



H2020-INFRAEOSC-2018-3

NI4OS-Europe

National Initiatives for Open Science in Europe

Deliverable D2.5

Business models recommendations

Lead beneficiary(s): UoB

Author(s): Milan Kuželka, Eleni Toli, Ilias Papastimiou,
Branko Marović

Status –Version: Final – g

Date: February 11th, 2022

Dissemination Level: Public

Abstract: Deliverable D2.5 “Business models recommendations” provides a set of recommendations related to business modelling aspects, based on the state of the art in NI4OS-Europe countries and recommendations adapted from the leading pan-EU initiatives.

This document covers procurement practices and business models stemming out of the EOSC Governance Board, related initiatives and EOSCpilot, EOSC-hub, INFRAEOSC-05b projects. It describes and analyses the NI4OS-Europe survey on national procurement practices, funding, costs for making data FAIR, and NOSCIs funding and sustainability. After summarizing the expected future work, the report integrates prior findings, NI4OS-Europe specifics and prospects, and gives general recommendations for the observed aspects, but also NOSCIs business models.

© Copyright by the NI4OS-Europe Consortium



The NI4OS-Europe project is funded by the European Commission under the Horizon 2020 European research infrastructures grant agreement no. 857645.

The NI4OS-Europe Consortium consists of:

| | | |
|---------------|-------------|-----------------------|
| GRNET SA | Coordinator | Greece |
| ATHENA RC | Beneficiary | Greece |
| CYI | Beneficiary | Cyprus |
| UCY | Beneficiary | Cyprus |
| IICT | Beneficiary | Bulgaria |
| SRCE | Beneficiary | Croatia |
| RBI | Beneficiary | Croatia |
| KIFU | Beneficiary | Hungary |
| DE | Beneficiary | Hungary |
| ICI BUCURESTI | Beneficiary | Romania |
| UEFISCDI | Beneficiary | Romania |
| ARNES | Beneficiary | Slovenia |
| UMUKM | Beneficiary | Slovenia |
| IPB | Beneficiary | Serbia |
| UOB | Beneficiary | Serbia |
| RASH | Beneficiary | Albania |
| UNI BL | Beneficiary | Bosnia-Herzegovina |
| UKIM | Beneficiary | North Macedonia |
| UOM | Beneficiary | Montenegro |
| RENAM | Beneficiary | Moldova (Republic of) |
| IIAP NAS RA | Beneficiary | Armenia |
| GRENA | Beneficiary | Georgia |

COPYRIGHT NOTICE



This work by Parties of the NI4OS-Europe Consortium is licensed under a Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>).

The NI4OS-Europe project is co-funded by the European Union Horizon 2020 programme under grant number 857645.

The information herein does not express the opinion of the European Commission. The European Commission is not responsible for any use that might be made of data appearing herein. The NI4OS-Europe beneficiaries do not warrant that the information contained herein is capable of use, or that use of the information is free from risk, and accept no liability for loss or damage suffered by any person using this information.

Document Revision History

| Date | Issue | Author/Editor/Contributor | Summary of main changes |
|-------------|--------------|--|--|
| 04.06.2021. | a | Milan Kuželka | Skeleton and the first draft |
| 11.10.2021. | b | Milan Kuželka | First draft version with initial material |
| 30.11.2021. | c | Milan Kuželka, Eleni Toli, Christos Liatas, Ilias Papastimiatiou | Draft version with all sections completed |
| 05.12.2021. | d | Milan Kuželka, Eleni Toli, Ilias Papastimiatiou | Updated version following an internal review |
| 11.01.2022. | e | Milan Kuželka, Eleni Toli, Ilias Papastimiatiou | Draft full version with all sections completed |
| 31.01.2022. | f | Branko Marović, Eleni Toli, Ilias Papastimiatiou | Updated version following an internal review |
| 11.02.2022. | g | Milan Kuželka, Milutin Radonjić, Branko Marović, Eleni Toli, Ognjen Prnjat | Final |

Table of contents

| | |
|---|-----------|
| 1. Introduction | 11 |
| 2. Approach and methodology | 13 |
| 3. Previous work by EOSC related initiatives | 15 |
| 3.1. Work by EOSC Governance Board and other initiatives | 15 |
| 3.1.1. <i>EOSC Sustainability Working Group</i> | 16 |
| 3.2. Work by EOSC projects | 17 |
| 3.2.1. <i>EOSC-hub project</i> | 17 |
| 3.2.2. <i>INFRAEOSC-05b projects</i> | 20 |
| 4. NI4OS-Europe analysis and results | 21 |
| 4.1. Context of the questionnaire..... | 21 |
| 4.2. Presentation of results | 21 |
| 4.2.1. <i>Procurement</i> | 21 |
| 4.2.2. <i>Funding</i> | 23 |
| 4.2.3. <i>FAIR</i> | 23 |
| 4.2.4. <i>NOSCI's funding/sustainability</i> | 24 |
| 5. Future work | 25 |
| 5.1. Task Force on Defining Funding Models for EOSC..... | 25 |
| 5.2. From the current grant-based approach to public procurement..... | 26 |
| 6. Analysis of main findings | 27 |
| 7. Recommendations | 29 |
| 7.1. Important aspects of business models for NOSCI's | 31 |
| Appendix: NI4OS-Europe questionnaire on business models | 33 |

References

- [1] EOSC Association Task Force on “Defining Funding Models for EOSC”, https://www.eosc.eu/sites/default/files/tfcharters/eosca_tfdefiningfundingmodelsfo_reosc_draftcharter_20210614.pdf
- [2] Project NI4OS-Europe-857645 – Annex I – Description of the Action
- [3] European Data Initiative, <https://eudat.eu/european-data-initiative>
- [4] Business Model Innovation for Sustainability: Towards a Unified Perspective for Creation of Sustainable Business Models, <https://onlinelibrary.wiley.com/doi/epdf/10.1002/bse.1939>
- [5] From Strategy to Business Models and onto Tactics, <https://www.sciencedirect.com/science/article/abs/pii/S0024630110000051>
- [6] EOSC Association Task Force on “Defining Funding Models for EOSC”, https://www.eosc.eu/sites/default/files/tfcharters/eosca_tfdefiningfundingmodelsfo_reosc_draftcharter_20210614.pdf
- [7] European Open Science Cloud (EOSC) strategic implementation plan, <https://op.europa.eu/en/publication-detail/-/publication/78ae5276-ae8e-11e9-9d01-01aa75ed71a1/language-en>
- [8] Prompting an EOSC in Practice – Final report and recommendations of the Commission 2nd High-Level Expert Group on the European Open Science Cloud (EOSC), <https://op.europa.eu/en/publication-detail/-/publication/5253a1af-ee10-11e8-b690-01aa75ed71a1>
- [9] Science|Business Cloud Consultation Group – The European Open Science Cloud: Who pays for what?, <https://sciencebusiness.net/science-cloud/news/european-science-cloud-who-will-pay>
- [10] EOSC Sustainability Executive Working Group, <https://www.eoscsecretariat.eu/working-groups/sustainability-working-group>
- [11] Solutions for a Sustainable EOSC A FAIR Lady (olim Iron Lady) report from the EOSC Sustainability Working Group, <https://op.europa.eu/en/publication-detail/-/publication/581d82a4-2ed6-11eb-b27b-01aa75ed71a1/language-en/format-PDF/source-175468053>
- [12] EOSCpilot project, <https://eoscipilot.eu/>
- [13] EOSC-hub D12.2 Report on business model analysis for procuring services in the EOSC, <https://documents.egi.eu/public/ShowDocument?docid=3627>
- [14] EOSC-hub D12.3 Business models and procurement: evaluation and recommendations, <https://documents.egi.eu/public/ShowDocument?docid=3633>
- [15] ELIXIR organisation, <https://elixir-europe.org/>
- [16] EOSC-Pillar D3.1 Summary Report of the National Initiatives’ Survey, <https://zenodo.org/record/3937318#.YZfRrtDMKHs>

