UNLOCKING INNOVATION: ADDRESSING THE FUNDING NEEDS OF EU TECHNOLOGY INFRASTRUCTURES

European Investment Bank

European Commission

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European Investment Bank
98-100, boulevard Konrad Adenauer
L-2950 Luxembourg

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EXECUTIVE SUMMARY

Technology infrastructures – facilities, equipment, capabilities and resources that support the development, testing and scaling of technologies before they enter the market[1] – are an essential element of research and innovation. Technology infrastructures primarily support industrial users, lowering the risks of private investments in technology and accelerating the uptake of cutting-edge and mature technologies across various industries.[2]

This report presents the findings of a study commissioned by the European Investment Bank to assess the funding needs[3] for capital expenditures and operational costs of technology infrastructures in the European Union by 2030. It draws on desk research, a survey questionnaire to technology infrastructure operators, and interviews and workshops with operators and other stakeholders. In addition, the study examines the potential of financial instruments to expand the available funding for technology infrastructures and highlights key barriers related to the financing of these infrastructures.

Key findings

1. Technology infrastructures' capital expenditure needs

- An estimated €13-16 billion in capital investment is required by 2030 to build and upgrade technology infrastructures across the European Union. This will enable operators – primarily research and technology organisations – to keep up with critical and emerging technologies and remain globally competitive.
- Capital expenditure needs are projected to grow by over 200% over the next five years compared with current investment levels.
- The highest investment needs are in microelectronics and clean energy, followed by rapidly evolving sectors, such as quantum technologies, artificial intelligence (AI) and data, and avionics and space.
- Current capital expenditure funding models rely almost exclusively on public sources, including competitive grants, block funding, internal reserves and ad hoc public investments.
- Funding is sourced from regional (47%), national (31%) and EU-level (11%) programmes. Most infrastructures combine funding from different levels, depending on their scale and scope.
- EU-level funding focuses on specific technology areas and instruments, such as open innovation testbeds (materials), testing and experimentation facilities (AI), and chip pilot lines (microelectronics and photonics).
- The main challenges in funding capital expenditures are:
  - limited availability of funding to satisfy demand;
  - a lack of single funding sources for large-scale technology infrastructures;
  - difficulty in combining funding sources;
  - rapid technological change, requiring agility and speed;
  - limited predictability of funding availability, which hampers long-term sustainability.

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1 European Commission. (2019). Technology Infrastructures – Commission staff working document.

2 European Commission Directorate-General for Research and Innovation. (2025). Towards a European policy for technology infrastructures – Building bridges to competitiveness. Publications Office of the European Union.

3 The funding needs presented in this study are based on data collected from 41 technology infrastructure operators – primarily research and technology organisations – with a combined annual turnover of €15 billion. These findings were extrapolated to estimate sector-wide investment needs across Europe. Based on a literature review and analysis conducted in this study, the total annual turnover of the research and technology organisation sector in Europe is estimated at about €30 billion. This estimate only marginally includes the technical university sector and other independent technology infrastructure operators and should therefore be considered a **conservative lower-bound estimate** of overall funding needs.

2. Securing demand for services (operational expenditures)

- Understanding and securing industry demand is essential for long-term engagement and generating predictable fee-based revenues. Despite their proximity to market, many operators still struggle to attract sufficient demand.
- Three main factors shape technology infrastructure needs and industry demand:
    - market structure (differences between large multinational and smaller firms);
    - geographic distribution (regional disparities);
    - private sector investment capacity in research and innovation.
- Operational expenditures are mainly covered by public competitive funding (34%) and private funding (31%); and complemented by public block funding (19%) and internal reserves (12%).
- Funding for operational expenditure is distributed across regional sources (33%), national sources (39%) and EU sources (29%). These proportions vary depending on the infrastructure type and user base.
- Technology infrastructure operators serve a wide range of sectors, with the most prominent being the mobility, transport and automotive industries, energy-intensive industries and renewables.
- Business cases for technology infrastructure investments assess future demand by evaluating market needs, expected user base, revenue potential, collaboration models, utilisation rates, value propositions, funding availability and alignment with policy priorities.
- Financial viability is reinforced by balancing private and public users, optimising capacity use, managing demand fluctuations, and securing long-term partnerships.
- The implementation of EU State aid rules may pose challenges for technical infrastructure operators in stimulating private sector demand. Awareness raising is needed to clarify perceived limitations and improve engagement.

3. Greening technology infrastructure

- Green investments in technology infrastructures aim to reduce environmental impact and support the development of decarbonisation solutions.
- Operators are increasingly investing in energy-efficient building upgrades, renewable energy installations and advanced sustainability measures, such as wastewater treatment and green energy sourcing, to meet future legislative requirements and achieve carbon neutrality. Energy-efficiency improvements are the top priority for 80% of operators.
- Beyond cutting their own carbon footprint, technology infrastructures are also investing in green technology development. This includes testing equipment for solutions solar panels, batteries and carbon capture solutions, which aligns with the EU taxonomy for sustainable activities criteria for reducing greenhouse gas emissions.

4. Financial instruments to support technology infrastructures: Uses and barriers

- Available funding must increase sharply to enable the 200% increase needed by 2030. Technology infrastructure operators in Europe rely heavily on grants and internal reserves to fund their investments, and although this model has enabled many to operate successfully, the overall volume of available funding is insufficient for the scale and urgency of current and future investment needs.
- Funding sources can expand through financial instruments tailored to the unique characteristics of technology infrastructures. Such instruments could unlock new sources of investment and close existing funding gaps, enabling technology infrastructures to meet growing demand and remain at the forefront of innovation.

Some examples of financial instruments supporting technology infrastructures are:

- Bank loans backed by technology infrastructure operator guarantees and long-term user commitments, possibly through joint ventures;
- Bank loans to finance energy infrastructure, resulting in utility cost savings;
- Commercial bank credit lines to partially fund annual capital expenditure, enabled by the operator's positive earnings before interest, taxes, depreciation and amortisation (EBITDA) performance.

The main challenges in using financial instruments include:

- the general financial standing of technology infrastructure operators;
- business culture factors (such as risk aversion and limited experience with financial instruments);
- cash flow generating capacity;
- governance and legal issues.

Recommendations

Based on the study's findings, three key recommendations are proposed to broaden the funding available for technology infrastructures through financial instruments and grants:

- **Increase and facilitate access to technology infrastructures** for startups and small businesses by expanding the use of demand-side support instruments (for example, innovation voucher schemes, access schemes, etc.) at the EU, national and regional levels.
- **Introduce blended financing instruments** that combine grants with equity or loans under the Horizon Europe programme. This would help unlock and mobilise private sector investment in technology infrastructures building on business models with increased revenue generation through usage fees, subscription/commitment agreement, success-based pricing, and strategic partnerships, aligning financial incentives with user innovation successes.
- **Establish a technical assistance** programme to address three key needs**:**
  - raise awareness among technology infrastructure operators and non-specialised investors;
  - provide advisory services for structuring technology infrastructure projects;
  - build a pipeline of technology infrastructure projects attractive to non-specialised investors.

INTRODUCTION

Technology infrastructures – facilities and services that support the development, testing, and scaling of technologies – are essential to Europe's innovation landscape. This study, commissioned by the European Investment Bank, assesses the investment needs of these infrastructures across EU sectors by 2030 and explores how financial instruments could complement existing public funding.

Drawing on desk research, interviews and workshops held during the EU Presidency Event on Technology Infrastructures in May 2025, the report presents:

- **an assessment of the financing gap** for capital and operational expenditures;
- **an analysis of current funding sources** and the potential role financial instruments;
- **considerations on sustainability** and green investments;
- **recommendations for expanding the funding pool** through financial instruments and grants.

