ENVIRONMENT RESEARCH INFRASTRUCTURES

INNOVATION ROADMAP

HORIZON-INFRA-2023-DEV-01

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Deliverable 4.1
ENVRI Digital Platforms Long-Term Operation Strategy

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V.05	12/10/2025	Version for review		FZJ, CYI
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1. Executive Summary

This deliverable outlines the long-term operation and sustainability strategy for the ENVRI Innovation Hub (EIH) Digital Platforms. The strategy is anchored by the recent ENVRI Board decision to designate the ENVRI HUB (which hosts the EIH) as the ENVRI Node in the European Open Science Cloud (EOSC). This mandate ensures the EIH's institutional backing and secures its position as a central resource for the entire European Environmental Research Infrastructure (ENVRI) community.

The operation strategy addresses technical, organizational, and financial requirements, confirming the EIH's commitment to the ENVRI HUB next platform architecture, utilizing Django/Wagtail CMS for content management, and robust DevOps practices (CI/CD, Kubernetes). It also formalizes the plan for the long-term uptake of services developed within ENVRINNOV and related projects like IRISCC, maximizing the successful implementation of the ENVRINNOV roadmap (T6.1) and reinforcing the ENVRI contribution to EOSC.

2. The EIH Digital Platform

The ENVRI Innovation Hub (EIH) is designed as a sustainable, long-term digital ecosystem that consolidates the innovation capacity of the ENVRI community. To ensure the Hub meets the diverse needs of Research Infrastructures (RIs) and external partners, it is built upon two primary pillars, the content of which has been developed through preceding deliverables:

1. The Innovation Resources Toolbox (derived from D3.1): A capacity-building knowledge repository designed to help RIs structure their internal innovation strategies, manage intellectual property, and navigate technology transfer.
2. The Catalogue of Innovation Services (derived from D1.1): A user-oriented interface showcasing high-value "non-data" services, such as physical testing, expert consulting, and training, available to industry and technology developers.

Both components have been integrated into the ENVRI-Hub digital architecture (staging environment at innovation.staging.envri.eu), utilizing modular, open-source technologies to ensure scalability and compatibility with the European Open Science Cloud (EOSC).

The top-level navigation menu defines the primary functional domains of the platform. These include:

1. Innovation Services
2. Innovation Toolbox
    - Innovation Strategy
    - Collaboration for Innovation
    - Technology Development
    - Technology Transfer
    - Additional Resources

3. Innovation Training
4. Glossary
5. Contact Us
6. About

This hierarchical structure organizes the website into thematic areas that reflect the intended workflow for supporting innovation capacity building within the ENVRI community.

The following sections detail the structure, content, and digitalization status of the content.

2.1 The Catalogue of Innovation Services

The ENVRI Catalogue of Services was described in detail in Deliverable: D1.1 ENVRI catalogue of services construction & ongoing update and is summarized in the following paragraph.

While the ENVRI community is well-known for data services, Deliverable 1.1 focused on compiling and making visible the Innovation Services, capabilities beyond data provision. This catalogue provides a structured interface for external users to access physical, technological, and expert capacities within the RIs.

Service Typology

Based on the compilation in Milestone 1.1, the services are grouped into a high-level typology designed for external stakeholders:

- Technological Services: Includes access to specialized instrumentation (lab/field), validation and calibration against reference standards, mobile lab quality control, and instrument loan services.
- Expertise: Covers the development of new methodologies or observation techniques, co-design of cutting-edge instrumentation, and expert consulting.
- Research Services: Support for scientific exploitation (e.g., publication) to promote technology adoption.
- Training Services: Specific, on-demand technical training.

Digital Architecture and User Experience

The Catalogue is hosted on the ENVRI Innovation Hub (Staging Environment) on a Kubernetes Cluster provided by EGI/LIP (see Figure 1). Its architecture is designed for ease of access and interoperability:

- Dashboard-Style Interface: The catalogue minimizes hierarchical depth (max 1-2 levels) and avoids complex dropdown menus to reduce search time and enhance user experience.
- Interoperability: The system uses semantic web technologies and is compatible with the federated ENVRI-Hub and EOSC, incorporating standard Authentication and Authorization Infrastructure (AAI).

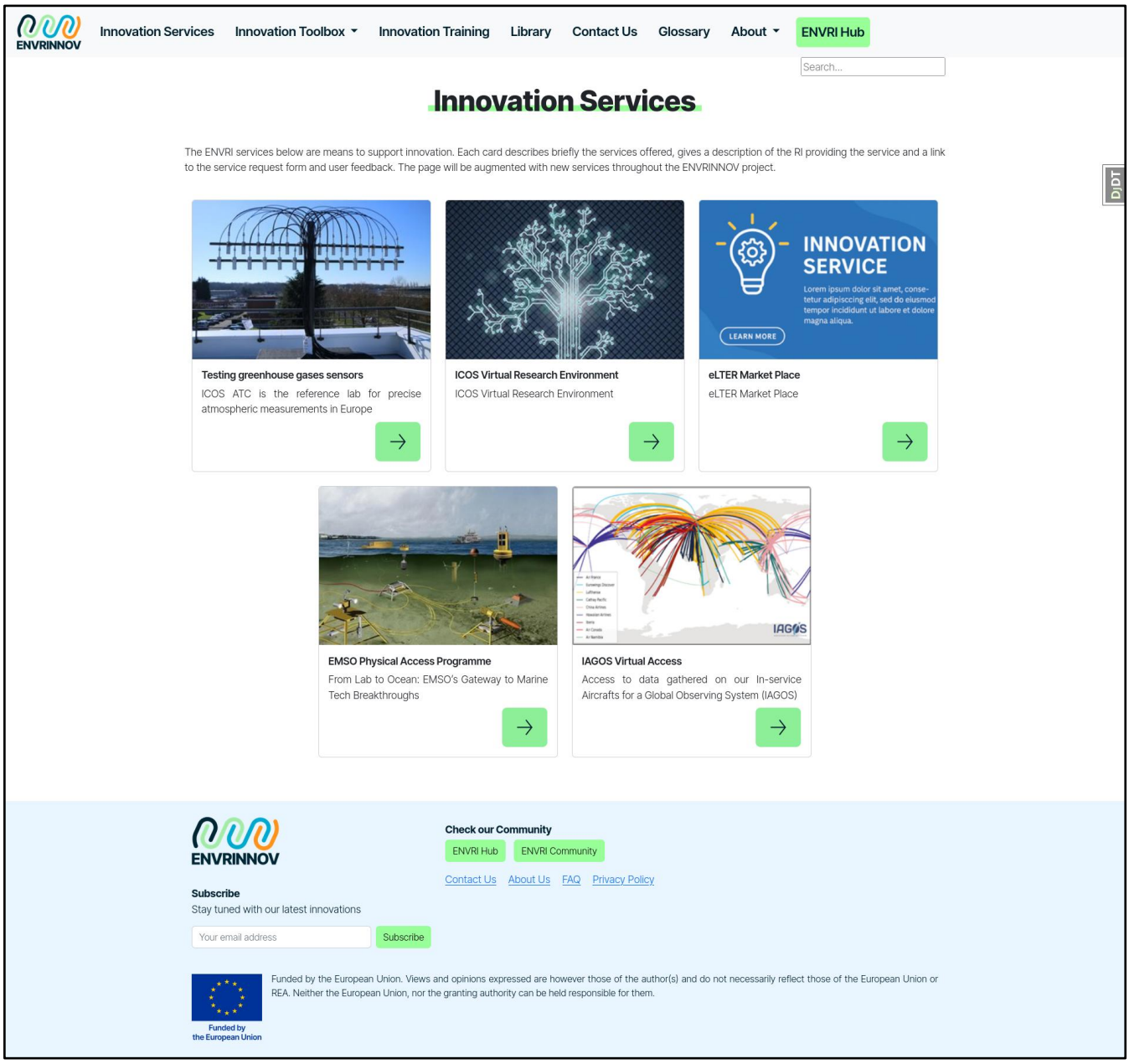


Figure 1) Screenshot of the Innovation Services landing page on ENVRI Hub

Service Presentation Template

To ensure consistency, all services in the catalogue are presented using a common template derived from D1.1 requirements:

1. Service Title
2. Description of the Service
3. Provider Details (Infrastructure/Lab and website)
4. Action Mechanism (Link to service request form or contact)
5. Success Story (Past user feedback/proof of value)