- [17] Incentives & Rewards for supporting Open Research Data Management and FAIR, https://ni4os-europe.eu/wp-content/uploads/2021/06/NI4OS_RI_ORDM_web_EN_single_pages.pdf
- [18] European Open Science Cloud, <https://www.eosc.eu/sustaining-eosc>
- [19] EOSC Association Task Force on “Defining Funding Models for EOSC”, https://www.eosc.eu/sites/default/files/tfcharters/eosca_tfdefiningfundingmodelsfo_reosc_draftcharter_20210614.pdf
- [20] Horizon Europe Research Infrastructures Work Programme 2021-2022, https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2021-2022/wp-3-research-infrastructures_horizon-2021-2022_en.pdf
- [21] EOSC Future project, <https://eoscfuture.eu/>
- [22] Final Report and Action Plan from the European Commission Expert Group on FAIR Data – Turning FAIR into reality, https://ec.europa.eu/info/sites/default/files/turning_fair_into_reality_1.pdf
- [23] Cost-benefit analysis for FAIR research data – Cost of not having FAIR research data, <https://op.europa.eu/en/publication-detail/-/publication/d375368c-1a0a-11e9-8d04-01aa75ed71a1/language-en>

List of tables

| | |
|---|----|
| TABLE 1: THE METHODOLOGY SCHEME | 13 |
| TABLE 2: THE SEVEN MAIN COST CATEGORIES FOR THE EOSC ACCORDING TO THE SCIENCE BUSINESS NETWORK'S CLOUD CONSULTATION GROUP | 16 |
| TABLE 3: SIX PATTERNS FOR DESIGNING BUSINESS MODELS FOR PROCURING SERVICES..... | 18 |

List of Acronyms

| | |
|--------------|---|
| B2B | Business to Business |
| EC | European Commission |
| EOSC | European Open Science Cloud |
| FAIR | Findable, Accessible, Interoperable, Reusable |
| GB | Governance Board |
| MoU | Memorandum of Understanding |
| NAP | National Action Plan |
| NOSCI | National Open Science Cloud Initiative |
| OS | Open Science |
| OSC | Open Science Cloud |
| TNA | Transnational Access |
| VA | Virtual Access |
| WG | Working Group |

Executive summary

What is the focus of this deliverable?

This report intends to provide basic findings on open-science related business models, based on adapted ones from the leading pan-EU initiatives and the analysis of the national state of the art. The goal is to define the common ground and recommend mechanisms that can be used by different stakeholders involved in the establishment of the National Open Science Cloud Initiatives (NOSCI) and support their sustainability aspects. The research has been done from the perspective of NOSCI and focuses on four main business aspects that were identified. All findings and recommendations of this document aim to support the future EOSC developments in this area that is now under investigation by the newly created EOSC Association Task Force on Defining Funding Models for EOSC[1].

What is next in the process to deliver the NI4OS-Europe results?

The current deliverable gathers and highlights elements that should be considered when developing business models for open science and EOSC-connected outputs. The findings and recommendations of this deliverable are thus primarily intended to support EOSC stakeholders at large. In parallel, it will provide guidance in a number of NI4OS-Europe deliverables and activities that will take into account the sustainability of related project outcomes: foremost, the deliverable "D7.7 Sustainability Report". The recommendations included in the current deliverable will find, however, their direct applicability in the development of the NOSCI sustainability plans. Overall, deliverable and workflow progress is described in the project Annex-I – Description of the Action[2].

What are the deliverable contents?

This document consists of findings useful to get a decent level of understanding of a business perspective of the European Open Science Cloud (EOSC) scene and NOSCI within. The proposed recommendations may be used to support NOSCI business modelling.

The first section includes business models findings stemming out of several EOSC related projects. Then, the analysis of national procurement practices, access models, FAIR costs and funding details follow. Finally, fruitful recommendations are suggested to ensure the alignment of business models and support sustainability.

Conclusions and recommendations

The report provides recommendations on several aspects of business models that will support the sustainability of NOSCI. Procurement is an area that will certainly be of great importance for sustainability. Forms of funding of the entire EOSC ecosystem are an integral part of every planning. On top of all that, one needs to consider the principles of setting up all supporting aspects of open science and FAIR as its cornerstone.

Procurements of digital services differ by a demand-side user group. Six patterns for designing business models for procuring services should be considered. Being free at the point of use does not mean being free of charge. Service costing activities need to establish accurate costs for service operation. NOSCI should invest additional effort to recognize cost categories related to FAIR and make them applicable for funding. Even

though the majority of funding will be provided through national sources or European funds, membership fees could be considered as a supplementary funding scheme too.

The future actions of NOSCI and the EOSC Association should be as coordinated and coherent as possible and thus easier to implement in practice since NOSCI will play a prominent role at a national level to promote and support the idea of EOSC as an underlying platform that supports Open Science (OS) and innovation in Europe.

1. Introduction

Europe is the largest producer of scientific data[3], nevertheless, its fragmented research infrastructure makes European scientific cooperation difficult. Additionally, the research outputs need to be findable and available in standardized formats through an interoperable infrastructure. The European Commission launched the European Open Science Cloud (EOSC) that will offer Europe's 1.7 million researchers and 70 million science and technology professionals a virtual environment to store, share and re-use their data across disciplines and borders. It is a process that requires a coalition of national organisations that have a prominent role and interest in the EOSC. To conduct this, the INFRAEOSC-05b call was launched aiming at providing the support to integrate national initiatives across Europe. The National Open Science Cloud Initiatives (NOSCI) should be an integrative part of the national Open Science (OS) synergy and the main national contributor to European and global challenges in the field of the OS. To successfully implement this, NOSCI have to demonstrate value and impact to diverse groups of research stakeholders.

