D10.4
RI STRATEGY FOR FLEXIBILITY AND SUSTAINABILITY

WORK PACKAGE 10 – Governance for sustainable and adjustable access to RIs

LEADING BENEFICIARY: CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

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ABSTRACT

This document discusses the main issues related to the provision of sustainable access to the facilities, resources and services of environmental research infrastructures. Being mostly of distributed nature, environmental research infrastructures need to develop appropriate access funding strategies that allow ensuring the viability of access provision in the long-term. Particularly the funding of service provision to users via physical and remote access to national nodes of Research Infrastructures is often not sufficiently secured and politically challenging. The potential funding sources and their benefits and drawbacks are discussed, as well as the principle aspects for developing an adequate access cost model. The recommendations aim at addressing the needs for developing sustainable solutions considering the open access principles, and complement the documents related to the guidelines, governance and management tools prepared in ENVRIplus WP10 (deliverables D10.1, D10.2, D10.3) for easy, efficient and effective access provision.

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PROJECT SUMMARY

ENVRIplus is a Horizon 2020 project bringing together Environmental and Earth System Research Infrastructures, projects and networks together with technical specialist partners to create a more coherent, interdisciplinary and interoperable cluster of Environmental Research Infrastructures across Europe. It is driven by three overarching goals: 1) promoting cross-fertilization between infrastructures, 2) implementing innovative concepts and devices across RIs, and 3) facilitating research and innovation in the field of environment for an increasing number of users outside the RIs.

ENVRIplus aligns its activities to a core strategic plan where sharing multidisciplinary expertise will be most effective. The project aims to improve Earth observation monitoring systems and strategies, including actions to improve harmonization and innovation, and generate common solutions to many shared information technology and data related challenges. It also seeks to harmonize policies for access and provide strategies for knowledge transfer amongst RIs. ENVRIplus develops guidelines to enhance transdisciplinary use of data and data-products supported by applied use-cases involving RIs from different domains. The project coordinates actions to improve communication and cooperation, addressing Environmental RIs at all levels, from management to end-users, implementing RI-staff exchange programs, generating material for RI personnel, and proposing common strategic developments and actions for enhancing services to users and evaluating the socio-economic impacts.

ENVRIplus is expected to facilitate structuration and improve quality of services offered both within single RIs and at the pan-RI level. It promotes efficient and multidisciplinary research offering new opportunities to users, new tools to RI managers and new communication strategies for environmental RI communities. The resulting solutions, services and other project outcomes are made available to all environmental RI initiatives, thus contributing to the development of a coherent European RI ecosystem.

TABLE OF CONTENTS

1. INTRODUCTION

This document aims at giving recommendations to environmental (ENV) research infrastructure (RI) for developing appropriate strategies for access to RI services towards long term sustainability and viability. The provision of services, data, tools, and resources is only successful as long as an RI ensures excellent science and outstanding quality of services in line with the demands and evolving needs of its user communities. The provision of access to RI services requires proper governance and management tools to ensure efficient and effective access and long-term sustainability. RIs require suitable mechanisms and financial models for funding access while considering the basic RI principles of open and FAIR[1] access to promote research and foster innovation.

RIs can be 'single-sited', 'virtual', or 'distributed' and provide access to, for example, major scientific equipment and state-of-the-art instrumentation, scientific data, knowledge-based resources such as collections, archives of scientific data, data products, training, expert support and other tools and resources. ENV RIs have the particularity that a majority of them are distributed, implying that physical and remote access to their resources and services is provided from different geographical locations and their operations may represent activities that are conducted on national rather than European level – as compared to virtual RIs whose resources can be accessed from anywhere via communication networks. Effective mechanisms to support access is challenging and depend on the RI type. In case of single-sited and virtual RIs, including access to virtual services within distributed RIs, operational cost for service provision maybe shared among the contributing countries; challenges related to ensuring effective access concern aspects related to national legislation, licenses, or potential restrictions. On the other hand, in case of distributed RIs, effective physical and/or remote access is politically challenging for developing an appropriate financial model, as some RI member countries do not per se contribute to the operations of national facilities in other RI member countries.

The present deliverable addresses the required ingredients for ensuring efficient and effective access to RIs, and particularly addresses the funding mechanisms related to physical/remote access offered by ENV RIs needed for sustaining access to ENV RI services in the long term.

