Deliverable D2.2: Technical requirements report

Project Title: Towards a pan-European Research Infrastructure for Excellent Citizen Science
Project Acronym: RIECS-Concept

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Description	Consolidated catalogue of existing technologies (citizen-science literature and European technology-sovereignty solutions), the gap analysis, and the first technical requirements for the RIECS, derived from the engagement evidence in D4.2, D4.3 and D4.4.
Key words	citizen science; technical requirements; technology catalogue; digital sovereignty; gap analysis; RIECS

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Version History

Version	Date	Comments
v0.1	2026-06-10	First draft
v0.2	2026-06-11	Validated draft
v0.7	2026-06-22	Draft for review
v0.9	2026-06-27	Review meeting, validation of tone, need to revisit tables to incorporate CSIC's full record on technologies, update data from D4.4, include reference to the tool for visualising needs.
v0.17	27/06/2026	External-reviewer round addressed: accepted changes/comments; numbers reconciled to the master (796 stories, 37 needs).
v0.27	2026-06-29	Styled, final comments
v0.28	2026-06-29	Acronyms list revised: removed 15 unused (template) entries, added 16 in-text acronyms; re-sorted
v1.0	2026-06-30	Formatting and minor edits.

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Disclaimer

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This deliverable has been prepared in the framework of the RIECS-Concept project, grant agreement Nº 101188210 under the HORIZON-INFRA-2024-DEV-01-01 topic.

AI use disclaimer

Parts of the analysis and drafting of this deliverable were carried out with the assistance of AI tools, including Anthropic's Claude, Microsoft's Copilot and a locally-run large language model (via Ollama) for offline text processing. AI was used as a co-analyser under human direction to support the labelling and clustering of user stories, the summarisation and coding of engagement notes, the consolidation and mapping of the technology and needs material, and the drafting and editing of text and not as an autonomous author.

All AI-generated outputs (needs, themes, gaps, mappings, summaries and draft text) were reviewed and validated by the responsible consortium partners, who remain responsible for the content of this deliverable. No personal data was sent to external AI services: interview and workshop material was processed locally on consortium machines in line with the project's GDPR and data-management arrangements.

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Executive summary

This deliverable turns the engagement evidence collected in D4.2 (citizens), D4.3 (stakeholders) and D4.4 (international and policy stakeholders) into a first list of technical requirements for the RIECS. We started from 793 analysable user stories, grouped them into 37 needs, and from those derived 18 functional, 7 non-functional, 4 compliance and 2 integration requirements; 11 of them are marked as MUST following a MoSCoW (Must, Should, Could, Won't integrate) grading strategy. Every requirement is linked back to the stories it comes from and to example technologies taken from our desk-research catalogue, which now holds 4,487 entries, of which 823 are shortlisted as the most relevant. We also report ten structural gaps that the RIECS will have to close. As this is a first pass, all the statements, priorities and mappings are drafts that the consortium still must validate. Follow three highlights of the analysis contained in this document:

- The evidence points towards a federated infrastructure, with shared identity, common standards and a single discovery layer. The idea is to connect the platforms that already exist rather than replace them.
- The MUST requirements concentrate on discovery, hosting, collection tools, training resources and community spaces. These are the things people asked for across all the groups we engaged with.
- The biggest gaps are not inside any single tool but in what must work across all of them: identity, search across platforms, quality assurance offered as a service, recognition, and getting results into policy.

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Abbreviations and acronyms

Acronym	Meaning
AAI	Authentication and Authorisation Infrastructure
AI	Artificial Intelligence
API	Application Programming Interface
BOINC	Berkeley Open Infrastructure for Network Computing
CARE	Collective benefit, Authority to control, Responsibility, Ethics (data principles)
CS	Citizen Science
CSIC	Consejo Superior de Investigaciones Científicas (Spanish National Research Council)
CSV	Comma-Separated Values
D	Deliverable
DCAT	Data Catalogue Vocabulary
DIY	Do-It-Yourself
DMP	Data Management Plan
DOI	Digital Object Identifier
ECSA	European Citizen Science Association
EOSC	European Open Science Cloud
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
FAIR	Findable, Accessible, Interoperable, Reusable
GA	Grant Agreement
GBIF	Global Biodiversity Information Facility
GDPR	General Data Protection Regulation
LLM	Large Language Model
M	Month (project month; M1 = project start)
MoSCoW	Must / Should / Could / Won't (prioritisation)
OBIS	Ocean Biodiversity Information System
PPSR	Public Participation in Scientific Research
RI	Research Infrastructure

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Acronym	Meaning
RIECS	Research Infrastructure for Excellent Citizen Science
T	Task
UI	User Interface
UN	United Nations
VGI	Volunteered Geographic Information
WCAG	Web Content Accessibility Guidelines
WP	Work Package

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About RIECS-Concept

RIECS-Concept “Towards a pan-European Research Infrastructure for Excellent Citizen Science” is a 36-month Research and Innovation Action funded under HORIZON-INFRA-2024-DEV-01 (grant agreement Nº 101188210). See concept.riecs.eu.

The project has three specific objectives: (SO1) conduct a technical feasibility study for the development of a permanent and shared Research Infrastructure for Excellent Citizen Science (RIECS); (SO2) develop a strategic plan for the RIECS lifecycle; (SO3) achieve open governance through the conceptualisation of a RIECS.

RIECS-Concept is structured in seven interlinked Work Packages (WPs). WP2 identifies the technical challenges and drafts the tentative list of features and functionalities that RIECS should provide, in strong collaboration with WP4, which leads the engagement of diverse stakeholder groups in the co-exploration and co-definition of the RIECS concept. WP3 is the natural continuation of WP2 and opens the floor to governance, sustainability and data & metadata dialogues.

This deliverable is produced in the first phase of the project (M1–M18) and contributes to Key Exploitable Result 1 (Catalogue of services and resources) and Key Exploitable Result 2 (Technical integration and cross-disciplinary feasibility study).

Purpose and scope of this deliverable

This deliverable covers the technical synthesis of the first phase of the project and provides the reader with: the catalogue of existing technologies, the gap analysis, the functional and non-functional requirements, and how these map onto feasible technologies. It builds on the needs collected from user stories in D4.2, D4.3 and D4.4, D2.1, and it feeds the preliminary catalogue (D2.3) and the WP3 roadmap.

The precise scope of RIECS and all the outputs of RIECS-Concept were deliberately left open during this first phase of the conceptualization process, so as not to constrain the external inputs gathered through engagement and to keep the exploratory space as wide as possible. The requirements below should therefore be read against the convergence of two reference frames: research infrastructures (in the ESFRI and European Commission sense) and citizen science (the ECSA ten principles); with a fuller definition of the RIECS concept to be fixed at month 36.

Relationship to the other project deliverables

This deliverable does not stand alone; it is one node in a connected chain of project results. It draws on two kinds of input and feeds several downstream results. Upstream, the demand side comes from the WP4 stakeholder engagement process: the engagement methodology (D4.1, month 6) defined how the user stories were gathered, and the same body of stories is reported, from the participants' side, in the citizens' requirements report (D4.2) and the stakeholders' requirements report (D4.3) as well as the global policy organisations report (D4.4). The supply side draws on the consortium's challenges assessment (D2.1, month 12),

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which surveyed the existing platforms and challenges and which this deliverable triangulates against in Section 3.6. This deliverable then turns that evidence into technical requirements and a first technology mapping at month 18.

Downstream, the requirements distilled here are the direct basis for the preliminary catalogue of services, resources and functionalities (D2.3, month 18). Further ahead, they feed the Work Package 3 roadmap: the data and metadata criteria (D3.3, the project's third key result, month 36) and the implementation and sustainability roadmap (D3.4, month 36). In short, this deliverable is the bridge between the community requirements (WP4) and what the project will design and recommend (the catalogue, the data model and the roadmap).

