**Research Infrastructure Technology Infrastructure for Impact**

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RITIFI

Research Infrastructure
Technology Infrastructure
For Impact

**Deliverable Report:**

# D4.4 White paper on project recommendations and findings

**Project Deliverable Information Sheet**

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# White paper on project recommendations and findings

## Executive summary

The RITIFI project (Research Infrastructure and Technology Infrastructure For Impact) offers one of the most comprehensive analyses to date of the European landscape of Research Infrastructures (RIs) and Technology Infrastructures (TIs). Spanning 19 countries and five strategic sectors—Biomedical, Clean hydrogen, Circular materials economy, Accelerators and superconducting magnets, and Microelectronics—the project assessed infrastructure needs, governance models, and policy frameworks, and developed recommendations to enhance Europe's research and innovation (R&I) system.
RIs and TIs are complementary pillars of the R&I ecosystem: RIs drive scientific excellence, while TIs support innovation closer to market. Yet challenges remain, including limited policy recognition of TIs, fragmented governance, and funding gaps across the infrastructure lifecycle.

This white paper is structured around three thematic pillars:

1. **Status Quo** – Provides a shared understanding of RI and TI definitions, business models, and collaboration modes, while identifying key systemic barriers.
2. **Policy Landscape** – Presents a cross-country inventory of EU and national policy instruments, highlighting persistent gaps in funding, coordination, and governance.
3. **Pathways for Impact** – Outlines five strategic pathways to enhance RI–TI integration, long-term investments planning, impact, access, and talent development.

The findings are based on 18 case studies, stakeholder consultations, and policy analyses. They point to the urgent need for a European policy framework for TIs—one that ensures alignment with industrial priorities and complements RI strategies. By acting on these recommendations, Europe can reinforce its innovation capabilities, industrial resilience, and technological sovereignty.

## Setting the scene

**Research Infrastructures (RIs) and Technology Infrastructures (TIs) are both essential and complementary elements for functional and efficient R&I ecosystems in Europe**. They play a crucial role in strengthening European R&I capacities, from exploratory research to the development, validation and integration of innovative knowledge-based solutions into new products, processes and services.

**The RITIFI consortium,** composed of RI and TI stakeholders from 19 European countries, aimed to improve the integration and structure of the European R&I landscape. It has done so by:

- Developing a functional framework for the integration of RI and TI services tailored to the needs of end-users.

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- Providing guidelines and methods to improve the visibility and access conditions of RI and TI to end-users
- Developing an agile and TI-friendly governance model at European level;
- Providing a comprehensive and multi-level analysis of the RI and TI policy landscape and proposing an action plan to ensure alignment and synergies of access policies;
- Developing a process for prioritisation and synergies of investment plans for RI and TI sustainability;
- Raising awareness and stimulating the inclusive engagement of managers, users and policy makers in the development of an integrated RI and TI landscape.

The project focuses on five thematic areas:

- Biomedical
- Clean hydrogen
- Circular materials economy
- Accelerators and superconducting magnets
- Microelectronics.

**The project has followed a 4-phase methodology**: 1) the validation of RI and TI concepts to ensure a common understanding, 2) development of a strategic analysis of the TI landscape and a strategic analysis of the integrated RI and TI landscape in 5 selected areas; 3) Based on the information gathered and extended beyond the selected areas, recommendations to policy makers and the RI-TI community have been drafted; 4) in parallel, the project has engaged with the community from the beginning, creating awareness, promoting knowledge sharing, validating results and encouraging adoption.

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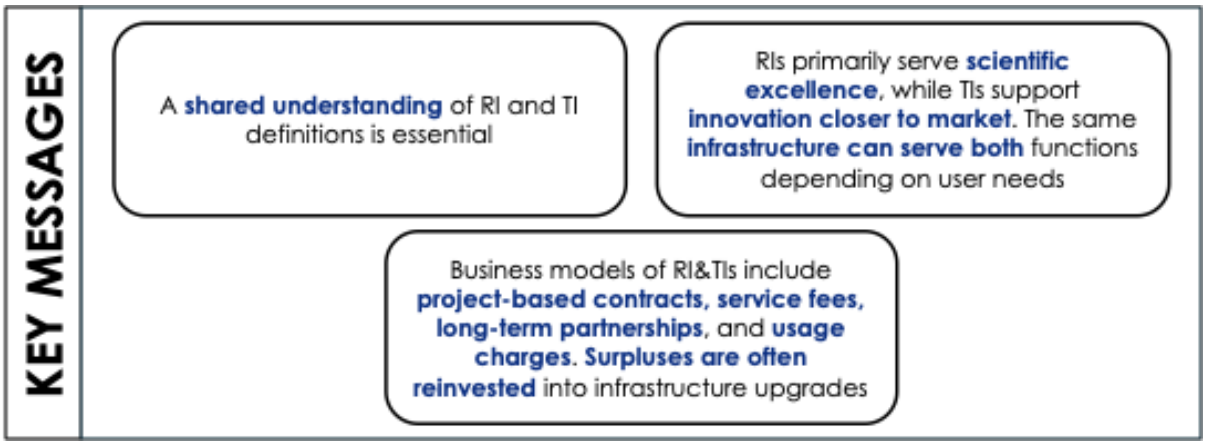
# Part 1: RIs and TIs in the European R&I ecosystem

## 1.1 Definitions & business models




**Definition**

"Research infrastructures" (RI) and "technology infrastructures" (TI) are two conceptual terms with different acknowledgment in the EU and in the Member States. This task (RITIFI Deliverable 1.1 ) aimed to collect definitions and criteria used to define RIs and TIs in different Member States and in the EU with the purpose of establishing a common set of criteria and a common vocabulary to define RIs and TIs.

The term "Research Infrastructure" has been an integral part of the EU Framework Programmes for Research and Innovation for decades, whereas "Technology Infrastructure" was formally defined by a European Commission staff working document in 2019[1]. Nevertheless, TIs have a range of common features, there is a conceptual recognition of the term, and the term is used in a number of EU documents with various degrees of strictness in the definitions.

The fact that the same infrastructure can be used as both RI and TI, sometimes simultaneously, suggests that the definition should rather focus on the main purpose of the infrastructures and the type of user needs being addressed. **If the user needs are mainly scientific, i.e., the user main aim lies in advancing the scientific frontier, then the infrastructure is used as an RI. If, on the other hand, the user needs lie more towards taking an innovation closer to market, then the infrastructure is used as a TI.**

Our work provided background material for the definition of the Expert Group on Technology Infrastructures (EGTI)[2]: "*Technology Infrastructures are facilities, equipment, capabilities and*

[1] *Technology infrastructures – Commission staff working document*, Publications Office, 2019, **https://data.europa.eu/doi/10.2777/83750**

[2] European Commission: Directorate-General for Research and Innovation, *Towards a European policy for technology infrastructures – Building bridges to competitiveness*, Publications Office of the European Union, 2025, **https://data.europa.eu/doi/10.2777/0876395**

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*resources required to develop, test, upscale and validate technology. They enable and accelerate technological innovations towards societal/market adoption, fostering industrial competitiveness. They provide a wide range of capacities and services from pre-competitive applied research services, through demonstration and validation of technology, up to small-scale production. They include, amongst others, test beds, demonstration and testing facilities, pilot lines or living labs, usually embedded within non-profit research and technology organisations, universities active in technology fields or technology centres, which are open to private and public users. They can be public, semi-public or privately owned, physical or digital*." (February 2025)

Technology Infrastructures are typically managed and hosted by RTOs and technical universities, while Research Infrastructures (RIs) are usually stand-alone organisations with a separate legal status, or managed and hosted by Public Research Organisations (including universities). There are various examples of co-ownership models, including partnerships between Research and Technology Organisations (RTOs) and applied science universities. One such example is the SEEL infrastructure, which is jointly owned by RISE (holding 50.5% of the shares) and Chalmers University of Technology (holding 49.5% of the shares).