2. GOVERNANCE TOOLS FOR SUSTAINABLE ACCESS

Sustainable access to RI services requires a set of standards, principles, governance and management tools, and best practices that should be taken into account

[1] FAIR data meet standards of **F**indability, **A**ccessibility, **I**nteroperability, and **R**eusability (cf. reference section, 8).

particularly in the case of physical/remote access to services provided by distributed RIs. The following subsections shortly address these fundamental aspects and refer to complementary deliverables established within WP10 that provide a more detailed description of the corresponding governance and management tools to be employed by the RI. Any RI access governance and management tools should be developed in consideration with the European Charter for Access to RIs[2].

2.1: Principles and terminology

The underlying terminology used in this document is briefly summarised in the following:

- FAIR access

FAIR access is based on principles that ensures access on a FAIR - Findable, Accessible, Interoperable, and Reusable - approach, designed to enhance access and the sharing and use of data.

- Flexible and easy access

Flexible and easy access aims at facilitating the access process for users while ensuring that the procedures for selection of users is based on defined criteria and access modes and a transparent, fair and impartial process.

- Free access

Free access ensures that access of users to data and services is made available free-of-charge.

- Open access

Open access to services implies that services are findable and accessible and that access to RI services is open and unrestricted to all users (non-open services are not meant to be accessible). Open access and open science[3] are part of the strategy promoted by the European Commission to improve knowledge circulation and innovation. Furthermore, open access to scientific information includes on-line access that is free-of-charge to i) peer-reviewed scientific publications (primarily research articles published in academic journals) and ii) scientific research data (data underlying publications and/or other data such as curated but unpublished datasets or raw data).

- Physical/remote/virtual access

Different types of access exist which may be physical (hands-on access of users visiting a facility), remote (users do not physically visit a facility), or virtual (access via communication network).

- Sustainable access

[2] https://ec.europa.eu/research/infrastructures/pdf/2016_charterforaccessto-ris.pdf
[3] Open science: http://ec.europa.eu/research/openscience/index.cfm?pg=openaccess

Sustainable access aims at supporting access to RI services and resources in the long term and with secured funding.

2.2: User strategy

A successful and performant RI provides services, resources and tools in line with the demands and needs of its user communities. Therefore, each RI should develop an appropriate strategy that takes into account the user dimension and user requirements and identifies potential gaps between the user needs (current and future) and its services offered. A research- and innovation-oriented user strategy must be developed that is clearly articulated and transparent, and which is continuously updated based on a solid knowledge of its user community, taking into account the category of users, their origin, size, and purpose of use and aiming at widening its use base.

Users can be individuals, teams or institutions that benefit from services provided by an RI. They may originate in RI member or observer countries, or countries that do not financially contribute to the RI (other European countries or countries outside Europe). RI users predominantly represent i) academia and public research organisations (researchers, engineers, technical and educational personnel from universities and higher education organisations, public research organisations, international organisations, and non-profit private research organisations) but also comprise users from ii) business and Industries (e.g., private companies and businesses - SMEs and large enterprises - that are not government-owned), iii) public services (e.g., organisations and institutions that are owned or supported by the government, other than academia and public research organisations), and iv) other users including citizens or persons from institutions that are non-governmental, or non-profit or that do not belong to any of the above categories. Depending on the user category, the use of any RI services may differ and be for scientific, technological, or innovative purposes.

Adequate tools are required to implement a suitable RI user strategy, allowing to effectively engage and exchange with its user communities and to develop a high level of user satisfaction. The sustainability of an RI depends on the provision of user-relevant services and effective use by a reasonably-sized user community.

2.3: Guidelines for access

RIs are expected to take into account and follow a set of guidelines that are recommended to ensure successful access to their data, services, and resources. The ENVRIplus deliverable 10.1 describes the principles and guidelines for access to ENV RIs and addresses aspects related to common data policy and data management plan, access policy and access management plan, classification of access, access units, access modes, type of access, legal and ethical aspects, confidentiality,

intellectual property rights, and licensing issues, access process and monitoring of access using corresponding performance indicators.

