

‘ENVironment Research infrastructures INNOVation Roadmap’



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MS 1.1 – Compilation of ENVRI services

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Content

1	Current ENVRI Catalogue.....	4
2	Definitions and typology of services envisaged in ENVRINNOV.....	6
3	Going beyond the current ENVRI Catalogue	9
3.1	ACTRIS services.....	9
3.2	EMSO services.....	11
3.3	ICOS services.....	12
3.4	eLTER services.....	16
4	Services beyond data services	18
4.1	Methodology for Regular and Ongoing Updating of the Extended e-Catalogue.....	20
5	Roadmap for innovation and related services	22
6	RIs website and contact points for innovation catalogue (ENVRINNOV).....	23

1 Current ENVRI Catalogue

ENVRI stands for European environmental research infrastructures. A research infrastructure (RI) is an organization that enables the research community to use specific facilities, resources and services in order to accelerate scientific achievements and promote sustainable research. The current ENVRI Community brings together 26 European Research Infrastructures that are studying different aspects of the Earth system. These RI can be regrouped into different domains that are: Atmosphere, Ecosystem, Marine, Multidomain, Solid Earth.

The ENVRI Community fosters collaboration and joint development among environmental research infrastructures across Europe. It is neither a project nor a legal entity, but rather a dynamic forum where research infrastructures at all stages of development can connect, share good practices, and drive innovation. The community is supported by the ENVRI Board, its core assembly.

The ENVRI Community decided to establish a Board of European Environmental Research Infrastructures, BEERi, which was active until June 2024. The BEERi has now been replaced by the ENVRI Board. The main objectives of the ENVRI Board are to:

- be a single representative body for the ENVRIs, the coordinating body for promoting ENVRI activities and the “go-to” contact for expert advice
- bring together directors of RIs from across Europe and be a catalyst of networking to facilitate the exchange of operational experiences, coordinate ideas and activities
- interact with the main stakeholders of the RIs in Europe (European Commission, Parliament, etc.) and globally (UN, IPCC, etc.)
- highlight and promote the work of the ENVRIs and how it relates to policy
- stimulate collaboration across clusters

The community has a web-portal accessible at <https://envri.eu/> and a so called ENVRI Hub <https://envrihub.vm.fedcloud.eu/> which access page is reproduced below.

Welcome to the Data Portal of the European Environmental Research Infrastructures

Tell us what you are looking for: a dataset, policies, a service, ...

Or explore our services



ENVRI Catalogue of Services

Access the descriptions of the RI services that provide data, metadata, semantic assets, taxonomic information, and more.



ENVRI Knowledge Base

Access technical practices, common data and service requirements that facilitate search and analysis of existing RI solutions for interoperability challenges.



ENVRI Training Gateway

Access training resources developed by and for the ENVRI Community.



ENVRI Science Demonstrators

Use reliable Jupyter Notebooks to support interactive data science and scientific computing.



Dashboard for the State of the Environment

Under one easy-to-use interface, access crucial European environmental variables indicators.



Hands-On Area

Experiment with the powers of the ENVRI-Hub using our hands-on examples based on Jupyter notebook, on the Catalogue of Services API and the Training Gateway API.

The hub's main focus is concerning data. Even though there is a nice ENVRI Training gateway part and a few science demonstrators. The sections on Dashboard of the State of the Environment, the ENVRI Knowledge Base and the Hands-On area are really still in early stage of prototype.

The ENVRI Catalogue of services is somewhat more mature and is focusing on data services: these include:

Aggregating, Catalogues, Data, Harvesting, EOSC resource description, Metadata, Plotting, Processing, Publishing, spatial search.

In the rest of the document, we will describe ENVRI services from environment research infrastructures beyond data services and especially those services useful for innovation. In the next section we start with a definition of services for innovation.

2 Click on a service to read its description. Click on "Details" to access the technical info.

 All	71
 ACTRIS Data Centre	5
 British Oceanographic Data Centre	1
 CREA-Consiglio per la Ricerca in Agricoltura e l'analisi dell'Economia Agraria	1
 ENVRI	2
 EPOS	11
 IAGOS	2
 ICOS ERIC	8
 IFREMER	8
 LifeWatch ERIC	2
 SIOS Svalbard AS	2
 SeaDataNet AISBL	3
 Vlaams Insituut voor de Zee vzw.	26

[Check availability of services.](#)

1 Filter the available services. You can choose several options for each field.

➤ Service type

Aggregating
Catalogue
Data
EOSC resource
Harvesting
Metadata
Plotting
Processing
Publishing
SemAsset
Spatial

>Filtering service not working

ENVRI
Catalogue
of Services



Mix of human and M2M services

Access page of the ENVRI Catalogue of Services

2 Definitions and typology of services envisaged in ENVRINNOV

As stated in its project proposal, ENVRINNOV aligns with the interpretation of “innovation = invention + adoption” ([Schrange, 2004](#)). So, its Roadmap will set a credible pathway towards the adoption across the ENVRI community of a two-step interlinked model for **Technology Development (invention)** and **Technology Transfer (adoption)**. The Roadmap will plan for the sustainable implementation of this model through the ENVRINNOV Innovation hub, to ensure that new technologies and other Key Exploitable Results (KERs) aligned with ENVRI domain priorities, needs & gaps.

