An integrated European ecosystem for research and technology infrastructures

Position dated 27 June 2025

Europe's capacity to be a leader in science and technology across research, innovation and education relies on world-class infrastructures. These research and technology infrastructures (RTIs)—ranging from particle accelerators and quantum laboratories to cleanrooms, additive manufacturing sites, living labs and high-performance computing facilities—serve as vital platforms for scientific discovery, fostering talent, technological progress and scaling up of European companies into global champions. RTIs include both physical and digital (e-)infrastructures.

Europe's global competitiveness, prosperity, digital sovereignty, and green transition ambitions critically depend on these infrastructures. Strengthening RTIs is imperative as Europe faces intensifying global competition, particularly in strategic areas such as advanced science and technologies where progress often depend on access to cutting-edge infrastructures.

RTIs help turn ideas into impact: they are places where scientists explore the unknown, engineers push the boundaries of what is possible, students are nurtured into the next generation of leaders in science and technology—and where pioneering research and innovation can give rise to spin-offs and scale-ups that contribute to economic and societal progress.

Universities of science and technology are central to this landscape. As designers, hosts, managers, users, evaluators, governors, and partners in RTIs, they connect education, research, innovation for societal impact. Their integrated approach anchors ecosystems that drive competitiveness, prosperity and resilience.

The leading universities of science and technology united in CESAER welcome the European Commission's initiative to develop a comprehensive strategy for RTIs. This is a timely and essential step, aligning with Europe's ambition to lead in deep tech and science-based innovation. It also echoes the vision expressed by European Commission President Ursula von der Leyen, who at Sorbonne on 5 May 2025 reaffirmed that research, innovation, science and technology must be at the heart of Europe's future. This vision translates directly into

concrete objectives: establishing Europe as a global leader in advanced technologies, significantly increasing the number and scale of successful deep-tech start-ups, and maximising the contribution of Europe's research ecosystems to societal priorities such as prosperity, digital sovereignty, climate neutrality and resilience.

This position builds on our prior contributions—such as Scientific & technological infrastructures to help tackle local and global challenges (October 2022) and Competitiveness, reindustrialisation and strategic autonomy through leadership in science & technology (May 2024)—and outlines how Europe must now move towards a policy framework for RTIs that is holistic, user-oriented, and anchored in purpose and outcomes.

To achieve this, Europe must act in five interlinked areas:

1. unifying infrastructures through a purpose- and outcome-driven approach;
2. leveraging universities of science and technology as ecosystem anchors to boost access and visibility;
3. ensuring robust digital infrastructures and data quality assurance;
4. supporting talent and skills as boosters of RTI excellence and sustainability;
5. providing legal clarity and alignment with state aid rules, while ensuring sustainable funding models.

These areas form the foundation for building an integrated European ecosystem for research and technology infrastructures that can drive scientific excellence, technological leadership, and societal impact.

1. Unifying infrastructures through a purpose- and outcome-driven approach

The forthcoming European RTI strategy offers a crucial opportunity to establish a coherent, integrated, and outcome-oriented framework for RTIs. Europe must move beyond rigid divisions between research infrastructures (RIs) and technology infrastructures (TIs) and instead strengthen the continuum between them. RTIs should be understood as interconnected, multi-purpose assets that can serve a diverse range of users across the entire knowledge value chain throughout all of Europe and beyond.

Europe's diverse RTI landscape is a strength, with different facilities serving varied users— from academic researchers to start-ups and industry. A single RTI facility might support a PhD candidate in the morning with lab access, a start-up at midday with prototyping tools, and an established company in the afternoon through testing or scale-up services. What matters most is not how a facility is labelled, but the purpose and outcomes it delivers.

Purpose refers to the intended role or function of the infrastructure, for instance, fostering fundamental research, enabling technological development, or supporting entrepreneurship. Outcomes are the tangible results achieved, such as scientific breakthroughs, advancement of a technology to a higher technology readiness level, or skilled graduates.

