



European Cloud for Heritage Open Science

Milestone 11

Collaborative Research Scenarios Defined

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Abstract

The aim of the **ECHOES Showcases of Collaborative Research Potential (D14.2)** is to offer tacit knowledge about exemplar cases in Cultural Heritage (CH) where the ECHOES infrastructure and suite of tools and resources may enhance collaboration potential and consequently shape results of community exchanges and interactions. To illustrate the potential of ECHOES for enhancing existing operations in CH and for providing new opportunities for strong research results, exemplar collaboration scenarios and research workflows were analysed in T3.3 and presented here. The deliverable presents the methods, steps and measures employed in the design, iterative development, implementation and evaluation of a series of Collaborative Research Scenarios.

A new methodology for the field of Cultural Heritage was developed combines social science approaches with design thinking methods. This methodology integrates ethnographic methods of observation, questionnaires, interviews, focus groups and combines them with design thinking tools like personas and empathy maps to enable reflection on two parallel viewpoints: a) user-centric narrative presentation of a workflow of collaborative activities in everyday operations of user communities and b) activity-centric analysis of said operational activities. This dual lens of analysis employed by the methodology ensures correlated opportunities of reflection that helped the identification of meaningful moments of weak collaboration where WP3 could focus in to understand the possible impact ECHOES could deliver through the proposed infrastructure and resources.

Operationally, the scope of T3.3 is twofold: i) to work closely with T4.3.4 towards the identification of relevant communities who will engage in the development of each CRS and, by doing so, to stimulate collaboration that will benefit from the proposed Digital Continuum and ii) to monitor the impact of ECHOES services in enabling deeper collaboration between interdisciplinary teams across the project stakeholders. The CRS evaluation process will be aligned with the Common Evaluation Framework (T9.1).

Key data collection activities were designed in conjunction with major parallel activities in the relevant CH communities and with the collaboration of the other interlinked Work Packages, including WP4, WP5, WP6, WP7, WP8 and WP9. The list of these data collection activities included varied types of community participation and data collection processes spanning from ECHOES-dedicated sessions in major conferences and events in the field of cultural heritage, to focused co-design workshops with practitioners, scholars and museum professionals, the mobilisation of historical archive operations, as well as conducting dedicated interviews.

Dedicated metrics to measure collaboration include value of technology index improvement, knowledge improvement index, partnership synergy, capacity changes and others, as listed in the Methodology section. The CRS evaluation will be developed in close collaboration with T4.3 and T9.3 and will make use of specific pilot projects/pilot tests as appropriate. The results and impact assessment of each CRS will be showcased on a dedicated page on the ECHOES website as good practices.

It is expected that this approach will ensure that the Cultural Heritage Cloud becomes a meaningful, user-friendly infrastructure for its target user communities, optimising the reuse of the outcomes of EU and national cultural heritage projects, to meet their needs. The goal of this analysis of Collaborative Research Scenarios is to demonstrate paths of collaboration

across different professional settings, disciplines and topics, informed by the Community needs with the scope of alignment with varied needs and scales of operation.

This is the document of Milestone 11 that presents the process of defining CRS by means of the proposed methodology, listing some preliminary results of target user feedback collection as the first step towards the development of the D14.2 by M60.

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List of abbreviations

3S	Simple Storage Service
AAI	Authentication and Authorization Infrastructure
API	Application Programming Interface
ASKI	Contemporary Social History Archives
CH	Cultural Heritage
CLARIN	Common Language Resources and Technology Infrastructure
CRS	Collaborative Research Scenario
DARIAH	Digital Research Infrastructure for the Arts and Humanities
DT	Digital Twin
EKT	National Documentation Centre
E-RIHS	European Research Infrastructure for Heritage Science
ECCCH	European Collaborative Cloud for Cultural Heritage
EITF	ECHOES Integration Task Force
EOSC	European Open Science Cloud
ERIC	European Research Infrastructure Consortium
ESFRI	European Strategy Forum on Research Infrastructures
FAIR	Findable, Accessible, Interoperable, and Reusable
GLAM	Galleries, Libraries, Archives, and Museums
LOD	Linked Open Data
HDT	Heritage Digital Twin
HDTO	Heritage Digital Twin Ontology
HPC	High Performance Computing
KB	Knowledge Base
NSRF	National Strategic Reference Framework
VA	Vertical Application