Among other pre-conditions, sustainability of NOSCI requires the application of business models that balance financial, legal, technical and operational aspects. Commonly accepted explanations consider that business models refer to the logic of how an organisation does business, and explain how an organisation creates, delivers and captures value[4]. It should be emphasized that there is a major difference between a model and a plan. The key difference is that the model can always be modified to serve the exact needs of those who request it, which is usually a dynamic process. On the other hand, the plan is a constant in the business world and daily operations are led by the plan. To separate and relate the concepts of strategy and business model one should realize that a business model is a reflection of an institution's realized strategy[5].

This document aims to:

- Provide an overview of important elements of the prospective EOSC business model.
- Raise the level of readiness of the NOSCI from the project's countries to create business models.
- Respond to the compliance of the business model of NOSCI with the EOSC plan.

All findings and recommendations of this document aim to support the future EOSC developments in this area that is now under investigation by the newly created EOSC Association Task Force on Defining Funding Models for EOSC[6].

The structure of the document is based on three sections.

The first section strived to synthesize the procurement, purchasing, and service access guidelines stemming from the lead pan-EU initiatives and national best practices, which the interested organisations from the region and beyond can use to acquire digital services from publicly funded providers.

The second section of the deliverable deals with the inputs obtained from the project partners. The questionnaire was created and sent to partners. Based on the feedback received, certain similarities were identified, as well as differences that were presented in the deliverable.

In the third section, the deliverable presents expectations of future steps regarding financing as well as general recommendations usable for creating the NOSCI business model.

The research done within the NI4OS-Europe project is a part of broader business models and sustainability activity. The NI4OS-Europe project has been working on the subject aligned with other EOSC-related initiatives to contribute to the common EOSC platform.

2. Approach and methodology

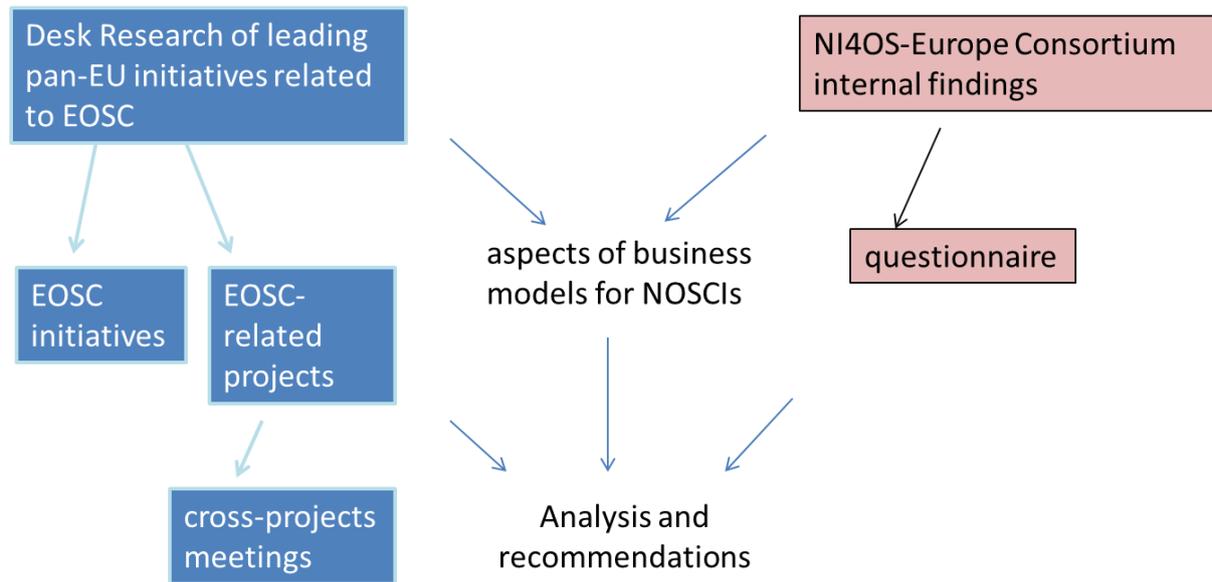


Table 1: The methodology scheme

During the work on the development of recommendations for business models, the two lines of work have been established: the desk research focusing on outcomes of previous projects and initiatives, and the dedicated NI4OS-Europe questionnaire. The desk research, among others, was a good baseline for identifying the areas and questions that were included in the questionnaire.

To provide basic data on the proposed business models of the EOSC, close alignment with the procurement practices and business models stemming out of the INFRAEOSC-05b projects, other initiatives related to the EOSC governance, as well as previous EOSC-related projects such as the EOSC-hub project, were taken into consideration to ensure the complete picture on the European level.

During the work on desk research, any available information relating to procurement practices and business models which ensure the sustainability of EOSC was undertaken. The main perspective has been, however, the one of NOSCI's, since the recommendations on their sustainability and their integration in the overall EOSC governance plan are of major importance for the NI4OS-Europe project.

It was crucial to determine the applicability of the information both on the EOSC level and NOSCI's level. The research was based on both the available public information and the internal information obtained by participating in the EOSC-hub project's workshops and on cross-projects meetings organized with the EOSC-Pillar project.

It was a challenge to recognize the main aspects of business models for NOSCI's, as they are a structure in development. The role of NOSCI's in the EOSC ecosystem has been defined and developed in parallel with the work on recommendations for their business models. The focus was on potential operational mechanisms for national OSC initiatives, both at the level of infrastructure and the level of research funding, intending to ensure alignment of procurement practices and sustainability. After detailed consideration, four of the most important aspects of a business model were identified: procurement legislation and practices (services and goods); funding (main and supplementary funding streams

including services charging models); costs concerning FAIR and NOSCI's funding/sustainability.

To understand the present constraints and requirements of NOSCI's, the analysis of national procurement schemes and regulations, and funding agreements and principles within the NI4OS-Europe project's area was pursued. As a result of that work, the self-assessment questionnaire was designed and conducted.

The target audiences for this questionnaire were research organisations that meet the two pre-conditions: they are familiar with and support the role of NOSCI's, and additionally, they are familiar with and understand the challenges of procuring research support services. They have been represented by their managers, procurement and financial managers. It has been made clear, however, that the purpose of the questionnaire was to collect answers at the level of organisation and not individual views. Thus, the participants have been invited to reach out to any other departments or colleagues within their organisation for providing the necessary information.

Findings presented in the current deliverable provide recommendations that can contribute to the strategic and organizational framework of NOSCI's, but are not delivering a business model. The aim is to raise the level of readiness of NOSCI's regarding the establishment of their business models. Further development and deployment of models should focus on the evolvement of EOSC and secure organizational coherence and complementarity with EOSC, which is a basic requirement for mutual sustainability.

3. Previous work by EOSC related initiatives

This section summarises the results of business model findings and suggestions from several selected projects. The approach of the NI4OS-Europe project is based on the research from the perspective of NOSCIs. The main challenge was to extract the information that can be applied in the development of NOSCIs business models.