**Business model**

**Most RI/TIs, are funded through a combination of public funding sources ("public-public" funding mix)**. These typically include ad-hoc government grant or (competitive) regional/national programme funding, RI/TI operator's base funding, and other sources e.g., at EU or international levels (e.g., ERDF, TEFs, OITBs). Some infrastructures of smaller scale (mostly place-based TIs) can be fully funded by regional public funds.

Naturally, the R&I activities provided tend to span across a wide range of dimensions, varying from a strong focus on pre-competitive research, to activities aimed at supporting technology adoption by industry users. Some of these infrastructures also provide close-to-market services to industrial users, including product demonstration and testing, experimentation, validation, measurement and certification (support) activities.

The main types of revenue models include ad-hoc contract R&D project-base models (usually short-term), service fee or infrastructure usage/charge models, long-term collaboration arrangements between users and operators, residency models, and monthly access models. Most RI/TIs are not allowed to generate profits, and those that make surpluses often re-invest those as CapEx into the infrastructure (e.g., Bioruukki Pilot Centre).

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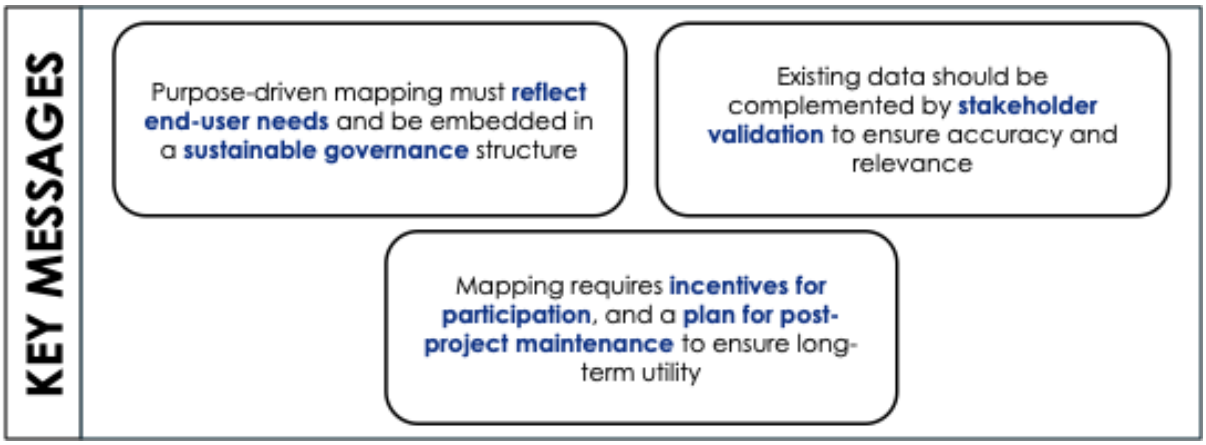
## 1.2 Lessons learned from the infrastructure mapping exercise




The key factors to be considered when carrying out the mapping are listed below.

| | |
|---|---|
| **Purpose of the pilot mapping exercise and how it is intended to be used** | This will influence the criteria to be mapped, including the level of details to be provided. The features of an information repository are closely linked to the varied requirements of its users. |
| **Long-term sustainability** | A structural anchor through the uptake by existing structures (e.g., European Partnerships) should be preferred to a static project-based data repository. This would enable to leverage the dynamic nature of the mapping, which requires regular updates and maintenance to keep it up to date. Considering that this mapping is being developed within the context of a Horizon project, a strategy for post-EU funding is proposed to ensure its long-term sustainability. |
| **Governance framework** | Having the appropriate stakeholders involved in the governance framework is crucial for contributing to the design and review of the data collected, ensuring that the scoping criteria are properly fulfilled by the mapped entity and fostering the coherence of the exercise. In the scope of the mappings carried out in the RITIFI project this can be ensured by the RIs and TIs providers involved in the consortium, possibly together with members of the initiatives that could ensure their long-term sustainability (e.g. Partnerships). |
| **Collecting data from existing sources to be refined by stakeholders' involvement** | The starting point for the inventories will entail collecting and leveraging existing/previous mappings and inventories at EU, national and regional levels. Based on this, stakeholders need to be contacted to refine and complete the mapping – for that the support of existing networks and structures (multipliers) would be essential for a broader coverage. However, stakeholders are often reluctant to engage in such exercises, as they may not see the direct benefit for themselves or the added value of investing time in filling in surveys. To overcome this and the associated fatigue, strong incentives are needed, particularly by ensuring that the results have a clear long-term use and purpose. |

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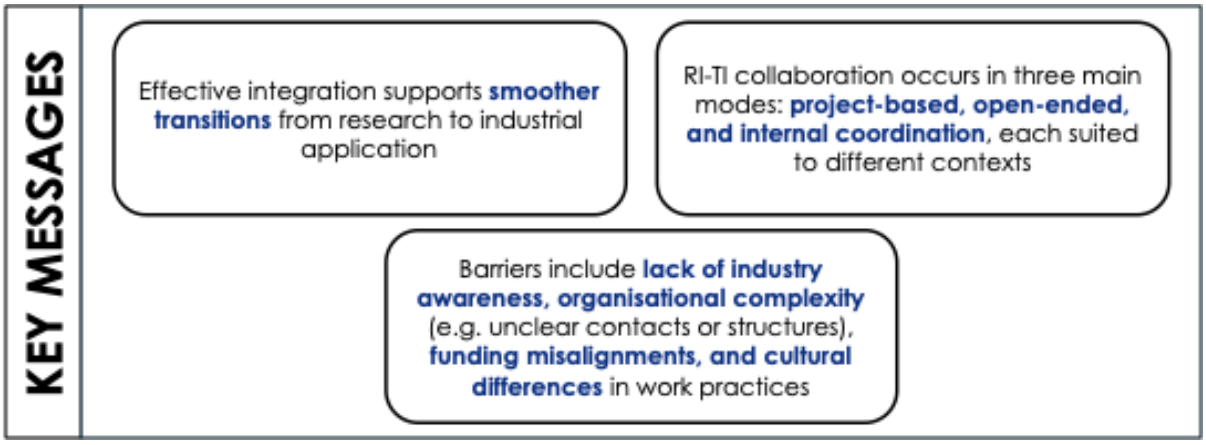
### 1.3 RI-TI collaboration & integration




We can distinguish three "modes" of collaboration between RIs and TIs:

| **Project-based formal consortia coming together to jointly support industry** | **Open-ended collaboration, either in consortia or bilateral, to connect the research base with industry** | **Collaborations where TIs support RIs or v.v. – without an explicit remit to support industry** |
|---|---|---|
| TEESMAT, ReMade EU and ASCENT+ are prime examples of this mode of collaboration. Inherent in this type of collaboration is its limited lifetime (as projects by definition come to an end) and its explicit focus on industry as the beneficiary. | Examples of this mode include Hydrogen Europe and Hydrogen Europe Research; and the collaboration between VTT and Aalto University in the Bioeconomy RI. These collaborations do not necessarily have a defined lifetime and may have a broader (and potentially vaguer) remit. | The case study on particle accelerators and the Fraunhofer/ESRF case study in the circular materials area are good examples of this. This mode is essentially an internal mechanism to increase the efficiency of RI and TI operations. |

The boundaries between these modes are porous: e.g., project-based consortia can continue after the project as open-ended collaborations, while internal collaborations will build trust and familiarity that will make both project-based and open-ended collaborations easier and more fruitful. Nor is any one mode superior to others: different modes suit different use cases and partners. **Nevertheless, it is important to recognise that a healthy RI-TI ecosystem requires a mixture of all these collaboration modes, with room to move facilities and activities between them when required**.

