EBRAINS 2.0

D5.5 Co-design strategy for WP5

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Abstract:	D5.5 presents the Co-Design strategy and summarises the Co-Design Actions for WP5 (Platform Services) in the EBRAINS 2.0 project as of M6 (June 2024). WP5 co-design actions are partially specific to WP5, but mainly integrated into actions across the EBRAINS 2.0 project. WP5 Co-Design strategy and actions are categorized along the involved stakeholders amongst contributors of WP5 tasks, between WP5 contributors and contributors from tasks of other EBRAINS 2.0 WPs and between WP5 contributors with contributors from external projects.

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1. List of Abbreviations and Acronyms used

WP	Work Package
WG	Working Group
HPC	High Performance Computing
MIP	the Medical Informatics Platform
HIP	the Human Intracerebral EEG Platform
EEG	Electroencephalography
FAIR	Findable, Accessible, Interoperable, and Reusable
API	Application Programming Interface
CWL	Common Workflow Language
TRE	Trusted Research Environment
KPI	Key Performance Indicator
RI	Research Infrastructure
CSIRT	Computer Security Incident Response Team
EC	European Commission
EOSC	European Open Science Cloud
EHDS	European Health Data Space
EDITH	Ecosystem for Digital Twins in Healthcare
CSA	Coordination and Support Action
SGA3	Specific Grant Agreement 3
PaaS	Platform as a Service
SaaS	Software as a Service
IaaS	Infrastructure as a Service
KG	Knowledge Graph
WF	Workflow
AI	Artificial Intelligence
MRI	Magnetic Resonance Imaging
TC	Technical Coordination
TVB	The Virtual Brain
FERES	Federating European Registries for Stroke
AISN	Integrating AI in Stroke Neurorehabilitation
BIDS	Brain Imaging Data Structure
CDE	Common Data Elements
CIS	Clinically Isolated Syndrome

2. Introduction

“EBRAINS is a dynamic research infrastructure, aiming to address and adapt to the emerging needs of the neuroscience community and brain research at large. To achieve this, a comprehensive model of the different and complementary pathways by which EBRAINS software and services can be built upon and extended by its user community at large is inherent in its architectural design.”

This deliverable presents the strategy the EBRAINS 2.0 partners will follow to perform co-design activities within their respective work packages, across the entire project as well as with other project partners and external stakeholders.

Definition of Co-Design:

Co-Design is an iterative process to collect the requirements and expectations from different stakeholders and integrate them into the *design and implementation of a tool, service or platform with the objective of maximizing its adoption, usability, reliability, transparency and impact*. Stakeholders could be project-internal users, partners from other WPs, external users, communities, indirect beneficiaries, external institutions, society, policy makers etc.

The planning of the co-design deliverables (D1.6, D2.5, D3.6, D4.4, D5.5 and D6.5) was developed in close coordination between the work packages, and the template for the reporting was developed jointly over several iterations.

Brief description of the WP5-Scope

WP5 coordinates all technical activities of EBRAINS. WP5’s activities aim to revise, improve, and extend the EBRAINS Architecture to increase efficiency, scalability, flexibility, usability, and user-centricity, leveraging all lessons learned during the development and provision of EBRAINS during SGA3. WP5 specifies the needs and KPIs of EBRAINS through continuous requirement elicitation to ensure a common and comprehensive source of truth for user requirements. WP5 is also developing and operationalizing an end-to-end open metrics framework, capturing, analysing, and continuously conveying the real-world performance, relevance, KPIs and impact of EBRAINS across its broad user community. WP5 initiated and performs a continuous and disciplined effort to extensively test and integrate all components comprising the EBRAINS RI, in a manner that ensures the absolute satisfaction of the established KPIs and technical guidelines and performs the deployment, migration, and acceptance of EBRAINS components, as well as the delivery of the EBRAINS RI.

3. Co-Design Roadmap

3.1 Identified Co-Design Activities

This deliverable provides an overview of co-design actions aimed at achieving key goals of WP5 in the domain of designing and implementing tools, services, or platforms to maximize adoption, usability, reliability, transparency, and impact. WP5 co-design actions are partially specific to WP5 but mainly integrated into actions across the EBRAINS 2.0 project. All actions are regularly monitored, and if necessary, updated along the project.