For the last five years, several projects have addressed the issue of the business model of EOSC. The goal of all these activities is to find sustainable business and funding models, as well as to harmonize the expectations, needs and capabilities of all stakeholders.

The content of the section is divided by work done by the projects and work done by EOSC-related initiatives.

3.1. Work by EOSC Governance Board and other initiatives

To establish governance that sets the rules for the use of EOSC, several documents included considerations around developing a sustainable business model, such as:

- EOSC Strategic Implementation Plan presents the activities that contributed to the implementation of the EOSC for 2019-2020[7].
- The report "Prompting an EOSC in Practice"[8] covers several elements of the EOSC establishment and operation, from defining the minimum viable research data ecosystem to establishing the main rules of participation; it also pays attention to issues such as governance and possible business models.

EOSC business modelling was a matter of interest for external expert groups too, and they produced reference documents on the EOSC such as the report of the Science|Business Network's Cloud Consultation Group "The European Open Science Cloud: Who pays for what?"[9]. The immediate benefits of the EOSC have been emphasised since only a small percentage of European science is taking advantage of hyper-scale cloud technologies today, there is enormous scope for a transformation in the way in which researchers share and analyse data. Among other findings, the report identified seven main cost categories for the EOSC.

| Cost category | Description |
|---|---|
| Employing cloud-computing services | The cost of getting data into the cloud and storing it for decades, and the cost of using cloud computing resources to access and analyse scientific data, including the necessary connectivity. |
| Opening up scientific data | The implementation of data management plans to make research data findable, accessible, interoperable and reusable (FAIR principles). |
| Federation of existing scientific data infrastructures | Nodes will be needed to link national data centres, European e-infrastructures and research infrastructures. |
| Development of specifications for interoperability and data sharing | To enable data to be shared across disciplines and infrastructures, more standardisation of meta-data and perhaps the data itself will be needed. |
| Creation of search tools | New software tools will be required to enable scientists to search, browse and access research data. |
| Creation and maintenance of a secure environment | The European Commission envisions a suitable certification scheme will be designed at the EU level to guarantee security, data portability, and interoperability in compliance with legal requirements. |
| The management of the EOSC | The EOSC will need a full-time executive body that can oversee federation, long-term funding, sustainability, data preservation and stewardship. |

Table 2: The seven main cost categories for the EOSC according to the Science|Business Network’s Cloud Consultation Group

3.1.1. EOSC Sustainability Working Group

EOSC Working Groups have been formed as an official part of the EOSC Governance structure which ensured a community-sourced approach to the challenges of the EOSC. One of them is the EOSC Sustainability group[10], which examined suitable business models of EOSC, governance structures and legal entity. The analysis resulted in a set of strategic and financing orientations important for EOSC in its second phase of implementation.

The EOSC Executive Board WG Sustainability in the guiding document “Solutions for a Sustainable EOSC” (A FAIR Lady report) determined two basic conditions to ensure EOSC sustainability[11]:

1. Added value for researchers such as to pursue their research activities more effectively and co-research possibilities, which can build up a culture of sharing the results. It should be the place where researchers can be recognised and find career opportunities. Constant improvements through training or to guide others are also perceived as strong value gains.
2. Added value for the stakeholders explored and explained via business models which encompass the financial, legal and governance aspects. It should lead to the answers to how EOSC itself will operate and how the resources it federates will be used and acknowledged by researchers.

3.2. Work by EOSC projects

In 2017, the first analysis and recommendations as to different funding and business models had been produced by the EOSCpilot project[12]. This project has been funded to support the first phase in the development of the EOSC and its outputs now are used by several other projects funded to establish the EOSC.

3.2.1. EOSC-hub project

Very detailed research of the business model aspects was performed within the EOSC-hub project, which assigned a significant amount of effort to the particular area. One of its work packages has been working on the design of future business models and procurement frameworks for acquiring digital services. The project organized the research within which more than 300 organizations participated. A detailed analysis of the current situation has been performed including the rationale and landscape.

Public sources of funding (either nationally or internationally) are the primary source of funding for 92% of respondent organizations.

Finally, the project provided the patterns and approaches of procurement of digital services.

3.2.1.1 Procurement of digital services

To conduct procurement frameworks and future business models, the first step is to understand the need for digital services for research. The EOSC-hub project had done demand-side market research and presented results[13]. Several insights were identified and used to conduct proposing mechanisms for acquiring digital services and making them available to users. Three approaches were identified and they represent the three most common demand-side user groups: researchers, institutions and demand aggregators.

1. Voucher access – applied when an individual researcher or a small research group needs limited access to commercial services on an ad-hoc basis.
2. Virtual approach – institutional use is achieved through special purchase agreements between the service provider and the institution.
3. “Aggregate Procurement” approach – aims to facilitate aggregation of demand and joint purchases to share the costs and efforts required for expensive and lengthy procurement procedures and achieve a better position for price/condition negotiations.

These different approaches are supported by the examples given in the case studies[14]. They were intended to illustrate a scenario that has two common assumptions.

1. The first assumption is that the beneficiaries are individual researchers or small study groups whose:
 - Requires limited-scale access to commercial services.
 - Expect access to services – free at the point of use.
 - Necessarily require a secure but fast authentication and authorization process.

- Ease of use of services is also a priority.

2. Another assumption was that the user always works in a relationship between organizations (B2B) and never as a customer (according to the EU Consumer Rights Directive) for certain issues. Regardless of the final source of funds used to pay for that special service, the user of the EOSC resource will always act as an employee, representative or associate of the parent institution or ultimately as an employer. This assumption is important because it eliminates the need to comply with consumer protection regulations.

3.2.1.2 Patterns for designing business models for procuring services

The term pattern is used to refer to a common principle or architectural idea that can be used to generate new business models.

The table of six patterns can be used when one creates a business model of the procurement process.

| # | Name | Description |
|---|--|--|
| 1 | Let the best emerge | Stimulates competition, to let the best emerge by leveraging reputation or differentiating by quality. |
| 2 | Simplify/streamline the procurement process | Reduces administrative costs and barriers for organisations to efficiently procure or participate as suppliers. |
| 3 | Aggregate demand for economies of scale | Aggregating demand leads to higher volumes, lower prices and more suppliers. |
| 4 | Opening up existing research resources to more researchers | Opens up access to existing research resources and services. |
| 5 | Joint funding on common interest | In big endeavours with a common interest, joining funding from different parties allows them to pursue the objective and share the benefits. |
| 6 | Public-to-public cooperation with reimbursement | Simplifying the way public institutions can collaborate with cost reimbursement; can lead to better public services and cost efficiencies. |

Table 3: Six patterns for designing business models for procuring services

Most research organizations in the EU countries are public and must follow the guidelines of the EU Procurement Directive 2014/24/EU. It also means that they have to go through a tender process. There are several options to keep in mind on this occasion.