Although each sector and each mode of collaboration is different, there are some barriers to collaboration that are consistently mentioned (albeit in different forms) across the case studies:

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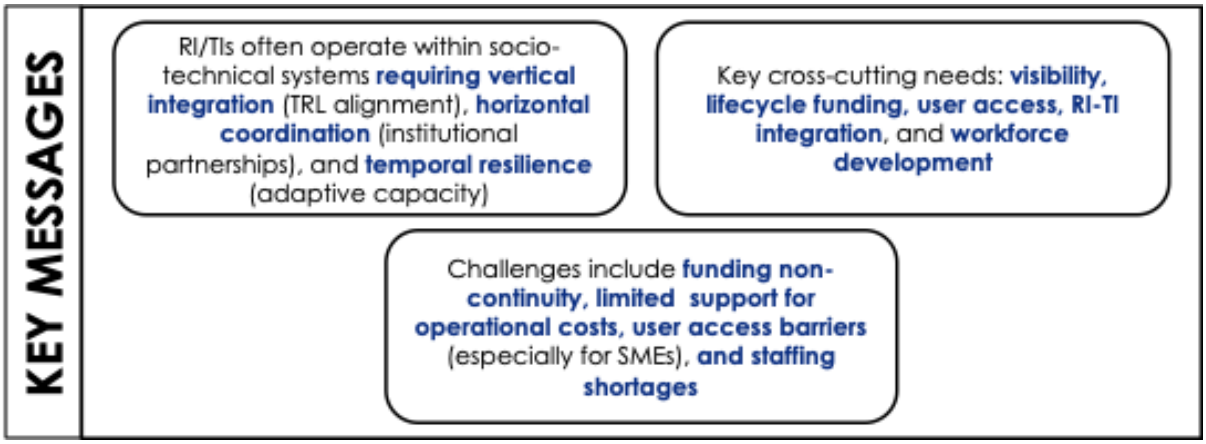
| Barrier | Description |
|---|---|
| **Knowledge of needs in industry** | While some companies are highly knowledgeable about the technologies and expertise that RIs and TIs can offer, there are many companies that do not know what expertise they need or do not have the right skills to interpret results. This is exacerbated by companies having a 'blind spot', where they are not aware or willing to acknowledge these gaps in their knowledge. |
| **Organisational complexity** | There are too many different structures and processes within TIs and RIs, which need to be navigated and aligned in different projects. This complexity slows down and complicates collaborations from being initiated altogether, especially if the right contact points are not identified. For instance, in interviews conducted within the project it was noted that some academic infrastructures maintain extensive websites outlining their scientific capabilities but lack clear information on how to engage in partnerships with industry. This lack of clarity particularly around contact persons and service accessibility can deter companies from pursuing collaborations, especially across borders, as they struggle to navigate fragmented systems. |
| **Funding of access** | Infrastructures are mainly funded from national and regional sources. The nature of European funding limits access to transnational projects (i.e., companies can only access infrastructure in other countries) and existing regional and national funding mechanisms for users (companies) have limitations to use public funding outside the region/country. |
| **Ways of working** | There is a cultural difference between projects that address immediate challenges from individual companies and projects that develop speculative solutions for collective challenges. While these cultural differences do not necessarily manifest between TIs and RIs (both infrastructures work on both types of research), they can cause friction between project teams within a collaboration, making it harder to achieve impact – and thus, to make the case for collaboration. |

## 1.4 Challenges & needs in the RI-TI lifecycle




Research and Technology Infrastructures are embedded within larger socio-technical systems. Their needs cannot be understood solely through internal performance metrics or cost-efficiency assessments. They must be framed through three interdependent system logics:

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- **Vertical Integration**: TIs must connect with upstream Research Infrastructures and downstream industrial ecosystems in a coherent TRL continuum.
- **Horizontal Coordination**: RI&TIs must align with other institutional actors (universities, industrial alliances, funding bodies) to generate collective capacity.
- **Temporal Resilience**: RI&TIs must evolve across time, adapting to shifting technological paradigms, policy missions, and industrial trajectories.

**RI&TI needs must therefore be analysed as systemic failures in the design, implementation, or governance of instruments that should deliver these three functions.** The analysis identified **five cross-cutting categories of needs**, validated across sectors and geographies:

| Need | Description |
|---|---|
| **1. Institutional visibility** | TIs lack formal recognition in EU R&I strategic frameworks, resulting in weak governance and limited funding coherence. |
| **2. Lifecycle investments** | Funding mechanisms fail to cover the full lifecycle of RI&TI operations, from CAPEX to upgrades, creating instability and planning bottlenecks. |
| **3. Access and user orientation** | Procedural complexity and service opacity hinder engagement, particularly among SMEs and cross-border users. |
| **4. RI-TI integration** | Functional disconnects between RIs and TIs obstruct the TRL continuum and reduce innovation throughput. |
| **5. Workforce and skills** | Talent shortages and insufficient training capacity undermine RI&TI functionality and strategic adaptability. |

The main challenges **related to the planning and upgrade** phase of these infrastructures include:

- The lack of predictability and stability of public funding and the difficulties in combining funds, which makes it difficult to adopt a long-term perspective for sound business models.
- Lack of public funding to cover operational costs while used in projects activities or insufficient revenues to cover their cost.
- Difficulties faced by the users (particularly SMEs) in accessing the facilities.
- One of key challenges underpinning the provision of (non-)R&I activities identified by RIs/TIs is the lack of experienced staff to provide such activities.

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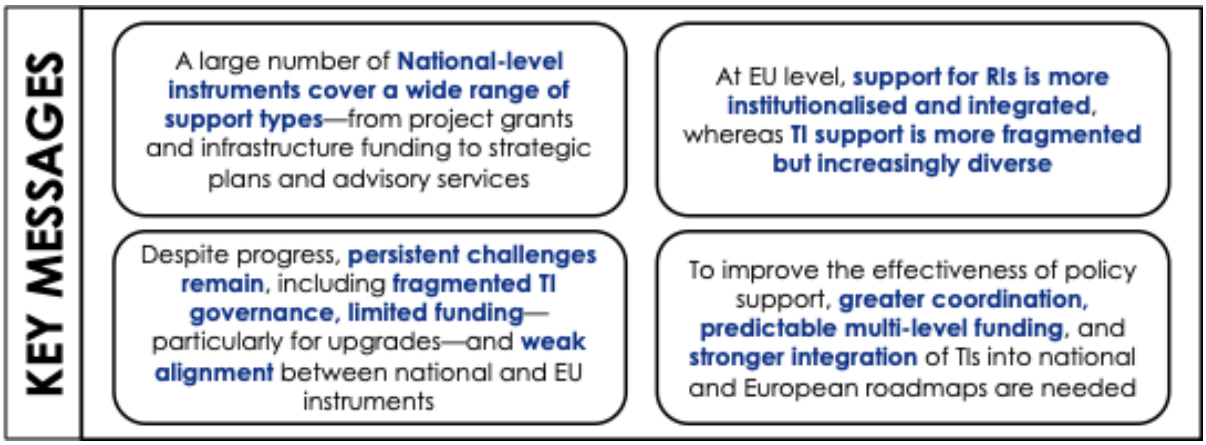
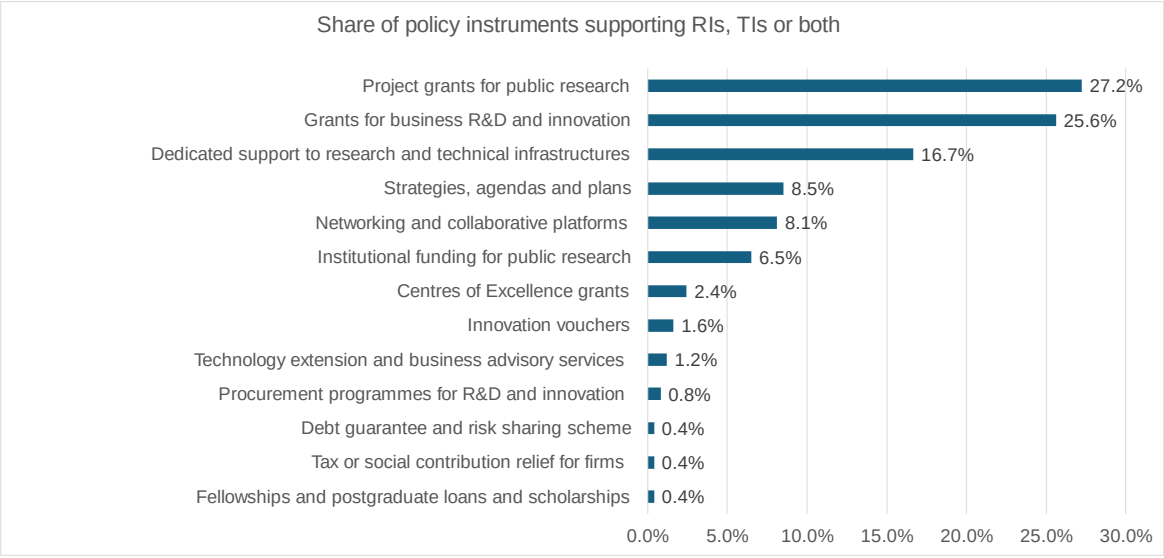
# Part 2: RIs and TIs in the policy landscape