1. Introduction

The intended users of ECHOES encompass a broad spectrum of practitioners and researchers in the GLAM sector, as well as the public. The project seeks to engage museum curators, librarians, archivists, conservators, archaeologists, historians, architects, ethnologists, and cultural managers. A key priority is the inclusion of institutions, and independent professionals who often face barriers, envisioning a network that will benefit all institutions regardless of size, discipline, or technical capacity, with particular attention being paid to addressing the challenges faced by smaller or more remote institutions. ECHOES also targets educators through capacity-building and training initiatives, fostering interdisciplinary skills in data management and digital tools. Beyond institutional users, the project aims to reach policy and decision makers, creative industry professionals, as well as the public, promoting co-creation, participation, and knowledge exchange across different communities.¹ The scope of this deliverable lies at the core of ECHOES's mission to nurture meaningful collaboration by identifying how collaboration can be effectively enabled among institutions and professionals, laying the groundwork for the ECCCH to become a truly inclusive and interconnected digital ecosystem.

The main tasks that support this deliverable, Task 3.3/14.3, Enhancing and evaluating the collaboration potential of ECHOES, act as a bridge between the project's technical and community dimensions, ensuring that the Cloud evolves to a functional collaborative ecosystem responsive to real needs. The deliverable presents the collaboration potential of the ECHOES ecosystem as mapped out through the **design, iterative development, implementation and evaluation of a series of Collaborative Research Scenarios** using the datasets, tools, HDTs and workflows offered by ECHOES. T3.3/14.3 works closely with WP4 to identify relevant communities to engage in the development of each CRS and, by doing so, to stimulate collaboration that would benefit from the proposed Digital Continuum. Moreover, these tasks fulfil the purpose of monitoring the impact of ECHOES services in enabling deeper collaboration between interdisciplinary teams across the project stakeholders.

In the core of T3.3/14.3 lays the concept of the **Collaborative Research Scenarios**, that can be thought of as narrative-based models of operational collaboration that are designed in a way that can reveal diverging views (i.e., user based and activity based views) of the way different actors might collaborate within the ECHOES environment to achieve a shared goal. In a sense, they are narrative blueprints of real-world collaboration, and they aim to get an understanding of how different professionals deal with their motivations, barriers, and needs, as well as how they use or could use data and tools collaboratively.

WP3 is closely connected to WP4, as it provides empirical foundation by identifying the communities involved and analysing their needs and workflows. This supports T3.3, which, through the CRS methodology, investigates how these communities can collaborate effectively in practice. Apart from WP4, T3.3/14.3 is closely connected to WP 8 (Vertical Applications), since they both address the ways in which ECHOES will facilitate collaboration across disciplines and institutions through user-driven tools and workflows. WP3 provides the methodological foundation for identifying and analysing collaborative research scenarios,

¹ European Commission, *ECHOES*, 29.

mapping user needs, and understanding how CH professionals interact with data, tools, and each other.