2.4: Access management and tools

Effective use of RI services, particularly in the case of distributed ENV RIs, requires an efficient access management plan and management tools to ensure that the entire access process is easy, flexible, and facilitated. Fundamental requirements include i) the establishment of a single entry point, representing the interface between the users and the RI and its key elements (facilities, services, access providers, reviewers), and ii) a central RI access management ensuring a well-organized and harmonized handling of the entire access process, including advertisement and communication activities, helpdesk support, managing of the application and selection process, access workflows, access provision and support, post-access activities and outreach, and monitoring of access. The central management accompanies and supports the users throughout the entire process and is underpinned by proper management tools for efficiently managing and monitoring the access and results and for continuous and efficient information exchange and communication with the key players involved in the access process. Details for access management and tools are described in ENVRIplus deliverable D10.2.

2.5: Catalogue of services

RIs should develop an on-line catalogue of services that allows users to easily find all relevant information about the RI services and access, availability, access modalities, costs, etc. The catalogue of services should be interactive and regularly updated, and help guiding the users in their quest for the needed infrastructure services. The catalogue of services aims at improving the visibility of the available RI services, and increases the efficiency in the RI services management.

2.5: Key Performance Indicators (KPIs)

RIs should develop a monitoring system to assess the performance of their service provision and improve the access process. The monitoring system should use appropriate KPIs for both quantitative and qualitative evaluation of the RI access to services. KPIs help assessing the progress of access provision towards the fulfilment of the intended results and allow identifying critical issues for improvement. Access-related KPIs should be well chosen as a function of what is considered relevant and require the setting of targets as desired level of performance and tracking of the process against that target, using adequate tools. KPIs should be periodically revised and updated within the RI. KPIs are a basis for decision making to achieve a strategic and operational goal. ENVRIplus deliverable D10.3 provides recommendations for selecting performance criteria to be used by ENV RIs.

3. IMPLEMENTING ACCESS FOR DISTRIBUTED RIs

The implementation of access to RI services requires the development of a suitable and coordinated funding framework, taking into account an optimized flow of funding from the available financial sources. There is a broad variety of RIs, having each its peculiar organisation, legal and financial model, and range of unique services offered. There is no one-size-fits-all funding model for access, and some requirements, being pre-requisites for long-term sustainability, are common among all RIs. Due to the diversity in funding sources, the mixture of funding sources allowing to fund the provision of access to services of distributed RIS and particularly provided by national nodes differs from one RI to the other, with each having drawbacks and benefits. The concept for funding of access should be negotiated and agreed by the RI and stakeholders involved.

3.1. Common minimum requirements of RIs

Independent from the type of RI, all need to have:

- a legal status and governance structure with clear responsibilities and reporting lines;
- an access policy and single entry point for all users, based on a user strategy, including central access management and access rules enabling efficient and effective free or peer review-based provision of services as well as adequate user support;
- a data management system and data policy based on FAIR and open access principles;
- measurable Key Performance Indicators (KPI) addressing both excellence of scientific services and sustainability;
- an adequate human resources policy to guarantee effective operation, service provision, skilled staff and trained users;
- a joint investment strategy with long-term RI vision (both scientific and financial), pan-European relevance, commitment of relevant stakeholders, international dimension, socio-economic impact.

3.2. Challenges related to distributed RIs

Among the different RI types, distributed RIs are particularly challenging, requiring a high level of coordination and harmonized procedures. The principles of cost sharing for accessing the services depend on the specific RI type (virtual, single-sited, distributed). A funding mechanism appropriate for each RI type and its activities and common elements (including access and services provision) should be developed to guarantee long-term sustainability.

i) **Virtual research infrastructures** aim at providing digital services including data, computing systems and communication networks. Access to resources and services of virtual RIs is provided electronically / on-line through communication networks. Although they are often distributed RIs and the construction is made on national or institutional level, the funding of (part of) its operation costs is typically shared by the RI member countries (or participating institutions) and the services are available independent of the location of the users.

ii) **Single-sited research infrastructures** are geographically localized central facilities whose resources and services are available at a single and dedicated location. They provide services in the form of virtual, physical, and remote access, access is generally free-of-charge to users originating from the RI member countries. Construction and operation are planned as joint endeavour and the funding of the associated costs, including access, is mostly shared among the RI member countries.

iii) **Distributed research infrastructures** are structured as a network of geographically distributed resources and services. They are typically organised with a central hub, interlinked national nodes and European- and international-level facilities. Distributed RIs provide a variety of distributed resources and services either via virtual, physical or remote access. The national nodes are mostly built, funded and managed on a national level. Some of the operation costs for the central services are shared among the RI member countries, whereas the operation costs for services provided on national level are not necessarily equally shared.