See Appendix A for the methodology of this study.

Definition of technology infrastructures

In this study, technology infrastructures are defined according to the European Commission's staff working document on Technology Infrastructures published in 2019, which stipulates that:

Technology infrastructures are facilities, equipment, capabilities – physical or virtual – and associated support services required to develop, test and upscale technologies.

- They help advance technologies from laboratory validation to higher technology readiness levels before entering the market.
- They can be public, semi-public or private, and are often non-profit. They are usually embedded in research and technology organisations, technical universities and technology centres, which are generally referred to as technology infrastructure operators.
- They are open to a wide range of users, mainly industrial users, including small and medium-sized enterprises (SMEs), which rely on these infrastructures to commercialise new products, processes and services, while ensuring feasibility and regulatory compliance.
- They provide services beyond technology support, including technology transfer, access to finance, legal support, business advice and market entry support.
- They require public support, due to their high cost and the limited accessibility to other uses when they are privately funded.

Various terms are used across policy documents to describe technology infrastructures, including open innovation testbeds, living labs, pilot lines, technology platforms, technology (co-creation) labs, cleanrooms, open innovation facilities, bio-hubs, and prototyping facilities. All are relevant to the scope of this study.

Further details on the European Union's approach to technology infrastructures can be found on the European Commission's dedicated webpage.

The role of technology infrastructure operators

Technology infrastructures in the European Union are primarily owned and managed by a diverse range of operators, reflecting national differences in legal frameworks for research and innovation. These operators include:

- public research organisations (for example, national research institutes);
- non-profit research and technology organisations;
- public-private partnerships or semi-autonomous agencies;
- university-affiliated entities, such as technical universities and competence centres;
- in rarer cases, private organisations (mainly small businesses) running publicly mandated or privately owned open infrastructures.

Most technology infrastructures are not standalone legal entities but are embedded within larger institutions. Operating these facilities requires specialised skills and ongoing investment to maintain cutting-edge capabilities.

The scale of operators varies significantly. Survey responses in this study came from organisations with annual revenues ranging from €1 million to over €4 billion, including research and technology organisations and technical universities of all sizes. This diversity highlights the fragmented nature of the technology infrastructure landscape in Europe. Among respondents, 32% (19 organisations) reported revenues of €10 million to €25 million, and 25% (15 organisations) had revenues below €10 million.

Types of technology infrastructures in research and innovation

Technology infrastructures play a critical role in enabling the development, validation and deployment of technologies across a wide range of industrial sectors. According to survey responses in this study, the most prominent user sectors include:

- mobility, transport and automotive;
- energy and renewables;
- energy-intensive industries (for example, chemicals, steel, paper, plastics and cement);
- electronics (design and manufacturing of electronic components, raw materials and manufacturing tools);
- healthcare (including pharmaceuticals, medical equipment, healthcare services and health tech);
- construction;
- aviation, aerospace and defence;
- information and communication technology (ICT).

Technology infrastructures typically tailor their activities and services to the specific needs of these sectors. While some infrastructures serve multiple industries, others are highly specialised. This diversity explains the wide range of business models – there is no one-size-fits-all approach (see Section 2 for more details).

Technology infrastructures operate under mixed funding models that reflect their quasi-public mission. Funding needs span the entire lifecycle – from planning and creation (capital expenditure) to operation, upgrades and eventual decommissioning. Most investment costs are covered by public grants, while revenues are mainly generated through industry contracts – for example, collaborative research and innovation at low- to mid-technology readiness levels, and fee-for-service; EU, national and regional competitive grants; base (block) funding from governments; and internal reinvestment of surpluses. The mix of funding sources varies significantly depending on the infrastructure's size, market focus and geographical context.

The technology infrastructure market operates as a hybrid system, neither fully commercial nor purely public. This quasi-market structure influences the feasibility and suitability of various funding instruments. Infrastructures with strong industry ties and a higher proportion of private service delivery are generally better positioned to access co-financing and financial instruments, while more research-oriented or public infrastructures may require stable public funding to ensure long-term sustainability.

1 FUNDING NEEDS OF TECHNOLOGY INFRASTRUCTURES FOR CAPITAL EXPENDITURE

1.1 Funding needs by 2030

Technology infrastructures support the development and maturation of emerging technologies, facilitating their market uptake across sectors. These infrastructures help bridge the gap between research breakthroughs and commercial viability – an area that presents unique challenges. By lowering the risks associated with private investment, technology infrastructures accelerate the adoption of innovations and drive market transformation across industries. Sectors characterised by rapid technological change or emerging technologies require sustained investment to ensure that infrastructures remain cutting-edge.

Most operators of technology infrastructures can reliably estimate their annual spending on the infrastructures by using internal budget monitoring systems, capital expenditure analysis and strategic investment planning. While most operators have annual investment plans for technology infrastructures, several have adopted multiyear investment plans aligned with government strategic priorities to foster long-term financial sustainability, which is highly dependent on the availability of public funding sources. Capital expenditure is therefore often prioritised through an approach that combines long-term strategic planning with agile short-term or annual adjustments.

The operators consulted in this study – primarily research and technology organisations – have a total annual turnover of €15 billion, amounting to €75 billion over five years. Their total capital spending on technology infrastructures over the past five years is estimated at €5.6 billion. A literature review and analysis conducted as part of this study estimate the total annual turnover of the European research and technology organisation sector to be around €30 billion.

Based on the data collected from technology infrastructure operators and extrapolated to reflect a European market with an estimated annual turnover of €30 billion,[4] the minimum funding needed for capital investments in technology infrastructures in Europe by 2030 is estimated to range between €13 billion and €16 billion. However, this figure only marginally accounts for the investment needs of the (technical) university sector and other independent infrastructure operators, making it a conservative lower-bound estimate. Moreover, optimal capital expenditure needs of technology infrastructures are projected to grow by over 200% over the next five years compared with current levels.

Regarding the rationale behind the funding gap and projected funding needs, operators emphasised the importance of continuous investment to keep pace with technological advancements and maintain competitiveness in rapidly evolving industries. Significant capital investments – often reaching hundreds of millions of euros – are required to establish new infrastructures in emerging technology fields. For example, developing cleanrooms and pilot lines can demand capital expenditure of up to €1 billion. In addition, existing infrastructures require upgrades or expansions to adapt to evolving technological advances and industry needs, rather than being replaced entirely. However, financial constraints often limit investments to essential equipment replacement rather than comprehensive facility upgrades. Several operators also reported challenges in aligning their long-term technological strategies with fragmented funding landscapes, which are often characterised by ad hoc and highly competitive mechanisms earmarked for specific policy priorities.

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4 This is a lower conservative limit, taking into consideration the research and technology organisation market and knowing that many technology infrastructures are operated by technical universities and that some infrastructures are private or managed by private organisations.

1.2 Types and prioritisation of technology infrastructure investments

The scale of minimal and optimal technology infrastructure investments varies across operators, reflecting substantial differences in their financial capacities. Some research and technology organisations operate with turnovers as low as €5 million, while others exceed €5 billion, resulting in stark disparities in their ability to fund large-scale infrastructure projects.

The largest operators of technology infrastructures – such as the French Alternative Energies and Atomic Energy Commission (CEA), Fraunhofer-Gesellschaft and Łukasiewicz Research Network – have multibillion euro turnovers and typically invest between €1 billion and €2.5 billion in technology infrastructures over a five-year period. In contrast, mid-sized research and technology organisations – such as VTT Technical Research Centre of Finland, AIT Austrian Institute of Technology GmbH, and the Danish Technological Institute – with turnovers of €200 million to €500 million – can allocate €5 million to €10 million from existing budgets and available funding sources. However, larger investments – typically ranging from €10-15 million to more than €100 million – are more challenging and often require alternative financing mechanisms and ad hoc public funding.