Along this path several services for innovation can be envisaged. But let’s first start with a definition: Services for innovation are offerings designed to help businesses, organizations, and individuals develop, implement, and scale **new ideas, products, processes, or services**. These services aim to **foster creativity, improve efficiency, and enhance competitiveness**. They typically focus on various stages of the innovation process, from **idea generation to execution and market launch**.

To make the definition more explicit and concrete, we list hereafter some key services for innovation that can include:

1. Innovation Consulting

- **Strategy Development:** Help businesses define innovation strategies, set goals, and align them with business objectives.
- **Market Analysis:** Provide insights into market trends, customer needs, and competitive landscapes to guide innovation efforts.
- **Innovation Culture Building:** Assist in cultivating a culture of innovation within an organization, encouraging creativity and risk-taking.

2. Research and Development (R&D) Services

- **Product Development:** Assistance in designing and prototyping new products or services.
- **Technology Scouting:** Identifying emerging technologies and assessing how they can be applied to create new opportunities.
- **Testing and Validation:** Services that focus on testing the feasibility and effectiveness of new ideas before they are fully developed.

3. Design Thinking and Creative Workshops

- **Idea Generation:** Facilitating brainstorming sessions, workshops, and design sprints to generate new ideas.
- **Customer Journey Mapping:** Understanding the customer experience to design more relevant and impactful innovations.
- **Prototyping and Testing:** Rapid creation of low-fidelity prototypes to test concepts before investing in full-scale development.

4. Innovation Management Software

- **Idea Management Platforms:** Software that enables companies to collect, evaluate, and manage ideas from employees, customers, or partners.
- **Collaboration Tools:** Platforms that facilitate collaboration among teams or across different departments to accelerate innovation.

5. Incubators and Accelerators

- **Startup Support:** Provide resources such as mentorship, funding, networking opportunities, and infrastructure for early-stage startups.
- **Acceleration Programs:** Support for scaling innovative ideas into market-ready products through structured programs.

6. Corporate Venturing

- **Investment in Startups:** Corporate venturing involves larger companies investing in or partnering with startups that bring innovative technologies or solutions.
- **Open Innovation:** Collaborating with external innovators (e.g., startups, universities, independent inventors) to explore new ideas and technologies.

7. Intellectual Property (IP) Services

- **Patent Strategy:** Offering services related to protecting new innovations, including patent searches, filing, and licensing.
- **IP Valuation:** Helping companies assess the value of their intellectual property assets and make strategic decisions.

8. Crowdsourcing and Open Innovation Platforms

- **Crowd-Based Idea Generation:** Using online platforms to gather ideas or solve problems through crowdsourcing from a global pool of contributors.
- **Collaborative Innovation:** Engaging external experts, customers, or the public in co-developing solutions.

9. Technology Integration and Digital Transformation

- **Technology Adoption:** Helping organizations integrate new technologies (e.g., AI, IoT, blockchain) to innovate their business processes or customer offerings.
- **Process Automation:** Automating workflows and systems to improve efficiency and drive innovation in operational processes.

10. Sustainability and Social Innovation Services

- **Sustainable Product Development:** Assisting organizations in creating products or services that align with sustainability goals and environmental standards.
- **Social Impact Innovation:** Focused on creating solutions that address social challenges, such as poverty, education, and healthcare.

11. Innovation Metrics and Evaluation

- **Innovation Audits:** Assessing a company's current innovation practices and identifying areas for improvement.
- **Impact Measurement:** Evaluating the success of innovation initiatives based on key performance indicators (KPIs), such as return on investment (ROI), market adoption, and customer satisfaction.