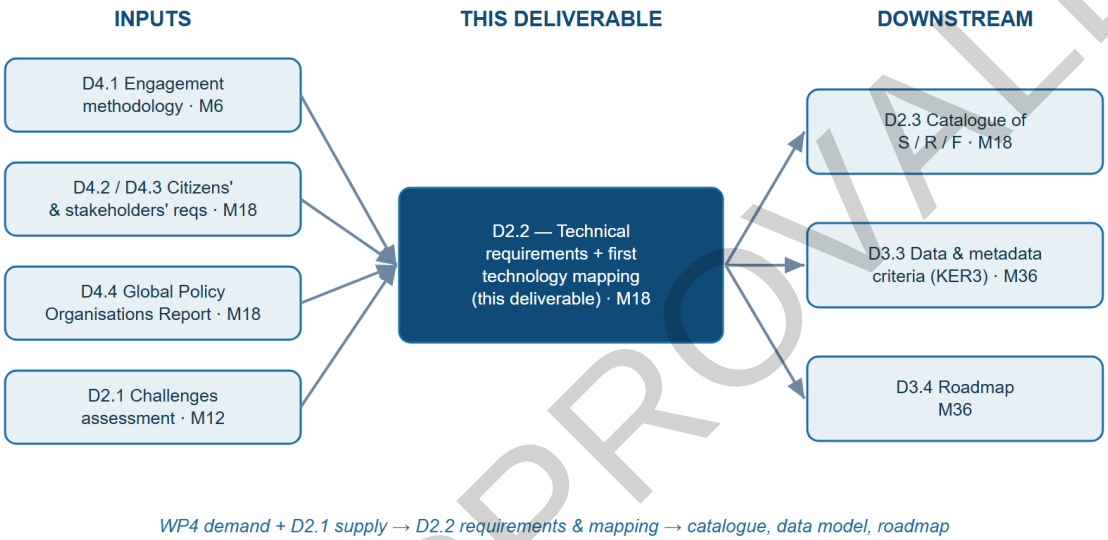

Figure 1. The positioning of this deliverable in the project chain: WP4 demand and D2.1 supply feed D2.2, which feeds the catalogue, the data model and the WP3 roadmap.

1. Method: from user stories to technical requirements

This section explains how we turned the material gathered through the RIECS-Concept engagement activities and conversations reported in D4.2, D4.3 and D4.4 into requirements, and which conventions we used.

1.1.Synthesis pipeline

We collected a substantial amount of data primarily through workshops. As explained in D4.1, the main mechanism for engaging with different target groups is the workshop, where we followed a template that enabled the collection of hundreds of data points about speculative visions of what RIECS could become in the future. The main aspects of this process are outlined below and further explained throughout the deliverable:

- **Harvest user stories**: 823 stories from 42 workshops, the online questionnaire and related engagements (D4.2/D4.3/D4.4).
- **Consortium labelling session** (13 partners, May 2026): every story was tagged by researchers with target user, story concept, thematic labels, relevance;

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double-labelling was used for conflict detection by forcing an overlap of 5% of the user stories offered to each partner for evaluation. Partners used a labelbook initially derived from D2.1, respecting different EU dictionaries, with clear definitions and the possibility to add new labels on the fly, which were then available to the rest of the team.

- **Consolidation**: from the human-made analysis, a small number of stories was identified as not valid for the project as they were not focused on the challenges at hand, nor did they bring any other relevant aspect to be considered. 27 stories of the total of 823 were excluded (those that were not citizen science / not relevant for RIECS / too project-specific / duplicates / or had no parseable content).
- **Clustering:** 37 needs (N01–N37) were derived from the co-occurrence of labels across the stories. We applied an automated classification mechanism to identify how the labels in the labelbook would relate by means of the user stories. I.e. we built clusters based on how the stories related to one another to identify needs that would inform the design of the RIECS concept. For prioritisation, and to stay aligned with D4.2 and D4.3, further analysis is made looking at the ten most frequently expressed needs rather than applying fixed frequency thresholds.
- **Cross-check** against the desk-research technology catalogue (D2.1) and **gap derivation**. We identified gaps in the literature, identified needs, and possible technical solutions and documented them.
- **Requirement drafting**: each need translated into functional/non-functional/compliance/integration requirements with MoSCoW priorities. This initial draft of technical requirements is the key contribution of the deliverable that will spark the work in D2.3.
- **Validation**: consortium review of this document was performed to ensure that the data is in line with the other deliverables with the same due-date, but also to make sure that the outcomes of the different automations used during the data analysis produced verifiable inputs to subsequent phases of the project.

1.2.Data labelling and analysis tooling

To process the engagement evidence at the scale required (823 user stories and a technology catalogue of several thousand entries) the consortium developed a set of purpose-built repositories for the collaborative labelling of the data, for the (offline) analysis of interviews[1] and workshop notes, the scraping of the European technology catalogue (, a tool to visualise how labels relate to needs and those to themes, and a shared design system underpinning these tools. They are summarised below and listed, with links, in the table at the end of this subsection.

Collaborative labelling tool (riecs-label-validation). We developed a collaborative web application (FastAPI / Python) that lets RIECS research team collaborate in the classification and validation of user stories against the shared labelbook from their browsers during moderated sessions. The facilitator runs the server locally and shares it over a secure

[1] During the first half of the project, we performed over 30 interviews with experts within the field of CS, as well as their transcription and an initial analysis of the outcomes. However, we have not brought that work at this stage into the deliverables since we would like to devote a longer time to look for coincidences among the different interviews and relate those to the larger corpus of user stories.

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tunnel; stories are tagged with target user, concept, thematic labels and relevance, with double-labelling for conflict detection and results exported to spreadsheet for consolidation.

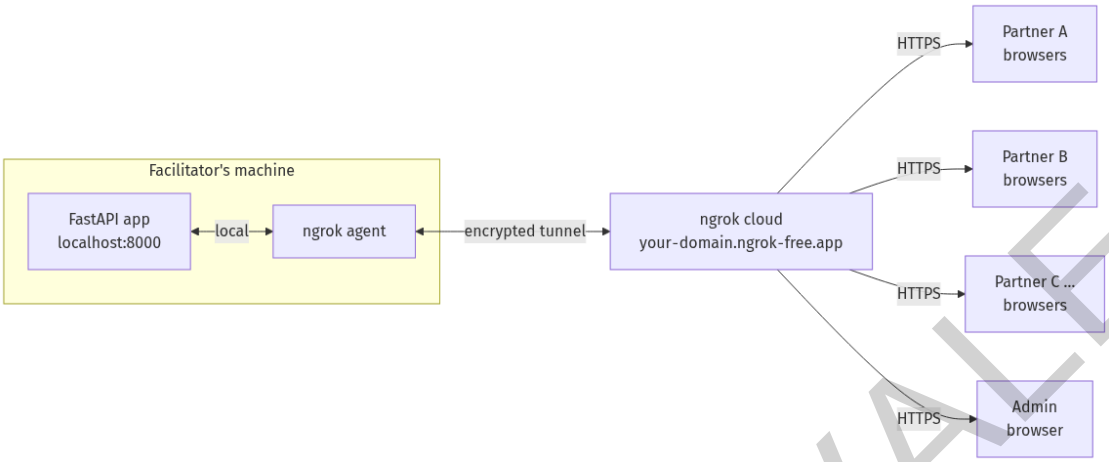

Figure 2. Architecture of the collaborative labelling tool (riecs-label-validation).

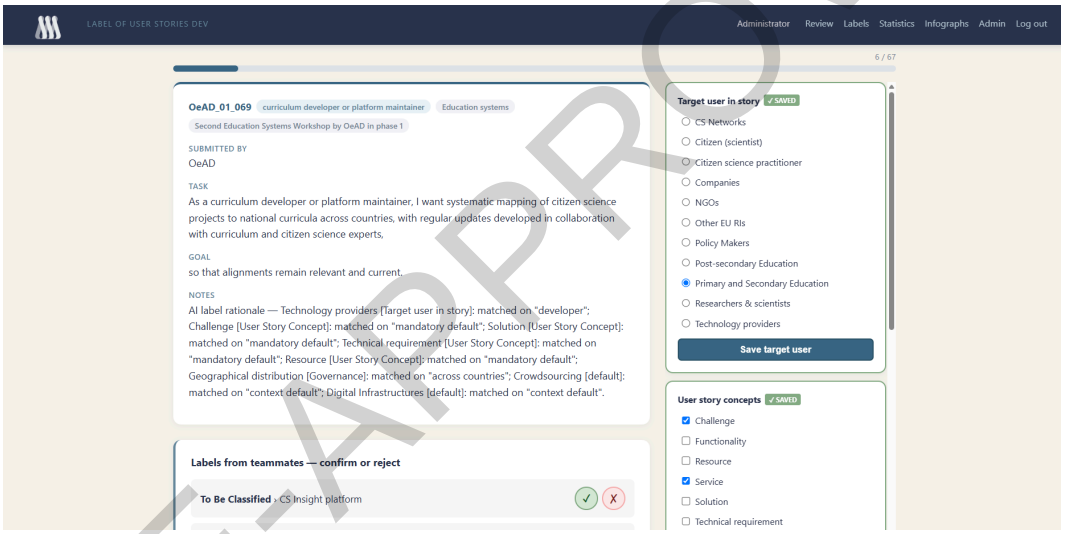

Figure 3. Collaborative labelling tool: the story-review and labelling interface.