The co-design actions can be categorised along the involved stakeholders:

- amongst contributors of WP5 tasks (Table 1)
- between WP5 contributors and contributors from tasks of other EBRAINS 2.0 WPs (Table 2 and Table 3)
- between WP5 contributors with contributors from external projects (Table 4)

The identification of the co-design actions was guided by the following questions:

- What are the needs and requirements of the users of WP5-relevant tools/services/platforms?
- How can information about user needs and requirements effectively be collected?
- How can success in terms of adoption, usability, reliability, transparency, and impact of WP5-relevant tools/services/platforms be measured?
- How can the consortium effectively deliver co-design actions?

3.1.1 Co-Design Activities within WP5

During the first months of EBRAINS 2.0, several co-design activities have been established for the members of WP5. A SharePoint Page for the EBRAINS 2.0 has been created since the beginning of the project by EBRAINS Coordination team. This is the central page that members of each consortium partner are using, with a folder for each Work Package, with accordingly distinct access rights (view/edit) to each member. Via WP5 folder, all relevant content is shared to members accordingly. WP5 management team (T5.8) created an EMDESK mailing list for WP5 members: “EBRAINS 2.0 WP5 members” (ebrains2_WP5@groups.emdesk.com). All WP5 members are welcome to use it for any communication related to WP5. This group currently includes twenty-one (21) members, while any additions can be made at any time. EMDESK mailing list for Technical Coordination has also been created: “EBRAINS 2.0 Technical Coordination” (ebrains2_tc@groups.emdesk.com), currently including ninety (90) members, while any additions can be made at any time. Moreover, in the framework of WP5, T5.8 is organising WP5 internal meetings. They aim to offer ground for discussion of all matters related to WP5 work, to WP5 tasks’ collaboration and to align WP5’s efforts. WP5 meetings are organised to facilitate focused discussions about any outcomes, feedback, updates, ideas, progress, or problems related to WP5. WP5 recurring meetings are held once a month. Supporting documents i.e. agenda, meeting minutes, action items, presentations etc are shared and available to WP5 members through EBRAINS 2.0 SharePoint page.

Furthermore, we have established a weekly **EBRAINS Development and Operations** meeting, to facilitate communication, coordination, and alignment within the scope of EBRAINS Operations (EBRAINS AISBL and ATHENA RC). We discuss and fine-tune our ways of working, provide updates, dive into challenges encountered, and engage in open discussion towards collaboration and efficiency.

Table 1 shows the identified actions to organise the co-design activities internally of WP5 and includes the whole list of co-design activities within WP5.

Table 1: Internal WP5 co-design actions undertaken towards key goals

Goal	Action	Responsible for Action (Task, WP or Person)	Time line (Project Month)	Indicators
Identify co-design activities between tasks	Request every TL to identify what activities is foreseen to support the link	T5.8	M5	Report about co-design activities

	between science and technology			
	Establish a pilot channel for offering technical support to WP5 integration	T5.3, T5.8	M3	Report about co-design activities
	Build Template projects (examples of good practices for integration into EBRAINS)			
Create a space for data/software exchange and repository	Set-up a Gitlab project for WP5	T5.3		Gitlab project exists, and WP members have access to it
WP5 internal alignment	WP5 meetings to facilitate focused discussions about matters related to WP5	ATHENA, CHUV, CHARITE, AISBL, FJZ, ETHZ	Monthly	Minutes of the meetings available to all WP5 members
	WP5 EMDESK Group / Mailing List	T5.8		
	SharePoint Page (WP5 folder)	T5.8, all tasks		
	EBRAINS Development and Operations meeting: Meeting to facilitate communication, coordination, and alignment within the scope of EBRAINS Operations	ATHENA, EBRAINS AISBL	Weekly	
Programmatic integration of the EBRAINS KG with the HIP and the MIP to support FAIR principles and support user needs	Investigation of available APIs, interfaces, and connectors (potentially to be developed)	T5.6 & T5.5	M6 – M12	Datasets on the MIP and the HIP can be found via metadata descriptions in the KG.
Automated pipeline for iEEG electrode localization published on the HIP	Goal is to come close to a fully automated pipeline, dealing with multiple modalities (e.g., MRI, CT scans, etc.); automations and workflow based on work done and guided by Francesco Cardinale, Milano	CHUV, T5.6	M6-M12	New iEEG (semi)-automated pipeline available on the HIP.

3.1.2 Co-design activities with project-internal stakeholders

At the beginning of EBRAINS 2.0 (M2), WP5 and WP6 convened for a three-day meeting in Heidelberg. During this session, both WP5 and WP6 presented their respective tasks and initial strategies. The meeting facilitated in-depth discussions on various technical issues, culminating in the development of a comprehensive and unified plan.