## 2.1 Policies and programmes supporting RIs and Tis




**A total of 167 national-level instruments were identified, with the most common types being project grants for public research (67), grants for business R&D and innovation (63), and dedicated support to research and technology infrastructures (41)**. These are followed by a mix of strategies, institutional funding, collaborative platforms, Centres of Excellence grants, and more targeted schemes such as innovation vouchers, procurement programmes, and advisory services. Importantly, many instruments serve multiple policy functions simultaneously and have therefore been classified under more than one category.

*Figure 1 Overview of national level instruments by their type*




**At the EU level, support for RI is more institutionalised and integrated, with Horizon Europe, ESFRI, and ERICs forming the core pillars of a structured and long-term approach**. RI funding tends to rely on public investment and serves scientific communities. Conversely, TIs benefit

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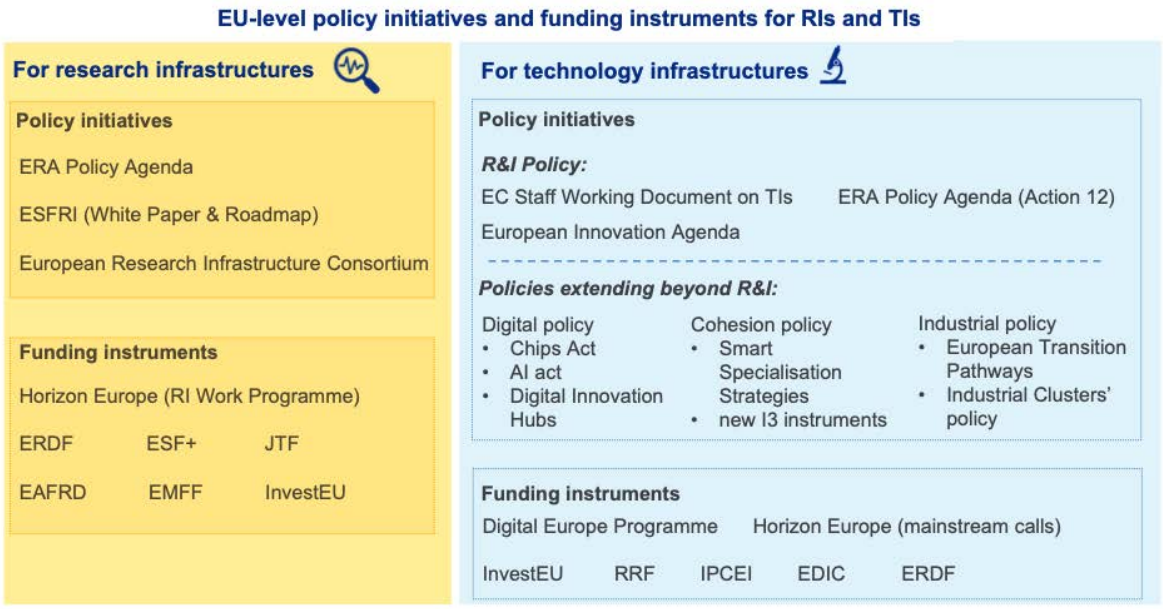
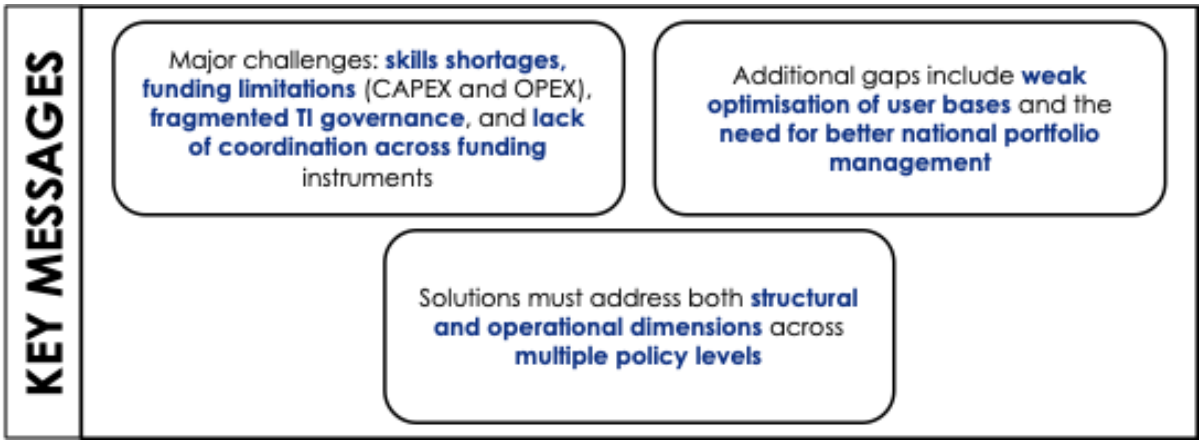
from a more varied and decentralised set of instruments, many of which operate under public-private partnership models and target industry needs. EU programmes such as Open Innovation Testbeds (OITBs), Testing and Experimentation Facilities (TEFs), the Chips Pilot Lines, Important Projects of Common European Interest (IPCEIs), and InvestEU can play important roles in this ecosystem.

*Figure 2 EU-level policy initiatives and funding instruments for RIs&TIs*




**Overall, the policy landscape analysis points to persistent challenges, including fragmented TI governance, limited availability of operational (OPEX) and capital (CAPEX) funding (scale), especially for upgrades, insufficient coordination between national and EU funding schemes, and skill shortages affecting long-term sustainability**. Best practices examples to address these challenges include effective and efficient combination of funding streams, and dedicated national strategies explicitly targeting RIs and/or TIs in some EU countries.