A clearly articulated purpose aligned with concrete outcomes, through a single purpose- and outcomes-driven approach, will help Europe move beyond fragmented, siloed, and
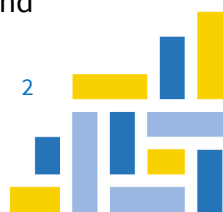
outdated linear innovation models, enabling a more integrated, user-focused, and effective research and innovation ecosystem. This is exemplified by many leading science and technology universities, where RTIs are seamlessly integrated to advance breakthroughs at the scientific frontier and accelerate technological development — often in partnership with industry — while also driving startup creation, strengthening talent development and retention, and attracting greater investment.

Our modern understanding of interconnected innovation ecosystems requires a RTI landscape that is dynamic, integrated, and accessible under suitable and differentiated conditions — including funding models, cost structures, access modalities, and intellectual property frameworks — tailored to the diverse needs of users. Such an ecosystem perspective keeps infrastructures agile, relevant, and impactful over time.

CESAER supports a holistic and integrated RTI framework that encompasses both physical and digital assets, serving research, education, and innovation in advanced science and technologies. The same infrastructures should, where appropriate, be enabled to contribute flexibly across the knowledge ecosystem — from advancing frontier research to accelerating technological development, and from training students to supporting the scaling of start-ups.

We call on the EU institutions to:

- Adopt a holistic, user- and outcome-oriented framework that treats the RTI landscape as an interconnected and federated ecosystem serving research, education and innovation in science and technology.
- Recognise the continuum between RIs and TIs, by ensuring that funding, access, and governance policies are designed from a purpose- and outcome-driven perspective to better reflect diverse user needs.
- Promote synergies between RTIs, aligning investments and enabling interoperability across domains and borders.
- Deepen international cooperation on RTIs and enable mutual access frameworks.
- Continue engaging with key partners across the full continent, both inside and outside the EU, and globally. Association to Horizon Europe, as well as CERN's global partnership model, provide best practice examples for effective global engagement.

2. Leveraging universities of science and technology as ecosystem anchors to boost access and visibility

Universities of science and technology are cornerstone actors in the infrastructure landscape. They host and operate world-class RTIs, educate and train talent, generate scientific knowledge, drive technological development, foster innovation, and serve as trusted anchors that connect ecosystems across borders and sectors.

The February 2025 report of the Commission Expert Group on Technology Infrastructures is a valuable and timely contribution to the ongoing debate on the future of RTIs, highlighting many important points. Looking ahead, it is crucial to further articulate the value of an interconnected landscape and a continuum approach to RTIs across the entire knowledge

value chain. Equally important is to underscore the central role of universities of science and technology as ecosystem anchors in enabling and sustaining such an approach. Their contributions can be further enhanced through stronger coordination, greater visibility of RTIs at European level, and continued efforts to remove barriers to access.

Furthermore, it is vital that European policies and initiatives recognise the essential role of global, regional and local RTIs — both large- and small-scale — in strengthening research and innovation ecosystems.

For example, the engagement of CESAER Members spans from large-scale pan-European initiatives, such as the European Spallation Source—a multi-billion-euro, 75-hectare facility expected to become the world's most powerful neutron source for analysing advanced materials. It also includes smaller-scale infrastructure housed in a single room, such as state-of-the-art quantum facilities valued at tens of millions of euros, yet driving frontier university-industry collaborations in quantum technology. Strengthening these infrastructures complements mobility initiatives and reinforces the broader research and innovation ecosystem.

We encourage the EU institutions to:

- Partner with leading universities of science and technology that have a strong track record in anchoring public-private ecosystems and supporting start-ups, scale-ups, and broader societal missions.
- Pursue a triple helix partnership approach engaging academia, industry and government in the governance, management and strategic planning for RTIs.
- Develop a European coordinated approach to access for RTIs, ensuring visibility, transparency and openness.
- Support co-investment schemes and shared-use models that reduce costs and risks for early-stage users.
- Recognise the importance of global, regional and local infrastructures, as well as both larger- and smaller-scale RTIs, in a resilient and inclusive RTI landscape.