Further, five working groups (WGs), i.e. thematically driven teams comprising members of the EBRAINS 2.0 Consortium providing directions, discussion points, and critique on a series of cross-RI areas, have been established. These groups focus on various aspects of software distribution, integration, quality, architecture and security within the EBRAINS ecosystem:

1) **EBRAINS Software Distribution Integration and Quality**

   The EBRAINS Software Distribution, Integration, and Quality Working Group (WG) is dedicated to ensuring the seamless integration and quality of EBRAINS software tools. Its primary objective is to establish and expand the EBRAINS Software Distribution (ESD), a unified ecosystem encompassing all EBRAINS components, as well as key EBRAINS use cases and workflows. This initiative aims to guarantee consistency and interoperability among tools and their dependencies and streamline their deployment across diverse

environments. Key areas of focus for the WG include defining quality standards for EBRAINS packages, implementing testing and validation mechanisms and structured release processes.

Given that the ESD encompasses tools from various project domains such as simulation engines, data management, analysis and visualisation tools, and clients for EBRAINS services like neuromorphic computing and brain atlases elaboration with developers and maintainers across several work packages (WP1, WP3, WP4, WP6) is essential. Additionally, the EBRAINS Software Distribution container, an outcome of the WG, will serve for defining workflow components for data analysis in T4.3. Members from most of those WPs regularly participate in the WG, and the maintainers of all EBRAINS tools have been invited to join. To promote knowledge sharing and facilitate the contribution of tools and workflows to the EBRAINS Software Distribution, the WG plans to conduct focused presentations and hands-on workshops with different WPs.

2) **EBRAINS Software Distribution on HPC (organised by WP6)**

The EBRAINS Software Distribution on High-Performance Computing (HPC) Working Group (WG) focuses on ensuring EBRAINS software operates efficiently in HPC environments. It works on adapting and optimising the EBRAINS software stack for HPC, refining build processes, continuous integration (CI), and deployment across various HPC sites. The WG also aims to create optimised ESD container images for HPC (milestone M6.4).

Due to its significant alignment with T6.4, which focuses on developing HPC containers, and the critical involvement of WP6 members, particularly administrators from HPC centres, the WG is mainly organised by WP6. It collaborates closely with T5.4, responsible for the maintenance of the EBRAINS Software Distribution, as well as component owners from other WPs as needed to address the optimisations required for specific simulation tools and ensure the usability and efficiency of the EBRAINS Software Distribution across the different HPC systems.

3) Services Quality

The Service Quality Working Group (WG) is dedicated to maintaining and enhancing the quality of services offered by EBRAINS. This WG is tasked with developing and enforcing comprehensive quality and deployment guidelines for all EBRAINS core/platform and science services. By prioritising monitoring, evaluation, and continuous improvement in service delivery, the WG ensures that all components and services meet the ambitious standards expected by users and stakeholders. The guidelines will cover aspects such as performance, scalability, and reliability, providing a robust framework for developers to follow, thereby ensuring uniformity across all EBRAINS services.

Collaboration across different WPs is fundamental to the success of the WG, which will include representatives from all WPs to ensure the guidelines and requirements are comprehensive and cater to the unique needs and challenges of each project domain. Through regular meetings, the WG will identify common issues and co-design solutions that are practical and beneficial across the entire EBRAINS ecosystem. Specific guidelines for K8s-based deployment and for testing and integrating all components will be a key focus, ensuring that the services are consistently reliable and scalable. The initiation of this WG has been strategically timed following the completion of the critical migration of services to a common PaaS (K8s-based) infrastructure, which was essential to ensure a stable and scalable foundation upon which quality guidelines can be effectively implemented.

4) Architecture

The EBRAINS RI Architecture has been defined in SGA3 and will subsequently be revised continuously to address changing or newly emerging requirements. The first revision of the EBRAINS RI Architecture will be delivered by M12. We collect, analyse, and reconcile background material & planning documents and expand on relationships/dependencies and interfaces with other components & HPC/IaaS. Most of this work will be done by Task 5.2 (with help of the Technical Coordination (TC) tasks in the different WPs). This process will be supervised by the EBRAINS Architecture (EA) WG with the primary role of the WG is to review the produced work. The work will be done in close coordination with Support Task T6.5 and the Science Support Team (SST).

The EBRAINS Architecture will be continuously revised until M36, activities will include identification of potentially missing components, major interactions between components. The EA-WG will identify the mismatches and resolve mismatches by the alignment of requirements or features, and critical functionality that needs to be added to existing components or creation of new component or services not yet on the component list.