Offline interview- and workshop analysis tool (riecs-interview-coding). A fully offline, GDPR-compliant qualitative-analysis system (Python, using a local large language model via Ollama) that processes interview transcripts and workshop notes entirely on the local machine, with no data leaving it. It performs anonymisation, summarisation, thematic coding (optionally against a labelbook or any list of keywords), sentiment analysis and cross-document comparison, and can be run on air-gapped hardware via either a web interface or the command line.

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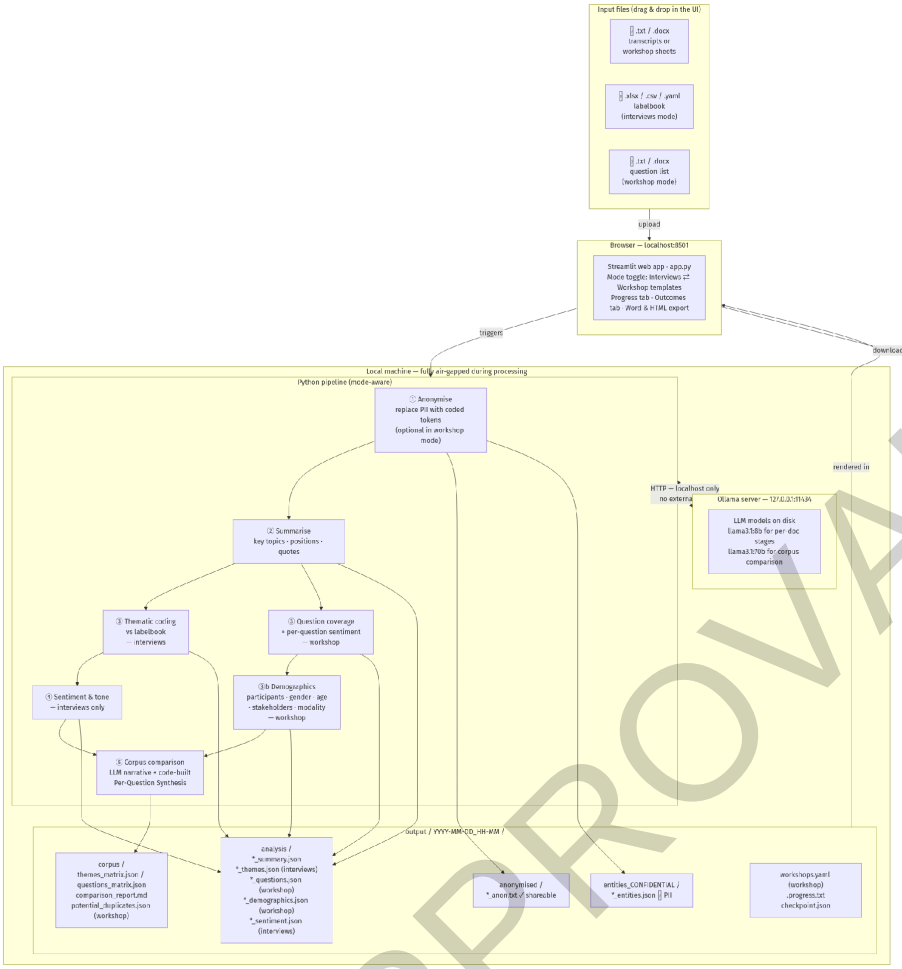

Figure 4. System architecture of the offline interview- and workshop analysis tool (riecs-interview-coding).

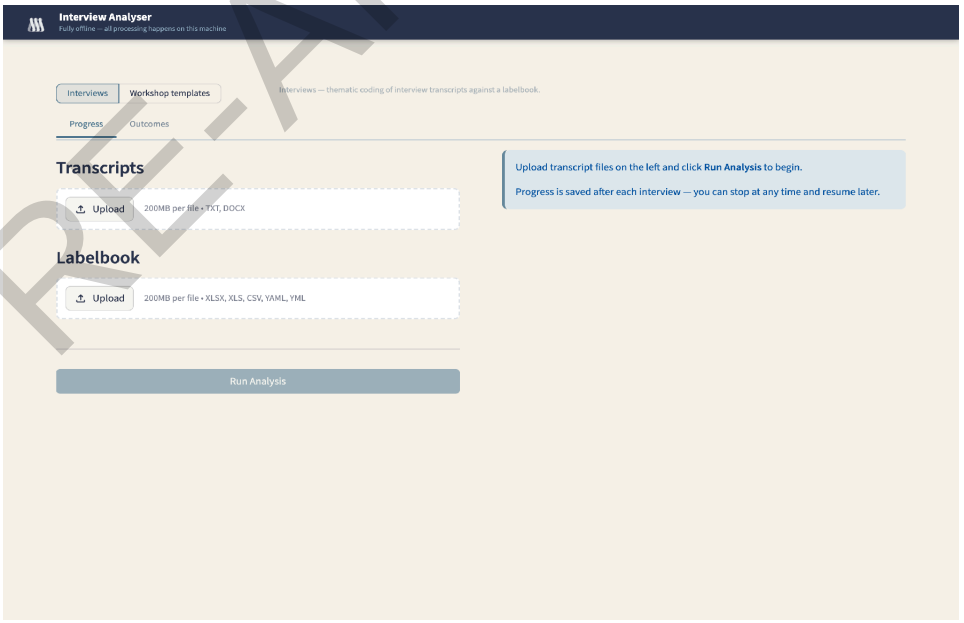

Figure 5. Offline interview- and workshop analysis tool (riecs-interview-coding): the analysis interface, where transcripts and a labelbook are loaded and the coding is run locally.

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Shared design system (riecs-design-kit). A self-contained user-interface design system (HTML / CSS / JavaScript) originally created for the labelling application, providing shared styling, components and branding so that the RIECS analysis tools present a consistent interface.

Technology-catalogue scraper (riecs-techsov-scrapper). A Playwright (Python) based scraper that extracts the full European Tech Sovereignty Catalogue (https://techsov-catalogue.eu/tech-catalogue/), driving the site through JavaScript extracting data in two passes for robustness; the first pass extracts the list of projects and their information excerpt, while the second one extracts, one by one, each one of the descriptions of the different technologies. At the time of writing, the latest run produced 115 entries. The downstream consolidation, de-duplication and technology-to-need mapping reported in this deliverable were carried out with additional analysis scripts produced for D2.2 and researcher intervention.

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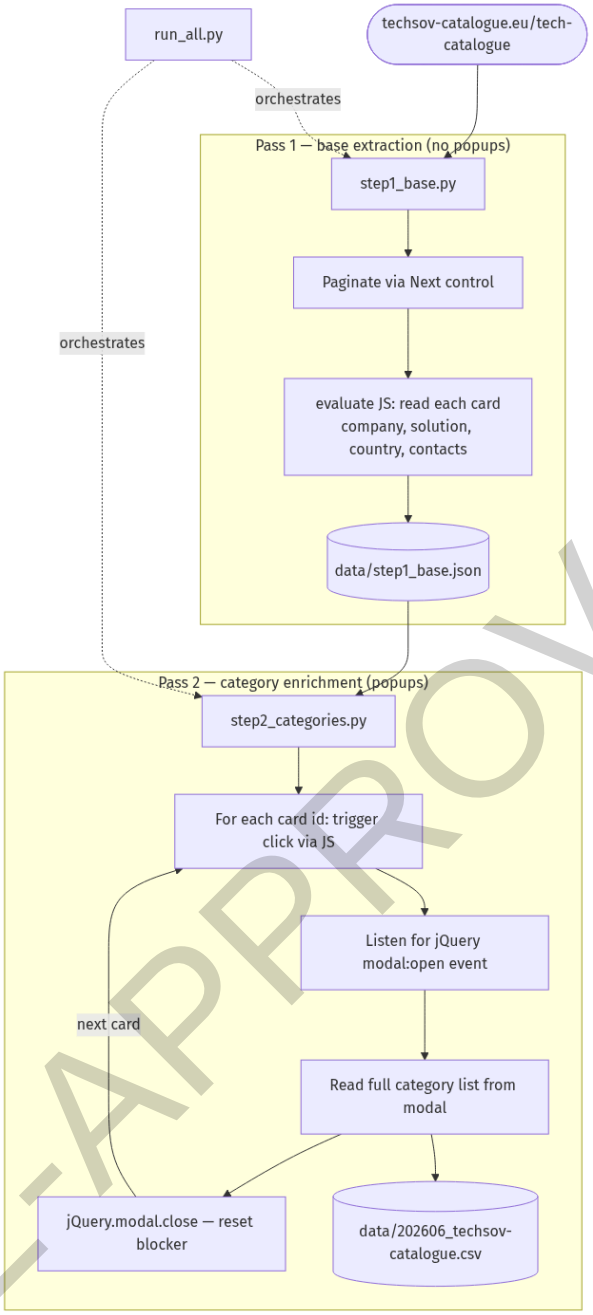

Figure 6. Scraping pipeline of the technology-catalogue scraper (riecs-techsov-scrapper).