3. Ensuring robust digital infrastructures and data quality assurance

Digital infrastructures are a key element of the RTI landscape, with high-quality data being essential for scientific advancement and technological innovation. The FAIR principles (Findable, Accessible, Interoperable, Reusable) offer a robust framework for effective data management and are fully compatible with the responsible handling of sensitive information, including commercially sensitive data and digital assets.

It is important to note that FAIR does not automatically imply open data. Instead, the FAIR principles provide a robust framework for deciding who can access which data, when, and under what conditions—an approach that is particularly important for protecting sensitive information, such as medical data and patient privacy or commercially sensitive assets. Therefore, it is crucial to ensure that these principles, along with data quality controls, are widely adopted to enhance data accessibility, collaboration, and overall data integrity across

research and innovation ecosystems. For example, the European Open Science Cloud (EOSC) has notably enhanced cross-border research collaboration and productivity by supporting the operationalisation of the FAIR data principles. It provides a practical and concrete model for extending and federating effective digital infrastructures and robust data management standards across the RTI landscape.

Embedding these practices also helps strengthen Europe's digital and data sovereignty—an increasingly vital foundation for safeguarding academic freedom and democratic values in a time of growing pressures.

We call on the EU institutions to:

- Encourage all RTIs that generate data and digital assets to adopt the FAIR principles and support the provision of tools, resources and training to help users apply these principles.
- Facilitate wide and equitable access to RTIs for researchers and innovators.
- Support open-source AI development and access to high-quality training data.
- Promote the development of federated data platforms that enable data sharing and working with data across domains and countries, ensuring interconnections between initiatives such as the European Open Science Cloud, the Common European Data Spaces and GAIA-X.
- Support the standardisation of metadata schemas and vocabularies to enable genuine cross-domain integration and automated reasoning.
- Promote the use of data quality controls in pipelines, including data cleaning tools as a standard part of data ingestion processes.
- Incentivise contributions to data quality by encouraging RTIs that generate data and digital assets to implement data quality assurance procedures and guidelines, including dashboards where appropriate, and to monitor data quality over time.

4. Supporting talent and skills as boosters of RTI excellence and sustainability

Research and technology infrastructures (RTIs) depend on a diverse range of professionals, including instrumentation engineers, technicians, interdisciplinary researchers, data stewards, FAIR experts, and specialised managers and governors. Supporting the development, retention and especially the mobility of such talent is essential to advancing RTI excellence and long-term sustainability.

Mobility of talent should not be viewed merely as an enabler but recognised as a core function of physical infrastructures: diverse talent enhances the performance and relevance of facilities, while access to world-class infrastructures stimulates researcher movement. Strengthening mobility therefore goes hand-in-hand with reinforcing RTIs across all scales—from local to global and from smaller to large-scale flagship infrastructures.

High-quality RTIs function as key nodes in the wider European ecosystem. They enable more equitable access to advanced capabilities and serve as a foundation for fostering cross-border collaboration. This interconnected approach strengthens the research and

innovation landscape, maximises the impact of mobility programmes, and ensures that talent from all regions can contribute to and benefit from RTIs.

To realise this potential, it is crucial to invest in well-funded and well-structured mobility schemes and career pathways for RTI professionals and managers. Instruments such as Erasmus+ play a vital role in supporting education, training, and mobility, and should also be leveraged to strengthen the RTI landscape.

We call on the EU institutions to:

- Boost support for interdisciplinary training, mobility schemes, and career pathways for RTI professionals and managers, and connect efforts to broader European efforts to boost research careers. The report Research careers: A critical choice for Europe provides detailed guidance and recommendations.
- Financially reinforce instruments with a proven track record in advancing research, innovation, education, training, mobility, and cooperation in the advanced science and technologies that underpin RTIs and contribute to a sustainable talent pipeline — notably Horizon Europe and Erasmus+. Double and triple, respectively, the budgets of their successors to align with growing needs, and to meet bold ambitions, ensuring that Europe remains a global leader in advanced science and technologies.
- Recognise talent development and mobility, especially for early-career researchers, as key components of ensuring world-class RTIs and supporting long-term RTI sustainability.
- Establish a dedicated category to support mobility for research-based education for students, including graduate and PhD candidates, to strengthen links between education and research, as elaborated in our Erasmus+ position.