1. Certainly, the simplest form is a tender procedure in which the selection of the most suitable provider for the required resources or services depends on the optimal technical solution, the lowest price or a combination of these two criteria.

Care must be taken not to come into a situation in which the cheapest bidders win through such procedures, to the detriment of quality or by hiding subsequent costs: "What you measure is what you get!"

2. Every procurement process is organizationally, administratively, legally and time-consuming. To simplify procurement, an individual institution may benefit from a tender organized by a third party (acting as a central purchasing entity) and acquire resources or services through that third party's framework agreement. A framework agreement is an "umbrella agreement" that sets out the conditions (especially those relating to price, quality and quantity) under which individual institutions may conclude individual contracts throughout the agreement. In practice, this is applied by the OCRE and GEANT projects.

This extracts the need for the related effort, background knowledge and market access from individual organisations and allows them to delegate the related business functions to specialised entities.

3. A similar pattern refers to the aggregation of demand for resources or services from multiple entities that are done through a central purchasing entity. The goal is to increase the interest of suppliers through increasing demand, which due to increased competition then provide better prices, better quality and conditions for obtaining resources or services. In practice, this is applied by the GEANT project.

The gains obtained during purchasing by the economies of scale should not be outweighed by the additional layer of operational complexity and governance that may be caused by the distribution of purchased resources.

4. To promote and open access to existing resources and services for multiple researchers, remote transnational access (TNA) over communication networks and virtual access (VA) can be applied. TNA is based on providing access to limited resources to a selected number of users who are selected according to some key of scientific excellence. A VA is an opportunity to use some resources or services using public funds. The intention is to reimburse the costs of providing services to researchers through an EC grant. Such a mechanism has been used in projects such as EOSC-hub and OpenAIRE.

It is best to determine in advance the criteria that are used to determine excellence and the corresponding assessment framework. It may be necessary to secure the guaranteed amount of services for the users of the least competitive partners while maintaining benefits for the most propulsive ones.

5. When several different public and private organizations want to achieve a common goal, they can form joint funding. Most often, a joint venture is formed. Examples are EuroHPC and CERN openlab (as a public-private partnership).

This approach is typically applied when a specialised single resource or facility that addresses the need of an international community is to be established. The result is to be owned by the joint venture, which also manages access and participation in operational costs.

6. The final form also concerns the cooperation of public sector bodies where it is possible to reimburse costs for a public body that acts as a supplier of resources/services. The provision of public services in the form of cross-border pooling of resources, such as cooperation between two or more public sector bodies, is exempt from the conditions of competitive tenders. ELIXIR,[15] with its national nodes, is an example of this.

Since the parties and, potentially, their members, act as both suppliers and consumers, elaborate requirements and procedures for member structure, duties or offering, application, admission, provisioning, reimbursement, compliance and governance must be established.

3.2.1.3 *FAIR*

FAIR usually is not a significant factor in assessing procurement needs, according to findings of the EOSC-hub project. There are concerns about the lack of definitions and guidelines for the implementation of FAIR. EOSC-hub project reports that their respondents generally did not apply FAIR principles. The main issues were costs and the lack of centralized data management plans. The importance of FAIR and the potential benefits are unanimously recognized, especially in the humanities and social sciences, but there is also a lack of simplicity in its implementation and implementation funding from the very beginning of the research life cycle.

3.2.2. *INFRAEOSC-05b projects*

To support the implementation of EOSC and to enhance synergies in all mutual activities related to the EOSC, the EC has funded several projects. The subgroup called INFRAEOSC-05b projects includes the four regional projects covering all corners of Europe, as well as the thematic project ExPaNDS.

The EOSC-Pillar project provided findings reached through the National Initiatives Survey[16], which has the section dealing with business modelling. They analysed two angles of business models: e-infrastructure and funding bodies. The objectives were to identify the e-infrastructures' elements and to find out what funding bodies fund and under what conditions. Here follow the key results of their survey.

The state and European funds are the main sources of recurrent funding for more than half of e-infrastructures followed by research institutions, universities, funding agencies, etc. The support for e-infrastructures by national institutions (state or ministry) is by far the most commonly reported source of funding (70%), followed by European funding (52%). Half (50%) of partners answered that they do not generate other income.

The main funding items are human resources and then software and hardware and finally operational expenditures. About one-third of e-infrastructures acquire their revenues other than funding. Grants of funding bodies are mostly based on a competitive process.

4. NI4OS-Europe analysis and results

4.1. Context of the questionnaire

Aiming to compare national procurement practices and funding models, the NI4OS-Europe project's partners were engaged via a questionnaire including open questions, which allowed the interviewees to provide more detailed answers. The main audience addressed were managers, procurement and financial personnel; they were advised to liaise internally when answering the questions. It was clear that questions cover a wide spectrum of business aspects and that it might not be realistic to gain answers from all necessary parties. However, the idea was to enable partners to express their point of view and get an opportunity to explain a broader picture of their business frameworks and issues they are facing and not just click the boxes or list of laws and regulations. To entice organisations to participate and provide fruitful feedback, it was made clear that the collected information would be treated with the highest confidentiality.

Participants from the project's target countries, 15 countries (7 EU Member States and 8 Associated or Third Countries) sent their feedback. Respondents mostly represented public education or research organisations or public research service providers. There was one feedback from the private sector.

The analysis here is based on the questionnaire responses. To entice organisations to participate and provide fruitful feedback, it was made clear that the collected information would be treated with the highest confidentiality.

Questions were divided into 4 categories recognized as important for business modelling in the thematic working area:

- Procurement
- Funding
- FAIR
- NOSCI funding/sustainability

Related to the responses of the NI4OS-Europe project's partners, the following conclusions were formed.

4.2. Presentation of results

4.2.1. Procurement

Question: *Is there any national procurement legislation – Is it aligned with the EU green procurement practices?*

All countries participating in the project have their national legislation on public procurement. Partners do report modernisation, simplification and reform of the public procurement framework, which is mostly related to the implementation of e-procurement platforms as national electronic public procurement systems. The big majority (>90%) of the electronic tenders for public organizations have been organized and central public procurement procedures are implemented. However, respondents from non-EU countries were not being able to provide sure answers whether it is in line with the EU Directives

governing the field of public procurement. This result is not surprising since the consortium of the NI4OS-Europe project consists of more than half of non-EU member countries.

All partners procure goods, works or services using tender or on pre-negotiated tender procedures depending on the cost or the special needs of each supply or service. Procurements are performed in accordance with legally defined financial thresholds. For procurements below a certain threshold, the direct award takes place, usually upon receipt and evaluation of three offers.