The majority of ENV RIs are distributed. The national nodes are aligned with national or institutional programmes and operated based on the availability of their respective resources. Therefore, the organisation and funding of access to the distributed resources has a higher degree of complexity, and the implementation of access and provision of services is more challenging compared to single-sited and virtual RIs, requiring specific commitments from the member countries due to the distributed nature of the available resources and the financial engagement of the national nodes. For distributed RIs, the funding of physical and remote access provided on national level, is a major issue, due to the fact that the members need to agree on the division of operation costs linked to access and arising in individual member countries (the organisation and funding of virtual access is comparable to the situation of virtual or e-infrastructures).

3.3. Potential sources for funding access

A robust funding framework ensures an RI's long-term perspective. The funding of access requires the calculation of the full cost of operations, and RI member should agree on how to cover the costs that are needed to ensure long-term sustainability of access. There are several potential sources for funding access costs (and in particular of physical and remote access), they are presented below and are

structured into the following four categories: national/regional funding, EU funding, RI funding, other funding.

(1) National and regional funding

The construction and operation costs of national nodes in distributed RIs are mostly covered by national and regional sources, although the level of national vs regional funding may vary from country to country. National and regional funding is mainly provided by public bodies and Ministries. The financial programming and operation of the research facilities is often aligned with national strategies for research, scientific programmes and national roadmaps (if available). Regions may furthermore allocate funding in the frame of the structural funds (see more also under (2) EU funding). Additionally, institutional funding may be available for funding RIs, but this is dependent on the countries' strategies. National and regional funding is a fundamental funding source for covering physical and remote access, allowing to cover the operation of the research facilities to which access is provided. Depending on the financial model, the costs may include a substantial portion of in-kind contributions.

(2) EU funding

Since its sixth Framework Programme, the EU has set up a research framework to provide particular funding to RIs. Under Horizon 2020, a range of instruments have offered funding to facilitate and support the construction, implementation and operation of RIs: INFRADEV for the development and long-term sustainability of new pan-European RIs, INFRAIA for integrating and opening RIs of European interest, INFRAINNOV to foster the RIs' innovation potential, INFRASUPP to support innovation, human resources, policy and international cooperation, EINFRA focusing on e-infrastructures, INFRAEOSC to implement the European open science cloud, and INFRAEDI to support the creating of the European data infrastructure. EU funding, and in particular the INFRAIA instruments, have been fundamental for developing and funding activities related to transnational access (TNA), especially for physical and remote access. The TNA programmes have been extremely successful, also with regard to structuring and harmonizing the procedures to facilitate and provide efficient access to distributed RIs' facilities and resources.

Furthermore, the European Structural and Investment Funds (ESIF) and European Regional Development Funds (ERDF) have played a substantial role for supporting RI investments and building research and innovation capacities, often across borders, towards development and implementation of national and regional research centres, often realized as synergy between national funding, H2020 funding, and ESIF. Regions are furthermore encouraged to develop smart specialisation strategies prior to receiving ESIF funding for project in the area of innovation. ESIF funding is a catalyst for RI funding (both from public and private) as it provides funding

opportunities to RIs and encourages co-financing from the national budgets which allows the construction, implementation, and upgrading of the national facilities to which physical and remote access is provided.

Finally, H2020 provides grants to research and innovation projects promoting excellent science. Other H2020 projects, such as Marie Sklodowska-Curie Actions, are further potential co-financing options. H2020 grants benefit a range of different users from public and private sector as they cover costs related to carry out world-class research projects utilising services provided by RIs and covering related user expenses (travel, accommodation, consumables for experiments, etc.). A restriction to H2020 projects is that access must be identified in the project preparation phase and the access provider included among the project beneficiaries.

(3) RI funding

Operation costs for joint RI activities are funded by the contributions of the RI member (and/or observer) countries, and principally consider the relevant costs for running the RI activities (personnel, consumables, equipment maintenance and upgrade, utilities, ...). For distributed RIs, this concerns the costs related to the central hub and European-level / central services: RI coordination, governance, joint operations. Operational costs of their national nodes are generally funded from national budgets. In order to ensure the access to services provided by the national nodes, RI access programmes funded by its own RI budget may be key to ensure free-of-charge physical and remote access to RI services, at least to those users coming from RI member/observer countries.