The EA-WG will review the produced updates of the architecture and will provide high-level guidance where choices need to be made concerning conflicting considerations.

5) **CSIRT (Computer Security Incident Response Team)**

The Computer Security Incident Response Team (CSIRT) is responsible for selecting appropriate security technologies and tools. They continuously assess and manage security risks, develop, implement, and enforce security policies, and maintain disaster recovery plans to ensure business continuity. Conducting regular security audits and assessments helps identify weaknesses, which CSIRT addresses with actionable recommendations to improve security.

On the technical side, CSIRT responds promptly to security incidents, ensuring swift containment and mitigation. They manage communication during incidents, both internally and externally, to keep stakeholders informed and coordinated. Post-mortem analyses of incidents help understand their impact and root causes, leading to recommendations for preventing future incidents and enhancing overall security resilience.

The collaboration of WP5 with other WPs operates through one major general meeting, a migration-specific meeting and many meetings specific for scientific WPs:

- **EBRAINS Technical Coordination meeting**

The aim of this meeting is to encourage collaboration, share updates, and align our efforts towards the development and operations of the EBRAINS RI. The agenda for the Technical Coordination meeting, is structured to cover both general and technical aspects related to EBRAINS. The meeting is divided into two main parts: the first part focuses on general and non-technical discussions, including welcomes and introductions, review of previous meeting notes and actions, addressing non-technical issues, EBRAINS support, and national nodes alignment. The second part is dedicated to technical coordination, featuring dialogues on specific EBRAINS projects such as Virtual Brain Twin (VBT), eBRAIN-Health, and Integrating AI in Stroke Neurorehabilitation (AISN), updates on operations and sites, in-depth technical updates on the GitLab board, and concludes with a summary of action items, next steps, and closing remarks. Supporting documents include the presentation, meeting notes, action items, attendance report, suggestions/questions, and chat history, all aimed at ensuring effective coordination and planning for EBRAINS projects and initiatives.

- **Migration-specific meeting**

Migration efforts started near the end of the Human Brain Project. Until the migration of all services (core platform and science services) is successfully marked, a continuous interaction with the a) base underlying infrastructure, b) (core/ platform/ science) service owners take place. Meetings between the Migration Task Force (MTF) team, DevOps team and representatives of the base underlying infrastructure were held on a weekly basis in the beginning of the migration efforts, establishing straightforward communication between both teams alleviating any problems or issues raised. Now, these meetings are less frequent and are held in an ad hoc basis since well and organised means of communication have been established with transparent and fast interactions between both teams whenever needed. From the beginning of the migration efforts DevOps team was closely collaborating with every science service owner on a case-by-case basis in ad hoc meetings whenever these were a necessity. This interconnection along with the communication channels via instant chat messaging, proved to be the right way to move forward, since both teams (DevOps and services) were confident that all issues, questions, clarifications raised were at the forefront of attention. The Dev Ops team is synchronising regularly every week about the migration of the Core/ Platform services assessing the migration status of these important components.

- **Meetings with scientific WPs**

Meetings with scientific Work Packages (WPs) are organised to facilitate focused discussions and coordination for specific areas within the EBRAINS infrastructure. The meetings include dedicated sessions for WP1, WP4, and WP3, as well as project-specific meetings for the Virtual Brain (TVB). These sessions aim to address the unique challenges and progress of each work package and project, ensuring alignment with overall objectives and fostering collaboration. By concentrating on individual WPs and projects, these meetings enable detailed technical dialogues, updates, and planning tailored to the needs and goals of each area, contributing to the advancement and integration of scientific efforts within EBRAINS.

Furthermore, a **technical handbook** is designed exclusively for current and future EBRAINS team members. It serves as a comprehensive guide to assist team members in performing their roles effectively.

This comprehensive handbook is crucial for efficient communication and identity. It enhances reading efficiency, facilitates asynchronous communication, streamlines onboarding, and fosters collaboration by providing a deep understanding of operations. It simplifies discussions and communication of changes and encourages all team members to contribute improvements via merge requests.

It includes detailed sections on the use of GitLab at EBRAINS, outlining its structure and how individuals can contribute. It covers core practices such as security protocols and the definition of done, along with comprehensive development lifecycle practices. Additionally, it addresses collaboration and support mechanisms, and provides an extensive array of tools and resources, including core services, and service offerings. The handbook also features several other sections designed to facilitate the discovery of information, ensuring that all team members have access to the knowledge they need.

