It is recommended, therefore, that the existence of these other metrics is explored and, once discovered, weighted to reflect the diverse situations in each EU region (e.g. in terms of technological readiness, resources and (researcher) populations),



to arrive at additional weights. The overall weightings would then contribute to a ranking of how EOSC services are allocated, based on a number of regional internal/external, push/pull, demand/capacity, etc. factors.

- The intent here is to reward the regions that exhibit a readiness to reach EOSC objectives without penalising disadvantaged regions.