Box 1: Prioritisation of technology infrastructure investments by operators

Technology infrastructure operators adopt various approaches to prioritising investments, most of which are based on the viability of the business cases for new or upgraded infrastructures. Common approaches include:

- **Mixed top-down/bottom-up models:** Many operators combine strategic oversight with input from operational levels to assess investment needs and prioritise based on predefined criteria.
- **Multiyear strategic planning:** Investment decisions are often made within multiyear cycles, aligned with national or regional funding frameworks and strategic objectives.
- **Annual committee reviews:** Researchers typically report investment needs at the institute level, and decisions are evaluated through annual reviews.
- **Industry collaboration:** Engagement with industry partners helps ensure that investments are aligned with broader market needs.
- **Guiding frameworks:** Investment decisions are often influenced by technology and research and innovation (R&I) roadmaps, funding eligibility and availability, and political priorities.

A key element in prioritising technology infrastructure investment is the development of robust, market-driven business cases. These support operators in attracting capital for new infrastructures or upgrades to existing ones. Operators emphasised the importance of distinguishing between capital expenditure and operational expenditure when designing business models, as each requires distinct financing approaches.

Building a strong business case typically involves a combination of technology-push – where innovation is driven by research and technological developments – and market-pull – guided by identified market demand or societal needs.

Box 2: Key elements of a technology infrastructure business case

- **Identify the market demand** and expected user base, including types of organisations and geographic distribution of users.
- **Select promising technologies** adapted to respond to market demand and expectations – in the short, medium, or longer term.
- **Assess the expected revenue generation** from the technology infrastructure and the ability to cover operational costs and the feasibility of setting service/product prices that reflect full cost recovery, while remaining competitive within market constraints.
- **Explore collaboration models with private users**, including long-term "guarantee of use" agreements with specific companies, defined access rights and tailored pricing strategies. These models should be adapted to different segments, such as startups, small and medium businesses and large corporations.
- **Forecast the utilisation rate** and evaluate the infrastructure's ability to meet demand. Include a long-term sustainability and scalability plan that considers private and public sector engagement.
- **Define the infrastructure's value proposition and unique selling points**, its technology readiness and competitive positioning. Highlight potential complementarities with other infrastructures in the same geographic market.
- **Identify available funding sources** to support capital and operational expenditures, with particular attention to competitive funding programmes.
- **Ensure that the business case aligns with the organisation's strategic objectives** and with regional, national and EU-level policy priorities.

Technology infrastructure operators employ different approaches to maximise their ability to secure funding, enhance the long-term sustainability of their technology infrastructure investments and manage associated risks. These strategies include structured scenario planning to stress-test business cases, early engagement with users and industrial partners to validate demand, and independent external reviews to strengthen the credibility of financial assumptions. These approaches can be further tailored to the specific context and strategic objectives of each infrastructure initiative.

Participants in one of the two workshops held during the conference "Technology Infrastructures: A Strategic Asset for European Competitiveness" in Warsaw identified the following components as essential to the success of technology infrastructures:

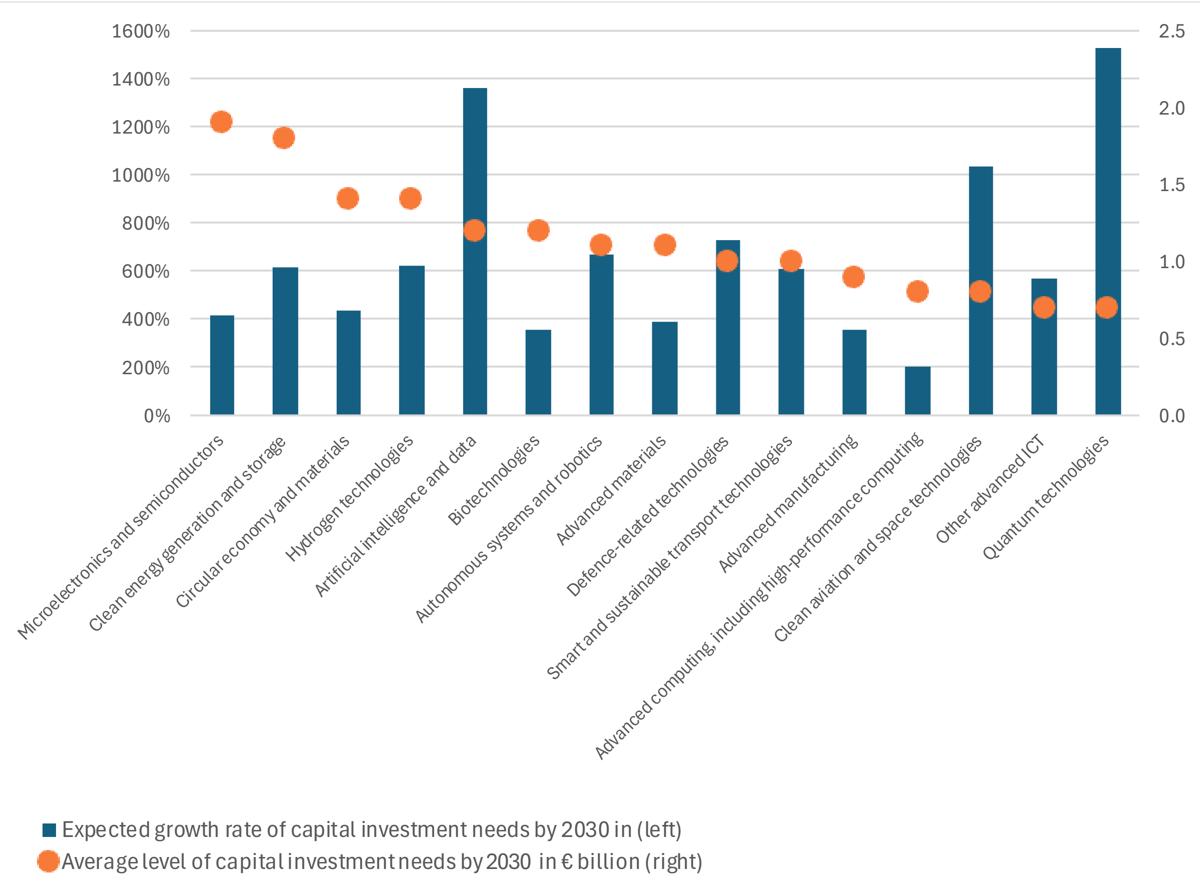
- **Integrated investment planning:** Effective planning combines bottom-up and top-down approaches. Bottom-up planning ensures responsiveness to user needs and internal capabilities, while top-down planning aligns with strategic objectives, national priorities and regional development goals.
- **Human capital as a core asset:** Excellence in service delivery and innovation depends on attracting and retaining top-tier talent. A compelling business case should highlight investments in human resources, skills development and a supportive working environment that fosters excellence.
- **Balancing market demand and technological potential:** A strong business case requires a nuanced understanding of current market needs and future technological developments. This is achieved through robust demand assessments combined with strategic foresight.
- **Staying ahead of technological trends:** Maintaining competitiveness requires continuous investment in cutting-edge equipment and a proactive approach to emerging technologies. Technology infrastructures must demonstrate their ability to remain ahead of the curve to attract users and funders.
- **Public-private business case:** For most of the participants, the business case is built on a public-private funding model. Technology infrastructures address societal challenges, support public research and require time to build a robust user base and project pipeline.