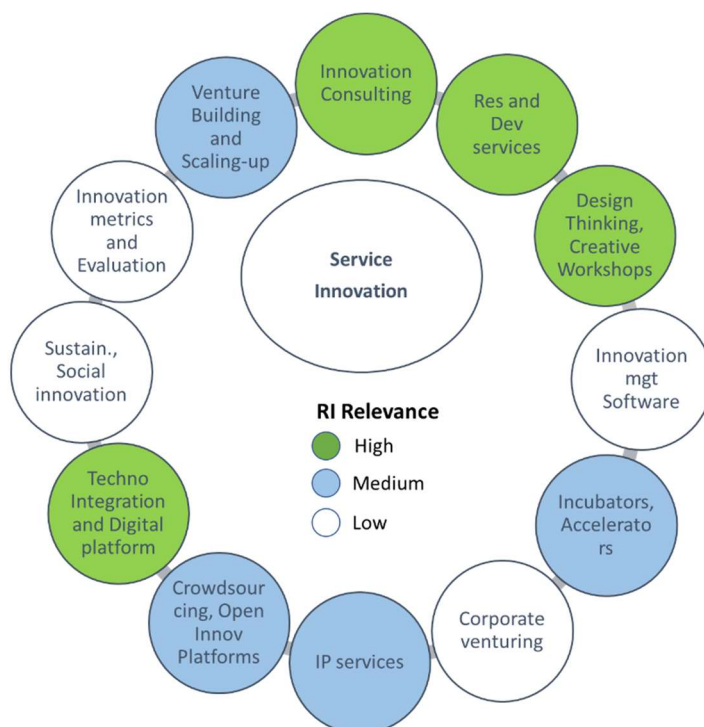
12. Venture Building and Scale-Up Services

- **Building New Ventures:** Supporting organizations in creating new business units or spin-off ventures to commercialize innovations.
- **Scaling Innovations:** Helping startups or innovation teams grow their products/services into larger, scalable businesses.

These services can be provided by innovation agencies, consultants, universities, research labs, or even dedicated in-house teams within larger corporations. They help businesses stay competitive, adapt to changing markets, and unlock new growth opportunities.

The previous list of key services is fairly comprehensive and covers the innovation process from in its globality. Research infrastructures don't have the mandate to contribute to all these key

services. However, several of those services are relevant to RIs and the figure below maps these in terms of relevance to research infrastructures.



In this document, service innovation is rather understood as service for innovation. It can regroup expertise and/or technological infrastructure.

3 Going beyond the current ENVRI Catalogue

Not all services from the individual RIs are exposed in the ENVRI Hub catalogue of services. In this section we go into an in-depth description of services, with an emphasis of services for innovation for the following RIs: ACTRIS, ICOS, EMSO, eLTER

3.1 ACTRIS services

ACTRIS stands for “Coordinated long-term observations of atmospheric aerosols, clouds, and trace gases in Europe.” It is the pan-European research infrastructure (RI) producing high-quality data and information on short-lived atmospheric constituents and on the processes leading to the variability of these constituents in natural and controlled atmospheres. ACTRIS provides services, including access to instrumented platforms and simulation chambers, tailored for scientific and technological usage for users from the public and private sectors. ACTRIS has an essential role in building new knowledge as well as in policy issues on climate change and air quality

ACTRIS has a fairly mature catalogue of services that can be accessed with the following filters:

1. **Provider:** Central facility (inc. data center); national facility
2. **Service type:** data services; research services, technological services; innovation services; training services
3. **Research area:** air quality; climate (interaction, aerosols+clouds); water cycle; hazards (volcanic ash); ecosystems; meteorology (aerosols, precipitation); aerosol lifecycle; atm chemical processes (coating, formation); atm composition; atm dynamics; health; energy
4. **Target users:** Academia; Private sector; Public sector; Research groups; Resource Managers; Research projects; Research organizations; Research networks; Research managers; Research Infrastructure Managers; Research communities; Businesses; Research & Innovation; Providers; Provider Managers; Policy Makers; Other; Monitoring Agencies; Innovators
5. **Access type:** Physical, Remote, Virtual
6. **Atmosphere type:** ambient, controlled
7. **Countries:** EU countries

Furthermore, ACTRIS is already offering an entry point dedicated to innovation. The offer includes:

- **training** on-demand or targeting specific user groups;
- the design and **co-design of cutting-edge instrumentation**, equipment or procedures,
- exploration of instrument synergies, and new innovative research capabilities.
- **collaborative research** activities
- joint instruments **testing**.
- development of **new observation techniques** for aerosol, clouds, and reactive trace gases;
- improvement of measurement and retrieval **methodologies** for aerosol, clouds, and reactive trace gases.

Note: technological services vs innovation services

Both appellations are present on the service type list of ACTRIS. Technological service is a service that uses technology as a platform (e.g. a drone) as opposed to expertise for example. Innovation services is to be understood as service for innovation. It can be innovative in its own way but not necessarily so!