When it comes to alignment with EU green procurement practices, all non-EU partners report non-compliance with them, while those for the Member States follow recommended criteria of the European Commission for Green Public Procurement (GPP). Among others, it includes the minimum requirements on environmental protection for certain groups of products and services required at the level of the specifications. The Green Public Procurement is a voluntary instrument, which means that the Member States and public authorities can determine the extent to which they implement it. Even though, there are very good examples of Member States countries where the recommended criteria are a part of the public strategy for sustainable development or supported by governmental GPP guides, etc.

The European Commission encouraged the Member States to draw up publicly available National Action Plans (NAPs) for greening their public procurement. According to the feedback, there is no country reaching the goal of having a 50% share of GPP at the moment. However, there are cases of governmental rules which oblige institutions covering public procurements to apply green public procurement criteria as part of the technical specification, or criteria for the selection of tenderers in all central public procurement procedures within the given jurisdiction.

Question: How does your organization charge users/clients for services? [e.g., pricelist, membership, other]

Charges by organisations depend mostly on the role of organizations and consequently on their main funding sources. In cases where organizations are recognized as national representatives or have some kind of a central role within their research and education communities, they are mainly funded by national governmental institutions or similar. Their services and resources are free of charge for a research/education community. Nevertheless, some of the services have a dedicated pay-per-use model for industry and non-affiliated organisations. Each service can be used within the terms of use that are defined.

If the main funding source are projects awarded based on competitive calls funded by a national programme, or by contracts with research institutions and universities, or it is a private organization, they charge users according to the resources they require for connectivity and services.

Pricelists are set by the organisation which provides services or by the relevant ministry. There are also cases where tariffs for some services are set by the contract on a case-by-case basis.

Question: How do you buy supplies, resources or services? [e.g., with tender, on pre-negotiated tender, without tender]

When procuring goods, works or services all three methods (with tender, on pre-negotiated tender, without tender) are applicable since public procurement laws allow them. Organizations make use of the appropriate procedure depending on the cost or the special needs of each supply or service. All procurements are performed following legally defined financial thresholds.

4.2.2. Funding

Question: *What is the main funding source for your organisation? [e.g., funding by national governmental institutions, European funds, research institution, region, industry, SMEs, funding bodies, other]*

The main sources of funding for most of the public research/education organizations are national public funding and with a significant part from the funds of EU projects. National funding mostly is from related national governmental institutions, but it's also from competitive calls funded by national funds. There is a small amount of industry funding through bespoke projects. It should be emphasized that there are two cases of funding mainly from contracts with research institutions, universities, and industry.

Question: *Do you have any funding streams (own revenues other than funding) as a result of service/product selling? [e.g., services, consultancy, training, hosting, other]*

Most partners do have revenue other than public funding. Only one respondent said they do not have any. They typically divide their revenue into regular and non-regular. Regular funding streams would be hosting and domain administration services. Those that are no regular funding streams are on-demand requests for specific services selling, like consultancy and certified training. Overall, those are a small part of funding streams and they account for around 2-3% of a total budget. There is also one case where these types of revenues are not so small and makeup to 11% of the total budget.

4.2.3. FAIR

Question: *What are the cost categories related to FAIR?*

Question: *Have you calculated or identified the costs of making your services and data FAIR?*

The situation within the NI4OS-Europe project's consortium confirms findings similar to previous projects. The cost categories related to FAIR usually are not applicable or these costs are not considered at all. Just one organization reported that they are recognizing two categories of costs related to the support of research teams working on the integration of their resources in EOSC and preparation and organization of FAIR related events and training.

All efforts to make data and services FAIR are usually funded by EU projects that cover these costs. Organizations did not calculate the costs yet because those categories of work and infrastructure are still hidden between all other activities and equipment. There is an expectation that by formalizing Open Research Data Management (ORDM)[17] one will be able to calculate the costs of its support services and dedicated infrastructure parts. The first step is to set up policies. The ORDM and FAIR principles cannot be promoted, regulated, and implemented without policies, especially the ones setting the rules for career advancement or funders' project evaluation. These policies are there to shape

researchers' behaviour and to motivate them to make OS and pertaining activities as part of their everyday work.

4.2.4. *NOSCI's funding/sustainability*

Question: *What are the potential funding mechanisms for NOSCI's?*

Currently, most NI4OS-Europe partners report activities related to the establishment of NOSCI's. Funding mechanisms for NOSCI's should be defined at a later stage according to the specific needs of each NOSCI and the discussions among the stakeholders and the governmental officials.

Most partners have chosen a lightweight consortium structure governed through a Memorandum of Understanding (MoU), coordinated and funded in-kind by its partners. All resources (computing, storage, software, connectivity and access to data) remain the property of parties who own them and make them available to users free of charge, for the sole and exclusive purpose of carrying out the activities covered by an MoU. Consequently, their management and operation, as well as the establishment of usage policies are the responsibility of each party. Therefore, each party shall decide on the establishment of its resources made available to the NOSCI, which may be referred to as "common resources" in an MoU, as well as on the access criteria associated with those resources.

The potential funding mechanisms for NOSCI's varies. A potential funding mechanism that most NOSCI's will try to acquire is national governmental or public funding. This solution should be supported as a part of a wide/national orientation towards open science.

In one case, a dedicated national project that will have a duration of several (four to five) years has been suggested as a potential funding scheme for the support of a NOSCI's operation/long time sustainability.

Membership fees are mentioned as a possible solution too, but with the highest risk on sustainability.

During this establishment and the initial period of NOSCI's, the activities are done mostly voluntarily. Even more, there are cases where the EOSC membership's fees are not covered by national governmental institutions but organisations pay on their own. A positive solution to this issue from national governments will be crucial for NOSCI's development.

5. Future work

5.1. Task Force on Defining Funding Models for EOSC

After the official establishment of the EOSC Association and the new EOSC governance scheme for 2021-2027, the creation of the Advisory Groups has been announced. It is supposed to create a structure to allow EOSC Association members and others to help steer the implementation of EOSC.

The newly created Advisory Groups and Task Forces address key areas of EOSC implementation. They are liaising with EOSC projects to offer feedback on developments, as well as identify strategic gaps and areas for investment to input to SRIA. Under this new form and because viable funding models are an essential element of ensuring an operational, scalable and sustainable EOSC federation, the Task Force on Defining Funding Models for EOSC has been created as a part of the EOSC Advisory Group “Sustaining EOSC”[18].

The objective of the Financial Sustainability Task Force is to produce by 2023 a proposal for long-term financial sustainability of the main building blocks of EOSC: EOSC-Core, EOSC-Exchange and the Federation of Data & Data Services as defined in the FAIR Lady report “Solutions for a Sustainable EOSC.” The definition of sustainability needs to cover both financial aspects and long-term digital preservation.

The Task Force will develop scenarios for financial sustainability for the period of Horizon Europe and beyond:

- Develop scenarios for financial sustainability of EOSC-Core.
- Develop scenarios for financial sustainability of EOSC-Exchange.
- Develop scenarios for financial sustainability of the federation of data and data services.
- Validate the feasibility of the scenarios with relevant stakeholders.
- Validate scenarios’ compatibility with national and European policies and legislation.
- Assess scenarios’ impact on the value proposition of EOSC.