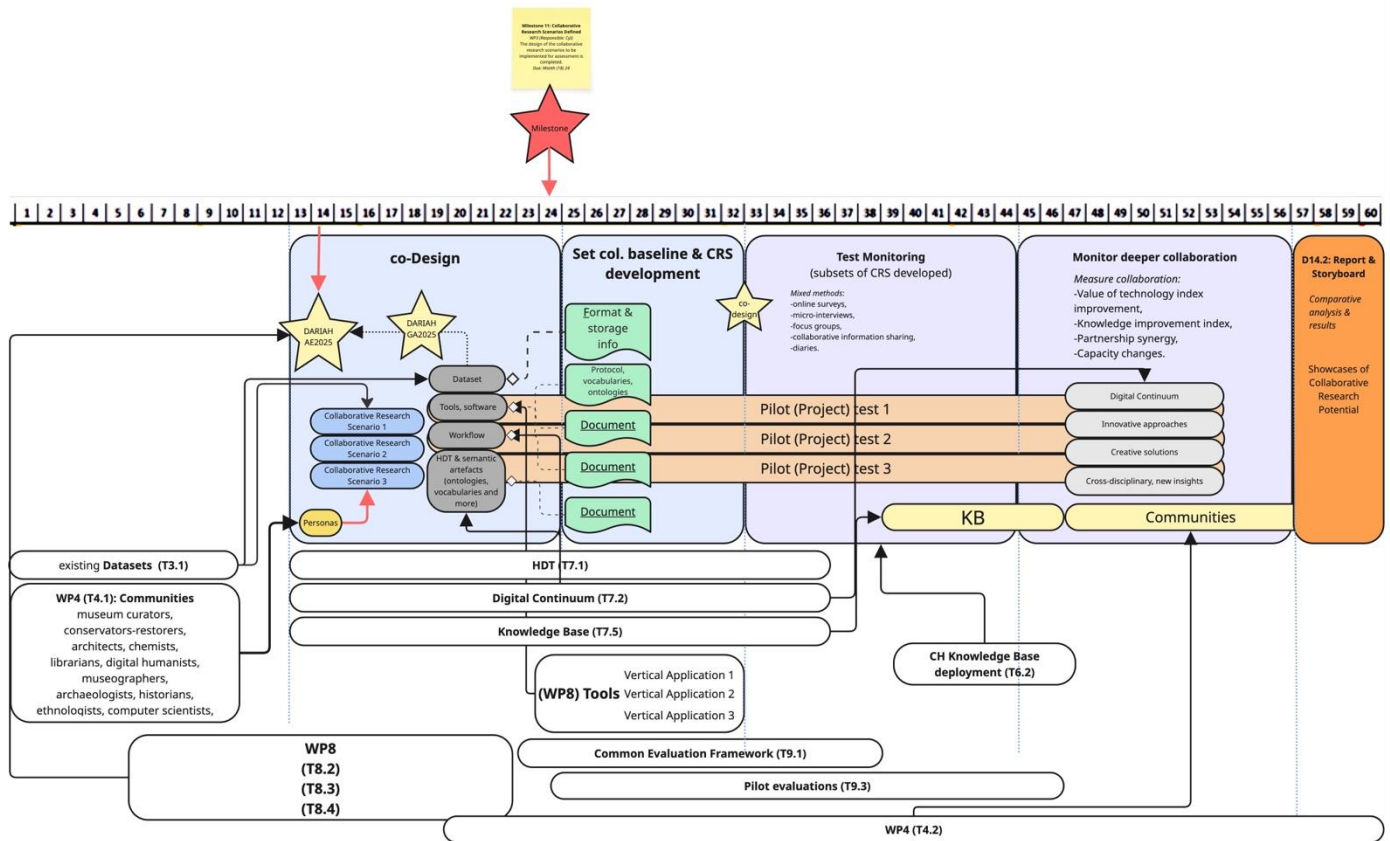


Figure 1. PERT diagram of Tasks 3.3/14.3. Overall, the diagram illustrates how community-driven co-design feeds into formalized research scenarios, which are tested through monitored pilots and evaluated for their impact on collaboration depth — with continuous support from shared infrastructure components (knowledge base, evaluation framework, digital tools) spanning the full project duration.

Description of work

Figure 1 illustrates the workflow and interdependencies of the task within the project. The task is organized into four sequential macro-phases, each feeding into the next.

Phase 1: Co-Design (months 1–24)

The initial phase centres on co-design activities, drawing inputs from DARIAH AE2025, and a group of stakeholder engagement events that included the Contemporary Social History Archives (ASKI) focus group, in Greece, interviews and DARIAH GA2025 sessions, as presented below. Three Collaborative Research Scenarios are proposed to be co-developed in parallel, informed by the analysis of the data collected in these sessions, the Personas and Activities co-designed during these sessions by the communities identified in WP4 (T4.1) and engaged by WP3, including representatives of actors who bare experiences and knowledge relevant to museum curators, conservators-restorers, architects, chemists, librarians, digital humanists, archaeologists, historians, ethnologists, and computer scientists. Each scenario is designed to use and rely on outputs of other WPs and Tasks: Datasets, Tools/software,

Workflows, and HDT & semantic artefacts (ontologies, vocabularies, and more). Scenarios are also aligning with existing datasets as mapped to be integrated in T3.1 in accordance with the developed integration strategy.