A technology infrastructure is defined in ENVRINNOV as an infrastructure for the provision of service for innovation that is developed by Ris for the industry to fulfil their service request (see Table 3 below)

		Who develops the technology? (using ENVRI Facilities)	
		RI/RPOs	Industry
Who requests the service? (end user)	RI	Intra-RI Tech Development (T2.4)	Tech-Boost pipeline (T2.2)
	Industry	Technology Infrastructure (T2.1)	
	Scientific Community	Scientific Service (T2.3a)	
	Society	Scientific Service (T2.3b)	

ACTRIS also provides on its website a section “Innovation portfolio” showcasing past experience and collaboration in innovation especially with the private sector.

ACTRIS Innovation portfolio

The Innovation Portfolio displayed below showcases the distinctive innovation offer of ACTRIS to facilitate the interaction and matching with the demand for innovation coming from the private sector.

Success stories of collaboration are also highlighted to demonstrate how the provision of the ACTRIS services impacted companies in the different sectors.

- Automotive industry
- Chemicals
- Cosmetics
- Cultural heritage
- Energy
- Environment
- ICT/Data
- Space
- Textiles, fashion and creative industries
- Electrical and electronic engineering industries
- Raw materials, metals, minerals and forest-based industries

Innovation portfolio



3.2 EMSO services

EMSO stands for European Multidisciplinary Seafloor and water column Observatory. It aims to gain a better understanding of the phenomena happening within and below the oceans and explain the critical role that these phenomena play in the broader Earth systems. EMSO consists of a system of regional facilities placed at key sites around Europe, from North East to the Atlantic, through the Mediterranean and the Black Sea, equipped with multiple sensors along the water column, in the deep sea and on the seafloor. These observatories constantly measure biogeochemical and physical parameters across temporal and spatial scales and support the transdisciplinary co-development of cutting-edge marine technologies. EMSO advances the knowledge of ocean processes improving the resilience to climate change and natural and anthropogenic disasters. EMSO promotes sustainable blue growth in the marine sector through innovative services helping to preserve the marine ecosystem.

EMSO offers services regrouped in the following list of ten items.

1. Access to the Infrastructure Services
2. Climate Change Services
3. Marine Ecosystem Services
4. Geo-hazards Services
5. Training & Best Practices Services
6. Technology & Engineering Services
7. Data Management Services
8. Communications & Branding Services
9. Lobby & Policy Services
10. International Relations & Partnering Services

Technology & Engineering Services are further described in EMSO as providing the following:

- Provision of scientific knowledge and specialised infrastructures to **validate, testing and contribute to the development of new sensor** prototypes and/or observing platforms (fixed or mobile)
- Provision of fixed-point observatory technology, including **real time data collection** that could optimize data collection
- **Improvements of offshore operators** in the collection and processing of marine data for planning and operational purposes
- **Stimulating competition and innovation** in established and **emerging maritime sectors**
- Enriching company data through **access to other relevant data sets**
- Provision of submarine **communications cables** not only to transport data but also to acquire oceanographic variables with the integration of specific sensors
- Provision of a **platform to share your data** and data products in support of European research
- Provision of **test benches and innovation platforms**.

This list is actually not associated with specific services. It is rather describing themes that are indeed existing but rather under access services to the EMSO research infrastructure.

3.3 ICOS services

ICOS Integrated Carbon Observation System is about Standardised, high-quality & open greenhouse gas data. It provides the long-term observations required to understand the present state and predict future behavior of the global carbon cycle and greenhouse gas emissions. The objectives of ICOS RI are to provide effective access to a single and coherent data set to facilitate research into multi-scale analysis of greenhouse gas emissions, sinks and the processes that determine them, and to provide information, which is profound for research and understanding of regional budgets of greenhouse gas sources and sinks, their human and natural drivers, and the controlling mechanisms. ICOS RI tracks carbon fluxes in Europe and adjacent regions by observing the ecosystems, the atmosphere and the oceans through integrated national station networks, European central facilities and distributes the GHG data to the users via ICOS Carbon Portal.

ICOS has a mature Data portal¹ with over a million data objects as of end 2024. The main data products can be regrouped in terms of their availability and degree of elaboration in products that are:

- Near real time;
- Fully Quality Control;
- Historical dataset;
- Elaborated data products.

Classical to a data portal, the following functions are available for data: Search, preview, download.