Labels-to-needs-to-themes visualisation tool (riecs-needs-explorer). Labels, needs and themes were also explored through an interactive, web-based visualisation (Figure 7) which traces how individual labels aggregate into the needs and, in turn, into the themes. The reader can follow any label → need → theme path and inspect the relative weight of each connection. The tool is open source and can be checked live at: https://dcuartielles.github.io/riecs-needs-explorer/.

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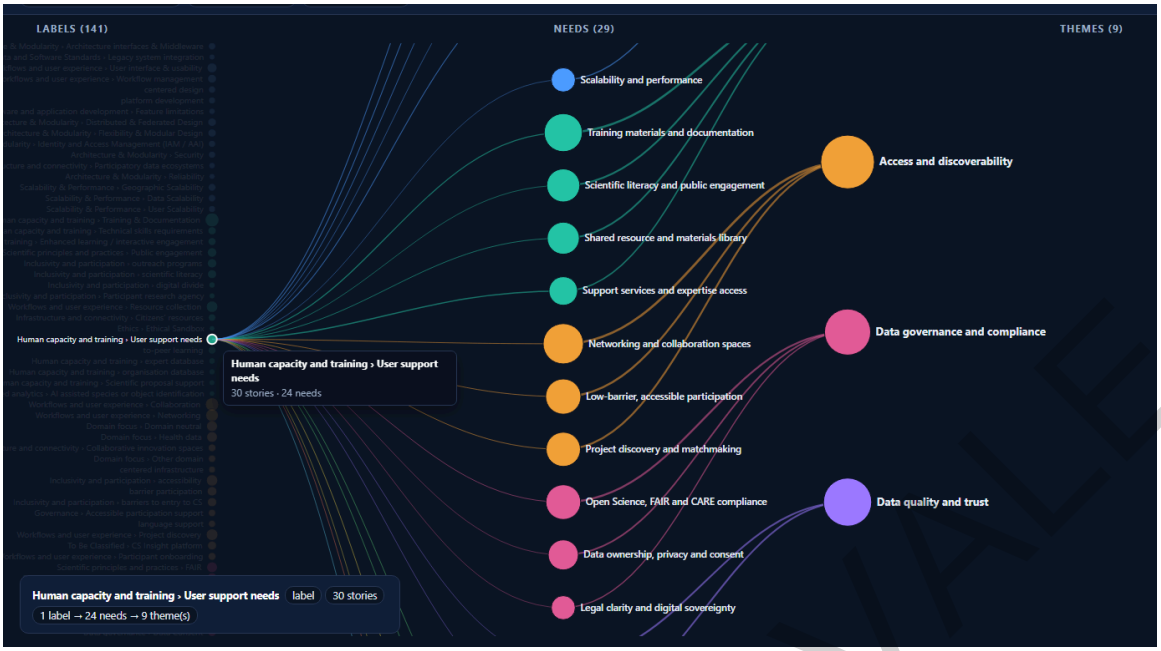

Figure 7. Labels-to-needs-to-themes visualisation tool (riecs-needs-explorer): tracing how labels aggregate into needs and themes.

Follows a table with the repositories created for this work. Please note that the scraper is kept private as the repository includes the outcome of the action to be shared with the other project participants. We developed this tool to automate the updating of the list of technologies listed in the mentioned website, since there is no proper machine-usable file containing all the data. It would have been optimal if that project shared a CSV file or an API endpoint.

Repository	Purpose	Used for	Access (link / availability)
riecs-label-validation	Collaborative web app for tagging/validating user stories against the shared labelbook in moderated workshops; double-labelling and conflict detection; export to spreadsheet	Data labelling	https://github.com/dcuartielles/riecs-label-validation (public)
riecs-interview-coding	Fully offline, GDPR-compliant qualitative analysis of interview transcripts and workshop notes using a local LLM (anonymisation, coding, sentiment, cross-document comparison)	Interview & workshop-note analysis	https://github.com/dcuartielles/riecs-interview-coding (public)
riecs-design-kit	Shared UI design system (CSS/HTML/JS) extracted from the labelling app, for consistent branding across the RIECS tools	Shared UI / design system	https://github.com/dcuartielles/riecs-design-kit (public)
riecs-techsov-scrapper	Playwright scraper extracting the European Tech Sovereignty Catalogue to CSV (115 entries)	Technology catalogue	https://github.com/dcuartielles/riecs-techsov-scrapper (private)

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		(European source)	
riecs-needs-explorer	Interactive labels → needs → themes visualisation explorer	Needs analysis / visualisation	https://github.com/dcuartielles/riecs-needs-explorer (public)

Table 1. Repositories created for data labelling, the design system, web scraping, labels to themes mapping, and data analysis.

1.3.Requirement taxonomy and notation

The main goal of D2.2 is to produce a list of requirements and offer a list of candidate technologies to support those as well as the needs they derive from. The analysis hereby presented has required long processes and the involvement of both automation tools and researchers. To ease the traceability of the decisions taken and facilitate the validation of the different steps of the process, we have developed a notation that can be found in the different documents as well as data files (CSV and XLSX) used to support the work done and the reporting documents.

Departing from the idea that there are different types of possible requirements, we have labelled them using the notation: **RIECS-REQ-<T>-xxx**. Where:

- **RIECS-REQ** indicates we are looking at a requirement of the RIECS Concept,
- **T** indicates the type of requirement, whether functional (F), non-functional (N), compliance (C), or integration (I).
- **xxx** is the number of the requirement of a certain type

Each requirement carries a MoSCoW (this method is explained in the following section) priority and links to source needs (labelled as **Nxxx**), source story IDs, and candidate technologies (that in turn will be labelled **TEC-xxx**).

1.4.MoSCoW rule

RIECS prioritises requirements using the MoSCoW scheme, which classifies each requirement as Must have, Should have, Could have or Won't have. The level is not a matter of technical preference: it is derived from the evidenced demand for the underlying need, taking the overall need priority from the frequency rule applied across the 793 analysable stories. That is, each need's priority band is set by the share of stories that raise it, see Table 2 for the chosen values for separating each category. We made this analytical rule deliberately mechanical at this point so that the consortium can eventually re-run it after validating the underlying clustering. As explained in the discussion section later, we would like to understand how to weight the opinions of the different types of target groups in a better way, a process we call *prioritization*. I.e. we acknowledge the fact that frequency analysis might not be the best way to validate the outcomes of this process, since not all groups are represented equally or in proportion to how they are represented in society.

• MUST (Must have):derived from a High-priority need: one raised in roughly ≥ 12% of the analysable stories (the eight most-frequently mentioned needs). Essential for a viable first RIECS.

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• SHOULD (Should have): derived from a Medium-priority need: raised in roughly 5–12% of the analysable stories. Important but not vital for the initial service.
• COULD (Could have): derived from a Low-priority need: raised in fewer than ~5% of the analysable stories. Desirable and included where resources allow.
• WON'T (Won't have this time): needs that fall below the requirement threshold or are out of technical scope for this phase: not implemented as requirements here but carried forward through the Aspect IDs.

MoSCoW level	Meaning	Derived from need priority	Example requirement
MUST (Must have)	Essential for a viable RIECS	High (≈ ≥12% of stories)	RIECS-REQ-F-004 - shared hosting for citizen-science projects (need N10)
SHOULD (Should have)	Important, not vital for launch	Medium (≈ 5–12%)	RIECS-REQ-F-013 - recognition mechanisms for contributors (need N19)
COULD (Could have)	Desirable if resources allow	Low (< ≈5%)	RIECS-REQ-F-012 - support services / helpdesk (need N17)
WON'T (Won't have this time)	Deferred to a later phase	below threshold / out of scope (via Aspect IDs)	e.g. long-term governance and sustainability tooling (routed to phase 2)

Table 2. MoSCoW prioritisation scheme: how each requirement's priority is derived, with a representative example.

2. Inputs from engagement activities (synthesis of D4.2, D4.3 and D4.4)

This section covers how the analysis done in D4.2, D4.3 and D4.4 influences this deliverable. We first look at the needs and how there are some that converge among D4.2 and D4.3. Then we make a brief comment about D4.4's contribution to then focus on the themes that will have a larger impact on the work packages to come (WP3 and WP5) as they will help determine the line of work to depart from,

2.1.Citizens and students (from D4.2)

From D4.2 we have 378 analysable stories from citizen scientists, CS practitioners and students. The needs they raise most often are shared digital infrastructure and hosting (N10, 83), data collection and crowdsourcing tools (N11, 69), training materials and documentation (N16, 67), networking and collaboration spaces (N02, 63), low-barrier, accessible participation (N03, 53), and recognition and credit for contributions (N19, 49). What stands out is that citizens care about recognition, feedback and trust much more than the institutional groups do. We think these should be built in as proper features of the service from the start and not added as an afterthought.