Phase 2: Set Collaborative Baseline & CRS Development (months 14–30)

This phase establishes the aspects, key moments and collaboration baseline and respective interactions during existing operations mapped by the scenarios co-designed in the Phase 1 sessions. This collaboration baseline will be used to enable measuring points of change and enhancement expected to be offered to communities by ECHOES solutions. There is a provision for a feedback loop between this phase and the next one to allow for the update of the CRS based on insights collected through testing the validity of the proposed scenarios in alignment with other WP evaluations.

Phase 3: Test Monitoring (months 25–45)

Workflows and chains of interactions and information exchange that belong to the designed scenarios will be conducted as tests to validate the relevance and appropriateness of the monitoring methodology. Monitoring employs mixed methods: online surveys, micro-interviews, focus groups, collaborative information sharing, and diaries. Test monitoring will be conducted on Pilot (Project) tests in WP7 aiming to observe the relevance of the scenario to workflows that integrate as many as possible cross-cutting project components.

Phase 4: Monitor Deeper Collaboration (months 40–55)

Observing and monitoring how the pilots and other activities, as defined by D3.1 and D3.2, feed into the Knowledge Base (KB), is expected to offer deeper understanding of ECHOES on collaboration. Metrics to be used in this phase of monitoring collaboration include value of technology index improvement, knowledge improvement index, partnership synergy, and capacity changes.

Final Deliverable: D14.2 — Report & Storyboard (month 60)

Deliverable D14.2, in its final version will present the original methodology of CRS developed for the project, an analysis of data collected, results of monitoring collaboration across the target ECHOES communities, reflections on the needs of the fields involved in collaboration activities within communities engages, along with the respective specs.

1.2 Context: Collaboration in the Cultural Heritage Ecosystem

The Cultural Heritage domain is characterised by a high degree of diversity in institutional types, disciplinary approaches, and levels of digital maturity. Museums, archives, libraries, research institutions, independent scholars, and public stakeholders all contribute to a complex and heterogeneous ecosystem.

Within this environment, collaboration is both essential and structurally constrained. While stakeholders express strong interest in interdisciplinary and cross-institutional cooperation, existing practices remain fragmented, uneven, and often dependent on informal networks.

Work conducted within Task 3.3 articulates and demonstrates that collaboration is not absent; rather, it is distributed across disconnected infrastructures, shaped by institutional limitations, and constrained by technical, legal, and organisational barriers.

These conditions create a paradox:

- On the one hand, there is a growing need for integrated, transnational collaboration
- On the other, the current ecosystem lacks the structural and technical coherence required to support it

ECHOES is positioned precisely at this intersection, aiming to provide an infrastructure that transforms fragmented collaboration into a coordinated, scalable, and inclusive system.

2. Brief Methodological Note

Expanded methodological framework

WP3 and Tasks 3.3/14.3 developed a hybrid methodology combining social science approaches, participatory research methods, and Design Thinking methodologies in order to capture the interdisciplinary and multi-layered nature of collaboration in the Cultural Heritage domain.

Co-design and participatory engagement

The methodology builds on workshops, focus groups, interviews, surveys, collaborative information-sharing sessions, and co-design activities conducted with representatives of museums, archives, libraries, research institutions, digital humanities communities, conservators, architects, archaeologists, historians, and computer scientists. Personas and Empathy Maps were employed as tools for identifying tacit knowledge, professional cultures, barriers to collaboration, and expectations regarding digital infrastructures.

Collaborative Research Scenarios (CRS)

Collaborative Research Scenarios function as narrative blueprints describing how heterogeneous actors collaborate around shared goals within the ECHOES environment. The CRS framework follows a diagnostic, prescriptive, and evaluative logic: identifying collaboration challenges, defining baseline collaboration moments, introducing infrastructural interventions, defining expected outcomes, and establishing measurable indicators.

Monitoring collaboration

The methodology conceptualises collaboration as a multidimensional process involving actors, workflows, frequency of interaction, intensity of engagement, and the means through which collaboration occurs. Mixed methods are used to monitor collaboration, including surveys, micro-interviews, focus groups, collaborative diaries, and pilot observations aligned with WP7 and the Common Evaluation Framework.