The Task Force will ensure it takes into consideration the expected timing requirements of key decision points, in particular the update of the SRIA and the upcoming Horizon Europe work programmes. Moreover, the Task Force[19] will build on the FAIR Lady report “Solutions for a Sustainable EOSC”[11] and aims to base decision-making on consensus ensuring all TF members take responsibility to actively listen, engage and contribute.

The following tasks will be undertaken:

- Review of the relevant documentation, interaction with stakeholders (e.g., other EU R&I partnerships, alliances, initiatives and EU projects).
- Build a sufficient understanding of the evolution of the main EOSC building blocks; in particular, EOSC Exchange and federated Data, to calibrate financial requirements and support the development of scenarios.
- Explore different financial scenarios for each building block and identify advantages/disadvantages, taking relevant experiences from other national, European and international initiatives into account.

- Collect feedback from relevant stakeholders, e.g. community, policymakers and funding agencies on the applicability of these models.
- Consolidate work to define a proposal for long term financial sustainability of the main building blocks of EOSC.
- The Task Force may invite additional expertise as required to provide specific advice.
- The Task Force will regularly update the wider EOSC community on its progress.

5.2. From the current grant-based approach to public procurement

One of the most significant changes regarding procurement procedures, as concluded by EOSC-hub[14] from the Horizon Europe Research Infrastructures Work Programme 2021-2022[20], is expected to happen after the completion of the EOSC-Future project in 2023[21]. EOSC Core and parts of the EOCS Exchange will move from the current grant-based approach to public procurement organized by the EC. To ensure the continuous provision of key EOSC services, the related public procurement process for those who are interested in participating will have to start as early as the 3rd quarter of 2022.

Such a change could be a challenge for non-profit infrastructure and service providers, as they would have to participate in tenders. This means that they should, for example, provide invoices for their services, provide financial guarantees and assume business risks. Providers of this type of service are often unable to do so due to limitations they have with their status (e.g., the amount of revenue generated from paid services). In addition, public procurement is time-consuming and requires more human resources, probably on an expert level. On the other hand, the non-participation of non-profit providers in tenders can lead to disagreements with the research community, which is a key beneficiary of the EOSC, because non-profit providers and the research community work closely together.

However, the possibility of returning to the previous model is left here as well, because no one is sure whether the new model will be effective in practice. *"Although it is envisaged that the EOSC Core and parts of the EOSC Exchange will move to EC-led public procurement, a contingency plan could be made available as needed. An aid plan would be to use normal grants or a special type of grant."*[14]

6. Analysis of main findings

The European Commission is seeing the EOSC as an ecosystem of organisations and infrastructures from various countries in Europe and beyond, which should nurture open science and open innovation and support it with concrete services. To find a proper and sustainable business model solution for such a wide and multitask environment is a great challenge.

The development of the EOSC includes the development of its business model in parallel. The first round of H2020 projects has been developing outputs that act as the initial base layer of the EOSC. Among other objectives, EOSCpilot and EOSC-hub projects paid attention to the issue of possible business models. The call INFRAEOSC added another investment to support implementation and governance of the EOSC and the second set of projects, which included in their agenda various business models' aspects such as funding, sustainability, FAIR data, etc.

The EOSC Executive Board WG Sustainability marked a business model as an integrative part one of two basic conditions that ensure EOSC sustainability. Added value for the stakeholders should be explored and explained via business models which should lead to the answers to how EOSC itself will operate and how the resources it federates will be used and acknowledged by researchers.

The primary approach of EOSC related business models is to place a researcher as an end-user at the centre and to look at a researcher as a main and final consumer, but not the one paying for services: his/her organization does. That is important from a legal perspective but mostly because it should follow the basic paradigm "EOSC services have to be free at the point of use." Free at the point of use means an end-user does not pay directly for the service when it is delivered but their consumption will be paid for by other means.

Very detailed research of the business model aspects was performed within the EOSC-hub project. It provided procurement frameworks for acquiring digital services and findings on the implementation of FAIR principles. Their findings are applicable for NOSCIIs too.

EOSC-Pillar analysed the business models from two angles: e-infrastructure and funding bodies. The objectives were to identify the e-infrastructure's elements and to find out what funding bodies fund and under what conditions.

The NI4OS-Europe project approach was by defining 4 categories recognized as important for business modelling: Procurement, Funding, FAIR and NOSCIIs funding/sustainability. National legislation on public procurement is present and under rapid modernization through electronic public procurement systems. Common findings of all previously mentioned projects and NI4OS-Europe project too is about the main sources of funding. Most of the public research/education organizations are national funded and with a significant part from the funds of EU projects. They do have their revenues other than public funding but it makes less than 10% of a total budget.

As for charging services, the NI4OS-Europe project's partners have a combined approach for charging users/clients for services. Generally, this depends on users' origin. Services are mostly free of charge for the academic community. These services are funded by public funds. Otherwise, users are charged according to a price list. This is the most common scenario.

Uniformity of findings within several projects is present for FAIR also. According to the reviewed projects and NI4OS-Europe, cost categories related to FAIR usually are not applicable or these costs are not considered at all. Additionally, the Final Report of the European Commission Expert Group on FAIR Data reports that very little information has been published on the level of demand and spending on FAIR data management in the EU Member States[22].

Finally, the potential funding/sustainability mechanisms for NOSCIs varies. In the next chapter, indicative solutions related to the establishment of funding mechanisms for NOSCIs are presented, acknowledging in this the crucial role of national governments.

7. Recommendations

There is no one-size-fits-all approach for the NOSCIs and EOSC in general. A business model is necessary to describe the value that can be delivered to its users. It seems that an adapted business model template is appropriate.

This is a rapidly evolving field, as the EOSC is developing and also new projects continue and support the implementation work. The future EOSC developments in this area are now under investigation by the newly created EOSC Association Task Force on “Defining Funding Models for EOSC” and all findings and recommendations of this document aim to support this activity.

Since the setting up and support of NOSCIs is one of the major aims of the NI4OS-Europe project, the business models' task has strived to support them in addressing issues related to their sustainability.

Identified aspects of business models covered within this deliverable are procurement, funding, FAIR and NOSCIs funding/sustainability. NOSCIs should be aware of this approach. The development of business and funding models are needed for the sustainability of NOSCIs and EOSC in general.

Procurement

Procurements of digital services differ basically by a demand-side user group. The three most common demand-side user groups are researchers, institutions and demand aggregators. Accordingly, a procurement approach can be via vouchers; virtual; or aggregated procurement. Every approach has its advantages and disadvantages. All of them have been implemented already and analyses of case studies have been done. The recommendation is to study these cases before the development and implementation of new procurements processes.