2.2 The Innovation Resources Toolbox: A Core Component of the EIH

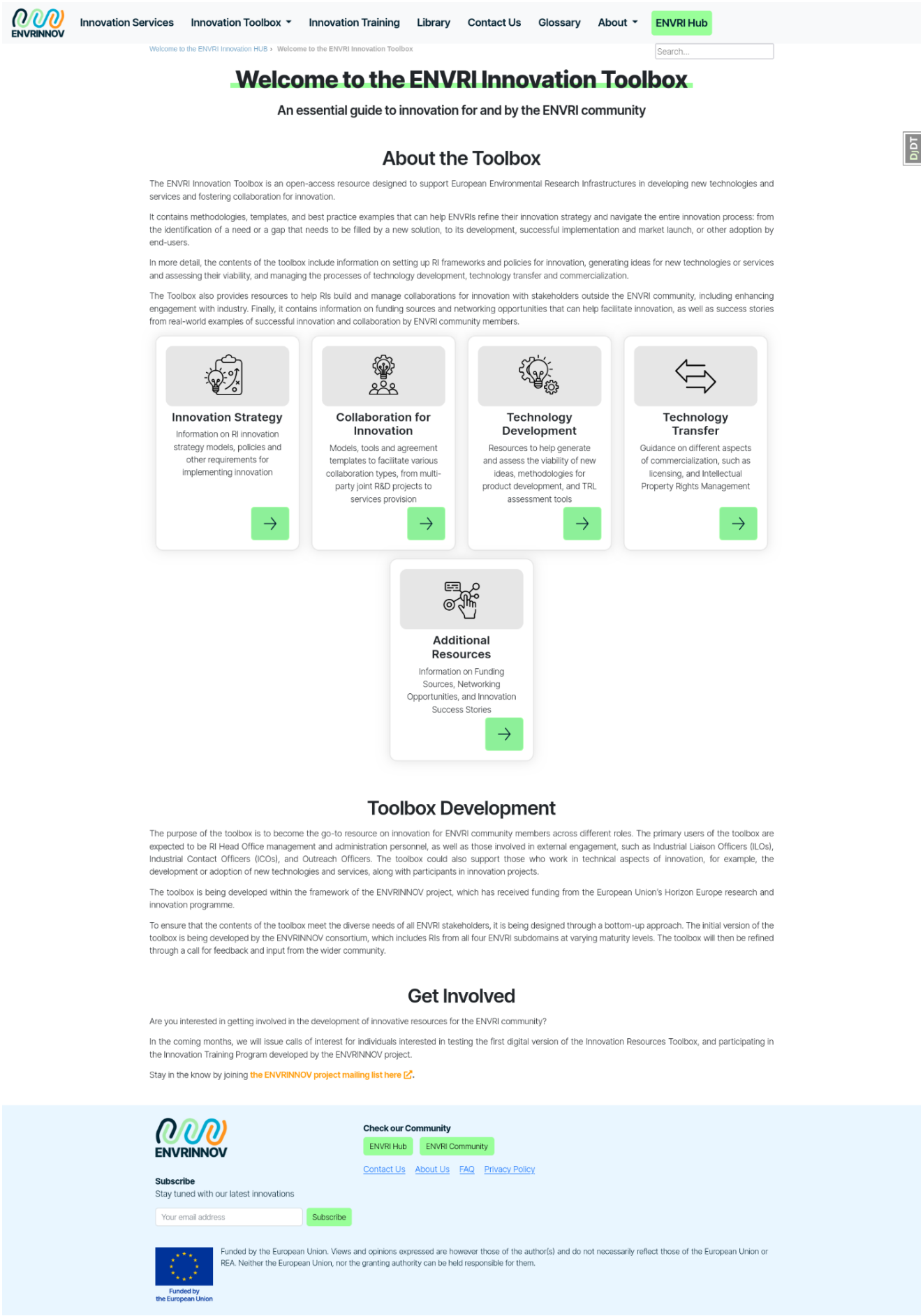
The Innovation Toolbox is described in detail in the deliverable: D3.1 ENVRI Common Policies Resources on Innovation and summarized in the following:

As a result of activities outlined in Work Packages 2 and 3, the content for the ENVRI Innovation Resources Toolbox has been completed and is currently being structured as an online demonstrator on the ENVRI-Hub (see Figure 2). This digital version aims to present the content developed in D3.1 in a format that is accessible, modular, and designed to evolve over time.

Toolbox Structure and Content

Reflecting the offline structure defined in D3.1, the digital Toolbox is organized around five main sections, mirroring the typical lifecycle of innovation capacity building within ENVRIs:

1. Innovation Strategy: This section frames the Toolbox. It provides resources to support RIs in shaping their internal innovation approaches, including guidance on linking innovation to the RI's mission and examples for drafting innovation strategies.
2. Collaboration Resources: Focusing on practical tools for engaging external partners (industry, public authorities, etc.), this section is divided into three subsections:
    - Innovation Collaboration Models: Information on joint R&D, contract research, and commercialization.
    - Collaboration Tools: Canvases, checklists, and planning resources for co-design and scoping.
    - Agreement Guides & Templates: Editable templates and implementation guides for formalizing partnerships.
3. Technology Development: This section assists RIs in advancing early-stage ideas. It includes frameworks for ideation, market need assessment, and innovation management (Discovery to Validation), alongside tools for assessing maturity via the Technology Readiness Level (TRL) scale.
4. Technology Transfer: This part covers the transition from internal development to external adoption. It examines pathways such as services, licensing, and spin-offs, providing extensive guidance on Intellectual Property (IP) management.
5. Additional Resources: A dynamic space for signposting funding calls, networking opportunities, success stories, and access to multimedia materials developed in WP2.


ENVRINNOV
Innovation Services
Innovation Toolbox
Innovation Training
Library
Contact Us
Glossary
About
ENVRI Hub
Welcome to the ENVRI Innovation HUB › Welcome to the ENVRI Innovation Toolbox
Search...
Welcome to the ENVRI Innovation Toolbox
An essential guide to innovation for and by the ENVRI community
About the Toolbox
The ENVRI Innovation Toolbox is an open-access resource designed to support European Environmental Research Infrastructures in developing new technologies and services and fostering collaboration for innovation.
It contains methodologies, templates, and best practice examples that can help ENVRIs refine their innovation strategy and navigate the entire innovation process: from the identification of a need or a gap that needs to be filled by a new solution, to its development, successful implementation and market launch, or other adoption by end-users.
In more detail, the contents of the toolbox include information on setting up RI frameworks and policies for innovation, generating ideas for new technologies or services and assessing their viability, and managing the processes of technology development, technology transfer and commercialization.
The Toolbox also provides resources to help RIs build and manage collaborations for innovation with stakeholders outside the ENVRI community, including enhancing engagement with industry. Finally, it contains information on funding sources and networking opportunities that can help facilitate innovation, as well as success stories from real-world examples of successful innovation and collaboration by ENVRI community members.
Innovation Strategy
Information on RI innovation strategy models, policies and other requirements for implementing innovation
Collaboration for Innovation
Models, tools and agreement templates to facilitate various collaboration types, from multi-party joint R&D projects to services provision
Technology Development
Resources to help generate and assess the viability of new ideas, methodologies for product development, and TRL assessment tools
Technology Transfer
Guidance on different aspects of commercialization, such as licensing, and Intellectual Property Rights Management
Additional Resources
Information on Funding Sources, Networking Opportunities, and Innovation Success Stories
Toolbox Development
The purpose of the toolbox is to become the go-to resource on innovation for ENVRI community members across different roles. The primary users of the toolbox are expected to be RI Head Office management and administration personnel, as well as those involved in external engagement, such as Industrial Liaison Officers (ILOs), Industrial Contact Officers (ICOs), and Outreach Officers. The toolbox could also support those who work in technical aspects of innovation, for example, the development or adoption of new technologies and services, along with participants in innovation projects.
The toolbox is being developed within the framework of the ENVRINNOV project, which has received funding from the European Union's Horizon Europe research and innovation programme.
To ensure that the contents of the toolbox meet the diverse needs of all ENVRI stakeholders, it is being designed through a bottom-up approach. The initial version of the toolbox is being developed by the ENVRINNOV consortium, which includes RIs from all four ENVRI subdomains at varying maturity levels. The toolbox will then be refined through a call for feedback and input from the wider community.
Get Involved
Are you interested in getting involved in the development of innovative resources for the ENVRI community?
In the coming months, we will issue calls of interest for individuals interested in testing the first digital version of the Innovation Resources Toolbox, and participating in the Innovation Training Program developed by the ENVRINNOV project.
Stay in the know by joining the ENVRINNOV project mailing list here.
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Check our Community
ENVRI Hub
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Figure 2) Screenshot of the ENVRI Innovation Toolbox on ENVRI HUB

2.3 Innovation Training

This section on the EIH (See Figure 3) is intended to host training materials, guidance modules, and capacity-building resources for stakeholders involved in innovation processes. It serves as the platform's pedagogical component, enabling skill development and supporting best practices across the ENVRI network.

Figure 3) Screenshot of the ENVRI Innovation Training Programme

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2.4 Supporting Sections

The following supporting sections are linked via the menu available on all pages of the EIH (e.g. see Figure 1)

- Glossary
  Provides definitions and terminology relevant to innovation management and research infrastructures. (see Figure 4)
- Contact Us
  Offers communication channels for stakeholders, users, and external partners.

- About
  Includes additional explanatory materials and clarifies the conceptual and methodological grounding of the Innovation Hub.

Figure 4) Screenshot of the Glossary on EIH

2.5 Overall Status of the ENVRI Innovation Hub (EIH)

The ENVRI Innovation Hub (EIH) is currently in an active implementation and validation phase, transitioning from content definition to a functioning digital ecosystem ready for community testing. The

core components, the Innovation Toolbox and the Catalogue of Services, have reached a key milestone where their content is defined and integrated into a digital demonstrator environment.

Component	Status	Key Achievements	Next Steps (D4.1 Focus)
Innovation Services Catalogue (D1.1)	**Operational Content/Pilot Ready**	Initial content list of operational, "non-data" innovation services compiled and standardized (e.g., GHG sensor testing, expertise consulting). Interface deployed on the ENVRI-Hub staging environment with a dashboard-style, accessible design.	Regular monitoring and expansion methodology to be fully implemented.
Innovation Resources Toolbox (D3.1)	**Content Complete/Digitalization Underway**	Full content structure was finalized around the five core areas (Strategy, Collaboration, Tech Development, Tech Transfer, Resources). Initial offline content has been digitized into a structured demonstrator on the ENVRI-Hub.	Launching the **beta version** for community-wide testing (Task 4.1). Integrating multimedia and linking with the Training Programmes.
EIH Digital Platform (Overall)	**Staging Environment Operational**	The EIH is hosted within the wider ENVRI-Hub NEXT architecture (on a Kubernetes Cluster/EGI). It features seamless integration standards (semantic web, AAI) and is designed for compatibility with the **EOSC** as a sustainable, federated service gateway.	Refinement based on user feedback, onboarding more services, and preparing for a broader public release as a long-term, living resource.

In essence, the EIH has moved beyond the planning stage to establish a technically sound, cohesive digital platform whose services and resources are currently being refined and validated by the ENVRI community ahead of its planned public launch.