Open Science and governance

The revised framework places stronger emphasis on Open Science principles, governance structures, and conditional openness. The ECHOES ecosystem is understood not only as a repository of finalised outputs but as a collaborative environment supporting experimentation, interpretation, exploratory engagement, and trust-based knowledge exchange across institutions.

The findings underpinning this milestone derive from the methodological framework developed in T3.3, which combines social science approaches with design thinking methods.

Empirical data was collected through workshops, interviews, focus groups, and co-design activities across multiple CH communities. These activities were operationalised through the concept of Collaborative Research Scenarios (CRS), which function as narrative models of real-world collaboration, capturing both user perspectives and activity-based workflows.

The methodology enabled the identification of critical moments of weak collaboration, revealing where infrastructural intervention could have the greatest impact. The present document does not reproduce the methodology in detail but builds directly on its outcomes.

3. From Findings to User Needs: A Systemic Interpretation

So far, the findings of T3.3 reveal a consistent pattern of challenges affecting collaboration in the CH domain. These include fragmentation of tools, lack of interoperability, uneven access to resources, legal uncertainty, and usability barriers.

At a deeper level, these challenges point to a set of structural deficiencies:

- The absence of shared infrastructures
- The lack of common semantic and technical frameworks
- The persistence of institutional silos
- The imbalance between large and small institutions

These deficiencies translate into a set of user needs that are not merely functional, but systemic. Users are not simply requesting new tools; they are articulating the need for a different mode of collaboration, one that is:

- More integrated

- More accessible
- More equitable
- More adaptable to diverse practices

The following sections elaborate these needs in depth.

3.1 Expanded User Needs

3.1.1 The Need for Integrated and Coherent Environments

One of the most consistently expressed needs is the desire for environments that bring together data, tools, and workflows into a unified framework.

Currently, users operate across multiple disconnected systems, each supporting only a fragment of the research lifecycle. This fragmentation results in inefficiencies, duplication of effort, and loss of contextual information. More importantly, it prevents the emergence of shared collaborative spaces where knowledge can accumulate and evolve.

The need for integration is therefore not only technical but epistemic. Users require environments where datasets, annotations, interpretations, and workflows can be connected into coherent knowledge structures. Such environments would enable:

- Continuity across research stages
- Traceability of contributions
- Reusability of outputs

In this sense, integration becomes the foundation for cumulative and collaborative knowledge production.

3.1.2 The Need for Interoperability and Semantic Alignment

Interoperability emerges as a central concern across all stakeholder groups. The heterogeneity of metadata standards, formats, and terminologies creates significant barriers to data reuse and cross-domain collaboration.

However, the need for interoperability extends beyond technical compatibility. It also involves the alignment of semantic frameworks, enabling users from different disciplines to understand and engage with each other's data.

Work conducted within Task 3.3 highlights the importance of modular and flexible approaches to interoperability, recognising that institutions operate at different levels of technical maturity.

Users therefore require solutions that:

- Support gradual integration rather than rigid standardisation
- Allow for multiple levels of metadata complexity
- Enable semantic enrichment without imposing excessive burden

This reflects a broader need for sustainable interoperability, where technical solutions are aligned with institutional realities.

3.1.3 The Need for Inclusive and Equitable Participation

A recurring theme in work conducted within Task 3.3 is the structural inequality between institutions. Smaller organisations often lack the resources, expertise, and infrastructure required to participate fully in digital collaboration.

This creates a risk that digital infrastructures may reinforce existing hierarchies rather than mitigate them.

Users therefore express a strong need for inclusive participation models, where access to collaboration is not determined by institutional capacity. This includes:

- Low barriers to entry
- Tiered levels of participation
- Support for incremental engagement

Importantly, inclusivity is not only a matter of access but also of representation and visibility. Smaller institutions seek recognition of their contributions and integration into broader networks.

3.1.4 The Need for Trust, Governance, and Legal Clarity

Legal uncertainty and governance challenges represent major obstacles to collaboration. Concerns about copyright, data ownership, and misuse often lead institutions to adopt restrictive practices.

Users therefore require environments where trust is actively supported through:

- Clear governance frameworks
- Transparent licensing mechanisms
- Controlled access conditions

T3.3 findings emphasise that collaboration should be supported even before formal publication, through mechanisms that allow safe and controlled sharing of materials.

This reflects a deeper need for conditional openness, where collaboration can occur without compromising institutional responsibilities.