Six patterns for designing business models for procuring services are provided in the deliverable. They aim to reduce costs or increase gains by aggregating the generic resources and works that can be commoditized, and, at the same time, shift the specialised work left (i.e., to those earlier in the delivery chain) or to those who are better suited to provide them. It is strongly recommended to study them as well.

Finally, even it is not under the direct jurisdiction of NOSCIs, the alignment with EU green procurement practices is strongly recommended.

Funding

Although “free at the point of use” is one of the main cornerstones of EOSC; it does not mean that services are “free of charge.”

In communication with funders, it should be emphasised that the OS-related costs have always existed but were typically incurred by each scientific exchange; the new model links them to the generation and publication of outputs to make them readily accessible and usable. Therefore, the funding for the new services and duties will, after the transition period, fully come in the place of old ones that have been obsoleted by new and accelerated collaborative modes and tools. Historically, most costs were with consumers; nowadays, the scientific outputs and services are free at the point of use. Still, countries and transnational associations will have to pay for them if they want their science to remain relevant.

Service costing activities need to establish accurate costs for service operation. The lack of experts for business administration, development and sales at the central level is becoming an increasingly urgent matter. A key feature of service delivery is assigning value to the resources that are expended, but a majority of resource providers are unaware of all the costs that they should include.

It would be beneficial for the NOSCI's to establish more sustainable operations and business-like skills, such as accounting, market analysis and business planning. One approach for achieving this is to delegate the related responsibilities to one or several of its members that have already developed the related capabilities or are generally driven to do so.

FAIR

Even though the importance of FAIR and the potential benefits are unquestionable, a lack of simplicity in implementation and the issues of funding are recognized as two major obstacles.

Instead of preaching and explaining FAIR, all levels (projects, services, governments, NOSCI's, research organisations) should establish direct and actionable requirements, plans, incentives and related funding schemes that would be suitable for their role in the ecosystem and would support fair principles. NOSCI's should try to articulate and communicate them to funders, policymakers, providers, research organisations, and researchers.

NOSCI's should invest additional effort to recognize cost categories related to FAIR and make them applicable for funding. There is a reasonable expectation that the adoption of policies related to FAIR principles (and ORDM) will contribute to their systematization and cost-covering. Meanwhile, conclusions of "Cost-Benefit analysis for FAIR research data – Cost of not having FAIR research data"[23] are valuable. Its detailed analysis exceeds the scope of this deliverable, but a recommendation can be made. Seven indicators were defined to estimate the cost of not having FAIR research data. Five of them are quantifiable: time spent, cost of storage, licence costs, research retraction, double funding. In terms of costs measurements, these indicators can serve as quantifiers for FAIR cost categories for which they are applicable.

To promote FAIR principles, institutions and organizations that support research in EOSC countries should recommend obtaining a decision on accepting the use of EOSC resources as an eligible cost in data management plans and grants submitted by researchers. One of the recommendations for expansion of EOSC, marked by the Sustainability Working Group, is to establish EOSC as the web of FAIR data.

NOSCI's funding/sustainability

It seems that the majority of funding will be provided through national governmental or other public sources, either from a dedicated national project or from the volunteering participation and the in-kind contributions from the NOSCI's partners.

Membership fees could be considered as an alternative and supplementary funding source. This is not a matter of an amount but more an indicator of members' readiness to support NOSCI's activities. These fees are not likely to make more than a few per cent of its total budget, but still, they might indicate NOSCI's long-term sustainability, proving that it provides value to its members and that they recognise this.

Multi-annual framework contracts or agreements with a clear level of service expected from research and education organizations for defined services, as postulated and observed by the NOSCI and monitored on its behalf, indicate a preference for partnerships with long-term commitments, well-defined terms and minimal risk. Furthermore, such arrangements position the NOSCI as OSC hub and authority recognized by the national research community. In the same manner, the NOSCI could define communities' voluntary targets, roadmaps and technical policies. This would allow the national government to recognise the NOSCI as an instrument of the community's self-regulation and partner in governance. The responsible governmental institution could therefore dedicate to strategic governance, policies and establishment and management of the programmes that would further the open science and accordingly transform the national landscape.

7.1. Important aspects of business models for NOSCI

NOSCI are national OS collaboration structures still under development, as already mentioned. So are their business and sustainability plans. Based, however, on previous work and findings, several critical aspects have been identified[11], that should be in any case considered in the drafting of the sustainability and business models for NOSCI:

1. Most of the research in Europe is funded at a national level from public funding sources

This form of funding is generally supplemented by national or EU funds obtained through calls for proposals. Other sources of income (such as private grants) are an exception.

2. The main obstacles to the provision of cross-border services can be overcome by in-kind contributions

Potential barriers to the provision of cross-border services include differences in access policies and appropriate security methods, then differences in VAT rules and finally restrictions on data security and intellectual property.

The research infrastructure can prevent most of these cross-border problems by focusing on contributions in kind. National investments in federated services and resources should be included and recognized as contributions in kind in the overall funding model.

3. The inability of service providers to accurately estimate the costs of individual services

Most providers are not able to accurately determine the cost of the individual services that they offer. A key feature of service delivery is assigning value to the resources that are expended, but most resource providers and users are unaware of all the costs that they should include.

The Virtual Access (VA) funding scheme, funded by the European Commission in Horizon 2020, has helped service providers develop a better understanding of service costs. However, the VA is based on the principles of co-financing and non-profit. This means that capital investments cannot be part of unit costs, which

implies that service providers contribute to the improvement of infrastructure with their funds.

This suggests that co-financing provided by the service provider should be recognized as an in-kind contribution.

4. Free at the point of use, but not free of charge

All services can be available free of charge or for a fee, but the basic precondition is that they remain free at the point of use. Each researcher individually approaches the resources as part of an institution that in a certain way cooperates with the service provider. An individual does not have to be familiar (and usually is not) with the financial and legal background of the services to which he or she has access.

Appendix: NI4OS-Europe questionnaire on business models

Questions are divided into 4 categories recognized as important for business modelling in our working area:

1. Procurement

- *Is there any national procurement legislation – Is it aligned with the EU green procurement practices?*
- *How does your organization charge users/clients for services? [e.g., pricelist, membership, other]*
- *How do you buy supplies, resources or services? [e.g., with tender, on pre-negotiated tender, without tender]*

2. Funding

- *What is the main funding source for your organisation? [e.g., funding by national governmental institutions, European funds, research institution, region, industry, SMEs, funding bodies, other]*
- *Do you have any funding streams (own revenues other than funding) as a result of service/product selling? [e.g., services, consultancy, training, hosting, other]*

3. FAIR

- *What are the cost categories related to FAIR?*
- *Have you calculated or identified the costs of making your services and data FAIR?*

4. NOSCI funding/sustainability

- *What are the potential funding mechanisms for NOSCI?*