- **Long-term partnerships and agreements:** Financial stability often depends on long-term collaborations. Trust-based relationships with users and industrial partners can lead to framework agreements that ensure predictable revenue streams. A clear commercial strategy and transparent engagement processes are key to securing such partnerships.
- **Context-specific risk management:** Risk management must be tailored to the specific operating environment, addressing technological, financial, legal and operational risks. For instance, while collaboration with startups is essential, it presents challenges due to their uncertain trajectories – making it difficult to calibrate risk and set realistic co-funding expectations.

1.3 Funding needs across technology areas

The survey of technology infrastructure operators regarding anticipated capital investment needs over the next five years highlights a demand for investments in technology infrastructures across all technology sectors (Figure 1).

Figure 1: Level and expected growth rates of capital expenditure needs across technology sectors in the European Union by 2030



Source: Technopolis Group (2025), survey of technology infrastructure operators.
Note: The data reflect 41 responses.

Investment needs are anticipated to be highest in the microelectronics and semiconductors sector, largely due to the substantial scale of individual infrastructure projects in this field. This is followed by strong demand in clean energy generation and storage; hydrogen technologies; circular economy and materials; and artificial intelligence and data. While digital and green technology infrastructure investment needs are concentrated among a moderate number of technology infrastructure operators, certain areas – such as the circular economy

– are relevant to a broader range of organisations. Some operators are planning significant capital expenditure investments for single technology infrastructure facilities, particularly in microelectronics and materials research, with individual investments exceeding €50 million.

Substantial growth in investment needs is also expected across all technology sectors. Quantum technologies and artificial intelligence and data are expected to experience particularly high growth rates. Clean aviation and space technologies also show strong projected growth, although the number of operators in these sectors is expected to remain relatively stable. The number of technology infrastructure operators in aviation, aerospace and defence and in artificial intelligence and data is expected to increase significantly by 2030.

Box 3: Examples of technology infrastructures in the fields of microelectronics and batteries

In the semiconductor sector, CEA-Leti, a technology research institute within the French Alternative Energies and Atomic Energy Commission technology research unit (CEA Tech), introduced the FAMES Pilot Line in June 2024. FAMES will receive €830 million in funding, contributed equally by the Chips Joint Undertaking (Chips JU) and participating EU Member States. FAMES aims to advance European semiconductor capabilities by supporting the development of five new technology platforms focused on higher-performance, energy efficiency, and sustainability in chip design.[5]

In the battery sector, Europe's production capacity is expected to quadruple to more than 500 gigawatt hours per year at the end of 2025 from 124 gigawatt hours per year in 2022, with potential growth to 1.5 terawatt hours by 2030.[6] The Fraunhofer Research Institution for Battery Cell Production FFB in Münster, Germany, is to become a development centre for modern and scalable battery cell production for Germany and Europe. The German federal government and the state of North Rhine-Westphalia are jointly investing up to €680 million to establish a comprehensive research and technology infrastructure. The facility will provide equipment and services to support small, medium and large companies and research institutions in testing, implementing and optimising near-series battery production.

1.4 Sources of technology infrastructure capital investments

Capital expenditure refers to the annual gross amount spent on acquiring fixed assets – specifically, technology infrastructures. This includes investments in facilities machinery, instruments, equipment, property, land, buildings, software and intellectual property.[7] All capital expenditures supporting the creation of new technology infrastructures and the upgrade of existing ones are included, regardless of the funding source.

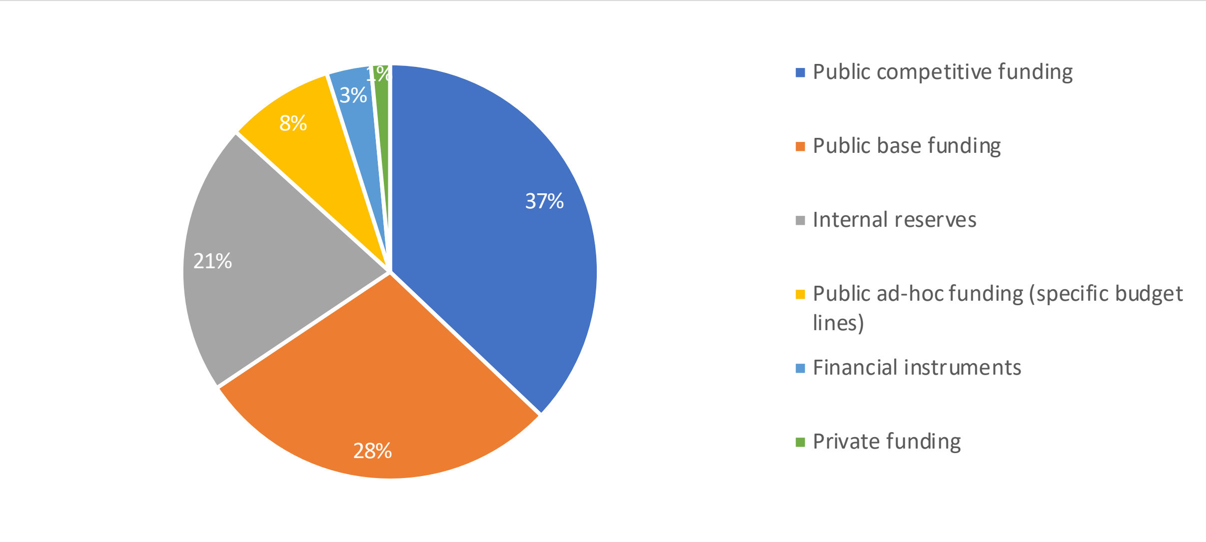
The funding mix for technology infrastructure capital expenditure varies considerably across different infrastructures, reflecting a fragmented funding landscape for technology infrastructures across Europe.

5 Chips JU, CEA-Leti announced the launch of the FAMES Pilot Line

6 Fraunhofer ISI, European battery cell production: Tenfold increase in production capacity by 2030.

7 OECD Library (2018).

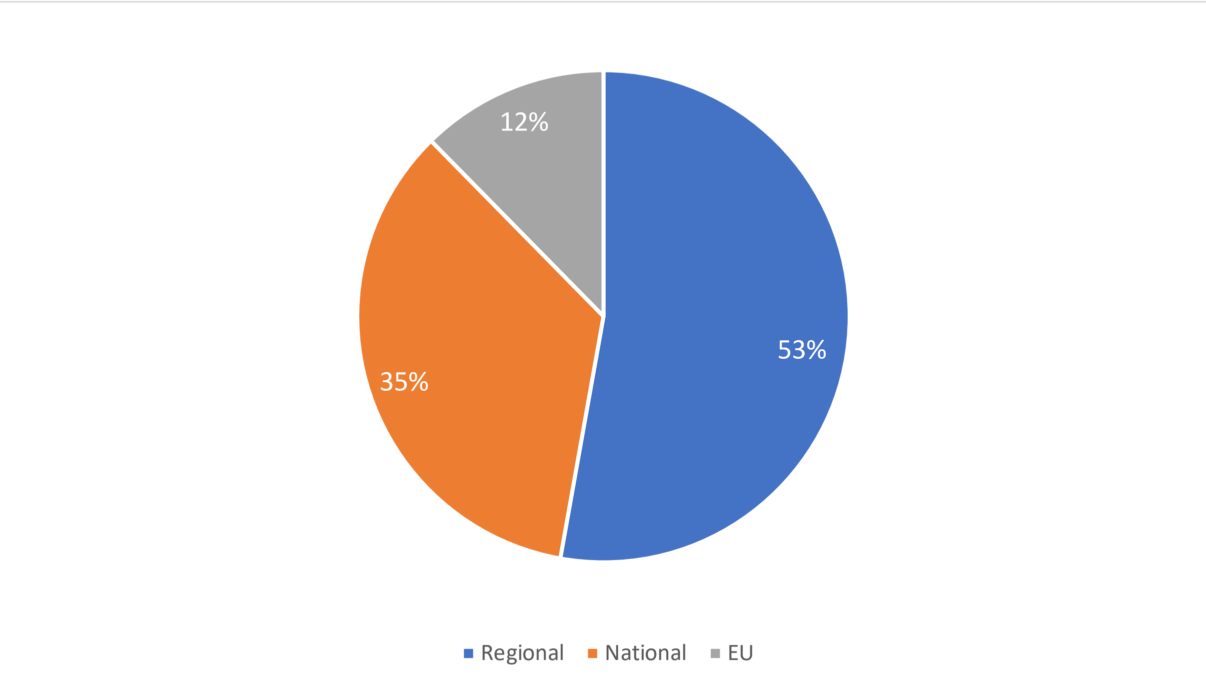
Figure 2: Funding sources of capital investment financing for technology infrastructures