## 2.2 Policy gaps & challenges

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The challenges and gaps related to RI and TI policy landscape were discussed during a dedicated expert co-creation workshop. The main identified and discussed challenges & gaps are presented in the table below.

| Challenges & Gaps | Description |
|---|---|
| **Lack of skills** | European RIs and TIs face increasing competition from other regions where higher investments in research environments and skills development make them more attractive<br>Competence development gaps, recruitment problems and the evolving nature of digital infrastructures underscore the necessity for RI-oriented prioritised skill development and training programs, notably through cooperation between RIs/TIs and academia.<br>Additionally, retention of highly qualified staff is something that RIs and TIs have identified as urgent. Training and professional development is a key solution to this challenge. Also, the development of HR policies and standardisation of competences for the mobility and career development of staff is needed. |
| **Limited availability of CAPEX funding for upgrades to remain competitive** | Continuous upgrades are necessary to remain competitive, yet current funding schemes often do not provide consistent support for ongoing improvements, creating long-term sustainability risks. Moreover, the process of securing funding remains highly resource-intensive, with institutions investing significant effort in proposal writing without certainty of financial backing.<br>Many TI funding schemes require co-funding from industry, which can disadvantage regions with weaker private sector engagement. |
| **Limited availability of OPEX funding** | Funding for infrastructure construction is frequently not followed by sufficient operational funding, leading to sustainability concerns |
| **Insufficient policy landscape coordination for TI** | • Disconnect between strategic roadmaps and actual funding availability. In contrast to RIs, which often benefit from more structured support. Unlike RIs, which are integrated into long-term strategic roadmaps, TIs rely on multiple, often dispersed national and regional funding schemes<br>• Fragmented nature of TI funding, TIs rely on multiple, often dispersed national and regional funding schemes.<br>• The need for better alignment between funding instruments to maximize impact and avoid redundancy. In general, there is a lack of coordination between national and European funding initiatives, leading to inefficiencies and overlap duplicating efforts at the national level, underlining the need for better alignment between funding instruments to maximize impact and avoid redundancy. Strengthening synergies, ensuring stable operational funding, and improving accessibility across different regions were all identified as essential measures to address these gaps and enhance the long-term sustainability of Europe's research and technology infrastructures |
| **Better optimisation of TIs and RIs user base**[3] | • Understanding and monitoring the current user base of RIs<br>• Access mechanisms to facilities, resources, and services<br>• Data access mechanisms<br>• Cost sharing and pricing<br>• Administrative and support service |
| **Better management of national TIs and RIs portfolios**[1] | • Addressing RI requirements in the context of the whole research base<br>• Long term planning for RIs |

[3] https://scienceeurope.org/media/cbchuqpj/se-oecd-policy-paper-optimising-the-operation-and-use-of-national-research-infrastructures-aug-2020.pdf

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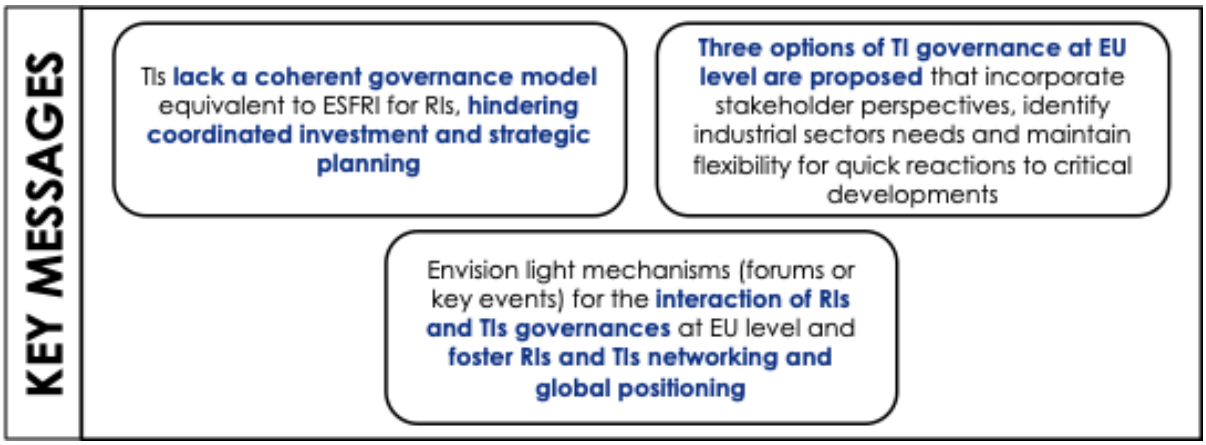
| | |
|---|---|
| | • Budget availability vs demand (including operating costs and balancing new and existing RIs)<br>• National vs international investment<br>• Transparency of decision processes (including research, strategic and socioeconomic factors) |

## 2.3 Multi-level governance for TIs and RI-TI interaction




Some support from European research and innovation actors to develop pilot facilities to demonstrate and scale-up innovative products or services exists already at European level, but efforts are not interconnected and lack a strategic direction to involve key industrial sectors. Comprehensive and effective support for TIs should coordinate relevant future and existing initiatives under a governance framework of technology infrastructures (TIs) at European level. This framework must enable Member States, the private sector and hosting organisations to focus investments effectively and maintain a long-term strategy aligned with industry needs, particularly for testing and development capabilities essential for innovation.

A fit-for-purpose governance of the landscape of TIs at national or European level based on a European roadmap or strategic agenda should ideally:

- Incorporate perspectives of industry, TI operators, and public funders.
- Identify and address gaps in industrial sector needs.
- Facilitate operator-user connections and access to TIs.
- Estimate funding requirements and help align investments across Member States and industries.
- Maintain flexibility for evolving innovation needs and critical developments.

Currently, the responsibility of providing R&I services to industry is dispersed across various national ministries and European Commission departments. Now, there is a timely opportunity to create an overarching governance model for TIs that would provide the whole ecosystem of innovation support to industry with directionality and coordination.

Based on the present review and analysis of existing EU initiatives relevant for joint TIs investments, the governance for an European programme on **TIs could be designed as a full-fledged governance model (option 1)**; as a **joint strategic investment agenda** co-developed in a set-up similar to the public private partnerships where committed industry, TI operators

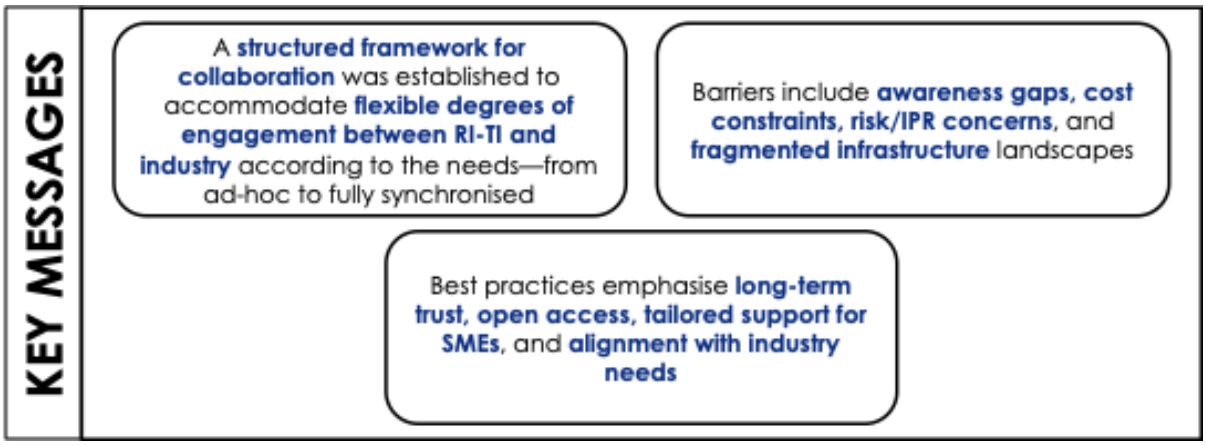
and public funders work together to prioritise (capital) investments in TIs **(option 2)**; or as a **plug-in advisory mechanism** which liaises with existing governance structures in a few selected industrial areas involving different Commission departments, as well as different departments in national ministries **(option 3)**.

An agile advisory mechanism should pro-actively provide input to relevant and emerging policy initiatives to coordinate investments in TIs. As the awareness of TIs increases among industry, different departments of the national administration of Member States, as well as different DGs at the European Commission, Option 3 can evolve into Option 2 and eventually into Option 1 as needed.

In addition, light mechanisms as a forum or key event may also be envisioned for the interaction of RIs and TIs governances at EU level, as well as for their networking and global positioning. In this view, the involvement of multinational organisations as the OECD through a new activity of the Global Forum on Technology, similar to the activity launched on research infrastructures under the Global Science Forum.