3. Strategic Context and Organizational Foundation

The long-term operation of the EIH Digital Platforms is no longer merely a project-specific goal but is integral to the strategic direction of the entire ENVRI community.

- ENVRI Node in EOSC

  The ENVRI Board's decision to establish the ENVRI HUB as the central ENVRI Node in EOSC provides the essential organisational foundation for long-term sustainability. This guarantees the platform's strategic importance and ensures the necessary institutional commitment for its maintenance and evolution.

- Multi-Project Uptake

  The sustainability plan is designed to facilitate the uptake of services and results not only from ENVRINNOV (e.g., e-catalogue, policies) but also from synergistic projects such as IRISCC, positioning the EIH as the consolidated access point for innovation across the ENVRI cluster. The uptake is currently guided by the onboarding group as part of the governance structure of ENVRI HUB (see Figure 5)

- Platform Scope

  The EIH Digital Platforms comprise:

  - Internal Innovation Repository (T4.1a): Targeting the ENVRI community via the ENVRI-Hub.
  - External Innovation Platform (T4.1b): Targeting external stakeholders and acting as the public, one-stop access point.

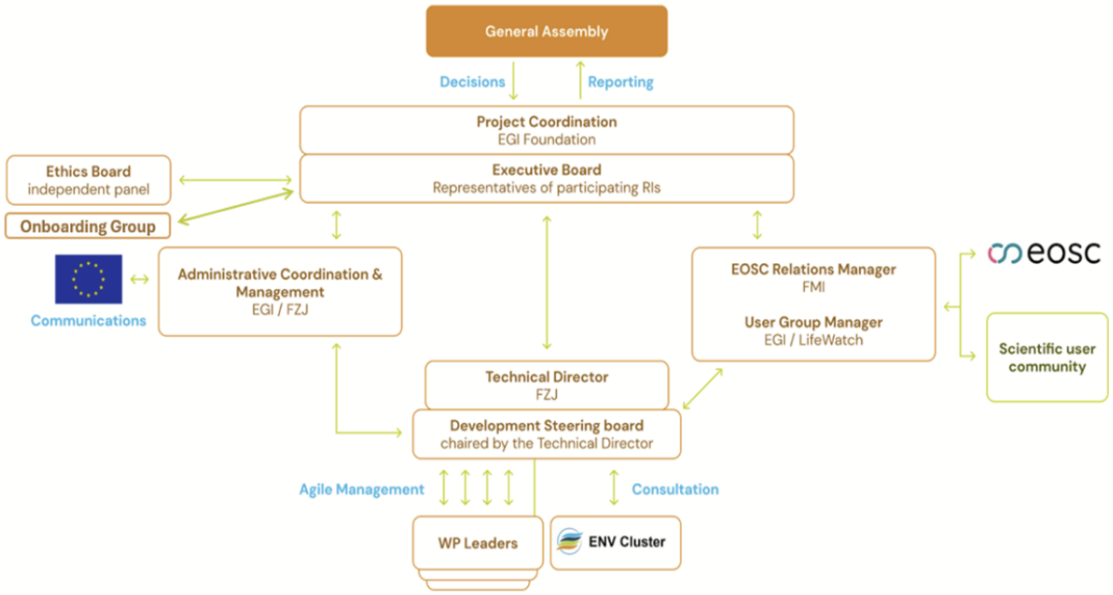

Figure 5) Current Governance Model of the ENVRI HUB NEXT. New Services will be evaluated by the Onboarding Group for technical readiness and content quality and compatibility.

3.1 Sketch of the upcoming ENVRI NODE Governance Model

The EOSC ENVRI Node is the coordinated bridge between the ENVRI Science Cluster and the European Open Science Cloud. It guarantees that environmental RI services and data are seamlessly integrated into EOSC, while ensuring EOSC tools are directly relevant and valuable for environmental science.

Core Building Principles

- Based on ENVRI-HUB
- Researcher-centric design
- FAIR-by-design services and data
- Interoperability and cross-domain integration
- Transparent and inclusive governance
- Long-term sustainability

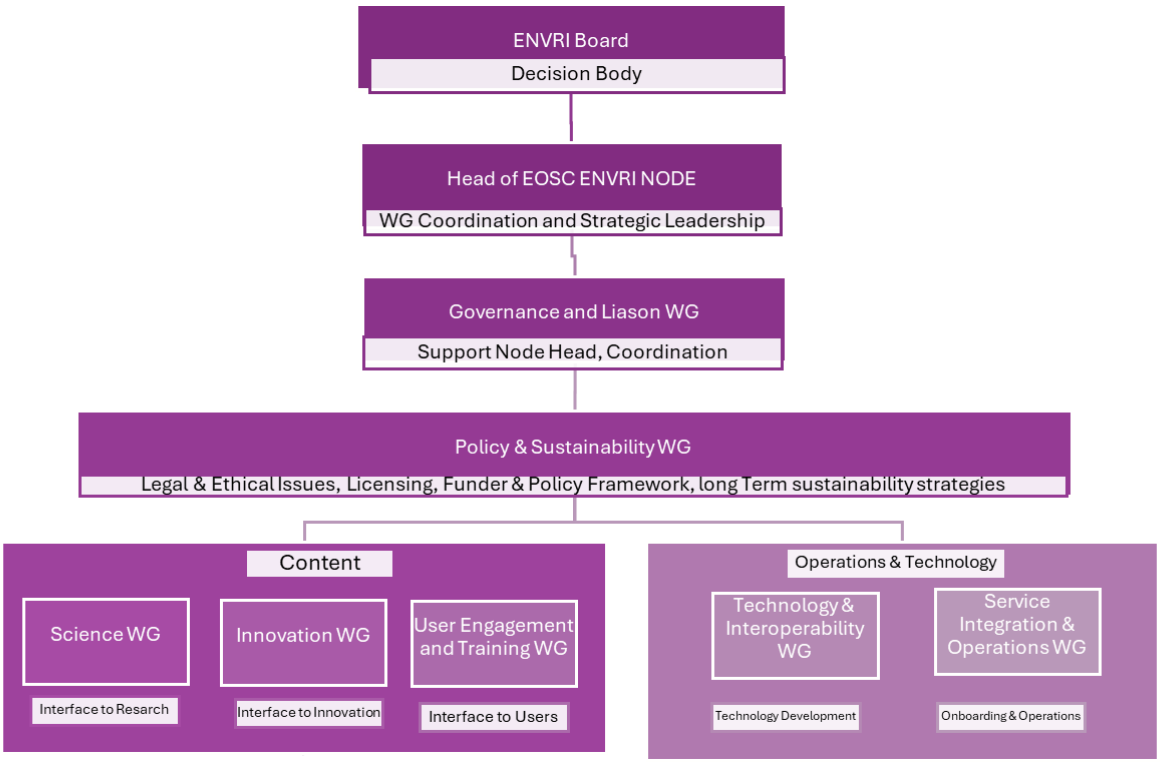

Figure 6) Sketch of the upcoming ENVRI NODE Governance Model

In the following, the core components of the foreseen Governance model (see Figure 6) are described.

The *Node Coordinator* provides strategic leadership and coordination across all Work Groups. This role is the main point of contact with EOSC-A, the EC, other clusters, and external forums. They chair the Governance & Liaison WG, ensure the delivery of Node objectives, and maintain alignment with EOSC policy and architecture. Ultimately, the Node Coordinator answers to the ENVRI Board.

The *Governance & Liaison Work Group* supports the Head of Node and is responsible for internal coordination, progress tracking, and making strategic adjustments. It ensures coherence and

collaboration among all WGs and facilitates alignment with EOSC-A, the EC, and other Science Clusters. It typically includes a Node secretariat and Communications functions. Major decisions are made within this WG, with essential input from all WG leaders.

Policy & Sustainability WG addresses licensing, legal, and ethical issues. Its primary function is ensuring compliance with the EOSC Rules of Participation and managing the ENVRI Node's own Rules of Participation (RoP). It develops long-term sustainability strategies for all Node services and actively works with funders and policy frameworks. Crucially, it manages the establishment of a Memorandum of Understanding (MoU) or equivalent cooperation document among the ENVRI Research Infrastructures (RIs) as a core part of the sustainability plan.

The *Science Working Group* is led by the Chief Scientist and is responsible for identifying and prioritizing cross-RI scientific use cases. It ensures ENVRI's scientific relevance in EOSC and maintains interfaces with research communities and Research Infrastructure (RI) science boards. The WG's primary function is to feed scientific priorities into the Technology, Service, and Engagement WGs.

The *Technological Development & Interoperability Working Group* coordinates technical development, standards, and tools. Its core mission is to ensure technical alignment and promoting interoperability across Research Infrastructures (RIs) with the EOSC-Core and EOSC-IF (Interoperability Framework). The WG leads FAIR (Findable, Accessible, Interoperable, Reusable) implementation and supports the technical onboarding of services. It works closely with the Service WG.

The *Architecture, Service Integration & Operations Working Group* defines the architecture of the EOSC ENVRI Node and focuses on actual service delivery through the EOSC (including connections to the EU Node and other relevant nodes). It oversees the onboarding of services into the EOSC ENVRI Node, ensures quality of service, usability, and operational coherence, and manages helpdesk, monitoring, and technical service support processes. This WG works closely with both the Tech WG and the Engagement WG.

The *Engagement & Training Working Group* gathers researcher feedback and requirements to inform development. It co-designs services directly with users and research communities. The WG develops training materials, promotes capacity building, and actively works to promote the uptake of all Node services.

The *Innovation Working Group* serves as the dedicated strategic and operational body for coordinating and amplifying the innovation-related activities of the ENVRI community within the context of the EOSC ENVRI Node. Its primary role is to bridge the scientific and technical capacities of Research Infrastructures (RIs) with the needs of industry, SMEs, and technology developers, ensuring the ENVRI Innovation Hub (EIH) remains a high-value, sustainable gateway for knowledge and technology transfer.