Source: Technopolis Group (2025), survey of technology infrastructure operators.

Additional details on the public sector funding for technology infrastructures, including public competitive funding, public base/block funding and public ad hoc funding, are obtained by examining the geographical sources of the funding (Figure 3).

Figure 3: Geographical sources of public funding for capital expenditure



Source: Technopolis Group (2025), survey of technology infrastructure operators.

At the EU level, competitive public funding – such as Horizon Europe (for example open innovation testbeds) or DIGITALEUROPE (for example chips pilot lines, testing and experimentation facilities) accounts for an average of 12% of the public funding mix. These funds sometimes combine competitive public funding with procurement mechanisms such as chips funds, targeting specific domains, such as advanced materials, AI, microelectronics and photonics. They typically support capital expenditure and access to infrastructures.

National level funding accounts for an average of 35% of the public funding mix and includes direct government appropriations (block funding), competitive funding and ad hoc funding. While block funding is a key source, some operators report limitations due to its designated use – often restricted to competence building and/or high-risk research and innovation activities. National competitive funding, including multicountry instruments like Important Projects of Common European Interest, also contributes, albeit in limited cases. The Recovery and Resilience Facility, a temporary instrument offering grants and loans to support reforms and investments in EU countries, has emerged as a significant funding source for technology infrastructures across various countries, raising questions among survey participants about future alternatives once the Recovery and Resilience Facility support concludes.

Regional level funding represents 53% of the public funding mix on average and covers competitive public funding – for example, through the European Regional Development Fund – and regional base funding. However, regional funding tends to offer lower certainty and smaller-scale investments.

Beyond public sources, technology infrastructure operators often reinvest profits, which account for 21% of the average funding mix. These internal reserves are distributed across various funding categories.

In contrast, external financial instruments – from European, international, national or regional institutions and commercial banks – represent on average only 3% of the technology infrastructure funding mix and are used by a limited number of operators. Barriers to investing in technology infrastructures include a scarcity of financial instruments and concerns over financial risk and indebtedness.

Private co-investments play a minimal role in supporting capital expenditure, accounting for an average of 1% of the funding mix. Public-private co-financing remains rare, with operators reporting that the private sector appears reluctant to assume investment risks. Some research and technology organisations report leasing their infrastructure to private firms, which supports operationalisation, but not capital investment.

Foundations also play a role. For example, Denmark's Novo Nordisk Foundation supports technology infrastructure upgrades through a specialised programme[8] offering grants up to €3.35 million (with €18 million available in 2024). These grants typically target projects and facilities at higher technology readiness levels.[9]

In summary, the findings underline a strong reliance on traditional public funding channels for capital investments in technology infrastructures, while alternative financial instruments and private funding sources remain underutilised, indicating opportunities for diversification and improved financial planning.

1.5 Challenges in funding capital expenditures

Technology infrastructure operators are facing growing investment demands that often exceed available funding. Many report that current funding sources are insufficient – both in overall scale and in their ability to support individual infrastructure investment streams. Limited and fragmented funding sources hinder the creation and upgrade of technology infrastructures – especially mid- to large-scale – even when robust, industry-validated business cases are in place. As a result, operators are often forced to balance user needs, emerging technological trends and revenue targets, while grappling with funding shortages.

Numerous operators report that many of their investments cannot be realised, although their investment planning is guided by strategic frameworks aligned with technological priorities and expected economic returns.

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8 For example, the Novo Nordisk foundation has granted DKK 118 million to the Danish Technological University for the development of a new fermentation plant.

9 European Commission, Directorate-General for Research and Innovation, Viscido, S., Strauka, O., Coroler E. (2024). Policy landscape supporting technology infrastructures in Europe.

A central challenge identified in this study is the limited availability of funding for technology infrastructures' investments. National support programmes, in particular, are often inadequate – particularly for facilities at mid-technology readiness levels. The relatively low amounts per facility hinder scalability, requiring the combination of various funding sources to reach viable investment levels. Combining funding from different sources is also a challenge, due to mismatches in application processes, eligibility rules and timetables across different programmes.

Another issue highlighted is the exclusion of instrumentation and equipment from direct eligible investment calculations of public funding programmes. These can be only partially offset through funding of indirect costs. To fill the resulting gap, operators must seek additional financing, which limits their ability to take risks and invest in high-stakes technological areas.