5. Providing legal clarity and alignment with state aid rules, while ensuring sustainable funding models

RTIs operate at the intersection of public and private interests: they serve public goods and address market failures, while also enabling commercial innovation. This dual role requires legal clarity, alignment with EU state aid rules, and sustainable funding models to maximise impact and reduce uncertainty.

A layered model built on a publicly funded core infrastructure with modular service layers can help distinguish between non-economic and economic activities. Non-economic activities—such as public research, education, and talent development—should be fully publicly funded and exempt from state aid rules. Economic activities—such as contract research and services provided to industry—should be offered at market rates, open to all, and comply with relevant exemptions such as the General Block Exemption Regulation and the RDI Framework. Importantly, care must be taken not to conflate cost-recovery mechanisms for academic users (e.g. cleanroom access fees) with state aid, provided these are non-discriminatory and operate within clear and proportionate frameworks.

In practice, the funding of RTIs often depends on complex and fragmented arrangements. Academic users frequently rely on competitive grants from public funding agencies, including EU programmes, to cover access costs. However, these grants often prohibit the use of funds to cover infrastructure-related underlying costs, placing RTIs in a difficult position: they are expected to provide access but cannot recover the full cost of maintaining and upgrading their infrastructure. This undercuts their ability to build reserves for reinvestment, threatening long-term sustainability. Over-regulation and ambiguity in eligible cost structures risk exacerbating this situation.

Clear and consistent guidance is therefore needed on the delineation of economic and non-economic activities, and on acceptable cost recovery and pricing practices—especially in the context of EU and national funding mechanisms. Partnering with experienced institutions operating at the public-private interface, such as universities of science and technology, can help shape this guidance at the European level, building on proven practices.

Finally, to support legal certainty and long-term viability—particularly for cross-border RTIs—national contributions should, wherever possible, be channelled into centrally managed EU instruments (e.g. Horizon Europe, Digital Europe) that are exempt from state aid rules. This would promote coherence, facilitate access, and safeguard the public value delivered by RTIs.

We call on the EU institutions to:

- Clarify the distinction between economic and non-economic RTI activities, drawing on the experience of frontrunners such as universities of science and technology, and develop practical guidance on legal structuring, cost recovery, pricing, access, and eligibility criteria in line with EU state aid rules.
- Promote centrally managed EU funding instruments—such as Horizon Europe and Digital Europe—that are exempt from state aid rules and incentivise member states to channel national co-funding through these mechanisms to ensure legal certainty, especially for cross-border RTIs.
- Support lifecycle funding models that cover the full continuum of RTI needs—from initial development and operation to upgrades and eventual decommissioning—taking inspiration from the ESFRI approach.
- Align funding criteria and infrastructure development with the EU's climate goals, ensuring energy-efficient and sustainable design and operations of RTIs across their lifecycles.
- Ensure full public funding for non-economic activities (e.g. public research, education, talent development), while enabling appropriate cost-recovery or private contributions for economic activities, provided these mechanisms remain transparent, proportionate, and state aid-compliant.
- Safeguard fair and compliant digital infrastructure conditions by requiring international cloud providers and technology companies to offer universities state aid–neutral, data protection–compliant, and AI Act–aligned terms—especially as RTIs increasingly rely, partly or fully, on cloud-based infrastructure rather than on-premise infrastructure.

Conclusion: building on experience, shaping Europe's future

Europe is not starting from scratch. Across the continent, integrated RTI ecosystems—many anchored by universities of science and technology—are already delivering impact. They advance scientific frontiers, train talent, power technological innovation, and enable collaboration across disciplines, sectors, and borders.

As a new European strategy for RTIs is forthcoming, we should learn from frontrunners and scale up what works. A future-oriented RTI strategy must embrace the full knowledge value chain—from frontier science to accelerated development of technology-based solutions. This means breaking down silos, investing across the lifecycle, supporting talent, and building a connected ecosystem with shared purpose.

With the right vision, instruments and partnerships, RTIs can be the bedrock of Europe's global leadership in science and technology to advance competitiveness, resilience and prosperity.

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