3.2 Application of the Governance model to the Innovation Hub

The upcoming Governance Model for the ENVRI Node is designed to provide a permanent, structured framework that fully supports and institutionalizes the technical and content management recommendations made for the Innovation Hub (EIH) Digital Platforms in Deliverable D4.1.

The Node Coordinator and the Governance & Liaison WG ensure the EIH's strategic longevity by embedding its operation within the highest level of the ENVRI structure, guaranteeing alignment with

the overall ENVRI Innovation Roadmap (T6.1) and the EOSC mandate. This directly addresses the need for sustainable, long-term uptake and engagement articulated in the D4.1 objectives.

The Policy & Sustainability WG directly takes over the responsibility for the EIH's future viability. It ensures that the digitalized policies and resources from T3.1 are compliant with EOSC Rules of Participation and manages the MoU among RIs. This structure provides the crucial financial and legal basis for the platform's long-term operational costs, which D4.1 required.

The Technological Development & Interoperability WG and the Architecture, Service Integration & Operations WG are the permanent custodians of the EIH's technical environment. They secure the use of the ENVRI HUB next platform architecture, continuing the commitment to CI/CD pipelines, Git Repository, and automatic code quality and security control (Sonarcube, Trivy). Specifically, the Architecture WG ensures the operational coherence and long-term hosting of the platform on the LIP Kubernetes Cluster infrastructure, while the Technological WG ensures the FAIR implementation of the e-catalogue of services (T4.1a-ii). This technical structure validates all the engineering standards set in the D4.1 project phase.

Content management and user feedback mechanisms are permanently handled by the Innovation WG, the Science WG and the User Engagement & Training WG. The Innovation WG has the overall responsibility of content for the Innovation related content, Science WG ensures the e-catalogue of services (T4.1a-ii) and the Innovation Toolbox content remain scientifically relevant by identifying and prioritizing use cases. The Engagement & Training WG operationalizes the Wagtail CMS strategy by undertaking the development of training materials for the Content Reporter Team (from WP1/WP3). Crucially, this group institutionalizes the continuous gathering of researcher feedback and requirements (T4.1b-iii) and the promotion of the Technology solution and provider database (T4.1b-iv), transforming project-specific tasks into permanent, demand-driven Node functions.

In essence, the entire Node Governance Model is the operationalization of the D4.1 strategy, guaranteeing that the Innovation Hub's initial design and content are maintained, technically sound, and strategically relevant to the ENVRI contribution to EOSC.

3.3 Technical Long-Term Operation Strategy

The technical strategy builds upon the robust, modern, and open-source foundation established in T4.1.

- Platform Architecture: The EIH is based on the ENVRI HUB next platform and the Django Web Application Framework as part of the overall ENVRI HUB architecture sketched in Figure 7.
    - Content Curation: Wagtail Content Management System (CMS) is used to ensure reporters can manage content (Innovation Toolbox, Catalogue of Innovation Services) without application code changes.
- DevOps and Infrastructure:
    - Sustainable Infrastructure: Continued hosting on the Kubernetes Cluster infrastructure on LIP facilities, secured through long-term service agreements.
    - Operational Excellence: Strict adherence to the CI/CD pipeline, Git Repository, and automatic quality control using Sonarcube (code quality) and Trivy (container security assessment) to ensure high reliability and security required for an EOSC-affiliated node.

- Maintenance and Technical Roadmap: Definition of processes for technology stack updates (Django, Wagtail, Kubernetes) and integration with the technical evolution of the overarching ENVRI HUB.

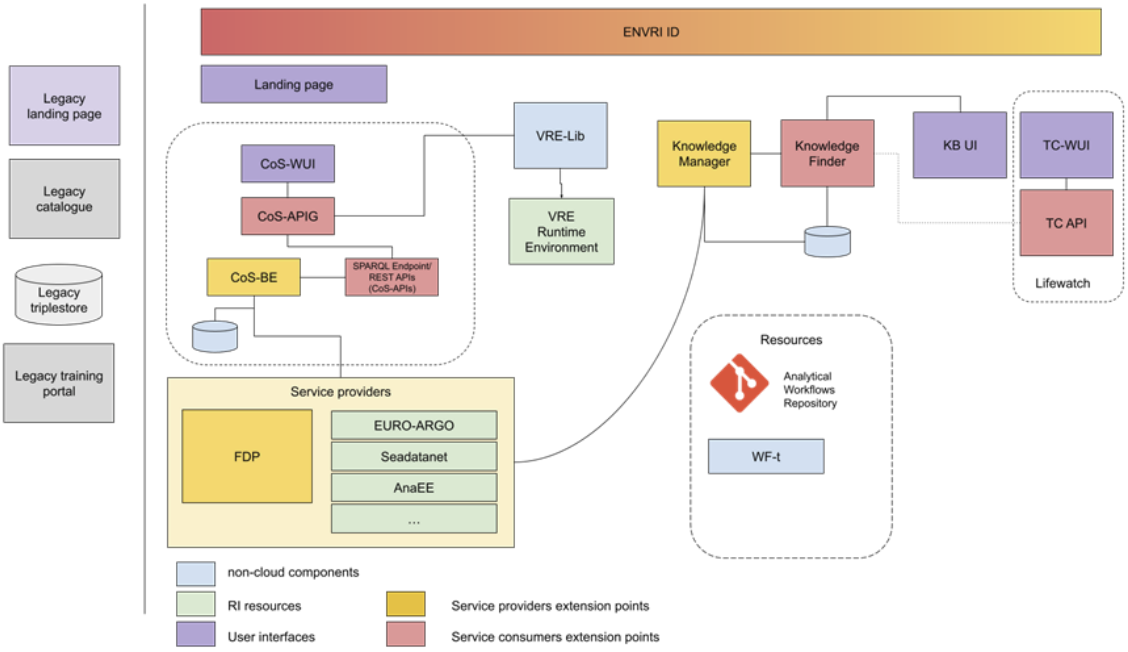

Figure 7): ENVRI-Hub Architecture

3.4 A State-of-the-art CI/CD Pipeline

3.4.1 Continuous Integration

Within a modern Continuous Integration/Continuous Deployment (CI/CD) workflow (Figure 8), the Git repository acts as the central hub for all code changes, serving as the single source of truth. When a developer pushes code or creates a pull request, this event triggers the automated CI/CD pipeline. During the pipeline's execution, a tool like SonarQube is used to perform static code analysis on the new code. SonarQube inspects the source code for bugs, vulnerabilities, and code smells, ensuring that the code adheres to quality standards before it can be merged or deployed. This integration ensures that every new version of the application automatically undergoes quality and security checks, directly integrating code review and quality gates into the standard Git-based development process

SonarQube and Trivy within a modern Continuous Integration/Continuous Deployment (CI/CD) workflow. The repository serves as the single source of truth, organizing the code through a structured directory layout and enabling collaborative development. Developers work on separate branches for new features or bug fixes, committing small, frequent changes to track progress.

The Git repository is the trigger for the entire automated process. A developer's push of code to a specific branch (or the creation of a pull request) is a "Git event" that initiates the CI/CD pipeline. Within this pipeline, orchestrated by tools like Jenkins or GitHub Actions, a series of defined stages are executed. This typically includes a stage for SonarQube to perform static code analysis on the new code, and a later stage for Trivy to scan the resulting container image for known vulnerabilities before it is deployed. By acting as the central hub for code changes, the Git repository ensures that all quality and security checks are automated and enforced for every new version of the application.

SonarQube and Trivy are both software development tools used to improve quality and security, but they focus on different aspects of the process.

- SonarQube is a static code analysis platform that primarily focuses on inspecting an application's source code. It detects bugs, vulnerabilities, code smells, and technical debt and helps enforce coding standards. SonarQube analyzes the "cleanliness" and maintainability of the code developers are writing.
- Trivy, in contrast, is an open-source security scanner that primarily targets vulnerabilities in the software supply chain. It scans for known vulnerabilities in container images, file systems, Git repositories, and infrastructure-as-code files. Trivy also looks for exposed secrets and misconfigurations in the deployment artifacts.

Used together in a CI/CD pipeline, these two tools provide comprehensive coverage: SonarQube checks the quality and security of the code itself, while Trivy ensures the security of the components and dependencies used to build and deploy that code

3.4.2 Continuous Delivery and Deployment

- Helm is a package manager for Kubernetes, used to define, install, and upgrade complex applications using "charts," which are packages of pre-configured Kubernetes resources. Helm standardizes the packaging of applications and manages them through a versioned chart, making it easier to deploy and manage applications consistently across different environments by simply changing a values.yaml file.
- Argo CD, in contrast, is a declarative, GitOps-based continuous delivery (CD) tool for Kubernetes. Rather than acting as a package manager, it functions as a controller that continuously monitors Git repositories for a desired state and automatically synchronizes it with the live state of applications in a Kubernetes cluster.

The two tools are often used together: Helm provides the templating and packaging of applications, and Argo CD automates the deployment and ensures synchronization by continuously pulling the latest desired state from Git. This powerful combination ensures a consistent, auditable, and automated deployment workflow.