(4) Other funding

Other funding sources may be available to co-fund physical and remote access to RI services: Such funding may be, for example, implemented via user fees or funding from private sector users and often concerns specific services and/or users.

- **User fees**

User fees may contribute to RI operation costs to gain access to RI services and may fully or partially cover the cost incurred by the country for providing access. While RIs aim at fostering excellent science by providing data, resources and services to wide user communities, user fees should only be applied in specific cases, for specific services, or specific users, and the principal benchmark for selecting users should be scientifically-oriented rather than financially-driven. Possible user fees should be based on transparent pricing policies for the target user group (public/private sector, RI internal/external).

- **Private sector funding**

Private organisations may contribute to the RI funding, they act as supplier or as user of (often tailored) services, ensuring joint developments, and contribute to optimal use. Private users may co-fund the expenses related to access provision for proprietary research and industrial/commercial exploitation of the resources and services. Thus, RI relationships with the private sector encourage technological development, knowledge transfer and promote innovation. Often, and in particular when the resulting data cannot be made open, private sector users may be charged full cost for use of RI services.

3.4. Benefits and drawbacks of access funding sources towards long-term sustainability

All possible pathways need to be explored to make optimum use of the available funding sources for access provision. Efficient funding is key to ensure high quality services that are aligned with the user needs. However, to date the majority of ENV RIs do not consider systematic funding related to physical and remote access in their business model, and mostly rely on EU funding, and in particular via INFRAIA TNA, for financing physical and remote access. Being based on competitive calls, EU funding may fund access to RI only on a short-term basis. Except for RI funding which is dedicated towards specific access programmes, none of the access funding sources by themselves may provide financial sustainability for access. The possible benefits and drawback related to each funding sources are listed in table 1 below. Therefore, only a combination of available funding sources towards an appropriate access funding model may ensure the balance between user-aligned service offer and necessary coverage of costs.

Table 1: Benefits and drawbacks of access funding sources

Funding source	**Benefit**	**Drawback**
National and regional funding	+ Visibility to national nodes and facilities + Foster international cooperation + Long-term leverage effect and socio-economic impact	- Access provision mobilizes substantial additional resources (unequal country investment) - Requires a cost-benefit approach from the national side
EU funding (TNA)	+ Access is open and free-of-charge to all users (including those from countries outside the RI) + Access is user-driven + Additional funding for user mobility	- Project based (short-term) funding - High administrative effort required - Long-term sustainability is not guaranteed

	+ Contribution to scientific excellence and user needs + Prevents potential user fees	
RI funding	+ Access provision is based on a coordinated and harmonized access programme + Attractive to users + Support to long-term sustainability of access provision and aligned with RI user strategy + Free access to users from at least RI member countries + User mobility costs may be partially covered + Contribution to scientific excellence and user needs + Prevents potential user fees	- Membership contribution from RI members required - Agreement among RI members is required for division of costs to support costs of providing distributed resources (country-dependent access? Third country access? …)
Other funding	User fees: + Additional funding to cover variable costs of services + Provision of tailored or added-value services Private sector funding: + Additional funding to cover full costs of services + Provision of services-oriented access (user-specific and tailored services) + Promote technological development, knowledge transfer and innovation capacity + Promote co-innovate public-private collaborations	User fees: - Undermines RI principles of open access to services advancing knowledge, services and open science (open access is a driver for achieving and sustaining scientific excellence) - Restricted access to RI limits attractivity to users - Selection based on scientific excellence must prevail over user fees Private sector funding - Small fraction of users concerned - Limitations with respect to IP rights and scientific output (publishing policies)

4. ACCESS FUNDING MECHANISMS

RI access funding mechanisms should be adopted to secure funding for covering the required resources for access provision and integrate the funding of access in the overall RI financial model. The funding mechanisms may differ from one RI to another and vary according to the overall RI type, strategy, structure, and targeted

user groups. Appropriate access cost models should be developed that allow estimating the relevant costs for efficiently deploying RI services based on the available access funding sources. The cost models need to be properly analysed and based on a calculation of access costs that consider all relevant costs required for access provision.