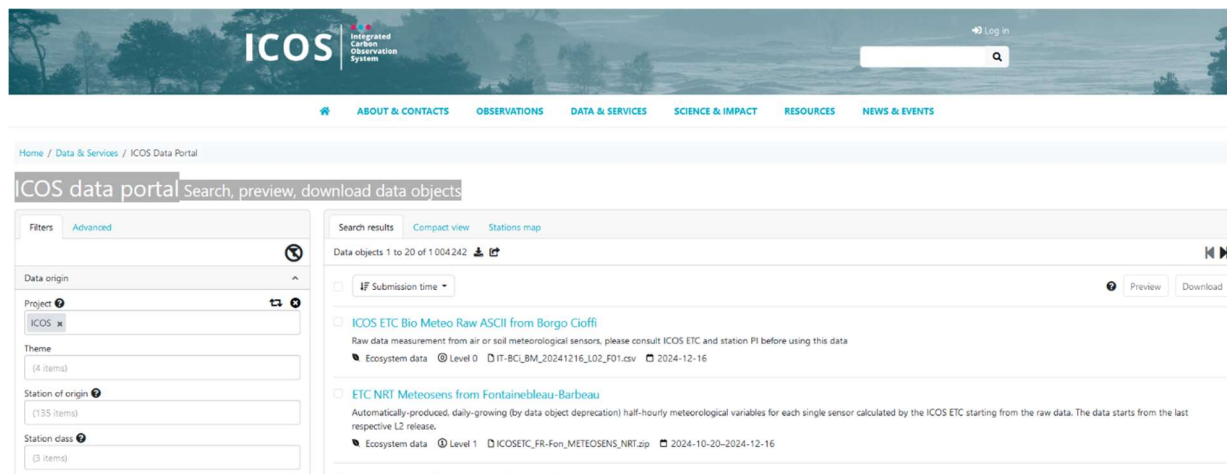


Figure 1: Capture of the ICOS data portal interface

The ICOS portal also offers a number of tools or services that go beyond pure data services, see Figure 2.

¹ <https://data.icos-cp.eu/portal/#?%22filterCategories%22%3A%22project%22%3A%22icos%22%22%7D>

In addition to providing free greenhouse gas data at the Data Portal, we offer services for visualisation, analysis and management of data, as well as support for co-operation in a Virtual Research Environment.

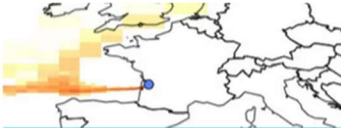






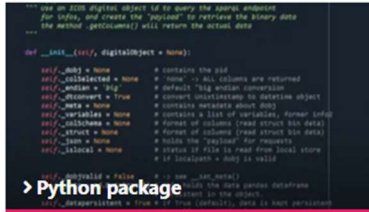
 <p>> STILT Footprint</p>	 <p>> Jupyter Notebook</p>	 <p>> DOI minting</p>
<p>An online tool to analyse the potential impact of natural and human-caused emissions on the atmospheric carbon dioxide at a selection of ICOS atmosphere stations.</p>	<p>A Virtual Research Environment incorporating a collection of tools for interactive computing and sharing of computational ideas.</p>	<p>We utilise Digital Object Identifiers (DOIs) to attach the data ownership to the data.</p>
 <p>> SPARQL endpoint</p>	 <p>> Statistics for data downloads</p>	 <p>> Upload to Data Portal</p>
<p>A tool to gain an access to the Data Portal's metadata.</p>	<p>Browse Data Portal's download statistics.</p>	<p>Request data to be uploaded manually to the ICOS Data Portal.</p>
 <p>> Forecast of air mass backtrajectories</p>	 <p>> Python package</p>	
<p>Daily updated backtrajectories for ICOS atmosphere stations and some other stations.</p>	<p>Access ICOS data using Python.</p>	

Figure 2: Tools available at the ICOS portal

However, most ICOS services that can be categorized as services for innovation are actually found under what is called on the ICOS portal: “Community services” (Figure 3)

> Community services

Services provided by ICOS to the community of scientists.

- > Cooperation tools
- > ATC services
- > CAL services
- > ETC services
- > OTC services

Figure 3: ICOS Community services

In the next section we detail the ATC (Atmosphere Thematic Center) services. Similar services exist for the Ecosystem and Ocean thematic centres (ETC and OTC).

The ATC is composed of three main entities: a metrology lab, a data unit, and a mobile laboratory:

The Metrology Laboratory services

- Instruments testing: test of the GHG instruments for the ICOS Atmospheric Network; certification and labelling
- Atmospheric measurement expert support: establishment of test protocols
- New sensors definition and development through R&D programmes at the national and international level; close link with the industry
- Training Center: European training centre for ICOS atmospheric measurements

The Data Unit services

- Data processing and support: Develop and maintain all instrument processing chain from instruments in ICOS stations, including in-house software to centrally process and quality control the data
- Data distribution and traceability: Ensure communication with ICOS Carbon Portal for metadata and data; ensure that data are traceable to the international primary standard for GHG, maintained in NOAA CMDL, Boulder, Colorado, USA
- Near Real Time NRT data product for PIs: NRT processing of data (24h); distributed via ATC website NRT monitoring products for PIs data and instrumental check
- Training Center: European training centre for ICOS atmospheric measurements and quality control, quality assessment

The Mobile Laboratory services

The services include conducting quality control (QC) by parallel measurements at atmospheric stations (AS). Aim is to improve measurement compatibility and development of competent quality assurance (QA) of the ICOS atmospheric station network that ensures credibility of the measurements. The Mobile Lab has a van, which is equipped with state-of-the-art analysers and standard gases, which are traceable to World Meteorological Organization.