# Part 3: Leveraging European RIs and TIs for Impact

## 3.1 Strengthening collaboration with industry (incl. start-ups & scale-ups)




A generic framework has been developed to outline successful RI-TI-industry collaborations. This framework offers guidance for collaboration partners to align on the nature of collaboration, expressed as a general aim and a targeted level of intensity. After infrastructures have aligned, the framework provides insights and examples on the concrete implementation of the desired collaboration. However, it should be noted that each collaboration is unique, and while the framework can offer guidance and examples, collaborating partners will need to adjust it to their specific needs.

This framework describes potential **end-states** of RI-TI-industry collaboration. It does not include the developmental journey that collaboration partners must undertake towards the envisioned end-state. Practical guidance on this journey is described in RITIFI deliverable 3.2, which details recommendations on the long-term sustainability of TIs and RI-TI integrated services for end users, including access conditions and RI-TI networks. Additionally, RITIFI deliverable 3.2 includes guidance for policymakers on how to support emerging collaborations in their development.

Collaboration intensity defines the depth of engagement between research and technology infrastructures. It determines governance complexity, funding structures, and long-term sustainability. Four levels exist:

- **ad-hoc** collaborations are short-term and project-based,
- **managed** collaborations involve structured agreements but remain time-limited,
- **coordinated** collaborations feature shared governance and investment, and
- **synchronized** collaborations fully integrate operations and strategy.

To make these intensity levels more concrete and manageable, six characteristics are used to describe them (see figure below).

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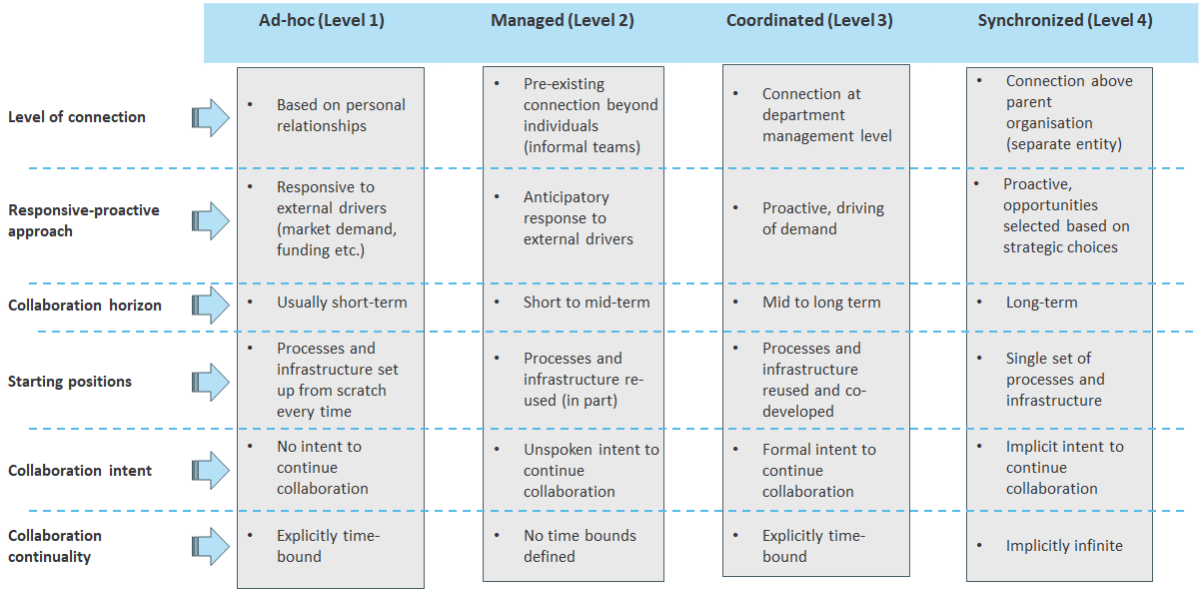


*Figure 3: Levels of collaboration intensity, with characteristics*

The most frequent **barriers** for fruitful RIs, TIs and client companies collaboration include:

- Awareness, availability or operational principles of RI/TI service providers are not known by the client companies, who rarely use databases, portals or centralised contact points.
- Costs of using complex infrastructures can be too high without public funding support, especially for SMEs.
- Direct CAPEX support (especially to TIs) is difficult to obtain and not always steered to the most relevant topics supporting the industrial sector SRIAs.
- Concerns and different views on risk and IPR terms.

The most frequently mentioned **best practices** for RIs, TIs and client companies collaboration are described in the table below.

| Best practice | Description |
|---|---|
| **Long-term partnerships, trust and well-functioning collaboration in project implementation between RI/TI and company** | Active and open dialogue in planning and implementation of the projects as well as flexibility in contractual and practical issues is very important.<br><br>Proximity of the service provider makes this easier, but trust and right competences are more important. |
| **State-of-the-art open access TI/RI facilities with highly skilled staff enables companies do not have to invest in large-scale, expensive plant or equipment themselves** | This is especially important for TIs used by startups and SMEs who do not yet have own scale-up capabilities.<br><br>Constant dialogue between the RI/Ti and industry helps to invest in relevant capabilities, and in best cases it can enable industry participation to investments. |
| **Clear, professional and flexible but not over-complex contractual terms and operation practices for joint projects or commissions** | Transparent and realistic descriptions of, e.g., timing, pricing, IPR rules, confidentiality, data and material handling, capability limitations, safety rules and risk assessments.<br><br>Contract and practices enabling information sharing and flexibility for necessary changes to the work plan. |

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Key recommendations stand out as relevant across all sectors:

**Increase awareness of RI and TI capabilities and complementary services:**

- Empower regionally acting nodes/multipliers and pan-European networks, clusters and partnerships but avoid unnecessary centralisation and administrative burden. This has the potential to resolve the "proximity effect" reported in some of the case studies.
- TIs and RIs should maintain online up-to-date accessible information about their service offer and contact persons – both targeting clients and multipliers.

**Improve the service efficiency and customer centricity of RIs and TIs:**

- Develop lean and effective operation practices, access conditions, pricing models, data handling and IPR rules, access and transfer of results.
- Enhance the competence in the customer interphase through specialised industry contact people and training of personnel to understand customer needs.

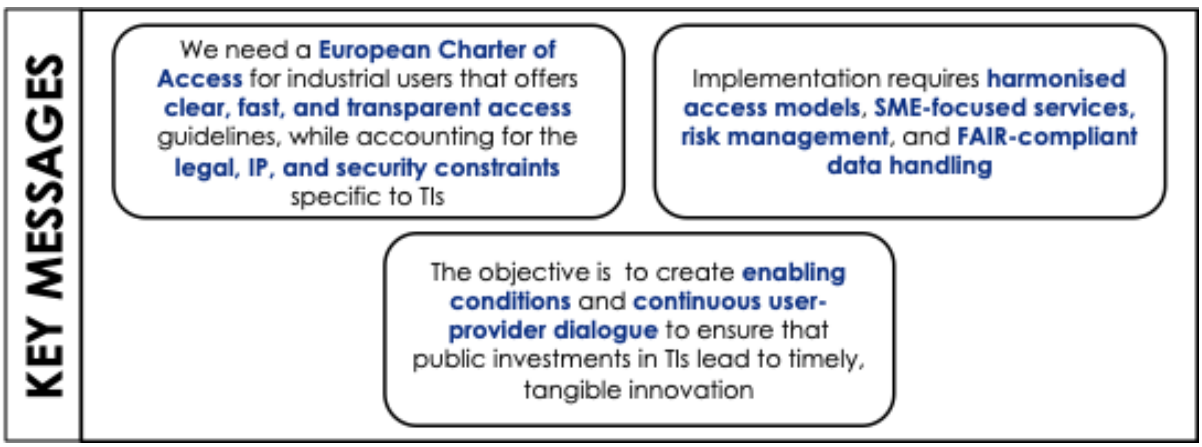
**Promote and support collaboration between complementary RIs and TIs:**

- For domains in which it is not already the case, establish networks and collaboration agreements between RIs and TIs to lower the threshold for covering wide TRL ranges.
- Streamline access conditions (including IPR issues and shipping/customs challenges) and practices to enable easy use of both RI and TI in same projects.
- Establish easy-to-use cross-border funding mechanisms for SME users of RIs and TIs.