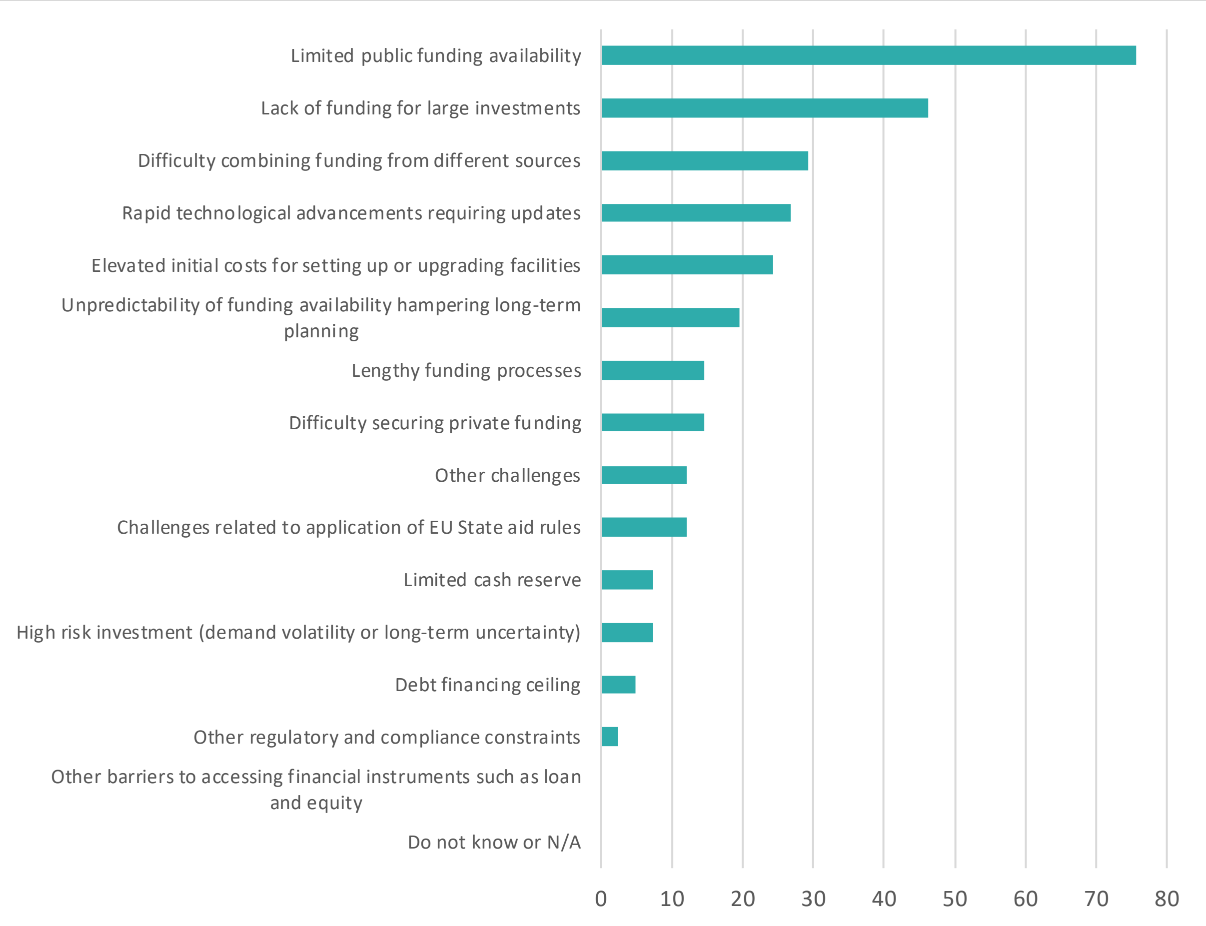
Technology infrastructure operators also raised concerns about the rapid pace of technological change, which demands continuous updates and customised technological solutions. In this context, many operators highlighted that the time required to secure public funding – along with the need to combine several funding sources to achieve scale – significantly delays the operationalisation of projects. They emphasised that the discrepancy between the fast-moving nature of technological development and lengthy public funding processes (also due to higher regulatory requirements in Europe), undermines Europe's competitiveness. Compared with regions like the United States, Japan and China, where investment processes are more agile, and funding decisions are made and allocated more swiftly, Europe faces a disadvantage.

Some of the operators interviewed noted that increasingly sophisticated research demands were outpacing the capacity of some institutions to upgrade their technology infrastructures accordingly.

High initial costs were also cited as a major barrier, particularly for multipurpose infrastructures covering several technologies and serving diverse sectors. These costs are compounded by the fact that most public funding instruments remain technology-specific. Conversely, infrastructures that are uniquely set up to serve the needs of specific industries require highly customised solutions, which often limits their long-term sustainability.

Finally, operators reported difficulty in securing private co-investments for capital expenditure (for example due to uncertainty of return on investment, complexity of deal structuration, lack of confidence, lack of interest, etc.), along with low predictability of funding sources, both of which complicate long-term planning and strategic investment.

Figure 4: Challenges for investing in technology infrastructure creation and upgrade (% of respondents)



Source: Technopolis Group (2025), survey to technology infrastructure operators.

Note: Technology infrastructure operators were asked to select their top three challenges for capital expenditure funding. The data reflect 41 responses.

2 SECURING DEMAND FOR TECHNOLOGY INFRASTRUCTURE SERVICES

2.1 Funding needs for technology infrastructures across sectors

From a demand-side market perspective, technology infrastructures play a critical role in enabling technology adoption across all sectors. This includes highly innovative industries, which are often early adopters of new technologies, and more conservative sectors, which are slower to adopt even mature technologies. Technology infrastructures also facilitate cross-sectoral exchange and integration of technologies between sectors.

Accurately assessing market demand is crucial for ensuring long-term user engagement. Strong industry demand supports sustained usage and generates predictable revenues through user fees, helping to reduce financial uncertainties. When industries are willing to co-invest, it signals robust, long-term demand, making infrastructure projects more attractive to potential investors. However, accurately assessing the expected demand in emerging technology sectors – when industry is not yet aware of the potential of such technologies – remains a challenge.[10]

Box 4: Examples of technology infrastructure investment needs in specific sectors

Aeronautics

The RINGO (Research Infrastructures – Needs, Gaps and Overlaps) project, funded by the European Commission, has identified and assessed the aviation research and technology infrastructures needed for Europe to achieve its Flightpath 2050 vision. The project highlighted more than 50 research/technology infrastructures needs, including 41 asset gaps (missing infrastructures across Europe) and 58 capability gaps (existing facilities requiring major upgrades) spanning 15 sectors.

One example is the 2019 modernisation of ONERA's wind tunnel facilities, a €306 million project supported by a €47 million loan of from the European Investment Bank (EIB) under InnovFin Science. This investment enabled substantial upgrades and improved testing capabilities, addressing long-standing investment deficits. It formed part of the Aero Testing Programme, which supports the maintenance and upgrading of wind tunnel facilities to enable testing of greener, next-generation engines. Similarly, DNW, the German-Dutch Wind Tunnels, allocates €2-5 million annually for capital investments in technology infrastructures, with a larger €20 million upgrade programme planned for 2019-2024.

Automotive

Historically Europe's largest private investor in research and innovation, the automotive industry relies heavily on technology infrastructures to maintain global leadership. According to the Draghi report, automotive companies have consistently ranked among the top three private investors in research and innovation in Europe over the past two decades. Major corporations include Volkswagen Group, BMW Group, Renault Group and Volvo Group, alongside numerous small and medium-sized enterprises.

One prominent example is Sweden's AstaZero testing facility, which underscores the critical role of technology infrastructures in keeping pace with technological advancements. In the coming years, the automotive industry is expected to undergo a significant transformation with the integration of AI. For

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10 See also European Commission Expert Group on Technology Infrastructures (2025). User needs for technology infrastructures.

example, AI-powered generative algorithms are revolutionising vehicle design by optimising structure and components to enhance performance and reduce material usage.

Construction

The construction sector, encompassing the design, renovation and operation of buildings and infrastructure, is under increasing pressure to decarbonise, industrialise and digitalise. Technology infrastructures play a vital role in this transformation by enabling the testing, demonstration and validation of innovative solutions such as low-carbon materials, smart building systems and energy-efficient building envelopes. These facilities support the transition from traditional project-based construction practices towards more scalable, product-based and circular models.

At the EURAC Research Institute for Renewable Energy in Italy, specialised laboratory infrastructures support three core areas: indoor environmental quality (including user-centred monitoring), adaptive building technologies (including passive and active systems) and the integration of digital data technologies for intelligent building operation. These facilities enable real-world testing and validation, including inhabited test buildings that provide valuable feedback to manufacturers and system installers facing practical deployment challenges.

Interviews conducted for this study reveal that operators in the construction sector often struggle to secure long-term investment, largely due to the predominance of small and medium businesses. Local mechanisms have emerged to stimulate demand – for instance, "lab bonus" vouchers issued by local authorities to encourage small firms to use regional facilities.

The table below presents some of the technology infrastructure operators active in the construction sector.