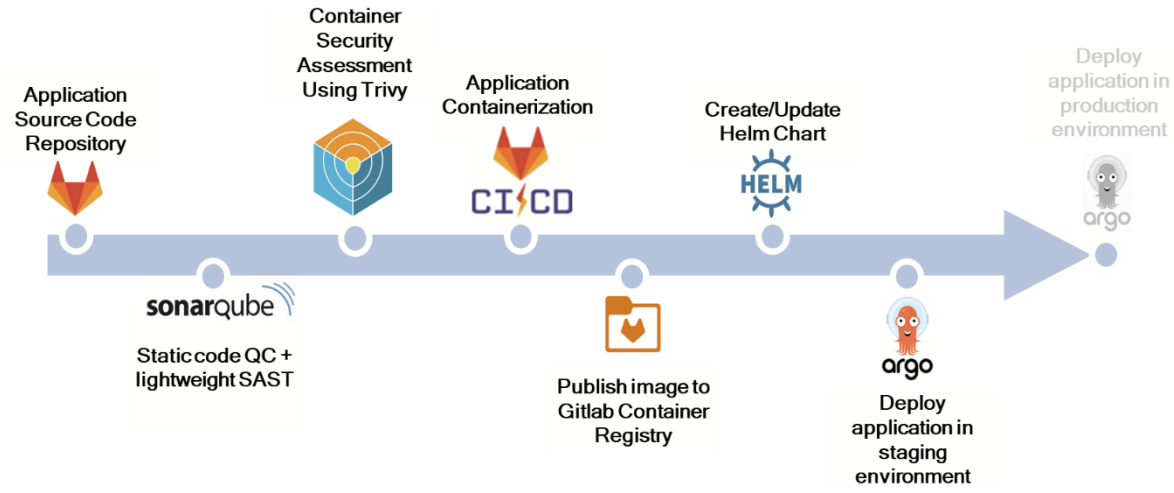

Figure 8): ENVRI HUB CI/CD Pipeline

3.5 The CMS Back Office

3.5.1 Technical background

Wagtail is an open-source Content Management System (CMS) built on top of the Python-based Django web framework. It is designed to provide a modern, flexible, and developer-friendly foundation for building content-driven websites. Relying on the underlying architecture of the Django Web Framework, Wagtail inherits its key characteristics as clean design, robustness, scalability, and strong security principles, while adding a dedicated editorial interface and a powerful set of content-management tools.

At its core, Wagtail is a headless-friendly CMS, offering a clear API layer and a flexible content modeling system that allows developers to define page types, reusable content blocks, editorial workflows, and custom logic. Its modularity makes it well suited for scientific infrastructures such as the ENVRINNOV project, where interoperability, maintainability, and long-term sustainability are essential.

The technologies powering Wagtail, Python and Django, are also the base architecture for the ENVRI Hub Next platform and related backend services. This provides several strategic synergies:

- Shared expertise: Teams already familiar with Python/Django development can smoothly transition to Wagtail-based development without steep learning curves.
- Shared deployment and runtime environments: The same Python virtual environments, deployment pipelines, and containerisation practices (e.g., Docker, Kubernetes) can be reused, simplifying DevOps and maintenance.
- Integration patterns: Existing Django-based modules, authentication systems, APIs, and data services can be integrated directly into the CMS backend.
- Reduced long-term costs: Since the technological stack remains consistent with ENVRI Hub Next, future maintenance and extension require fewer resources.

This continuity strengthens the sustainability and scalability of the project's technical ecosystem.

3.5.2. Separation of Content and Structure

One core architectural principle of Wagtail, aligned with good CMS practice, is the strict separation of content, structure, and presentation. This separation enables flexible governance and easier long-term maintenance.

Developers define the "shape" of content through page models and StreamField blocks, which determine what editors can create (e.g., headings, text blocks, images, datasets, metadata sections). These models ensure consistency across the platform and allow complex structures to be reused and extended.

To separate the work on editorial content vs. front-end implementation, the project assigns roles to different components of the system:

Structure:

- Site map definition

- Navigation architecture
- Page types and templates
- Reusable structural components

Presentation (Look & Feel):

- Style guides
- Branding fundamentals
- Typography, colours, design system
- Accessibility and UX guidelines

Editorial Interface:

- Tools that editors use to create and update content
- Validation workflows
- Previewing and publishing features

This division allows technical teams to focus on functionality and editorial tools, while front-end designers implement the project's visual identity independently. Editors only interact with the content layer; they do not alter structural or stylistic components. A more detailed explanation of content editing is provided in the following chapter.

3.5.3 Graphical User Interface (GUI)

While developers work mainly at the source-code level, editors and moderators use Wagtail's graphical user interface, with their responsibilities clearly managed through a robust role-based permissions system.

Editors are responsible for creating and modifying content within the CMS. They can save drafts as they work, submit pages for review, upload images and documents, and manage the sections of the page tree assigned to them.

Editors:

- Create and modify content
- Save drafts
- Submit pages for review
- Upload images and documents
- Manage sections of the page tree assigned to them

Moderators or reviewers, on the other hand, focus on ensuring the quality and consistency of content. They review submissions from editors, approve and publish pages, and may request changes when necessary to maintain the standards of the platform.

Moderators / Reviewers:

- Review of content submitted by editors
- Approve and publish pages

- Request changes
- Oversee content quality and consistency

This separation supports compliance with organisational publishing policies, improves quality control, and aligns with the workflow used in scientific communication.

Editorial Workflow: From draft to published content

Wagtail provides a structured and transparent workflow:

1. Save Draft: Editors can save their work at any time without affecting the public website. Drafts are stored internally and can be previewed before submission.
2. Submit for Moderation: When content is ready, editors submit the page for approval. Moderators receive a notification and gain access to a comparison view showing the changes.
3. Review by Moderators: This ensures that all published content goes through a validation process consistent with the project's dissemination standards. Moderators can
    - Approve and publish the content
    - Add comments and request additional edits
    - Reject the submission with explanatory notes
4. Publish: Once approved and published, the content becomes visible to the public according to the site's publication settings.

3.5.4 A Typical Wagtail CMS Workflow

The following sequence of screenshots illustrates a typical content workflow (see Figure 9- Figure 14) in Wagtail, highlighting the interaction between an editor and a moderator. In this example, the editor begins by viewing a live page on the public site and proceeds to log into the CMS. From there, they access the page tree, make content edits, save a draft, and submit the page for moderation. The screenshots also show the moderator's interface, demonstrating how submitted content is reviewed, approved, and ultimately published. This step-by-step example provides a concrete view of the editorial process and the roles, permissions, and workflow mechanisms built into Wagtail.
Finally, the example also demonstrates how the custom Glossary block developed by the project team allows editors to simply enter terms and definitions in a field panel, without needing to worry about alphabetical order or styling, and the CMS automatically renders a fully formatted, alphabetically sorted table-based glossary with an A–Z index.

First, the editor logs into the CMS system: (s. Figure 9)

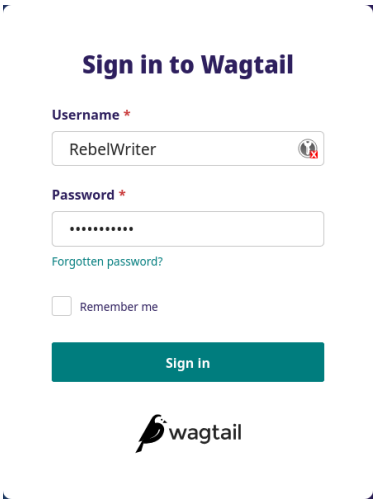

Figure 9) Login screen to the CMS Back office.

The editor navigates the Page Tree and selects the Glossary page: (s. Figure 10)

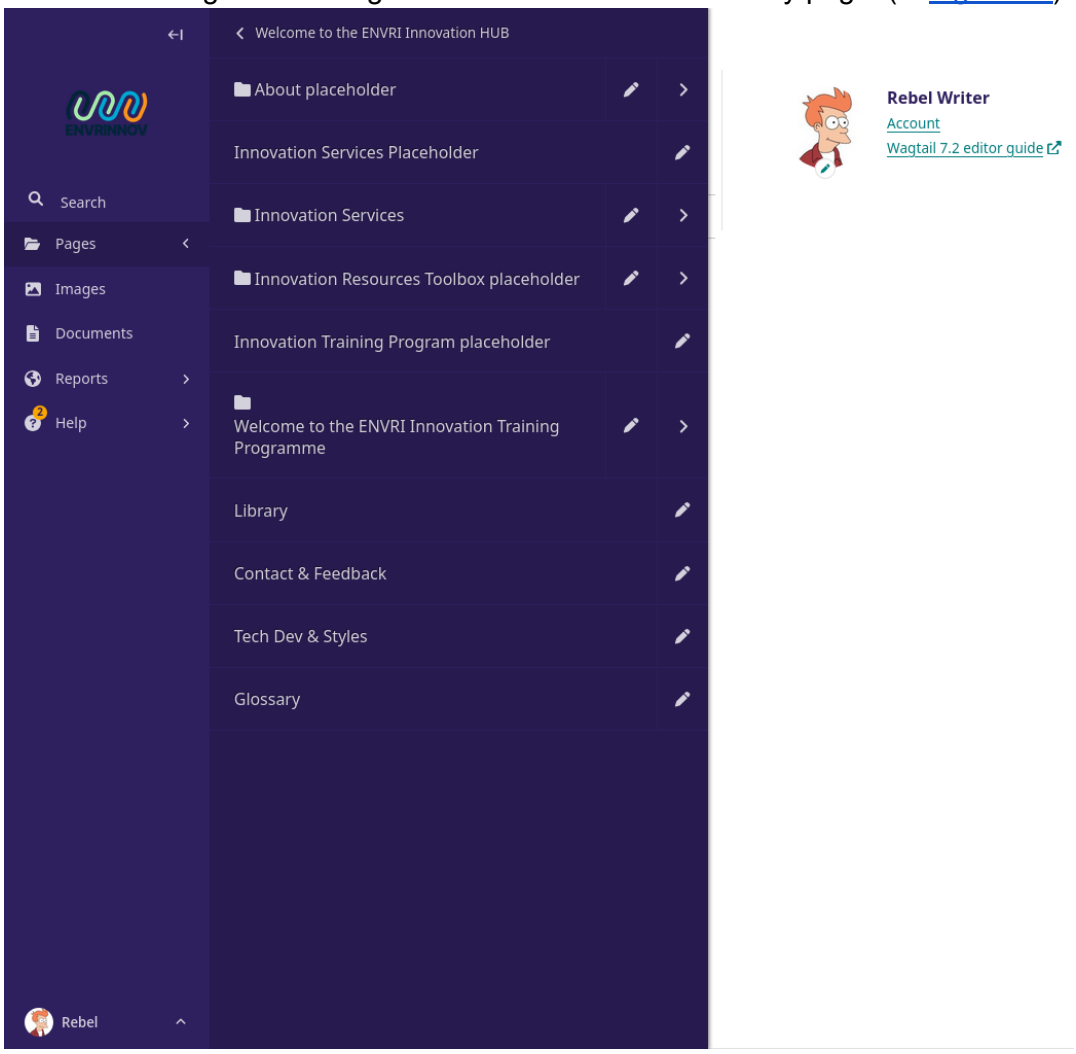

Figure 10) CMS Backoffice Navigation.