Moreover, the technical handbook is fully scalable and can be enhanced with non-technical information as well, including details relevant to all levels of the infrastructure, from product management and communication to marketing and other sections across the organization.

Table 2 shows the identified actions to organise the co-design activities internally of EBRAINS 2.0 project and includes the whole list of co-design activities driven by WP5.

Table 2: Overview of Actions for co-design activities with project-internal stakeholders

Goal	Action	Responsible for Action (Task, WP or Person)	Time line (Project Month)	Indicators	Co-Design Partner / Stakeholder
W5-WP6 collaboration	In person WP5-WP6 kick off meeting in Heidelberg (7-9/2/2024)	WP5-WP6	M2	Meeting minutes and presentations available online	WP5, WP6
EBRAINS Co-Design	Co-design meetings to facilitate EBRAINS Co-Design activities	Support team (Wouter Klijn), Technical Coordination	Monthly		WP1,WP2, WP3, WP4, WP5, WP6, WP7, WP8
Project internal alignment on management level	Leadership Board meetings	WP5 Leader (Yannis Ioannidis) / WP5 Deputy Leader (Amaryllis Raouzaiou)			WP1,WP2, WP3, WP4, WP5, WP6, WP7, WP8
	WP managers meetings	T5.8 leader (Evita Mailli) / T5.8 deputy leader (Evangelia Drymaliti)	Bi-weekly		
EBRAINS Education Coordination	Education WG to support and enable high-quality education and training activities and to ensure alignment and synergies between education activities organised by WP 1-6	T7.1 Education Coordination Team (Judith Kathrein/ Franziska Vogel)	Monthly	Meeting minutes and presentations available online to WG members	WP1,WP2, WP3, WP4, WP5, WP6, WP7

	TC meetings to encourage collaboration, share updates, and align our efforts towards the development and operations of the EBRAINS RI	T5.3 leader (Nikos Georgomanolis)	Bi-weekly		WP1,WP2, WP3, WP4, WP5, WP6
	EBRAINS Software Distribution Integration and Quality: WG to ensure the integration and high quality of software distributed through EBRAINS platforms	WG leader: Eleni Mathioulaki T5.4, T6.4	Weekly	KPI13, KPI23	WP1, WP3, WP4, WP5, WP6
EBRAINS Technical coordination	EBRAINS Software Distribution on HPC: WG to facilitate the distribution and efficient operation of EBRAINS software on High-Performance Computing (HPC) environments.	WG leader: Eric Müller T6.4	Weekly		WP3, WP5, WP6
	EBRAINS Services Quality: WG dedicated to maintaining and enhancing the quality of services offered by EBRAINS	WG leader: Eleni Mathioulaki T5.4	Monthly		WP1, WP2, WP3, WP4, WP5, WP6
	EBRAINS Architecture: WG - Build upon the EBRAINS architecture and its base infrastructure, suitably repurposing, revising and extending them to increase efficiency, scalability, flexibility, usability, and user-centricity	WG leader: Wouter Klijn T5.2, T6.5	Monthly		WP5, WP6
EBRAINS Security - CSIRT (Computer Security Incident Response Team)	WG to safeguard the integrity, confidentiality, and availability of information assets against cyber threats	WG leader: Michail Alexakis, deputy leader: Nikos Pappas T5.7, T6.1	Monthly		WP5, WP6
Collaboration with scientific Work Packages	Dedicated meetings to facilitate focused discussions and coordination for specific areas	T5.3 leader (Nikos Georgomanolis), technical responsible of	Monthly		WP1, WP3, WP4, WP5