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2.2.Stakeholder groups (from D4.3)

Looking at D4.3, there are 415 analysable stakeholder stories across 8 groups. Dominant needs: shared digital infrastructure and hosting (N10, 106), networking and collaboration spaces (N02, 87), analysis, visualisation and decision support (N12, 68), data collection and crowdsourcing tools (N11, 66), training materials and documentation (N16, 60), and interoperability and platform integration (N14, 52). However, as mentioned in the different deliverables, from the stakeholders considered in D4.3, there is an almost overwhelming presence of researchers in comparison to the others (41,2%). Taking that into account, it is worth looking at the aspects found more relevant by the different stakeholder groups: researchers centre on workflows, infrastructure, standards and quality; technology providers on architecture and interoperability; education systems on curriculum-compatible projects and materials; policy makers on evidence quality and official-statistics integration; NGOs and networks on governance, funding and community.

We consider that needs converge with evidence from 7 groups or more. Five of the six needs identified in D4.3 are also among the citizens' most-frequently raised needs: N10, N02, N12, N11, N16. They form a convergent core that is demanded right across the community and anchors the MUST requirements. In parallel, interoperability and platform integration (N14) is the one dominant need that is specific to the institutional stakeholder groups.

2.3.International and policy stakeholders (from D4.4)

Having made the analysis for D4.4 differently due to the specific nature of the interactions with this group, this section wants to highlight how D4.4 contributes to the analysis. Task 4.4 engaged international and policy-making organisations (target group TG10) through UN-level activities (the 4th UN Expert Group Meeting on Citizen Data and UNEA-7), the APPEC 2027–2036 Open Science & Citizen Science working group, the HEROES open-science-hardware workshop happening at CERN in January 2026, and a set of interviews. Its headline message is that RIECS should be a *connective infrastructure rather than a new silo* (linked to N24, N15, and N14); the strongest requirement is *interoperability and standards for integrating citizen-generated data with official and scientific data* (N14, N05, N08), alongside discovery and aggregation (N01, N10), policy-ready outputs (N25, N26), open science hardware (N34), and governance and sustainability (N23, N22).

Leaving aside N10 and N15, there seems to be little connection between D4.4 and the converging needs found in D4.2 and D4.3. This should offer us a point of reflection for what is to come in the following phase of the project and policy-drive process of RIECS towards ESFRI. We need to ask ourselves whether the needs of the stakeholders represented in D4.4 is or can be aligned with the ones of the communities and the researchers, or whether this is a matter of perspective. It is very likely that the data collected in the interviews will shed some light to this question as we move on with the analysis.

2.4.Cross-cutting themes

We find the following higher-level concerns that recur across the stakeholder groups and the source reports.

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1. The first is the high fragmentation of the citizen-science landscape: participants ask, for example, for “a one-stop-shop for citizen science projects and data … to avoid duplication and connect my project with existing initiatives” (IBE_ECS_01).
2. The second is a constant worry about economic sustainability: platforms and projects tend to die once their funding ends, prompting calls to “learn from successful open-source sustainability models … to support the sustainable funding and finances of services” (ECSA_FSB_003).
3. The third is the link between quality and trust, as data must be validated before anyone in policy will use it; one practitioner wants “support for data and metadata quality, validation and interoperability, so that citizen-science data can be trusted, reused and integrated across platforms” (IBE_ECS_02).
4. Inclusion recurs as something that must be designed in from the beginning rather than bolted on later: a wish for “an open and inclusive infrastructure that respects diverse research topics, cultures and communities, so that participation is broad and equitable” (ECSA_OCP_026).
5. Finally, there is a clear call for RIECS to be a public, European resource, for instance that “citizen science data [should] have a position in the European digital public infrastructure … with legal and political protection from commercial capture” (ECSA_FSB_008).

3. Catalogue of existing technologies and platforms

The desk-research inventory has been consolidated into a single catalogue of existing technologies, combining three sources: (i) 4,372 citizen-science technologies identified through the literature and desk research, each with its number of citing papers, (ii) 115 European technology-sovereignty solutions from the techsov-catalogue.eu / EuroStack initiative, and (iii) the technology inventory compiled for D2.1. After merging duplicate entries, the consolidated catalogue holds **4,487 technologies**, from which a curated working subset of 593 entries was derived. For readability, the table below shows a representative excerpt across the main building-block layers; the complete machine-readable catalogue is provided as an accompanying spreadsheet / CSV addendum (D2.2_tec_catalogue_v008.csv, for Zenodo deposit).

TEC ID	Example of Technology	Layer	Origin	Maps to need(s)	Role - why it is representative
TEC-050	SciStarter	Discovery & community	Literature	N03 N12 N14	Project directory and volunteer-project matchmaking; reference model for RIECS discovery services.
TEC-001	iNaturalist	Data collection & crowdsourcing	Literature	N11 N03 N23	Largest biodiversity recording/identification platform; candidate data source and federation partner.
TEC-002	eBird	Data collection & crowdsourcing	Literature	N03 N11 N12	Structured-protocol species recording; reference for protocol-driven data quality.

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TEC ID	Example of Technology	Layer	Origin	Maps to need(s)	Role - why it is representative
TEC-003	Zooniverse	Data collection & crowdsourcing	Literature	N10 N27 N03	General crowdsourcing/classification platform; reference for task workflows.
TEC-012	Galaxy Zoo	Data collection & crowdsourcing	Literature	N11 N03 N23	Iconic large-scale image-classification project (built on Zooniverse); engagement model.
TEC-116	PyBossa	Data collection & crowdsourcing	Literature	N08 N11 N37	Open-source crowdsourcing framework; candidate reusable component for task pipelines.
TEC-015	Globe Observer	Data collection & crowdsourcing	Literature	N03 N23	NASA protocol-based environmental observation apps; mobile-capture reference.
TEC-051	Arduino	Community sensing & hardware	Literature	N08 N34 N18	Open-source hardware platform underpinning many low-cost DIY environmental sensors.
TEC-062	PurpleAir	Community sensing & hardware	Literature	N03 N34 N02	Community air-quality sensor network; reference for low-cost sensing and open data sharing.
TEC-4882	Smart Citizen	Community sensing & hardware	CSIC inventory	N34 (suggested)	Open-source environmental sensor and platform (Fab Lab Barcelona); European community-sensing stack.
TEC-005	GBIF	Data infrastructure	Literature	N08 N34 N02	Global biodiversity data infrastructure; target for RIECS data publication and interoperability.
TEC-881	OBIS	Data infrastructure	Literature	N34 N17	Global marine biodiversity data system; domain interoperability reference.
TEC-068	Zenodo	Repositories & recognition	Literature	N08 N34 N27	Open repository with DOI minting; candidate for RIECS outputs, datasets and citable contributor recognition.
TEC-039	OpenStreetMap	Geospatial / VGI	Literature	N11 (suggested)	Volunteered geographic information at scale; reference for community mapping and data governance.
TEC-102	Darwin Core	Standards & interoperability	Literature	N05 N14 N30	Biodiversity data-exchange standard; baseline for RIECS cross-platform interoperability.
TEC-009	BOINC	Compute & backend	Literature	N10 N21 N29	Volunteer distributed-computing platform; candidate for

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TEC ID	Example of Technology	Layer	Origin	Maps to need(s)	Role - why it is representative
					compute-donation and analysis at scale.
TEC-624	PostGIS	Compute & backend	Literature	N10 N17 N05	Spatial database extension; core backend component for geospatial services.
TEC-523	Cloud Temple	European sovereign infrastructure	European (sovereignty)	N10 N15 N09	European sovereign cloud/compute provider; candidate for RIECS hosting without non-EU lock-in (F-004/F-005).
TEC-556	GreenPT	European sovereign infrastructure	European (sovereignty)	N12 N07 N24	European AI platform; sovereign option for AI-assisted analysis and visualisation (F-007).
TEC-578	Openapi	European sovereign infrastructure	European (sovereignty)	N14 N28 N15	European API/integration marketplace; sovereign option for APIs and harvesting (I-001).
TEC-615	midPoint	European sovereign infrastructure	European (sovereignty)	N15 N08 N22	Open-source identity and access management (European); candidate for the federated AAI layer.
TEC-573	Nextcloud Hub	European sovereign infrastructure	European (sovereignty)	N08 N02 N15	European open-source collaboration and file-hosting platform; sovereign sharing and hosting.
TEC-094	Anecdata	Civic & participation platforms	Literature	N11 N03 N12	General-purpose CS data-collection/management platform; reusable across projects.
TEC-5006	FixMyStreet	Civic & participation platforms	CSIC inventory	N20 (suggested)	Open-source civic issue-reporting platform; reference for participatory reporting.
TEC-5013	Ushahidi	Civic & participation platforms	CSIC inventory	N11 (suggested)	Open-source crowdmapping / crisis-reporting platform; reusable participatory mapping.
TEC-4984	Public Lab	Civic & participation platforms	CSIC inventory	N18 (suggested)	Community open-hardware and open-science platform; DIY environmental monitoring.
TEC-4930	OpenLitterMap	Civic & participation platforms	CSIC inventory	N20 (suggested)	Gamified open litter-mapping platform with open data; engagement and open-data reference.