In edit-mode (s. Figure 11), the editor adds another glossary item and submits it for approval:

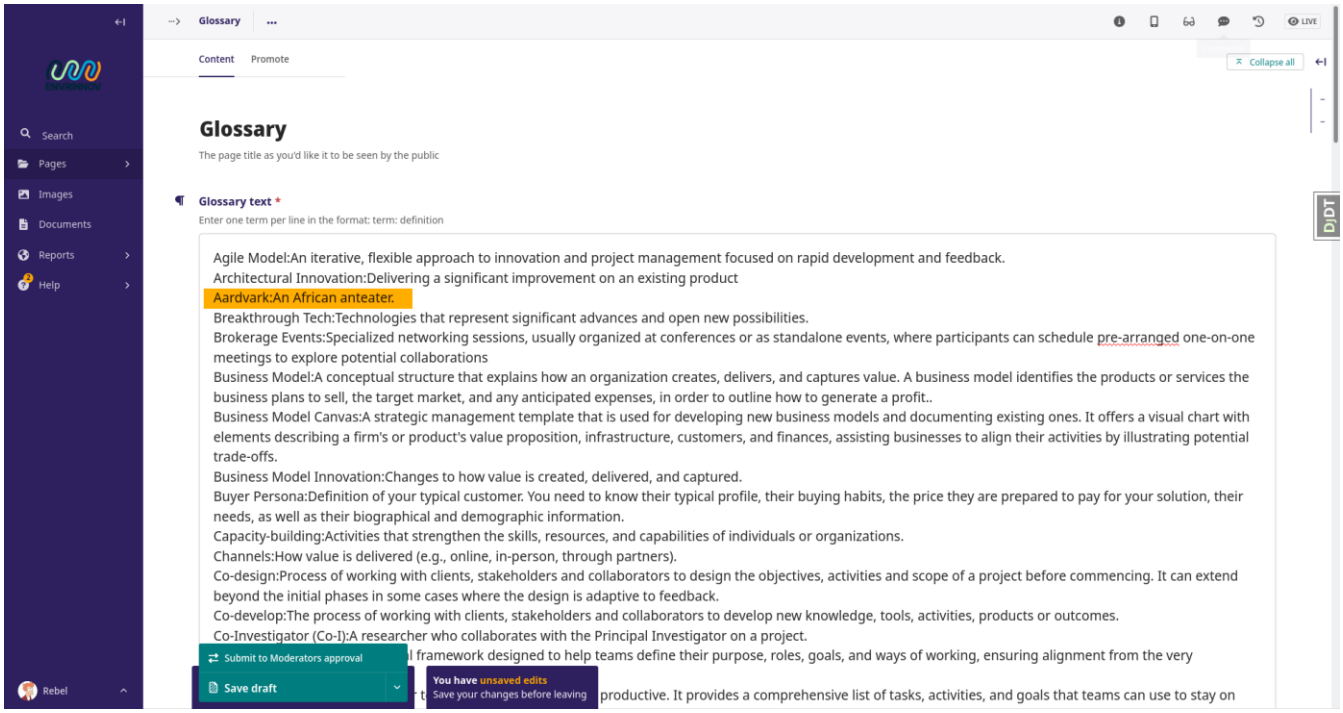

Figure 11) Editor Mode of the CMS Back Office.

The approval is done by a member of the Moderator group. The moderator logs into the CMS system:

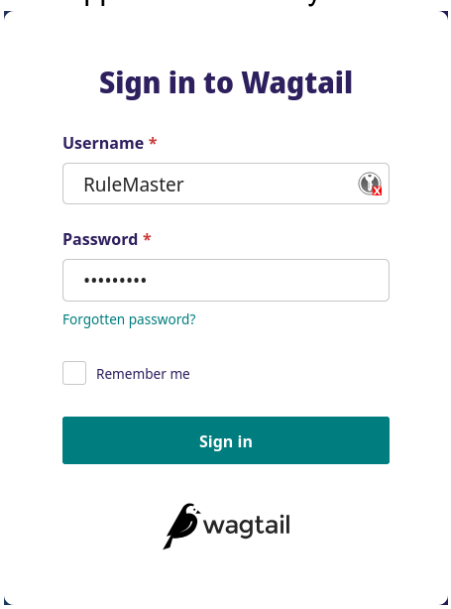

Figure 12 Login screen and login as moderator.

The moderator approves the editor's modification and publishes the page:

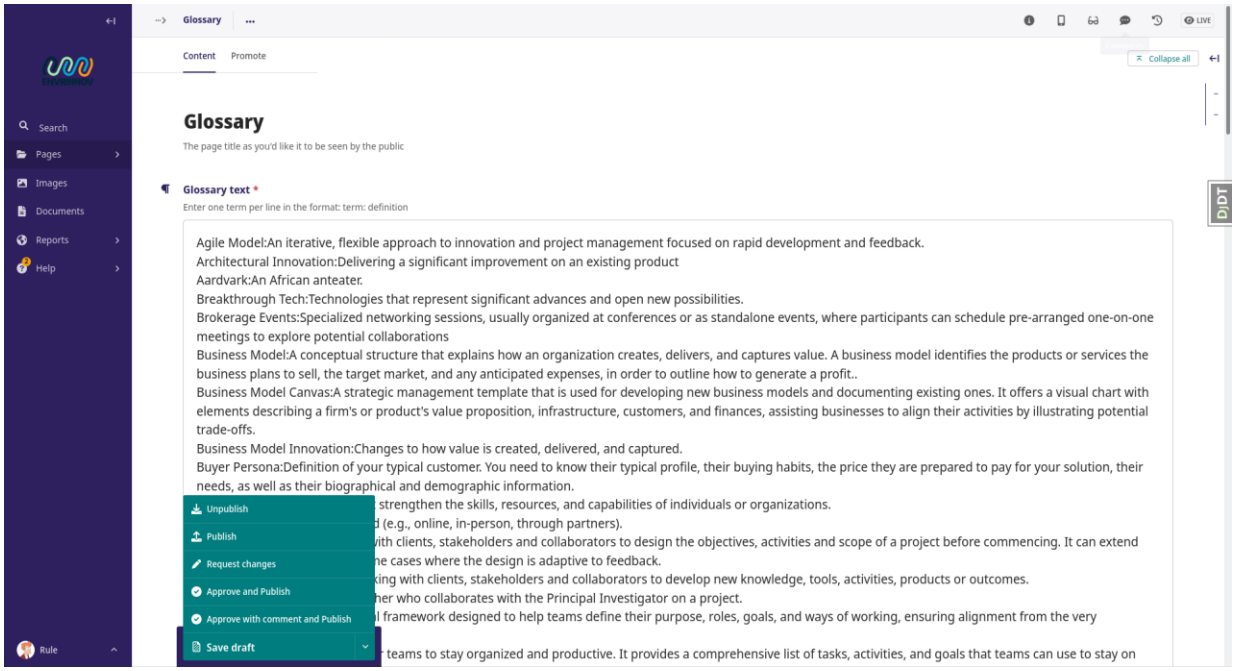

Figure 13) Editor Modus in Moderator modus. Showing the Moderator related action menu.

The "Live" button shows the final, rendered page:

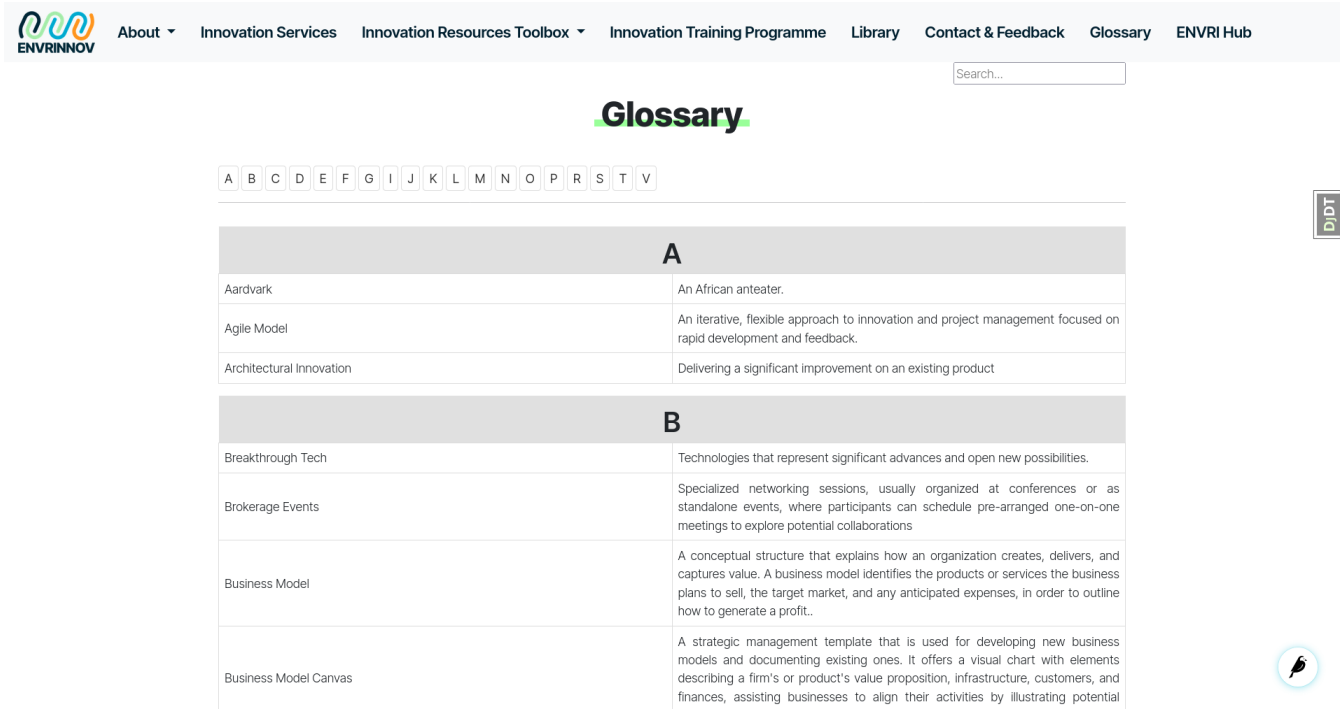

Figure 14) Final preview of the rendered page to be released.

3.5.5 EIH Content Reporter Team

To ensure the ENVRI Innovation Hub (EIH) content, including the Innovation Toolbox and the Catalogue of Services, is accurately curated and maintained, a dedicated Content Reporter Team will be established. This team will comprise designated representatives from the ENVRI Research Infrastructures (RIs) and the relevant ENVRI Node Working Groups (primarily the Innovation and Science WGs). The Engagement & Training Working Group will be responsible for institutionalizing the continuous capacity building of this team, specifically developing and delivering training modules on the use of the Wagtail CMS back-office pages. This training will cover essential workflows such as content drafting, revision, metadata tagging, and publishing, ensuring the team can efficiently and independently update the EIH, guaranteeing content relevance and high quality in alignment with strategic innovation priorities.

4. Content Curation and Stakeholder Engagement Strategy

Sustainability requires dynamic content and continuous user engagement.

- Content Reporter Team & Workflow:
    - The Wagtail CMS enables a dedicated Content Reporter Team to be formed from personnel contributing to WP1 (Innovation Toolbox content) and WP3 (Catalogue of Innovation Services).
    - A defined workflow for content creation, review, and publication is established to maintain the quality and currency of digitalized resources and policies.
- Uptake Strategy (T4.2):
    - Internal Uptake (ENVRI-Hub): Continuous engagement and training of ENVRI RI staff to integrate the platform's resources into their daily operations.
    - External Uptake (ENVRI Website): Maintenance of promotional material and event information (e.g., Workshops) and the continued operation of the user feedback functionality (T4.1b-iii) to ensure relevance to external stakeholder needs.
    - Matchmaking Database: Long-term plan for the management, expansion, and promotion of the Technology solution and provider database (T4.1b-iv) to facilitate industry/private sector engagement and innovation partner matchmaking.

5. Organizational and Financial Sustainability

The EOSC mandate is the cornerstone of the long-term organizational and financial model of the EIH Digital Platform.

- Organizational Integration: The EIH Digital Platform operation will be formally integrated into the permanent organizational structure supporting the ENVRI HUB/EOSC Node. This includes the transition of leadership and support from ENVRINNOV partners (FZJ, CyI, ICOS-ERIC, UHEL) to the established ENVRI long-term body.

- Dedicated Roles: Formalization of long-term roles for Platform Ownership (Governance), Technical Management, and Content Curation (Reporter Team Management) within the ENVRI structure.
- Funding Model: The platform's operation costs will be covered by the long-term funding secured for the ENVRI Node in EOSC, supplemented by core contributions from participating in ENVRI RIs, thus ensuring reliable financial sustainability beyond project funding.

The integration of the ENVRI Node Governance Model is the single most important element in the finalization of the D4.1 Long-Term Operation Strategy, as it replaces project-based roles with a permanent, institutionally mandated framework.

6. Integration into the ENVRI Node Governance Model

The long-term operation of the EIH Digital Platforms (ENVRI-Hub innovation repository T4.1a and external platform T4.1b) will be formally managed and sustained through the established ENVRI Node Working Group structure. The Innovation Working Group (IWG) will act as the dedicated owner, coordinating the necessary activities across all relevant groups. This integration ensures the platforms are permanent, compliant, and continuously updated based on community needs.

6.1. Impact on Technical Management and Operations

The technical stability and interoperability requirements of the EIH are secured by the Innovation Working Group coordinating the innovation related parts of all ENVRI Node Governance bodies with core functions to the technical WGs:

Technical Requirement	**ENVRI Node Working Group Mandate**	**IWG Coordination Role**
Platform Architecture & Interoperability: Ensure the ENVRI HUB next platform and the EIH (Django/Wagtail) are aligned with external standards.	**Technological Development & Interoperability WG:** Coordinates technical alignment with EOSC-Core and EOSC-IF, promoting interoperability across RIs. Leads the FAIR implementation of the EIH Catalogue of Services (T4.1a-ii).	Defines the technical requirements and standards for innovation services and ensures the IWG's content aligns with FAIR principles as implemented by the Tech WG.

Service Delivery and Monitoring: Oversee the operational status, quality of service, and technical support (LIP Kubernetes, CI/CD).	**Architecture, Service Integration & Operations WG:** Defines the architecture of the EOSC ENVRI Node. Oversees the technical onboarding of services (e.g., the EIH E-catalogue) into the Node. Manages monitoring and the helpdesk for technical service support processes.	Manages the onboarding process for innovation services (RIs as service providers), providing the necessary service description metadata, and ensuring IWG priorities are met in operational planning.

6.2. Impact on Content Curation and Relevance

The responsibility of the long-term relevance and continuous updating of the EIH content, the Innovation Toolbox, policies, and the service catalogue, is foreseen to be owned by the IWG and supported by the innovation, scientific and engagement WGs:

Content/Uptake Requirement	ENVRI Node Working Group Mandate	IWG Ownership Role
Innovation Content Management and Curation: Ensure up-to-date, high-value innovation content aligned with RI capacities and industry needs	**Innovation WG:** Defines strategic priorities for innovation-related content. Coordinates input from RIs, industry/ SMEs to guide the structure, updates, and curation of the Innovation sections, incl. Toolbox and services.	Directly responsible for the curation, maintenance, and continuous updating of all innovation-focused content on the EIH platform. Oversees the Innovation Toolbox and service catalogue to ensure alignment with industry relevance and technology transfer objectives, leveraging inputs from the Science and Engagement WGs.
Content Scientific Relevance & Prioritization: Ensure the EIH features the most impactful innovation use cases and technologies.	**Science WG:** Identifies and prioritizes cross-RI scientific use cases. Feeds scientific priorities into the Innovation, Technology and Service WGs, ensuring the EIH's content is scientifically relevant.	Directly responsible for the scientific content strategy of the EIH, including selection, vetting, and editorial oversight of the Innovation Toolbox and Service Catalogue based on input from the Science WG.

Content Workflow (Wagtail CMS): Formalizing the Content Reporter Team (WP1/WP3) and providing continuous training.	**User Engagement & Training WG:** Gathers researcher requirements to inform content and service design. Develops training materials and promotes capacity building for the Content Reporter Team to efficiently operate the Wagtail CMS.	Directly manages the Content Reporter Team and liaises with the Engagement WG to commission required training and documentation specific to innovation content.
External Stakeholder Engagement & Feedback (T4.1b): Maximize uptake and gather needs/gaps.	**User Engagement & Training WG:** Promotes uptake of the EIH platform. Co-designs services with users and captures feedback (T4.1b-iii) to inform the next version of the platform.	Acts as the primary external interface for industry and non-academic partners. Directs the Engagement WG on specific promotional campaigns targeting innovation uptake and provides market feedback for platform development.

6.3. Impact on Sustainability and Strategy

The overarching long-term viability, funding, and legal footing of the EIH are strategically owned by the IWG and secured by the Node's strategic WGs:

Sustainability Requirement	ENVRI Node Working Group Mandate	IWG Strategic Role
Legal/Financial Long-Term Planning: Secure the financial and legal basis for continuous operation post-project.	**Policy & Sustainability WG:** Develops long-term sustainability strategies for all Node services. Manages the required MoU or other form of cooperation document among ENVRI RIs. Addresses licensing, legal, and ethical issues related to policies and data shared via the EIH.	Identifies financial models and sources for innovation activities (e.g., EU funding, R&D projects, industry contracts) and works with the Policy WG to ensure the IPR and licensing aspects of the Innovation Toolbox are legally sound.

Strategic Oversight: Ensure the EIH contributes effectively to the ENVRI Node's mission.	**Governance & Liaison WG:** Oversees internal coordination and strategic adjustments. Ensures the EIH's operation maintains coherence with all other WGs and facilitates alignment with the broader EOSC ecosystem under the direction of the Node Coordinator.	Represents the innovation agenda within the Node's governance structure, ensuring the EIH's strategy aligns with the overall ENVRI Node mission and reports on the EIH's Key Performance Indicators (KPIs) to the Governance & Liaison WG.

7. Conclusions and Next Steps

The integration of the EIH Digital Platforms into the ENVRI Node structure secures their institutional backing and permanent financial foundation. The next steps will focus on operationalizing this structure:

1. **Formalizing Service Transition:** Defining the exact hand-off schedule and service-level agreements (SLAs) from WP4 technical leads to the **Architecture, Service Integration & Operations WG** for the Kubernetes infrastructure and monitoring.
2. **Launching the Curation Team:** Initiating formal training and establishing the mandate for the **Content Reporter Team** under the guidance of the **Innovation WG**, **User Engagement & Training WG** and the **Science WG**.