4.1. Calculating RI access costs

Access costs comprise the direct and indirect costs incurred by the RI for the provision of access to RI services. To obtain the full value for each service, the calculation of access costs should be based on a **full (direct + indirect) cost methodology** covering both investment and operating costs (which is not always feasible at some institutions). Full cost calculation should include all relevant cost elements that are directly linked to the RI access provision. These **direct costs** must incur in direct relationship with the RI operations and may comprise the following categories:

- Buildings and space of the facilities directly used for RI operation
- Depreciation of equipment
- Personnel costs
- Consumables, equipment maintenance and repair
- Utilities (energy, water, …)
- Facility management costs (insurance, security, quality control and certification)

Other costs that incur but are not directly attributable to the RI operations costs may be covered by **indirect costs**, e.g., rental, lease or depreciation of buildings and space not directly used for RI operation, legal fees, office equipment, general and other horizontal services (communication, cleaning, human resources, audit, accounting, general facilities management and consumables, energy, water, etc.).

Access costs are comprised of fixed and variable cost. **Fixed access costs** are those costs that occur on a regular basis and do not vary if the amount of access changes (for example, costs of buildings, utilities, certain personnel costs, etc.). On the contrary, **variable access costs** vary when the provision of services changes. The variable costs are not affected by the level of fixed costs.

Furthermore, the costs of each service are based on a defined **unit of access** which must be established when calculating access costs. The unit of access varies and may be different among RIs and/or RI services.

4.2. Access cost models

Access cost models are used to account the costs for service provision. Although the full costs of a service should always be identified (and users should be made aware

of the full cost of a service provided), an RI access cost model may consider recovering full or partial costs related its service provision, based on different criteria. Thus, an RI cost model may provide different options on how access costs are calculated and potential fees are charged to users, ranging from free-of-charge access to user fees that cover full costs, partial costs, or even for-profit costs. While full costs may be charged to users from the private sector for proprietary research at RIs, the costs charged to users from the public sector (mostly academic users) are often handled in a more flexible way with predominantly free-of-charge access for users from RI member countries. Cost models for physical and remote access should ensure that the full costs that incur are secured, with ideally the fixed costs being covered by the organisation(s) in charge of the national node, and - at least - the variable costs related to the additional effort required for access provision are covered in a sustainable way via other funding (RI funding, EU funding, or other funding). The predominant funding mechanism aims at targeting free-of-charge access, although some users may be concerned by potential user fees (e.g., users from outside RIs member countries, private sector users).

In order to avoid overly complex cost models, it is highly recommended to consider cost models that base their cost calculation on a fixed unit cost per service offered.

Free-of-charge access aims at providing free access of users to the RI services, and is expected to be the principal scheme for access of academic users and in particular users originating in RI member countries that contribute to the RI via a membership fee. To ensure sustainability, an access funding mechanism must be agreed among the RI and its stakeholders that allows implementing an access programme that supports physical and remote access to its services through RI membership contributions, especially in those distributed RIs where the variable fraction of the access cost may be significant.

User or service fees should only be considered in very limited cases, given the fact that open access to scientific resources and services is the fundamental aim of all ESFRI infrastructures, which to a great extent are publicly funded. The adopted pricing scheme should be transparent and consider clear rules for user rates to be charged. Possible RI user fees may consider, for example, academic and non-academic (or commercial) rates. Users from academia and public research organisations from outside RI member countries may qualify for preferential academic rates with limited user fees, where only a limited amount of the variable costs are charged. Users from the private sector may be charged for the full cost for access (both variable and fixed cost), as illustrated in figure 1. The user fees charged may furthermore depend on the availability of co-funding from the users (e.g., via other grants) or specific collaboration agreements and on the type of user.

To date, at the end of the ENVRIplus project, the majority of ENV RIs finance their physical and remote access via EU projects, based on the TNA costs model. Very few RIs have adopted systematic funding mechanisms to cover the costs of physical and remote access, i.e., most of the RIs are based on access cost models that do not ensure a sustainable access provision in the long run (see section 8, appendix 1 for more information).