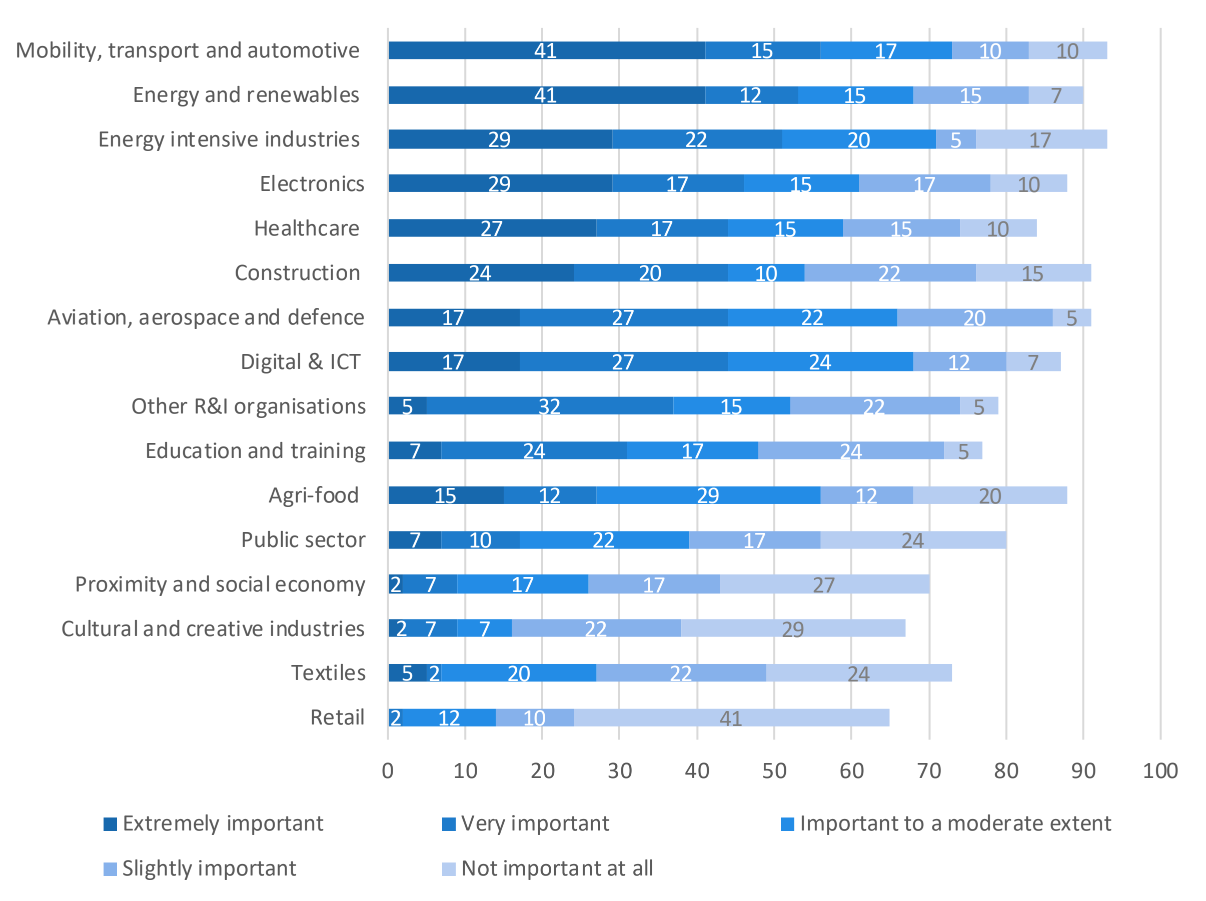
Category	Technology infrastructure operators in the construction sector
Large research organisations	CEA (France), CSTB (France), Deltares (Netherlands), TNO (Netherlands), Fraunhofer BIA (Germany), SINTEF (Norway), VTT (Finland), RISE (Sweden), Łukasiewicz Research Network (Poland)
Small/medium research organisations	AIT (Austria), BAM (Germany), Cenaero (Belgium), Fundación CARTIF (Spain), EMI (Hungary), INTROMAC (Spain), AIDIMME (Spain), AIMPLAS (Spain), BUILT CoLAB (Portugal), Eurac Research (Italy), ITeC (Spain), LEITAT (Spain), ZAG Ljubljana (Slovenia), LIST (Luxembourg)
Universities	Cardiff University (United Kingdom), Politecnico di Milano (Italy), NTUA (Greece), Ghent University (Belgium), RWTH Aachen (Germany), DTU (Denmark), NTNU (Norway), University College Dublin (Ireland), Tampere University (Finland)

When evaluating investment needs for technology infrastructures across various industrial sectors, several key dimensions emerge:

- **The market structure and industry demand**, including the types of technology infrastructure users and their ability to ensure sustained use of these infrastructures over time. While some sectors are dominated by large international corporations, others – particularly in Europe – consist of numerous smaller companies, which face challenges in securing long-term investments and achieving scale.
- **The scale and geographic distribution of industrial markets** across Europe varies: Some technology infrastructures address regional or national markets, while others – especially those with unique or niche capabilities – have a European or international relevance. Analysing this distribution helps identify regional disparities and informs targeted investment in specific countries or regions.

- **Understanding the level and evolution of research and innovation investments** across sectors provides insight into the sectors' ability to invest in and benefit from technology infrastructure.

Figure 5: Importance of industrial sectors as users of technology infrastructures (in %)



Source: Technopolis Group (2025), survey of technology infrastructure operators.
Note: The data reflect 41 responses.

2.2 Scale of technology infrastructure operational costs

Operational costs are the day-to-day costs for operating technology infrastructures. These typically include expenditures related to support, operations, usage and maintenance – for example, staffing, rent, utilities, materials and energy.

As previously stated, the technology infrastructure operators consulted for this study have a total yearly turnover of €15 billion (€75 billion over five years). Their estimated annual operational expenditure on technology infrastructures is €440 million, amounting to €2.2 billion over five years. These figures cover the entire portfolio of technology infrastructure managed by respondents, not only those created or upgraded in the last five years.

Operators indicated that, on average, annual operational costs represent 10% to 15% of the total capital expenditure over the lifecycle of a technology infrastructure. This highlights the importance of operational funding in the overall financial structure of infrastructure projects.

Cost structures vary widely depending on the infrastructure type. For example, cleanrooms and metrology equipment incur higher operating costs due to their continuous (24/7) operation. Large-scale technology infrastructure operators report substantial operating and maintenance costs, particularly for high-tech facilities such as cleanrooms, high-performance computing centres, quantum facilities, nuclear research and development

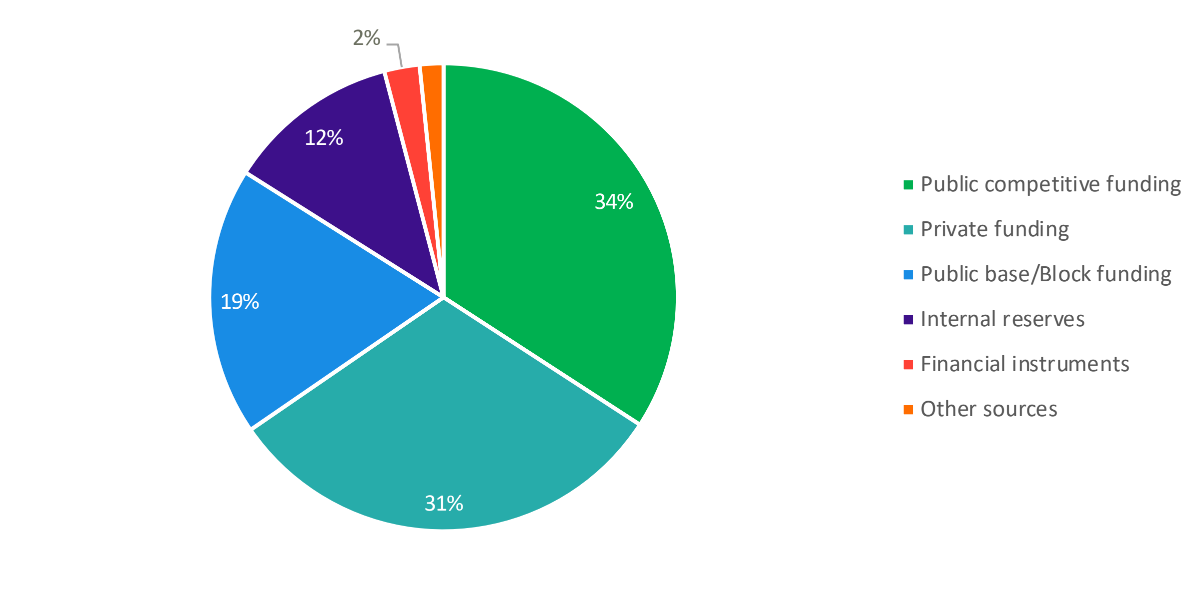
(R&D) installations and large-scale automotive testbeds. Key cost drivers include personnel, energy, consumables, maintenance and calibration.