Table 3. Illustrative excerpt of the consolidated technology catalogue.

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4. Gap analysis

When we compare the identified needs with what the catalogue currently offers, a set of structural gaps emerges. Most existing platforms already address aspects such as discovery, data collection and quality, and they do so largely within their own silos. The remaining gaps are therefore mostly horizontal: they concern functions that need to operate across platforms rather than within a single platform. The following table highlights the gaps we have identified and how they link to requirements for the following half of the RIECS Concept project.

Gap ID	Description of the gap	Impacted users	Requirements
GAP-001	No common identity/AAI layer across citizen science platforms; participants need separate accounts per project.	all	RIECS-REQ-N-001
GAP-002	No federated, cross-domain search/directory covering European CS projects; discovery is fragmented across national portals and domain platforms.	Citizens, students, researchers	RIECS-REQ-F-001; RIECS-REQ-F-002
GAP-003	CS metadata standards (PPSR Core) have low adoption and no shared tooling; cross-platform data exchange is mostly manual.	Researchers, CS networks, technology providers	RIECS-REQ-F-009; RIECS-REQ-I-001
GAP-004	No shared, domain-neutral validation/quality-assurance service; quality mechanisms exist only inside individual platforms (e.g. eBird, iNaturalist).	Researchers, policy makers	RIECS-REQ-F-008; RIECS-REQ-F-015
GAP-005	No sustainable hosting offer for small/medium CS projects; platforms depend on project grants and institutional goodwill (cf. OpenSenseMap, Artportalen interviews).	Practitioners, NGOs	RIECS-REQ-F-004; RIECS-REQ-N-007
GAP-006	No standardised recognition/credit infrastructure for citizen contributions usable across projects and in formal contexts.	Citizens, students, education	RIECS-REQ-F-013
GAP-007	No established pipeline from citizen-generated data to policy and official statistics; quality seals and accreditation mechanisms are missing.	Policy makers, NGOs	RIECS-REQ-F-015
GAP-008	Multilingual support and accessibility are afterthoughts in existing tools, excluding non-English-speaking and low-digital-skill audiences.	Citizens, education	RIECS-REQ-N-005
GAP-009	Cross-border legal/ethics handling (GDPR interpretation, ethics approvals, data location) is unresolved for pan-European participation.	Researchers, RIs	RIECS-REQ-C-001; RIECS-REQ-C-002
GAP-010	No shared impact-assessment instruments for CS; projects cannot demonstrate value to funders and institutions in comparable terms.	All organisational actors	RIECS-REQ-F-016

Table 4. Needs and how they link to the structural gaps.

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European sovereign infrastructure options. Several of the structural gaps mentioned above *concern the infrastructure layer rather than citizen-science functionality* e.g. the absence of a sustainable hosting offer (GAP-005) and of a common identity/AAI and shared-compute layer (GAP-001). The consolidated catalogue now includes 115 European technology-sovereignty solutions; among them the sovereign cloud, compute and storage providers (e.g. Cloud Temple, StorPool Storage, Clever Cloud), European AI platforms (e.g. GreenPT) and European data/API and identity services offer credible European-controlled building blocks for these gaps. They do not in themselves close the gaps, and RIECS must still integrate, govern and sustain them, but *they make a European, digitally-sovereign implementation of the infrastructure, compute and AI layer feasible without depending on non-European providers*. These options are reflected in the candidate technologies for requirements F-004, F-005, F-007, I-001 and I-002.

5. Requirements

The work conducted until this point, brings us to determine the different requirements that should lead the further development of the project. As previously presented, we distinguish between functional, non-functional, integration and compliance types of requirements.

5.1. Functional technical requirements

We have written each requirement in a short, testable form and linked it to the needs and user stories behind it. The statements and their priorities are first drafts to be validated; the complete story-by-story traceability is in Annex A.

Req. ID	Statement	Priority	Source needs (stories)	Example technologies
RIECS-REQ-F-001	The RIECS shall provide a federated, multilingual directory of citizen science projects, events and calls, searchable by domain, location and participation mode, so that citizens, students and organisations can find and join relevant activities.	MUST	N01 (92 stories)	TEC-050 SciStarter; TEC-289 EU-Citizen.Science; TEC-001 iNaturalist
RIECS-REQ-F-002	The RIECS shall provide matchmaking between volunteers (including schools and community groups) and projects based on interests, skills, location and availability, so that recruitment reaches beyond the usual participants.	MUST	N01 (92 stories)	TEC-050 SciStarter; TEC-289 EU-Citizen.Science
RIECS-REQ-F-003	The RIECS shall provide community and collaboration spaces (fora, working groups, partner search) connecting	MUST	N02 (149 stories)	TEC-289 EU-Citizen.Science

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Req. ID	Statement	Priority	Source needs (stories)	Example technologies
	coordinators, researchers, volunteers and organisations across countries and disciplines.			
RIECS-REQ-F-004	The RIECS shall offer shared hosting for citizen science projects including data storage, repositories and basic web presence, so that projects without technical teams can operate and survive beyond their funding period.	MUST	N10 (188 stories)	TEC-068 Zenodo; TEC-340 EOSC; TEC-523 Cloud Temple [EU]; TEC-596 StorPool Storage [EU]
RIECS-REQ-F-005	The RIECS shall provide access to computing capacity (including cloud and volunteer computing) for analysis of citizen science data at scale.	MUST	N10; N28 (205 stories)	TEC-340 EOSC; TEC-009 BOINC; TEC-523 Cloud Temple [EU]; TEC-596 StorPool Storage [EU]
RIECS-REQ-F-006	The RIECS shall provide configurable data-collection tools (mobile and web) supporting offline field work, media capture, geolocation and sensor input, reusable across projects and domains.	MUST	N11 (137 stories)	TEC-003 Zooniverse; TEC-116 PyBossa; TEC-124 Sensor.Community
RIECS-REQ-F-007	The RIECS shall provide online analysis and visualisation tools, including AI-assisted processing, that let projects and participants explore, analyse and present collected data without local software.	MUST	N12 (112 stories)	TEC-003 Zooniverse; TEC-340 EOSC; TEC-556 GreenPT [EU]; TEC-520 Business Intelligence, AI and Data Science Services [EU]
RIECS-REQ-F-011	The RIECS shall provide a curated, multilingual library of training materials, protocols, templates and best-practice examples for citizens, teachers, coordinators and institutions.	MUST	N16; N29 (172 stories)	TEC-289 EU-Citizen.Science
RIECS-REQ-F-008	The RIECS shall provide data validation and quality-assurance services, expert review workflows, automated checks, calibration support and quality scoring, applicable to citizen-generated data across domains.	SHOULD	N04 (70 stories)	TEC-002 eBird; TEC-001 iNaturalist
RIECS-REQ-F-009	The RIECS shall maintain and promote shared data and metadata standards for citizen science (building on PPSR Core, Darwin Core and DCAT) and	SHOULD	N05 (76 stories)	TEC-231 PPSR Core; TEC-102 Darwin Core

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Req. ID	Statement	Priority	Source needs (stories)	Example technologies
	provide tooling that helps projects adopt them.			
RIECS-REQ-F-010	The RIECS shall record and expose provenance for contributed data, so that contributors can see how their data are stored, validated and used, and data users can assess origin and processing history.	SHOULD	N06 (67 stories)	TEC-005 GBIF
RIECS-REQ-F-013	The RIECS shall provide recognition mechanisms, contribution records, certificates and citable acknowledgement, that credit citizen contributions in scientific outputs and beyond.	SHOULD	N19 (73 stories)	TEC-068 Zenodo
RIECS-REQ-F-014	The RIECS shall provide feedback channels that close the loop with participants: notifications on how contributed data were used, project result summaries, and participation statistics.	SHOULD	N20 (78 stories)	TEC-002 eBird; TEC-001 iNaturalist
RIECS-REQ-F-015	The RIECS shall provide policy-facing interfaces, quality seals, evidence summaries and integration paths with official statistics, that make citizen-generated evidence usable by policy-makers.	SHOULD	N25 (53 stories)	TEC-005 GBIF
RIECS-REQ-F-016	The RIECS shall provide impact-assessment tooling, indicators, instruments and reporting templates, for measuring the scientific, educational and societal impact of citizen science activities.	SHOULD	N26 (69 stories)	- (no established catalogue technology; candidate for custom development)
RIECS-REQ-F-017	The RIECS shall support outreach and public-engagement formats (campaigns, school programmes, science-literacy resources) that bring new and under-represented audiences into citizen science.	SHOULD	N18 (81 stories)	TEC-289 EU-Citizen.Science
RIECS-REQ-F-012	The RIECS shall provide support services, helpdesk, peer-to-peer exchange, expert and organisation databases, and proposal-writing support, for projects at all stages.	COULD	N17 (47 stories)	TEC-289 EU-Citizen.Science