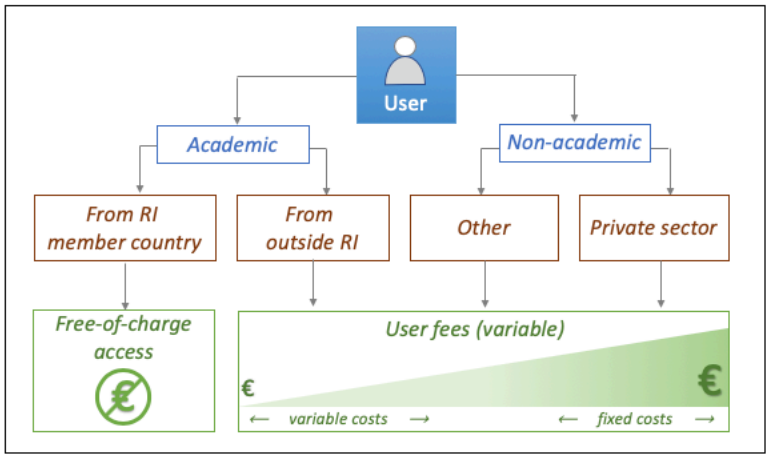

Figure 1: Schematic example of how a cost model may consider user fees based on the user category and origin. Although the majority of users, being academic and from within the RI, would be expected to mostly have free-of-charge access, the user fees may vary depending on the user and origin (i.e., inside/outside RI).

5. STRATEGIES FOR FLEXIBILITY AND SUSTAINABILITY

Sustainability of access can only be guaranteed by aiming at a synergistic and optimal combination of available access funding sources. Each individual access funding source may be limited in time by itself but contributes to cover a limited fraction of the access costs. To ensure sustainability, each RI should develop a suitable access funding strategy tailored to the specific needs of the RI and based on the following minimum principles:

- sufficient flexibility for alignment with the RI user strategy,
- maintaining user attractiveness,
- seeking optimal cost-benefit for the RI stakeholders.

A sustainable access funding strategy for distributed research infrastructures requires a coherent and coordinated approach on all levels where all stakeholders, including the RI, European and national funders, RI managers and access providers, and the users, contribute to a fair level of expenses and support the access costs through an adequate coordination of the available funding mechanisms.

Therefore, funding for access – and in particular for physical and remote access within distributed RIs, requires an access programme for the majority of services provided, based on a competitive selection process, and coordinated and financially supported by the RI through membership contributions. In cases where access to users cannot be provided free-of-charge, funding from other sources (EU funding, users fees) may help to close the gap but should not be a priority. Access funding mechanisms should be considered in the early stages of an RI lifecycle (during preparation and implementation of an RI). A sustainable access funding strategy requires a clear access policy, coordinated and harmonized access procedures, a centralized access management, and monitoring of access performance. A coordinated access funding plan along with an effective governance, trained personnel and staff, and long-term funding are fundamental conditions to facilitate and provide effective and efficient access to a large user community in a sustainable way.

6. CONCLUSIONS

This document discusses the major issues and requirements to be addressed for ensuring the sustainability of access provision to facilities, resources and services of environmental RIs. The majority of ENV RIs intending to provide physical or remote access to its geographically distributed resources still rely on access funding sources that are limited in time, such as short-term project funding via EU INFRAIA-type projects. Appropriate access mechanisms with dedicated access programmes are often not yet in place. Viability of access provision can only be guaranteed by implementing access funding mechanisms that aim at synergies of all available funding sources, including national and regional funding, RI funding based on membership contributions, EU funding, or other funding (user fees, private sector funding) to be properly explored and optimally combined and coordinated. RI access provision should be competitive, based on scientific excellence, with RI funding that guarantees free-of-charge access as much as possible to services aligned to the needs of a variety of users. A cost recovery option through user fees and other funding, e.g., from the private sector, is an option, but should not be the main driver. A coordinated access funding strategy where the RI stakeholders at all levels (research organisation, regional, national, European) contribute is essential to ensure flexibility and sustainability of services provision to users.

6.1. Impact on project

Four complementary deliverables have been developed within ENVRIplus describing the required guidelines, tools, and strategies for access to research infrastructures. The underlying activities have considered and analysed the RIs and projects participating in ENVRIplus and recommendations in D10.4 are based on the results of this work. The process has triggered fruitful discussion and feedback between the

different RIs from the various ENV domains, seeking best strategies and solutions for implementing physical and remote access to benefit from experiences for future implementation and operation. Impact on the project objectives is considered significant.