Glossary

A

Architecture, Service Integration & Operations Working Group (WG)

A core working group of the ENVRI Node responsible for defining the technical architecture of the Node, overseeing service onboarding, ensuring quality of service, usability, and operational coherence. It manages helpdesk, monitoring, and technical support, and ensures integration with the EOSC ecosystem.

B

Board (ENVRI Board)

The governing body of the ENVRI community that provides strategic oversight and makes high-level decisions, such as designating the ENVRI HUB as the ENVRI Node in EOSC.

C

CI/CD (Continuous Integration / Continuous Delivery and Deployment)

A DevOps practice used to automate the integration, testing, and deployment of software changes. The EIH uses a professional CI/CD pipeline to ensure rapid, reliable, and secure updates to its digital platforms.

CMS (Content Management System)

A software application that allows users to create, manage, and modify digital content without requiring technical coding skills. The EIH uses **Wagtail CMS**, built on Django, for managing content such as the Innovation Toolbox and Catalogue of Services.

Content Reporter Team / Reporter Group

A designated group of individuals (typically from ENVRINNOV WP1/WP3) responsible for curating and updating content on the EIH platforms using the Wagtail CMS. They receive training to perform their roles effectively.

Cross-Domain Integration

The ability of systems, data, and services from different scientific domains to work together seamlessly. A core principle of the ENVRI Node to support interdisciplinary environmental research.

D

DevOps

A set of practices that combines software development (Dev) and IT operations (Ops) to shorten the development lifecycle and deliver high-quality software continuously. The EIH employs DevOps practices including CI/CD, automated testing, and infrastructure as code.

Django

An open-source Python-based web framework used to build scalable and secure web applications. The EIH platform is built using Django, providing a robust backend foundation.

E

EIH (ENVRI Innovation Hub)

A central platform within the ENVRI community designed to foster innovation by providing tools, services, and resources for environmental research infrastructures. Hosted within the ENVRI HUB, it serves as the core of the ENVRI Node in EOSC.

ENVRINNOV

Short for *ENVironment Research infrastructures INNOVation roadmap*, an EU-funded project (Grant No. 101131426) under the HORIZON-INFRA-2023-DEV-01 call, focused on advancing innovation across environmental research infrastructures.

ENVRI (Environmental Research Infrastructures)

A cluster of European environmental research infrastructures collaborating to enhance scientific cooperation, data sharing, and innovation, particularly within the EOSC framework.

ENVRI HUB

A central coordination and access point for the ENVRI community. It hosts the EIH and is designated as the **ENVRI Node** in the European Open Science Cloud (EOSC).

ENVRI HUB next

The next-generation platform architecture of the ENVRI HUB, based on modern

technologies like Django/Wagtail and Kubernetes, serving as the technical foundation for the EIH and other services.

ENVRI Node

The official representation of the ENVRI community within the European Open Science Cloud (EOSC). It acts as a coordinated bridge between environmental research infrastructures and EOSC, ensuring seamless integration of services and data.

EOSC (European Open Science Cloud)

A federated environment enabling European researchers to store, share, analyze, and reuse research data across disciplines, infrastructures, and borders. The ENVRI Node integrates environmental RI services into EOSC.

EOSC-A (EOSC Association)

The organization responsible for governing and developing the European Open Science Cloud in collaboration with the European Commission and other stakeholders.

EOSC-Core / EOSC-IF (EOSC Interoperability Framework)

Core technical and policy components of EOSC that ensure services and data from different providers can interoperate. The Technological WG ensures alignment with these frameworks.

F

FAIR-by-design

An approach where data and services are made **Findable, Accessible, Interoperable, and Reusable** from the outset of system design. A core principle guiding the development of all ENVRI Node services.

FZJ (Forschungszentrum Jülich)

A German research center and the lead beneficiary (coordinator) of the ENVRINNOV project. Responsible for delivering key outputs such as D4.1.

G

Governance & Liaison Working Group (WG)

A central working group supporting the Node Coordinator. It ensures internal coordination,

strategic alignment, and external liaison with EOSC-A, the EC, and other clusters. Hosts major decision-making processes.

Graphical User Interface (GUI)

The visual interface through which users interact with a software system. The EIH platform includes a GUI for content reporters and end-users to manage and access innovation resources.

H

Head of Node / Node Coordinator

The individual responsible for strategic leadership and coordination of the ENVRI Node. Acts as the main contact with EOSC-A, the European Commission, and other stakeholders. Chairs Governance & Liaison WG.

Helpdesk

A support function managed by the Architecture WG to assist users with technical issues, service access, and platform usage.

I

Innovation Toolbox

A curated collection of methods, tools, and best practices for innovation management within environmental research infrastructures. Hosted and maintained on the EIH platform via Wagtail CMS.

Innovation Working Group

The dedicated strategic and operational body for coordinating and amplifying the innovation-related activities of the ENVRI community within the context of the EOSC ENVRI Node.

Interoperability

The ability of different systems, applications, or data formats to exchange and make use of information. A key focus of the Technological Development & Interoperability WG.

IRISCC

A synergistic EU-funded project whose services and results are intended for integration into the EIH, reinforcing cross-project innovation uptake.

K

Kubernetes

An open-source platform for automating deployment, scaling, and management of containerized applications. The EIH is hosted on the **LIP Kubernetes Cluster**, ensuring scalable and resilient operations.

L

LIP (Laboratório de Instrumentação e Física Experimental de Partículas)

A Portuguese research lab providing the Kubernetes infrastructure used to host the EIH platform.

M

MoU (Memorandum of Understanding)

A formal agreement among the ENVRI Research Infrastructures, managed by the Policy & Sustainability WG, to establish cooperation, shared responsibilities, and long-term sustainability of the ENVRI Node.

N

Node

In the context of EOSC, a national or thematic access point that connects research communities and infrastructures to the European Open Science Cloud. The **ENVRI Node** represents the environmental RI community.

O

Onboarding Group

A body responsible for evaluating new services (e.g., from ENVRINNOV or IRISCC) for technical readiness, content quality, and compatibility before integration into the ENVRI HUB or Node.

Open Science

A movement promoting transparency, accessibility, and reproducibility in research. EOSC and the ENVRI Node support open science principles through FAIR data and open tools.

P

Policy & Sustainability Working Group (WG)

Responsible for legal, ethical, licensing, and sustainability issues within the ENVRI Node. Ensures compliance with EOSC Rules of Participation and develops long-term financial and operational sustainability strategies.

Project Uptake

The process of integrating results, tools, or services from one project (e.g., ENVRINNOV, IRISCC) into the long-term operations of the ENVRI Node or other infrastructures.

R

Research Infrastructure (RI)

Facilities, resources, and services used by the research community to conduct research. In this context, it refers to environmental RIs within the ENVRI cluster.

Reporter Group

See *Content Reporter Team*.

RoP (Rules of Participation)

Policies governing how organizations and individuals can contribute to and use the ENVRI Node. Developed and managed by the Policy & Sustainability WG in alignment with EOSC requirements.

S

Science Working Group (WG)

Led by the Chief Scientist, this group identifies and prioritizes scientific use cases across RIs, ensures scientific relevance in EOSC, and interfaces with research communities and RI science boards.

Service Onboarding

The process of integrating new digital services into the ENVRI Node, including technical validation, quality assurance, and alignment with FAIR and EOSC standards.

SonarCube / Trivy

Automated tools used in the CI/CD pipeline for code quality analysis (SonarCube) and vulnerability scanning (Trivy) to ensure secure and maintainable software.

Stakeholder Engagement

Activities aimed at involving and gathering feedback from users, researchers, and external partners to co-design and improve services. Led by the Engagement & Training WG.

T

Technical Long-Term Operation Strategy

A plan ensuring the sustainable technical maintenance, evolution, and hosting of the EIH platforms, including infrastructure, CI/CD, security, and platform architecture.

Technological Development & Interoperability Working Group (WG)

Responsible for technical standards, tools, and interoperability across RIs. Promotes FAIR implementation and alignment with EOSC-Core and EOSC-IF.

Training

Structured learning activities developed by the Engagement & Training WG to build capacity among content reporters, researchers, and users on how to use EIH tools and services.

Wagtail CMS

An open-source content management system built on Django, used by the EIH to allow non-technical users to manage web content efficiently.

Work Package (WP)

A major component of a project plan that groups related tasks and deliverables. Example: WP1 and WP3 contribute members to the Content Reporter Team.

Working Group (WG)

A thematic team within the ENVRI Node governance structure focused on specific areas such as technology, policy, science, or engagement.

Z

Zero Downtime Deployment

An operational goal supported by CI/CD and Kubernetes, allowing updates to the platform without service interruption.

Acronyms Summary

Acronym	Full Form
EIH	ENVRI Innovation Hub
ENVRINNOV	ENVironment Research infrastructures INNOVation roadmap
ENVRI	Environmental Research Infrastructures
EOSC	European Open Science Cloud
EOSC-A	EOSC Association
EOSC-IF	EOSC Interoperability Framework
FAIR	Findable, Accessible, Interoperable, Reusable
FZJ	Forschungszentrum Jülich
GUI	Graphical User Interface

LIP	Laboratório de Instrumentação e Física Experimental de Partículas
MoU	Memorandum of Understanding
RI	Research Infrastructure
RoP	Rules of Participation
WG	Working Group
WP	Work Package
CI/CD	Continuous Integration / Continuous Delivery and Deployment
CMS	Content Management System
DevOps	Development + Operations
K8s	Kubernetes (common shorthand)
Django	Python web framework
Wagtail	Django-based CMS