A key feature of ICOS innovation services is their focus on enabling the development and validation of new technologies. ICOS observational stations provide real-world testing environments for instruments and methods, ensuring that emerging technologies meet rigorous scientific and operational standards. This process supports innovation in greenhouse gas measurement tools, data analysis algorithms, and climate monitoring systems, making them more accurate, efficient, and scalable.

List of ICOS services or innovation

1. Technology Testing and Validation

- Real-world testing environments at ICOS observational stations for instruments, sensors, and methodologies.
- Validation services to ensure compliance with scientific and operational standards.

2. **Access to High-Quality Data**
 - Open access to standardized, high-resolution data on greenhouse gas concentrations and fluxes.
 - Tailored datasets for specific applications, including carbon cycle modeling and climate monitoring.
3. **Collaborative Research Opportunities**
 - Partnership programs for co-developing innovative technologies and methodologies with academia and industry.
 - Access to expert networks and multi-disciplinary research projects.
4. **Capacity Building and Training**
 - Workshops and training sessions on advanced measurement techniques and data analysis.
 - Programs for knowledge exchange between researchers, policymakers, and businesses.
5. **Tool Development Support**
 - Guidance and resources for developing data visualization and predictive modeling tools (e.g. atmospheric footprint computation)
 - Opportunities to test and refine software solutions using ICOS datasets and Jupyter notebooks
6. **Standardization and Certification Services**
 - Development of standards for measuring greenhouse gases to ensure data consistency and comparability.
 - Certification support for emerging technologies and methodologies.
7. **Policy Support and Knowledge Transfer**
 - Expert consultations and evidence-based insights for policymakers and businesses.
 - Dedicated services for translating scientific findings into actionable strategies.

3.4 eLTER services

The Long-Term Ecosystem, critical zone and socio-ecological Research Infrastructure (eLTER RI) is now in the preparatory phase of formal implementation as a pan-European Research Infrastructure. The eLTER RI will comprise about 200 eLTER Sites and eLTER Platforms from over 20 participating European countries. It will offer a wide range of European-level Central Services for different users, including access to sites and site data from multiple sources. eLTER RI will enable standard observations and analyses of the environment in a holistic manner, encompassing biological, geological, hydrological and socio-ecological perspectives. Data gathered at the sites will be integrated with a wide range of other data from various sources, including remote sensing and official statistics. Research based on this wealth of information will provide insights into the functioning of our life supporting system.

The eLTER service specifications and pilots are currently being developed under **6 Thematic Service Areas** (see below). Additionally, the eLTER Head Office will lead central strategic and coordinating activities.

Head Office services

These will include both outward facing services such as access to field sites for external researchers and internal services such as managing the RI communications strategy and related web sites.

- Project development and support
- Liaison with a wide range of stakeholders
- Developing strategic partnerships
- Promoting eLTER RI
- Encouraging access to eLTER RI sites, platforms, data, tools and services

1. Data Management and Integration: from field site to users

These services will include both acquisition of data from the field site network, cataloguing of sites and related data, and the dissemination of quality assured data products through data portals and web services.

- Registering and cataloguing new eLTER RI sites
- Providing access to data and data products
- Compiling data usage statistics

2. Enabling Technological Innovation and Development

These services will be aimed at the commercial sector and other organizations that will benefit from the eLTER RI as a testbed for new sensors and observation technologies. Through these services eLTER RI will seek to collaboratively increase the technological capabilities of the RI through research and development of new commercial and open-source technologies in environmental monitoring.

- Interfacing with relevant industry representatives
- Coordinating activities aimed at testing and developing appropriate technologies (e.g. sensors) at eLTER RI sites

3. Synthesis Toward Actionable Knowledge

These eLTER services will provide a platform through which to develop solutions for complex environmental problems. This can be achieved by integrating the cross-disciplinary expertise gathered in eLTER with social sciences and decision-making processes. The services in this cluster will aim to provide an integrative framework for research in sustainability science, based on eLTER RI's network of eLTER Sites and eLTER Platforms. The implementation of these services will directly address the challenge of bridging the frequent gap between data acquisition and the actionable knowledge required for pursuing sustainable development using a whole system approach.

- Training in socio-environmental topics
- Facilitating the transfer of knowledge between eLTER observatories and relevant stakeholders

- Providing a range of bridging 'platforms' (workshops, labs, events, exhibitions, etc.)