	within the EBRAINS infrastructure	every scientific WP			
Platform Services	Infrastructure, platform, services and how they will interact in EBRAINS	WP5, T6.1	Continuous		WP5, WP6
Migration	Dedicated meetings to establish well organised efforts between DevOps team, underlying base infrastructure, and service (core / platform, science) owners	WP5	Continuous until end of Migration	Reports and presentations of Migration progress	WP1, WP2, WP3, WP4, WP5, WP6
EBRAINS Technical Handbook	Designed exclusively for current and future EBRAINS team members. It serves as a comprehensive guide to assist team members in performing their roles effectively.	T5.3		https://gitlab.ebrains.eu/ri/tech-hub/content-sites/technical-handbook	WP1, WP2, WP3, WP4, WP5, WP6, WP7, WP8
(International) Deployments	Deployment of the HIP in Italy (UNIPD/Infocamere) and possibly in France (INSERM, tbc) – modifications to the platform as required by hosting infrastructures	T5.6, T2.1	M12-M18 M14-M24	First deployment in Italy M6-M8, full deployment on final infrastructure M12; update of the platform with V2 (Kubernetes based) M14 to M24 (depending on release of HIP V2 but also depending on readiness of Kubernetes infrastructure in Italy)	WP2, WP5 CHUV, UNIPD, Infocamere (tbc: AMU & INSERM)
EBRAINS Integrations	Define programmatic interaction between the HIP and the MIP with the EBRAINS Knowledge Graph and data curation workflows for FAIRIFICATION efforts and findability of metadata	T5.6 (HIP and MIP developers), T5.5 KG together with T4.1 & T4.2; supporting several tasks in WP2	M12	Datasets on the MIP and the HIP will be findable via the EBRAINS KG	WP4, WP5, WP2
Extending the EBRAINS Core Platform with TRE capabilities	Alignment of platforms on GDPR and security compliance aspects	MIP: T5.6 (CHUV, ATHENA, Charité) HIP: T5.6 and external contributors	Ongoing to M36	GDPR compliance criteria evaluated across HIP, MIP, HDC. Streamlined processes in the EBRAINS TRE environments.	WP4, WP5
Provision of Clinical neuroimaging data processing workflows on the HIP	Completion of software for processing clinical neuroimaging data and publishing it to the HIP. Support WP2 in definition,	T5.6 with WP2	M12	Software with neuroimaging data processing workflow published on the HIP	WP2, WP5

	automation, and integration of the new pipeline in the HIP				
Provision of a toolbox for semi-automated iEEG data curation and feature extraction	Support WP2 in preparing iEEG toolbox integrated in the HIP to fulfil user and contractual requirements. Activities include finding agreement between iEEG processing centres on tools and processes to be used, prioritisation of tools to be prepared for integration, preparation of supporting documentation. Advice on development and automation strategies.	T5.6, T2.5	Ongoing to M 30	A semi-automated pipeline integrated in the IntraNat already available, additional tools integrated and workflow(s) defined and published on the HIP.	WP2, WP5
Programmatic integration of the EBRAINS KG with the HIP and the MIP to support FAIR principles & data curation flows (findability of metadata)	Alignment on integration and promotion of data curation workflows in the MIP & the HIP, respecting definitions of secure data flow and EBRAINS requirements for non-sensitive and sensitive metadata	T5.6 (MIP & HIP) & T5.5 (KG), T4.1, T4.2 & T4.4 (FAIR data, curation, and secure data flow), WP2 several tasks, specifically also T2.7 Public Release	M6 – M 12	Metadata of various datasets in the MIP and the HIP are findable via the EBRAINS KG	WP4, WP5, WP2
	Alignment with openMINDS metadata schema, specifically using the new BIDS and MRI extensions for OpenMINDS for the HIP; general investigation how to best map CDEs in the MIP to openMINDS; intention to use (semi-) automated extraction of non-sensitive metadata to facilitate publication of dataset-metadata in the KG	T5.6 (MIP & HIP) & T5.5 (KG), T4.1, T4.2 & T4.4 (FAIR data, curation, and secure data flow), WP2 several tasks, specifically also T2.7 Public Release	M 12 –M24	New openMINDS extensions for BIDS and MRI to openMINDS tested and integrated in a workflow for metadata curation for the HIP; Data cards for the MIP federations are updated and improved in the KG	WP4, WP5, WP2
	Technical discussion with CINECA on how to integrate WP2 public data in the HIP via the KG; all technical discussion with CINECA to be held	T5.6 HIP, various tasks in WP2 (Italian HIP deployment), specifically T2.7 Public release, T5.5 KG	M 12 - M24	Public data from HIP-Italy hosted by CINECA will be findable via the KG	WP5, WP2, WP6

Table 3: Overview of showcases identified in EBRAINS 2.0 and contribution from each WP

More comprehensive descriptions can be found in D6.5. Co-design actions related to showcases are supported and coordinated by T6.5.

Showcase	WP5 involvement
Atlas-driven analysis of multimodal feature maps	Availability of tools in EBRAINS RI, collaboration for technical issues.
QUINT workflow for the analysis of rodent microscopy data	Availability of tools in EBRAINS RI, collaboration for technical issues.
Collaborative Brain Wave Analysis Pipeline (Cobrawap)	Availability of tools in EBRAINS RI, collaboration for technical issues. Support of CWL use.
Personalised multi-scale brain models for the creation of digital twins in clinical applications	Availability of tools in EBRAINS RI, collaboration for technical issues.