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Req. ID	Statement	Priority	Source needs (stories)	Example technologies
RIECS-REQ-F-018	The RIECS shall enable cross-domain data linkage and transdisciplinary collaboration, allowing datasets and methods from different domains (e.g. climate, biodiversity, health) to be combined.	COULD	N27 (43 stories)	TEC-005 GBIF; TEC-340 EOSC

Table 5. List of functional requirements.

5.2. Non-functional requirements

The list of non-functional requirements does not have specific technologies attached to it. Instead, these requirements imply the need to consider different design solutions that could have a significant effect on the success of RIECS.

Req. ID	Statement	Priority	Source needs (stories)	Example technologies
RIECS-REQ-N-001	Federated identity and access management. The RIECS shall implement a federated identity and access management layer (AAI), enabling single sign-on across federated services with pseudonymous participation options.	SHOULD	N15 (44 stories)	-
RIECS-REQ-N-002	Modular and federated architecture. The RIECS shall follow a modular, federated architecture in which services can be adopted independently, components can evolve separately, and national/domain nodes retain autonomy.	SHOULD	N15 (44 stories)	-
RIECS-REQ-N-006	Security by design. The RIECS shall implement security by design: secure transport, role-based authorisation, auditing, and vulnerability management across all federated components.	SHOULD	N15 (44 stories)	-
RIECS-REQ-N-003	Performance and scalability. The RIECS shall scale to pan-European usage: growing numbers of users, projects, observations and data volumes, including campaign peaks, without degradation of service.	COULD	N28 (24 stories)	-

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Req. ID	Statement	Priority	Source needs (stories)	Example technologies
RIECS-REQ-N-004	Usability for non-expert users. The RIECS user interfaces shall be usable by non-experts: plain language, mobile-friendly, low-bandwidth tolerant, and co-designed with target user groups.	SHOULD	N13 (62 stories)	-
RIECS-REQ-N-005	Accessibility and inclusion standards. The RIECS shall meet accessibility and inclusion standards: WCAG 2.2 AA minimum, multilingual operation, and explicit support paths for users with limited digital skills or resources.	MUST	N03 (100 stories)	-
RIECS-REQ-N-007	Maintainability and operational sustainability. The RIECS shall be designed for maintainability within a realistic operational cost envelope: open-source preference, documented components, deprecation policy and exit strategies.	SHOULD	N22 (69 stories)	-

Table 6. List of non-functional requirements.

5.3. Integration and compliance requirements

A final group of requirements concerns integration with existing systems and compliance with relevant standards and conventions.

Req. ID	Statement	Priority	Source needs (stories)	Example technologies
RIECS-REQ-I-001	Integration with existing citizen science platforms and repositories. The RIECS shall integrate with existing citizen science platforms and repositories through open APIs and harvesting interfaces, connecting (not replacing) national portals, domain platforms and tools.	SHOULD	N14	TEC-001 iNaturalist; TEC-005 GBIF; TEC-289 EU-Citizen.Science; TEC-340 EOSC; TEC-578 Openapi [EU]; TEC-540 EUcalls – European Innovation Funding & Partner Matching Platform [EU]
RIECS-REQ-I-002	Interoperability with EOSC and ESFRI RIs. The RIECS shall be interoperable with EOSC and relevant ESFRI research infrastructures, publishing its resources through	MUST	N14, N08	TEC-340 EOSC; TEC-523 Cloud Temple [EU]; TEC-596 StorPool Storage [EU]

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Req. ID	Statement	Priority	Source needs (stories)	Example technologies
	EOSC-compatible interfaces and metadata.			
RIECS-REQ-C-001	GDPR-compliant personal data handling. The RIECS shall implement GDPR-compliant handling of personal data: granular consent management, data minimisation, right-to-erasure support, and clear data-controller arrangements for federated services.	SHOULD	N07	-
RIECS-REQ-C-002	Data ownership, licensing, and sensitive data handling. The RIECS shall provide clear, machine-readable data-ownership and licensing arrangements for contributed data, including handling of sensitive data (e.g. health, endangered-species locations).	SHOULD	N07, N09	-
RIECS-REQ-C-003	FAIR, Open Science and CARE-aligned practices. The RIECS shall operate FAIR and Open Science by default: open licences, persistent identifiers, open formats, and CARE-aligned practices for community-held data.	MUST	N08	-
RIECS-REQ-C-004	European public governance and digital sovereignty safeguards. The RIECS shall be operated under European public governance with digital sovereignty safeguards: public control of core infrastructure, EU hosting of core data, and no lock-in to non-European proprietary services.	COULD	N09	-

Table 7. List of integration and compliance requirements.

6. Mapping to feasible technologies

We map the functional and integration requirements to candidate components from the catalogue. A single component can cover several requirements. The risks and alternatives listed here are first notes, not final decisions as the project will explore this during its second half.

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A note on the European technology-sovereignty solutions. The Tech Sovereignty Catalogue consists predominantly of enterprise IT products (sovereign cloud and compute, cybersecurity and identity, AI and automation, and data/API services). These map cleanly onto the RIECS infrastructure, compute, AI and integration layer, but not onto the citizen-science-specific functional requirements (e.g. project discovery, data collection, recognition, feedback), where the relevant building blocks remain the citizen-science platforms identified through the literature. European sovereign solutions are therefore listed as candidates only for the infrastructure, compute, AI and interoperability requirements (F-004, F-005, F-007, I-001, I-002), where they offer a genuine European alternative to non-European hosting, compute and AI services; for the remaining functional requirements the candidate components are the established citizen-science tools.

Req. ID	Example technologies
RIECS-REQ-F-001	TEC-050 SciStarter; TEC-289 EU-Citizen.Science; TEC-001 iNaturalist
RIECS-REQ-F-002	TEC-050 SciStarter; TEC-289 EU-Citizen.Science
RIECS-REQ-F-003	TEC-289 EU-Citizen.Science
RIECS-REQ-F-004	TEC-068 Zenodo; TEC-340 EOSC; TEC-523 Cloud Temple [EU]; TEC-596 StorPool Storage [EU]
RIECS-REQ-F-005	TEC-340 EOSC; TEC-009 BOINC; TEC-523 Cloud Temple [EU]; TEC-596 StorPool Storage [EU]
RIECS-REQ-F-006	TEC-003 Zooniverse; TEC-116 PyBossa; TEC-124 Sensor.Community
RIECS-REQ-F-007	TEC-003 Zooniverse; TEC-340 EOSC; TEC-556 GreenPT [EU]; TEC-520 Business Intelligence, AI and Data Science Services [EU]
RIECS-REQ-F-008	TEC-002 eBird; TEC-001 iNaturalist
RIECS-REQ-F-009	TEC-231 PPSR Core; TEC-102 Darwin Core
RIECS-REQ-F-010	TEC-005 GBIF
RIECS-REQ-F-011	TEC-289 EU-Citizen.Science
RIECS-REQ-F-012	TEC-289 EU-Citizen.Science
RIECS-REQ-F-013	TEC-068 Zenodo
RIECS-REQ-F-014	TEC-002 eBird; TEC-001 iNaturalist
RIECS-REQ-F-015	TEC-005 GBIF
RIECS-REQ-F-017	TEC-289 EU-Citizen.Science
RIECS-REQ-F-018	TEC-005 GBIF; TEC-340 EOSC
RIECS-REQ-I-001	TEC-001 iNaturalist; TEC-005 GBIF; TEC-289 EU-Citizen.Science; TEC-340 EOSC; TEC-578 Openapi [EU]; TEC-540 EUcalls – European Innovation Funding & Partner Matching Platform [EU]

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Req. ID	Example technologies
RIECS-REQ-I-002	TEC-340 EOSC; TEC-523 Cloud Temple [EU]; TEC-596 StorPool Storage [EU]

Table 8. Example technologies mapped to each requirement.