**Keep RIs and TIs offering and capabilities competitive and updated vs. the needs of industry and society:**

- Systematic dialogue between RIs, TIs and industry on development and investment planning based on research targets and SRIAs of the industry field.
- Improve the mechanisms for direct CAPEX support for the larger investment of RIs and TIs (e.g. 5-30 M€). Public support should be coordinated by the EU framework program partnerships or industry organisations.
- Competitive RI and TI capabilities will enable industry to avoid making similar investments themselves and enhance their commitment to using RIs and TIs.

## 3.2 Establishing/implementing the conditions for success

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Streamlined, transparent, and effective access conditions are essential for ensuring that infrastructures supporting research, technology development, validation, and deployment deliver the full benefits of public R&I investment. This is a key recommendation from the European Commission Expert Group on Technology Infrastructures[4] (2025).

While Research Infrastructures (RIs) benefit from well-established access frameworks like the European Charter of Access to RIs, these frameworks do not suit Technology Infrastructures (TIs) well, as TIs focus more on industrial collaboration than on academic research.

To enable a European Strategy on TIs, we need a European Charter of Access for industrial users that supports TI focus on industrial collaborations. Such Charter of Access for industrial users must offer clear, fast, and transparent access guidelines, while accounting for the legal, IP, and security constraints specific to TIs. It must be balanced between a common approach and operational flexibility.

The objective is to create enabling conditions that facilitate the effective and timely use of technology infrastructures, while fostering continuous dialogue of users with technology infrastructure providers and between infrastructure to ensure that public investments translate into tangible innovation. These efforts should ultimately contribute to strengthening Europe's competitiveness, enabling the creation of new businesses, supporting intellectual property generation by companies, and ensuring the preferential exploitation of results within the EU.

[4] European Commission: Directorate-General for Research and Innovation, *Towards a European policy for technology infrastructures – Building bridges to competitiveness*, Publications Office of the European Union, 2025, **https://data.europa.eu/doi/10.2777/0876395**

## Recommendation for Implementation Guidelines – Summary

| ACCESS PRINCIPLES | |
|---|---|
| **Policy Implications** | **Management Measures** |
| **Define access guidelines** aligned with European and national missions and strategic priorities | Design **mission-aligned user access policies** at infrastructure level |
| Require **transparent publication of access procedures, service offerings, contact information and contract terms** (i.e. IPR, confidentiality rules) | **Maintain and update user portals** detailing procedures |
| **Support modular service development** through funding and operational flexibility | **Create scalable service packages** matched to different user profiles |

| TRANSPARENCY AND RISK MANAGEMENT | |
|---|---|
| **Policy Implications** | **Management Measures** |
| Encourage the adoption of **standardised access models** across Member States and **funding programmes** | **Develop a European Charter of Access** for industrial users that takes into account that TIs operate under different legal, IP, and security constraints |
| **Require infrastructures to apply transparent, fair evaluation procedures** to grant access in open calls supported by public funding | **Create internal access evaluation committees** with documented processes |
| **Integrate Risk Management into TI Access Frameworks**, particularly when supporting dual-use technologies | **Add Legal Compliance & Risk Screening in Access Procedures** and **collaboration workflow** ensuring internal staff are trained in research security protocols |
| Establish **monitoring and reporting requirements** on access operations within public funding agreements | **Track and report to funding body key access metrics** for public supported access, including user diversity and service efficiency |

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## SERVICE CONDITIONS FOR SMES AND START-UPS

| Policy Implications | Management Measures |
|---|---|
| **Integrate SME-focused access support** into funding programmes and infrastructure mandates | Design and implement **dedicated SME access programmes** with simplified procedures |
| Develop EU **cross-border innovation voucher schemes** to fund infrastructure access for SMEs | Establish **financial incentives and flexible pricing** models for SME users |
| **Fund user support services** through European and national programmes that **support sustained partnership between TIs and/or RIs and an industrial user** | Create **Business support teams or dedicated TI contact points** during the whole interaction with SME and start-up users |
| Launch European and regional **awareness campaigns on infrastructure access opportunities** for SMEs | Organise **outreach events, targeted calls, and partnerships** with innovation networks and clusters |

## DATA MANAGEMENT, RESEARCH SECURITY AND IPR CONSIDERATIONS

| Policy Implications | Management Measures |
|---|---|
| **Require data management plans** aligned with **FAIR principles** in access conditions | **Implement internal data policies** ensuring compliance with FAIR standards and the "as open as possible as closed as necessary" principle |
| **Standardise contractual templates** clarifying data, confidentiality, and IPR arrangements for all access modalities | Offer **differentiated user agreements** tailored to open, negotiated, or proprietary access pathways |
| **Protect sensitive industrial information** through reinforced confidentiality mechanisms and research security protocols | Establish **secure data environments, clear project security procedures** and **NDA frameworks** for industrial users |
| Support capacity-building initiatives in **data stewardship, research security** and **IPR management** across infrastructures | **Provide training sessions, user guides, and advisory services** on data governance and IPR for users |

## SYNERGIES AND INTEROPERABILITY ACROSS INFRASTRUCTURE TYPES

| Policy Implications | Management Measures |
|---|---|
| **Incentivise cross-infrastructure collaboration** through funding calls, and co-created strategic agendas | **Identify complementarity opportunities** across infrastructures and design joint action plans |
| **Promote coordinated foresight and roadmapping** exercises across RIs, TIs, and Industrial Infrastructures | Engage in **joint foresight initiatives** and integrate results into **infrastructure development planning** |
| Fund **shared service platforms** and **cross-infrastructure investment** projects | Create **shared technology hubs, pooled equipment**, and **integrated service bundles** |
| Launch **cross-infrastructure skills development** and **mobility programmes** aligned with ERA Talent initiatives | Develop and implement **staff exchange schemes, joint training modules**, and **professional networks** across infrastructure types |

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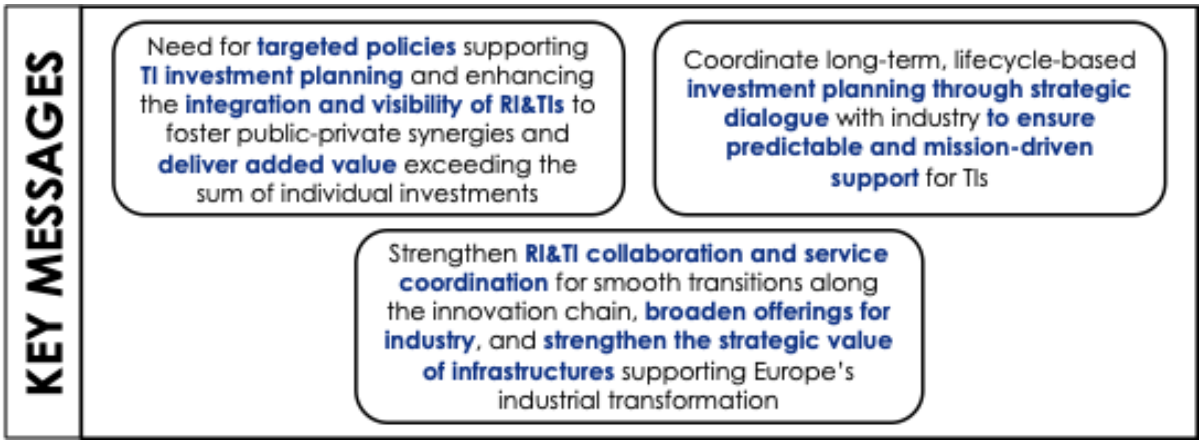
## 3.3 Final recommendation for evidence-based investment planning for TIs and better integration and visibility of RIs and Tis




A coherent European investment planning framework for Technology Infrastructures should function as **both an enabler and a catalyst,** complementing and aligning with the investment strategies of owners and end-users. When strategically designed, **such a framework can foster synergies between public operators and private industrial actors, resulting in added value that exceeds the sum of individual investments**. It is therefore essential that policymakers recognise the development of targeted policies to support investment planning for Technology Infrastructures, and to enhance the integration and visibility of both Research Infrastructures and Technology Infrastructures.