4. Optimised Design and RI Interoperability

The services in this set relate to the specification of the RI site network and its interoperability with other RIs, maximising potential for cross-RI research support (e.g. through multidisciplinary data sets). They will include specifying requirements for new measurements and protocols across the network and expertise on calibration of Standard Observations.

- Developing and maintaining a site design that enables a Whole System Approach
- Establishing and reviewing a set of eLTER Standard Observations
- Working with other relevant research infrastructures and networks
- Supporting decisions about the purchase of high-cost instruments

5. Analysis Tools and Modelling

This suite of services will bring together the capabilities to develop new analytical methods and modelling techniques for extending the use of eLTER Standard Observations either through statistical interpolation, combination with other contextual data (e.g. with remotely sensed data) or as driving data for process models to produce forecast data (e.g. through combination with climate scenario data). These services will include calibration and validation techniques for remote sensed data.

- A set of tools and models for integrating and analysing a wide range of ecological and sociological eLTER RI data
- A range of data products covering a range of scales and based on eLTER RI datasets
- Tools to enable the calibration and validation of remotely sensed data using eLTER Standard Observations

6. Central Analytics and Measurement services

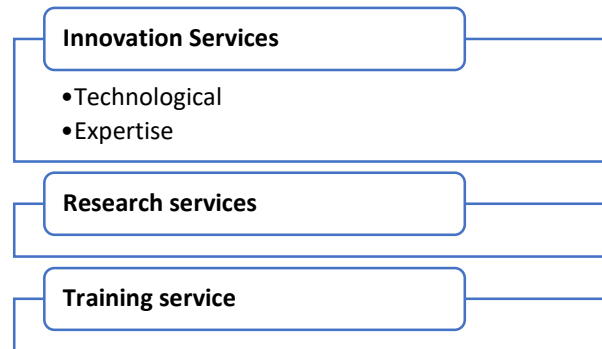
These services will address two aspects that complement eLTER's Standard Observation and the Whole System Approach. First, certain analyses (eDNA, hydrochemistry, etc) could be delivered through central laboratories that operate according to eLTER standardised protocols. Second, some data may be obtained through centrally organised campaigns (e.g. geophysics or aircraft-/drone campaigns) at eLTER sites. A sensor loan system is also anticipated to help reduce data gaps arising from malfunctioning sensors at eLTER sites, along with central facilities for cross-calibration at sites with in situ versus loaned central sensors.

- Centralised analytical laboratory services
- Organised data collection campaigns
- Sensor loan system and sensor cross-calibration program

4 Services beyond data services

The compilation of services made for the four infra ACTRIS, EMSO, ICOS, ELTER in section 4 above show that many services, beyond data services, exist or are in the implementation phase

in the infrastructures. These beyond data services are listed below and regrouped under the following typology of services:



Innovation services

Technological

1. Access to highly specialized environmental (physical, biological, chemical) analyses utilizing unique RI's scientific instrumentation either in the field or in the lab (e.g. instrumented platforms, simulation chambers, ...)
2. Test/validation/calibration/internal certification of technologies against RIs' reference instruments or standards; joint instrument testing
3. Mobile lab quality control platforms
4. Instrument loan service
5. Tool development support: Computation /Visualisation

Expertise

6. Development of new methodologies/protocols for specialized environmental applications.
7. Development of new observation techniques
8. Co design of cutting-edge instrumentation or new innovative research capabilities
9. Expert Consulting
10. Industry interfacing, collaborative research opportunities

Research services

11. Scientific exploitation (e.g. publication) to promote the use of new technologies by RIs and the Scientific community

Training services

12. Training services on demand and specific

4.1 Methodology for Regular and Ongoing Updating of the Extended e-Catalogue

To ensure the extended e-catalogue remains up-to-date and aligned with user needs, we propose a structured methodology comprising five key phases:

1. Stakeholder Engagement and Needs Assessment

Objective: Continuously gather input from users and stakeholders to identify gaps, refine offerings, and ensure relevance.

Steps:

1. **Identify Stakeholders:** Include researchers, industry users, research infrastructure managers, and policymakers.
2. **User Feedback Mechanisms:**
 - Implement a feedback form on the e-catalogue interface for real-time suggestions.
 - Conduct regular surveys and interviews with users.
3. **Focus Groups:** Organize periodic workshops with representatives from key user groups to validate updates and identify emerging needs.
4. **Advisory Board:** Establish a multidisciplinary advisory board to guide updates based on sector trends and technological advancements.

2. Data Collection and Integration

Objective: Maintain a comprehensive and accurate inventory of services.