3.1.5 The Need for Interpretative and Exploratory Collaboration

An important insight from work carried out within Task 3.3 is that collaboration in CH is not solely about data exchange but also about interpretation and meaning-making.

Users emphasise the importance of spaces where ideas can be explored, discussed, and developed collaboratively, without the pressure of producing finalised outputs.

This implies a shift from viewing digital infrastructures as repositories of knowledge to understanding them as spaces of knowledge formation.

Such environments should support:

- Early-stage exploration
- Iterative interpretation
- Dialogue and reinterpretation

This need challenges traditional models of research infrastructures and requires a more flexible and process-oriented approach.

3.1.6 The Need for Capacity Building and Knowledge Transfer

Finally, users highlight the importance of training and capacity building, particularly in relation to advanced concepts such as Heritage Digital Twins.

Engagement with digital infrastructures requires not only technical skills but also an understanding of their relevance to professional practices.

Users therefore require:

- Accessible training resources
- Contextualised learning materials
- Ongoing support mechanisms

This reflects the need for infrastructures that are not only usable but also learnable and adaptable.

3.2 Functional Specifications: A Systemic Response

The functional specifications of the ECHOES ecosystem must be understood as direct responses to the user needs outlined above. Rather than representing isolated technical features, they constitute an integrated system of capabilities designed to enable collaboration at multiple levels.

3.2.1 Integrated Data Environment

At the core of the system lies the need for an integrated data environment capable of aggregating and linking heterogeneous data sources.

This environment should support:

- Cross-format data integration
- Semantic linking
- Persistent identifiers and traceability

Its primary function should be to transform fragmented datasets into a connected knowledge space, enabling users to navigate and reuse data seamlessly.

3.2.2 Collaborative Workspaces

Collaborative workspaces should represent a central component of the ECHOES ecosystem. These environments enable users to interact, share resources, annotate data, and communicate in real time.

Importantly, these spaces must support both synchronous and asynchronous collaboration, reflecting the distributed nature of CH communities.

They should also incorporate:

- Version control mechanisms
- Contribution tracking
- Shared annotation systems

Through these features, collaborative workspaces should become the primary sites of collective knowledge production.

3.2.3 Advanced Search and Discovery

Given the increasing volume and diversity of CH data, advanced search and discovery functionalities are essential.

These functionalities should go beyond basic keyword search to include:

- Semantic search
- Cross-domain filtering
- Contextual exploration

The objective is to enable users to not only find data but also understand its relevance and relationships.

3.2.4 User-Centred Interfaces

Usability is a critical factor in ensuring adoption. The system must provide interfaces that are intuitive, accessible, and adaptable to users with different levels of expertise.

This includes:

- Simplified workflows
- Customisable interfaces
- Clear visualisation of data and processes

User-centred design is therefore essential for translating technical capabilities into practical usability.

3.2.5 Workflow Support and Management

To support complex collaborative processes, the system must include tools for workflow management.

These tools should enable:

- Task coordination
- Documentation of processes
- Tracking of contributions

Such functionalities would ensure that collaboration is not only possible but also structured and sustainable.

3.2.6 Governance and Access Control

In response to legal and institutional constraints, the ECCCH should incorporate robust governance mechanisms.

This includes:

- Role-based access control
- Licensing frameworks
- Usage monitoring

These features are essential for building trust and enabling responsible collaboration.

3.2.7 Support for Innovation and Experimentation

Finally, the ECCCH should support experimentation and exploratory collaboration. This includes providing environments where users can test ideas, develop prototypes, and engage in interpretative work.

Such environments are critical for fostering innovation and creativity within the CH domain.

4. Conclusion

The present document demonstrates that the development of the ECHOES ecosystem must be grounded in a deep understanding of user needs as articulated through empirical research. The findings of work conducted within Task 3.3 reveal that these needs are not limited to technical functionalities but reflect broader structural challenges within the CH domain.

By translating these needs into a coherent set of functional specifications, this document provides a foundation for the design of a system that is not only technically robust but also socially and institutionally meaningful.

The success of ECHOES will ultimately depend on its ability to move beyond fragmentation and enable a new paradigm of collaboration: one that is integrated, inclusive, and oriented toward the collective production of knowledge.

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