With this list of requirements in mind it is possible to proceed with a candidate RIECS technology-stack as part of D2.3.

7. Ethics, GDPR and accessibility

For further discussion about ethics approvals, Deliverable D1.5 includes the Data Management Plan (DMP) to observe the legal basis and retention to be completed by project management. Compliance requirements RIECS-REQ-C-001…004 above carry the technical translation of these obligations.

8. Input to T2.3: preliminary catalogue of services, resources and functionalities

Each MUST requirement is assigned a target catalogue family for D2.3. Non-technical needs route to D2.3 with shared Aspect IDs.

Req. ID	Priority	Target catalogue family in D2.3
RIECS-REQ-F-001	MUST	Discovery and findability services
RIECS-REQ-F-002	MUST	Discovery and findability services
RIECS-REQ-F-003	MUST	Engagement and community services
RIECS-REQ-F-004	MUST	Data and metadata services
RIECS-REQ-F-005	MUST	Cross-cutting policy: scalability; Data and metadata services
RIECS-REQ-F-006	MUST	Software and tooling resources
RIECS-REQ-F-007	MUST	Data and metadata services
RIECS-REQ-F-011	MUST	Knowledge and training resources; Training and capacity-building services
RIECS-REQ-I-002	MUST	Cross-cutting policy: FAIR and Open Science; Integration services
RIECS-REQ-N-005	MUST	Cross-cutting policy: accessibility and inclusion
RIECS-REQ-C-003	MUST	Cross-cutting policy: FAIR and Open Science

Table 9. Requirements mapped to their target D2.3 catalogue family.

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9. Discussion: from analysing the evidence to designing the infrastructure

9.1.A methodological reflection

The production of this deliverable was itself illustrative of the data-intensive analysis that RIECS may need to support. Translating the engagement evidence into technical requirements required processing 823 user stories collected through the project's workshops (796 in-scope once rejected items were removed, and 793 analysable after removing 3 duplicates), together with the reconciliation of a consolidated catalogue of 4,487 technologies drawn from two heterogeneous sources: the citizen-science literature and a European technology-sovereignty catalogue. Neither task could have been performed reliably by manual review alone within this short period of time.

To process this material at the required scale, a set of purpose-built tools was developed. These supported the scraping and normalisation of the European catalogue, the consolidation and de-duplication of the technology inventory, the clustering of needs from label co-occurrence across the user stories, and the mapping of technologies to needs. AI-assisted text processing was used to transform heterogeneous inputs into a structured evidence base suitable for analysis and translation into requirements.

These tools were deployed as a co-analyser operating under human direction rather than as a first-producer. In this hybrid approach, all their outputs, namely labels, summaries and technology-to-need mappings, were reviewed by the responsible partners before use. Morever, all the outputs and the analysis as a whole remains subject to consortium validation, project reviewers' feedback and, more importantly, community interactions for improvement, endorsement or rejection.

This experience carries a design lesson for RIECS. The tools were not turnkey solutions; they required data-engineering, text-processing and domain expertise to build, configure and, above all, validate. Automated technology-to-need mapping, for instance, occasionally produced high-confidence but incorrect matches errors (for example, cybersecurity "detection" conflated with project "discovery", or image "recognition" conflated with contributor "recognition and credit") that only domain expertise could detect and correct. The most effective approach was therefore mixed with human-in-the-loop: automation managed scale, while expert review defined the analytical logic, interpreted the outputs and corrected misleading classifications. The decisive resource was not software alone but the combination of appropriate tooling, transparent methods and the expertise to apply them responsibly.

9.2.The emerging role of RIECS

That situation closely reflects the challenges faced by the citizen-science communities that RIECS is intended to support. The engagement evidence already points in this direction through needs related to data collection and crowdsourcing tools (N11), analysis, visualisation and decision support (N12), usability for non-experts (N13), and the training

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and support needed to use them (N16, N17). The experience of producing this deliverable reinforces that message: many citizen-science projects cannot be expected to assemble, maintain, and validate the data-engineering and analytical capacity required to work with large-scale, heterogeneous data. his synthesis itself could not have been completed without developing dedicated tools and applying specialist expertise.

The implication for the second half of the project is that shared services for data collection, visualisation, analysis and decision support - increasingly AI-assisted - should be considered as core components of the RIECS infrastructure, rather than only cataloguing the tools that already exist. The aim would not be to replace community expertise but to make it reusable: to let a project collect, visualise and analyse its data on shared, well-supported services instead of rebuilding a stack from scratch, and to lower the expertise barrier that currently keeps advanced data work out of reach of many communities.

9.3.Direction for phase 2

Three implications follow for the revisiting of priorities in the second phase:

1. Make shared data tooling a design track, not just a catalogue entry. A thin "collect → visualise → analyse" service, prototyped end-to-end, would test the value of RIECS providing analytical capability rather than only connecting existing platforms.

2. Design it human-in-the-loop by default. The experience of automation that is powerful but fallible, and the trust findings running through the engagement evidence, argue for a workflow where the system proposes and a person validates, with provenance and correction built in rather than bolted on.

3. Budget for expertise and for sovereignty. The usefulness of any such service depends on documentation, templates, helpdesk and capacity-building as much as on code; and the European sovereign compute and AI options now in the catalogue (see the gap analysis) make it feasible to pursue scale without surrendering control of the data.

The above is a reflective, deliberately speculative note rather than a validated requirement. It is offered to inform the second-phase discussion on where RIECS should invest: in this reading, the way the analysis had to be done is itself an early piece of evidence that RIECS should help citizen-science communities produce knowledge from data and not only find the tools to do so.

10. Conclusions and open technical issues

To conclude with this deliverable, it is worth listing the main findings and how the work were presented with link to other tasks and deliverables.

10.1. Key findings

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- The evidence keeps pointing to a federated architecture: a shared identity layer (AAI), a common metadata layer, a single way in for discovery, and services that existing platforms can adopt one piece at a time.
- What people ask for most is simple / straight forward solutions to direct needs: reliable hosting, storage, standards and quality assurance that keep working after the original project funding is gone.
- The quality of the experience for the citizens themselves as in recognition, feedback, and accessibility, is a category of requirements in its own right, and it comes mostly from the citizen evidence in D4.2.
- None of the existing platforms covers the horizontal gaps (GAP-001…010) in full, and this is exactly where the RIECS can add value.
- The 11 MUST requirements form the Tier-1 core that we carry forward into D2.3.

10.2. Open technical issues, handover to WP3 (via D2.3)

Aspect ID	Open technical issue	Primary target	Cross-ref
WP3-01	Refine MUST technical requirements into operational specifications	T3.2 / D3.2	D2.3 - WP3-01
WP3-02	Define non-technical requirements (organisational, social, educational) that complement D2.2	T3.1 / D3.1; T3.2 / D3.2	D2.3 - WP3-02
WP3-03	Data and metadata compliance with the EU framework; cross-border legal clarity for participation and data flows	T3.3 / D3.3	D2.3 - WP3-03
WP3-04	Governance model: participatory decision-making, public-resource status, funding and sustainability strategy	T3.4 / D3.4	D2.3 - WP3-04
WP3-05	Technical integration feasibility study for the federated architecture and platform integrations	T3.5 / D3.5	D2.3 - WP3-05
WP3-06	Impact-assessment framework for the deployment phase, building on the impact	T3.6 / D3.6	D2.3 - WP3-06

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Aspect ID	Open technical issue	Primary target	Cross-ref
	needs evidenced in engagement		

Table 10. Open technical issues handed over to WP3 via the Aspect IDs.

10.3. Measurement and evaluation issues, handover to T3.6

At M18 we could not yet define success metrics for a few things: recognition (what should count as meaningful credit), retention (how long we want each audience to stay engaged), data-quality service levels per domain, how to prioritise different types of stakeholders during the analysis, and indicators for policy uptake. These will need KPIs and baselines, to be designed in T3.6 (Aspect WP3-06) and measured in WP5.

10.4. Next steps

The next steps are to consolidate everything into D2.3, and to start WP3 at M19 using Aspects WP3-01…06 as the agenda.

11. References

[1] RIECS-Concept proposal (GA 101188210), 2024.

[2] RIECS-Concept Deliverable D4.1 Engagement methodology protocol, v1.1, AE/OeAD, M6. https://concept.riecs.eu/deliverables/

[3] RIECS-Concept Deliverable D2.1 Challenges assessment, CSIC, M6. https://concept.riecs.eu/deliverables/

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Annex A. Requirements traceability matrix

Machine-readable matrix linking every requirement to source needs, the complete set of source stories, gaps, candidate technologies and WP3 routing: D2.2_traceability_annexA_v006.csv.

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