3.1.3 Co-design activities with project-external stakeholders

To identify and engage external stakeholders, we are designing and launching a comprehensive consultation process involving both internal and external participants.

We are strengthening our collaboration with EBRAINS National Nodes (NNs) through regular meetings with the NN Board leader and the NN representative in Technical Coordination Meetings.

Furthermore, we adhere to the EOSC Rules of Participation by integrating our services into their catalogue and managing orders and monitoring through their system. Our collaboration with the EDITH ecosystem allows us to share key advances with experts in in silico medicine and clinical practitioners, fostering innovation and knowledge exchange. We will also ensure our publications are stored in an OpenAIRE-compliant repository, such as Zenodo, to promote open access and wider dissemination of our research.

Additionally, we maintain connections with other EBRAINS AISBL projects, such as VBT, eBRAIN-Health, and AISN, through their participation in EBRAINS Technical Coordination Meetings. This ongoing collaboration helps to synchronise efforts and share valuable insights across different initiatives within the EBRAINS RI network.

Table 4 exhibits the actions identified to ensure co-design activities with external stakeholders.

Table 4: Overview of Actions for co-design activities with project-external stakeholders

Goal	Action	Responsible for Action	Time line	Indicators	Co-Design Partner Stakeholder
Identify external stakeholders	Design and launch an internal and external stakeholder consultation process (e.g. focus group, complemented by questionnaire), setting priorities, project selection and advance assessment; Identifying actions organisational decision-making and efficiency	WP manager	M12	KPI 18: Number of Stakeholder events attended: target [mid target: 5, final target:10]	WP6, WP7
Collaboration with EBRAINS National Nodes (NNs)	Meeting with NN Board leader, representative of NN in Technical Coordination Meeting	T5.3	In progress		WP8

Already established connections	EOSC[1]: adhere to EOSC Rules of Participation, expose catalogue services, order management and monitoring	WP5 leader, T5.5 leader	in progress		WP8
	EDITH CSA[2]: Collaboration with EDITH ecosystem actors and share key advances with experts from in silico medicine and clinical practitioners.	WP5 leader	in progress		WP3, WP1
	CWL[3]: allows users to discover, edit, experiment, and invoke highly complex, reusable, interoperable, scalable and reproducible scientific processing workflows based on the CWL standard. One of the PaaS offerings of EBRAINS, suited for complex scientific computations and endeavours, by definition portable across various base infrastructure resources and communities.	T5.4, T5.5 leaders	In progress	KPI06: Number of community-generated scientific workflows (notebooks, CWL workflows, services, libraries) extending and/or building on EBRAINS [start: 100; mid; 300; final target: 600]	WP1, WP3
	OpenAIRE[4]: Publications in an OpenAIRE -compliant repository (e.g., Zenodo).	WP5 leader	M18		WP8, WP4
	Other projects of EBRAINS AISBL through their participation in EBRAINS Technical Coordination meetings (e.g., VBT, eBRAIN-Health, AISN)	T5.3			WP8, WP6
Establishment of the Greek National Node of EBRAINS	Contacting potential members from Greece. Preparation of the Greek National Node Plan (EBRAINS PREP GA No. 101079717 deliverable)	Greek Node manager/ representative	In progress		National Node managers/representatives from all relevant countries / National stakeholders
Establishment of the Swiss National Node plan and service offer for EBRAINS	Preparation of the Swiss National Node plan (EBRAINS PREP GA No. 101079717 deliverable), defining scientific and technical priorities, collaboration agreements and decision-making processes, etc.	EPFL, CHUV (MIP, HIP) together with multiple Swiss partners	M8 ongoing	Deliverable submitted	CHUV, EPFL, CSCS, Inselspital Bern, HCUGE, USZ UNIFR, UZH, UNIBE, ITIS
Extending the EBRAINS Core Platform with TRE capabilities	Co-development of the next versions of the HIP as part of a CHUV TRE project called CHORUS-TRE together with an extended CHUV team and external contributors	CHUV T5.6 with additional CHUV groups	M1-24	Next version of the HIP released	WP5, WP2, WP6 plus external contributors

[1] https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science/european-open-science-cloud-eosc_en
[2] https://www.edith-csa.eu/
[3] https://www.commonwl.org/
[4] https://www.openaire.eu/