6.2. Impact on stakeholders

Physical and remote access is challenging and requires contributions from all stakeholders to secure operational funding for access. There is a large diversity of RIs and services and each RI will need to develop its adequate funding strategy. The work has demonstrated that, despite the diversity of RIs, only a coordinated and coherent approach based on robust pillars will contribute to the sustainability of access to resources and services that are geographically distributed and provided by national-level facilities. This deliverable provides the necessary elements that might serve as a basis for RIs to engage in an effective dialogue with the key actors and funders.

7. REFERENCES

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8. APPENDICES

Appendix 1: Overview of current RI funding for physical/remote access

Table 2 below list the current 27 RIs and projects participating in ENVRIplus and funding mechanism for the provision of physical and/or remote access. Almost all except three are distributed (EISCAT-3D is single-sited, IS-ENES is virtual, SIOS is considered regional distributed). Twelve RIs and projects are providing or have provided physical/remote access via linked EU projects (TNA). Only three of them have established a physical/remote access programme (SIOS, EISCAT-3D, EMBRC ERIC), although physical/access is principally planned by more RIs and projects in the future. All other RIs and projects provide access to virtual services only.

Table 2: Current RI funding mechanisms of RIs or projects providing physical/remote access. Relevant RIs on the ESFRI Roadmap 2018 are emphasised in green (ESFRI projects) or blue (ESFRI landmarks). ENVRI comprise the following Earth science domains: Atmospheric domain (ATMO), Bio-Ecosphere (BIO-ECO), Solid Earth (GEO), and marine domain (HYDRO); some RIs are multi-domain (MULTI).

RI (or project)	Type[4]	ENV Domain	ESFRI RM status	RM entry	RI legal status	Physical/ remote access
EMBRC ERIC	d	MULTI	Landmark	2008	ERIC, 2018	RI access
ICOS ERIC	d	MULTI	Landmark	2006	ERIC, 2015	n/a
LIFEWATCH ERIC	d	MULTI	Landmark	2006	ERIC, 2017	n/a
SIOS[5]	d	MULTI	-	2008-18	MoU	RI access
IS-ENES3	v	MULTI	-	-	-	n/a
ACTRIS	d	ATMO	Project	2016	-	TNA
EISCAT_3D	s	ATMO	Landmark	2008	Scient Ass	RI access
IAGOS	d	ATMO	Landmark	2006	AISBL, 2014	n/a
ARISE-2	d	ATMO	-	-	-	n/a
EUFAR	d	ATMO	-	-	-	TNA

[4] distributed (d), single-sited (s), virtual (v).
[5] The project is no longer listed on the ESFRI 2018 Roadmap as ESFRI project or landmark.

RI (or project)	Type[4]	ENV Domain	ESFRI RM status	RM entry	RI legal status	Physical/ remote access
EUROCHAMP-2020	d	ATMO	-	-	-	TNA
HEMERA	d	ATMO	-	-	-	TNA
ANAEE	d	BIO-ECO	Project	2010	ERIC step1, 2018	
ELIXIR	d	BIO-ECO	Landmark	2006	CA, 2013	n/a
DISSCo	d	BIO-ECO	Project	2018	-	TNA
eLTER	d	BIO-ECO	Project	2018	-	TNA
EMPHASIS	d	BIO-ECO	Project	2016	n/a	
INTERACT	d	BIO-ECO, ATMO	-	-	-	TNA
EPOS	d	GEO	Landmark	2008	ERIC, 2018	TNA
DANUBIUS-RI	d	HYDRO	Project	2016	-	
EMSO ERIC	d	HYDRO	Landmark	2006	ERIC, 2016	TNA
EURO-ARGO ERIC	d	HYDRO	Landmark	2006	ERIC, 2014	n/a
AQUACOSM	d	HYDRO	-	-	-	TNA
EUROFLEETS-2	d	HYDRO	-	-	-	TNA
EuroGOOS	d	HYDRO		-	AISBL, 2013	n/a
JERICO-NEXT	d	HYDRO	-	-	-	TNA
SEADATANET	d	HYDRO	-	-	-	n/a

An overview of the current RIs directly participating in ENVRIplus is illustrated in figure 2, representing the ENV domains atmosphere, bio-ecosphere, solid Earth and marine domain. Some are having a multi-domain approach.

Figure 2: RIs and projects participating in ENVRIplus (those projects not having an ESRFI Roadmap status are located outside the grey circle).