Steps:

1. **Service Provider Updates:**
 - Develop a standardized template for service providers to submit new offerings or updates to existing ones.
 - Require periodic reporting (e.g., biannual) from service providers.
2. **Integration with Existing Databases:** Sync with databases maintained by related projects and European networks.
3. **Automated Data Validation:** Use automated tools to identify outdated information (e.g., broken links, inactive services).

3. Technical Infrastructure for Updates

Objective: Streamline the update process using technology.

Steps:

1. **Content Management System (CMS):** Implement a robust CMS to enable real-time updates by authorized personnel.
2. **API Integration:** Facilitate data exchange with other relevant platforms to pull and push updates dynamically.
3. **User Authentication for Providers:** Allow service providers to log in, update their information, and track service metrics through a dashboard.

4. Communication and Promotion

Objective: Ensure stakeholders are aware of updates and can benefit from new services.

Steps:

1. **Update Notifications:** Notify registered users of significant updates via email or platform notifications.
2. **Training and Webinars:** Host sessions to educate users on newly added services or features.
3. **Social Media and Newsletters:** Promote new services via ENVRI's communication channels.

5. Monitoring, Evaluation, and Continuous Improvement

Objective: Evaluate the effectiveness of updates and refine the process based on findings.

Steps:

1. **Effectiveness Metrics:**
 - **Relevance:** Percentage of users reporting satisfaction with available services.
 - **Usage:** Number of services offered across key innovation domains.
 - **Timeliness:** Average time taken to incorporate new services or update existing ones.
 - **Availability**
 - **Cost**
 - **Provision of policies and agreements**
2. **User Analytics:** Use analytics tools to track user behavior and identify high-demand services.
3. **Annual Review:** Conduct an annual review of services, user feedback, and metrics to identify areas for improvement.
4. **Benchmarking:** Compare the catalogue against similar international initiatives to ensure competitiveness.

5 Roadmap for innovation and related services

In the ENVRIplus Deliverable D18.5 “RI-Innovation-Roadmap” published in June 2019, 13 recommendations were listed:

Table 3: Summary of the ENVRI services collected

RI “Innovation-Readiness” action-plan Recommendations

1. Introduce “Innovation Cooperation with Industry” as a priority in every ENVRI’s Annual Strategic Plan
2. Ensure that its website homepage has a high-level "Industry" or “Innovation” menu tab and section
3. Prepare an annual Innovation and Industry-Liaison Strategy as an annex to the RI Business Plan
4. Hire a full-time Innovation/Industry Liaison officer(s)
5. Hire a Communications Officer(s) with commercial experience
6. Set a target for how much cooperation with Industry should ideally contribute to RI annual revenues (%)
7. Establish a multi-disciplinary, gender-balanced, Industry Advisory Committee
8. Highlight four Industry-cooperation Success Stories on its website and in annual reports to the EC and ESFRI
9. Make sure its Data Portal offers users open, user-friendly access to RI data and services
10. Publish an online RI Services Catalogue, inclusive of specific services/opportunities for/with industry
11. On its website, make readily available a standard R Service-level Agreement and IP Policy Guideline for SMEs interested in licensing RI data to (co-)develop value-added products and applications
12. Establish an annual Training Action Plan and Program as annexes to the Business Plan in consultation with industry to bring together RI researchers and company engineers and managers
13. Develop an RI Talent-Attraction Exchange Program with industry to train the next generation of young scientists and engineers

Table 4: List of actions needed to further promote ENVRI’s services (ENVRI-FAIR D3.5, April 2022)

Topic	Proposed actions	Reason	Urgency
Uptake of this ENVRI Catalogue of services for private sector users	Further contact the RIs which are currently not included in the services table	Give a better overview of the overall ENVRI community services	short term

	Implement an online version of the "catalogue" in the ENVRI-Hub and / or ENVRI website	Give better visibility on services available. Easier to update and maintain. Allow to display the information in different ways (filtering)	short term
	Test the catalogue with ENVRI industrial users to check if it fits their needs	Ensure the relevance of the information displayed, fit to users' need	Short term / medium
	Promote this "catalogue" in events and on social media once the online version is available	Give better visibility on services available to a large public	Medium
Increase awareness	Update RI website with specific information targeting industry	Increase awareness on what RIs can offer to private sector users	Medium
	Promote and support the creation / Update of individual RI catalogue of services		
	Collect success stories of collaboration between ENVRI and industry	reply effectively to some requests to participate in industry-related events.	Medium / Long term
	Perform a market analysis	Better target industrial segments which are the most relevant for their activities	Medium
Build a sustainable innovation framework	Support the creation of an Innovation and industry Services Central Support Hub related to ENVRI	Make progress towards their innovation preparedness	Long term

6 RIs website and contact points for innovation catalogue (ENVRINNOV)

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