	Improve the platform security (MIP & HIP) – Kubernetes related activities	MIP: T5.6 (CHUV / ATHENA) HIP: T5.6 (CHUV / external contributors)	Ongoing to M36	Secure configuration and hardening, role-based access control, network security, software supply chain security and data encryption.	CIS benchmark for measuring, package scanning, fine-grained role-based access control and MFA (multi-factor authentication) in use.
	Monitoring, logging and auditing (MIP & HIP) - Kubernetes related activities	MIP: T5.6 (CHUV / ATHENA) HIP: T5.6 (CHUV / external contributors)	Ongoing to M36	Abnormal events traceable and logged. Alerts raised to an administrator. Auditing of CIS criteria will be performed.	Auditing results.
Expansion of the MIP FERES Federation (T2.6)	To expand the FERES stroke federation, we will first finalise the data integration with the first three national stroke registries (Switzerland, Greece, Austria). Further federation partners will join once ready. Achievements and best practices will be documented to promote results and highlight benefits of participation. Further registries or studies will be identified, and engagement will be strengthened by providing comprehensive onboarding support, leveraging our established documentation, tools and infrastructure to streamline their integration. User requirements will influence MIP developments in T5.6	CHUV T2.6 and T5.6	WP2, WP5	Continuous improvement through feedback and promoting collaborative research projects to foster a strong, engaged community, thereby enhancing the federation's scope and impact on research.	WP5 (CHUV & ATHENA), WP2 with EAN, Switzerland, Austria, Greece, Italy, Denmark, Ireland, and future collaborators
(Strategic) Partnerships with external projects in respect of FAIR data concepts	Initiate discussions with EPND, the European Platform for Neurodegenerative Diseases (https://epnd.org/about), a consortium of multidisciplinary public and private sector partners in neurodegenerative disease research, to define strategies for Metadata Syndication / Findability and Interoperability between projects; as a second step AAI federation could be discussed with EPND	Initiation of contact: CHUV; Curation team with WP4 Manager, EBRAINS Knowledge Graph T4.6 with team members from T5.5 (KG) T5.6 (MIP)	M12-M18	Path to syndicate metadata identified and projects aligned following FAIR data strategies	WP4, WP5; EPND
(Strategic) Partnerships with external projects in respect of FAIR data concepts	Initiate discussions with eCREAM (https://ecreamproject.eu/), a project with the central aim to enable clinical and quality of care assessment research using data extracted directly from Electronic Health Records (EHR) of Emergency Departments (ED). eCREAM will use the MIP for	Initiation of contact: CHUV; Curation team with WP4 Manager, EBRAINS Knowledge Graph, T5.5 (KG) T5.6 (MIP) T4.1 & T4.2	M24		WP4, WP5, eCREAM

	FAIRIFICATION efforts, their metadata will be represented in the EBRAINS Knowledge Graph and data will be federated via the MIP. Currently the project is following FHIR, SNOWMED CT and EEHRXF standards, some work on interoperability with openMINDs is going to be required. ECRIN is a major partner in the fairification efforts.				

4. Outlook

The WP5 co-design approach is a critical part of the EBRAINS 2.0 co-design strategy. As one of the two technical WPs, WP5 holds a pivotal role, both guiding and being guided by the co-design roadmap. This WP forms part of the Science Support Team, addressing technical issues, and collaborates closely with WP7, particularly in providing technical training for the Research Infrastructure (RI) both within and outside the consortium.

WP5, supported by various co-design activities with the scientific WPs, acts as the essential link between science and technology. Regular technical meetings organized by WP5 ensure the effective implementation of the co-design strategy. Additionally, the Open Metrics Framework[5], developed within WP5, will monitor the effectiveness of the co-design strategy in relation to the defined KPIs.

Co-design activities between the scientific and technical WPs, with the support of Education and Management, are ensuring that the RI meets the needs of the scientific community by providing a high-end infrastructure. Every category of EBRAINS user participates in this co-design process, offering feedback to build an RI that caters to the diverse needs of all user categories. Even if certain user needs are not initially included, the established co-design processes will identify these requirements and devise solutions to address the various aspects effectively.

The WP5 co-design approach aims to create a seamless integration of science and technology, ensuring a robust and responsive infrastructure that evolves in alignment with the needs of the scientific community. Through continuous feedback and collaboration, the co-design strategy will lead to an RI that not only meets but exceeds the expectations of its diverse users.

[5] **Open Metrics Framework**: built in the framework of T5.1. It is an end-to-end analytics platform for capturing, analysing, and conveying the real-world performance of EBRAINS, it monitors all KPIs related to the project objectives.