The methodology combines evidence from the eighteen RITIFI case studies, cross-sectoral gap analyses, and the review of European and national strategic roadmaps, complemented by extensive stakeholder consultations. It integrates lessons from needs assessments validated across the five technological focus areas of RITIFI and extends the analysis beyond these sectors to a system-wide perspective on infrastructure investment planning.

**RITIFI's concluding recommendations are structured into five strategic pathways**:

**1- Codify the strategic role of TIs in EU R&I policy:**

**Objective:** Position TIs as core enablers of industrial policy, aligned with the TRL continuum and supporting European strategic autonomy.

**Actions:**

- Adopt the EC expert group on TI definition at EU level and including EU partnerships, missions and industrial stakeholders.
- Establish a European governance framework for Technology Infrastructures (TIs), tailored to TI role and including TI stakeholders. The first step is to launch a dedicated CSA project that supports a dedicated TI secretariat. This secretariat would provide the operational foundation for EU-level coordination and dialogue, bringing together public and private stakeholders. It would facilitate the co-creation of sector-specific

roadmaps through strong links with public-private partnerships, and ensure continuity, expertise, and foresight in TI-related policy development and implementation across Europe.
- Create a central policy reference document defining the EU Technology Infrastructures roadmap procedures.

**2- Develop lifecycle-based funding through strategic dialogue and long-term planning**

**Objective:** Provide TIs with access to predictable, lifecycle-based funding tools that reflect technology maturity and strategic importance

**Actions:**
- Develop long-term, multiannual investment plans that combine capital funding, upgrade and transition financing, and public support for thematic RDI collaborative actions.
- Design a dedicated funding line in the next Multiannual Financial Framework (MFF) implementing the roadmaps from the TI pilot projects funded under the CSA HORIZON-CL4-INDUSTRY-2025-01-HUMAN-64 call.
- Involve private-public partnerships in shaping sectorial roadmaps and long-term investment planning to guide infrastructure development in key industrial areas.

**3- Strengthen a coherent RI-TI collaboration framework to support service integration for technology development and maturation**

**Objective:** Enable smooth transitions between scientific discovery, applied development, and technology maturation and validation through integrated services of infrastructures.

**Actions:**
- Fund interoperability and collaborations pilots between RIs and TIs in selected strategic areas with the support of RITIFI's business model framework for trans-infrastructure collaborations. Support the role of technology infrastructures in activating the continuum between the research infrastructures and industry.
- Establish joint RI-TI events, training programs, co-staffing mechanisms, and shared foresight platforms.
- Develop common language and approach for user interfaces, access pathways, and service catalogues according to the level of collaboration maturity.

**4- Promote Access for broader industry-research collaboration**

**Objective:** Create conditions under which RTIs can deliver accessible, tailored, and high-impact services to a broad user base and enables long term partnership between RTIs and industrial users, including SMEs and start-ups.

**Actions:**
- Deploy a European Access Framework for industrial users and in addition:
  - An interactive mapping tool to visualise and explore RIs and TIs across regions and domains, curated within each thematic network or public-private partnerships if available.

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    - Increase coordination of TIs and RIs with national and regional business support ecosystems
- Link RTI access support to SMEs and industrial-oriented funding instruments (e.g., Innovation Fund, EIC Accelerator, innovation vouchers) to reduce transaction costs for users.
- Encourage and incentivise more the possibility to subcontract research and technology infrastructures services in public funded instruments targeting companies RDI projects (e.g., EIC Accelerator)

**5- Anchor Talent and Capability in Infrastructure Platforms**

**Objective:** Ensure TIs have access to a skilled, future-ready workforce capable of evolving with technological frontiers, increase sharing of best practices.

**Actions:**

- Develop TI-specific competence frameworks co-developed with industry and universities.
- Launch a TI Talent Mobility Scheme to facilitate cross-border placements and skill transfer including confidentiality, responsibilities, liability and security measures.
- Organise events for RI industrial contact officers and TI business managers networking and collaboration to share challenges and best practices.

These pathways offer a roadmap for the European Commission, Member States, and stakeholders to transform TIs into coherent, accessible, and strategically aligned assets. They do not replicate existing efforts in research infrastructure, they fill a critical gap in the European innovation policy framework by focusing on the infrastructures that enable applied, industry-oriented technological transformation.

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## Conclusions

**The analysis conducted throughout this project reveals a complex and multi-layered landscape of gaps and unmet needs in the European Technology Infrastructure (TI) ecosystem**. These findings are not anecdotal. They result from a structured methodology integrating empirical data from 18 case studies, multiple strategic mapping exercises, and high-resolution stakeholder consultation during the Porto Needs Assessment Workshop.

The insights generated serve as a strategic knowledge base for public authorities and institutional leaders aiming to design a coherent, effective, and future-oriented policy space for TIs. **Technology Infrastructures serve as the functional catalyst between upstream research and market deployment.** Their capacity to deliver this role is directly tied to the availability of institutional, financial, technical, and human resources that can be structured in consistent, purpose-driven ways. The needs analysis confirms that current policy tools—when they exist—are insufficiently aligned to this mission. The landscape remains fragmented, policy support inconsistent, and strategic coordination limited. Individual owners of Technology Infrastructures cannot bear full responsibility for sustaining a coherent European Technology Infrastructure system. Instead, the development and coordination of such a system must stem from European RDI policy, reflecting a shared strategic commitment at the EU level. The RITIFI project has proposed **five implementation pathways** to translate needs into policy action:

1. **Codify the strategic role of TIs** in the EU policy framework
2. **Develop lifecycle-based funding** through strategic dialogue and long-term planning
3. **Strengthen a coherent RI-TI collaboration framework** to support service integration for technology development and maturation
4. **Promote access** for broader and strategic industry-research collaboration
5. **Anchor talent and capability in infrastructure platforms**, with training programs, mobility schemes, and competence frameworks.

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## List of Acronyms

**CAPEX** – Capital Expenditures
**CSA** – Coordination and Support Action
**DG CNECT** – Directorate-General for Communications Networks, Content and Technology (European Commission)
**DG RTD** – Directorate-General for Research and Innovation (European Commission)
**EATRIS** – European Infrastructure for Translational Medicine
**EC** – European Commission
**EIC** – European Innovation Council
**ERIC** – European Research Infrastructure Consortium
**ERDF** – European Regional Development Fund
**ESFRI** – European Strategy Forum on Research Infrastructures
**ESS** – European Spallation Source
**FAIR** – Findable, Accessible, Interoperable, Reusable (data principles)
**IPCEI** – Important Project of Common European Interest
**IPR** – Intellectual Property Rights
**MFF** – Multiannual Financial Framework
**OITB** – Open Innovation Test Bed
**OPEX** – Operational Expenditures
**PPP** – Public-Private Partnership
**R&D** – Research and Development
**RI** – Research Infrastructure
**R&I** – Research and Innovation
**RTO** – Research and Technology Organisation
**SME** – Small and Medium-Sized Enterprise
**SRIA** – Strategic Research and Innovation Agenda
**TEF** – Testing and Experimentation Facility
**TI** – Technology Infrastructure
**TRL** – Technology Readiness Level
**VTT** – Technical Research Centre of Finland