Most operators anticipate a rise in operational costs over the coming years, driven by inflation, rising energy prices, increasing technology infrastructure complexity and the expansion or upgrading of existing facilities. To ensure financial sustainability, operators are calling for public funding schemes that support cross-border access to technology infrastructures, particularly for small and medium companies, through demand-side instruments.

2.3 Funding sources for operational costs

The funding landscape for operational expenditure of technology infrastructures is fragmented, relying on a mix of public and private funding and internal reserves (Figure 6).

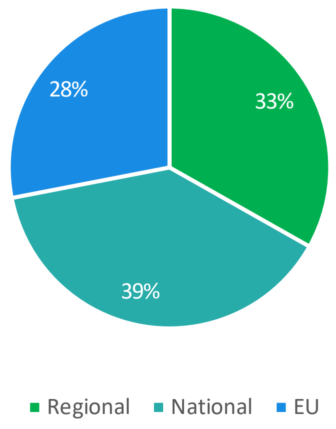
Figure 6: Sources of funding for technology infrastructure operational costs



Source: Technopolis Group (2025), survey of technology infrastructure operators.
Note: The data reflect 41 responses.

An analysis of the geographical sources of public sector funding (including public competitive funding and public base/block funding) to cover the operational costs of technology infrastructures reveals that the funding is obtained at similar levels from regional, national and EU sources (Figure 7).

Figure 7: Origin of public funding for technology infrastructure operational investments



Source: Technopolis Group (2025), survey of technology infrastructure operators.
Note: The data reflect 41 responses.

Funding from **competitive public programmes** at the European, national and regional levels is frequently used and can cover up to 55% of operational costs. However, operators and users noted that eligibility criteria and funding rules sometimes restrict the use of these funds for supporting access to technology infrastructure.

Private industry funding also contributes significantly to operational costs. However, technology infrastructures business models vary, with some relying on industry contracts, which can account for 60-100% of their operational expenditure, while others depend more on competitive public funding.

National and regional public block funding and internal reserves contribute variably, depending on the infrastructure's business model. In cases with limited industry involvement, internal reserves are often used to finance the operational costs for in-house research activities. However, many technology infrastructure operators report that a considerable portion of their operational expenditure remains unfunded, forcing them to absorb these expenses internally and posing serious financial challenges.

Financial instruments from commercial banks and public institutions are rarely used to cover operational costs (see Section 4 for more details).

Overall, the fragmented nature of funding presents a major challenge. Operators call for clearer and more accessible pathways to funding, including better awareness of existing opportunities at regional, national and EU levels, and better coordination between the funding sources. Many also raised concern that insufficient funding for operational expenditure is stalling investments and undermining the sustainability of existing infrastructures. In some cases, funding shortfalls have forced infrastructure operators to suspend planned investments, as inadequate resources hamper the maintenance and continued operation of facilities.

2.4 Contractual models and pricing strategies with users

Technology infrastructure operators employ different types of contractual models with external users of their facilities, including:

- **Contract-based collaboration agreements.** These are the most commonly used arrangements. They typically involve single ad hoc agreements with upfront in-kind or cash payments. Some operators also use performance-based models with ex-post payments.

- **Long-term partnership models.** These models, which are less common, include joint ventures and memorandums of understanding, among others. The degree of long-term commitment varies by format. Memorandums of understanding, for example, are a softer form of partnership, with more general terms.
- **Membership models.** Based on royalty fees or subscriptions, these models are the least frequently used contractual arrangements.

Box 5: Example of a joint development agreement between a Belgian R&D hub and industry partners

Imec, headquartered in Belgium, engages in joint development agreements with industry partners that combine cash and in-kind contributions to support the creation and upgrading of technology infrastructures. This structured public-private co-investment model is one of the few well-established approaches in the sector.

Under these agreements, industry partners typically co-own specific sections of the technology infrastructure, allowing them to use Imec's resources and benefit from its expertise, advanced technology, complementary equipment and sector-related services. In turn, these agreements enable Imec to scale up its capital expenditure investments, ensuring continuous infrastructure development.

The involvement of industry partners also enhances the financial sustainability of the technology infrastructure, creating a mutually beneficial innovation ecosystem that strengthens long-term collaboration between the public and private sectors.

Technology infrastructure operators always aim to establish long-term collaborations, but these take time to build and usually require three key conditions:

- **the presence of a large company or a mid-cap** among the infrastructure's users, with structured R&D units and the ability to make risky investments.
- **a unique selling proposal** that provides a clear differentiation and expertise not already widely available within the technology infrastructure landscape and easy to access for companies.
- **Strong trust** between the technology infrastructure operator and the large company or mid-cap to sustain the long-term agreement. Reaching this level of trust takes time and often requires multiple smaller projects before reaching long-term collaboration.

The technology infrastructure operators noted that long-term agreements are often not well-suited to startups and small and medium-sized enterprises as these businesses may lack a consistent pipeline of projects to sustain ongoing collaboration. To better meet the needs of smaller companies, operators could expand their service portfolios to include modular or transactional offers such as testing, certification, training and consulting. These would enable smaller businesses to access high-value infrastructure and expertise without committing to multiyear engagements.

Box 6: Sector-specific models for sustaining technology infrastructure partnerships agreements

Findings from this study highlight a range of strategies and challenges in securing long-term commitments from technology infrastructure users. While some operators – such as specialised wind tunnel testing centres and large-scale testbeds or cleanroom facilities – are able to secure stable engagement with industry, many others, particularly those catering primarily to small and medium businesses whose development and investment cycles are much shorter, rely on short-term and ad hoc contracts. Some technology infrastructures also lack the scale or capacity to offer sustainable, long-term services for companies that require exclusive access to specialised equipment.

While some research and technology organisations secure sustained partnerships, these arrangements remain sector-specific and relatively limited. For example, a specialised wind-tunnel-testing organisation with an annual turnover of €10 million, collaborates with major companies like Airbus, Rolls-Royce and Safran through memorandums of understandings. These secure operational expenditure investments for facility access, but most contracts remain ad hoc with no long-term commitments.

In contrast, a mid-sized research and technology organisation holds established annual contracts with companies in the microelectronics and energy-intensive sectors, providing a more stable revenue stream. Another mid-sized organisation with a turnover of €50 million leverages a board of trustees composed of key original equipment manufacturers, large enterprises and small and medium firms to secure stable, long-term partnerships.

In addition to strengthening collaboration models, technology infrastructure operators can improve financial sustainability by leveraging tailored pricing mechanisms and contract structures. Survey participants mentioned that effective pricing strategies are vital for cost recovery and financial sustainability. Many operators apply differentiated pricing models (with built-in margins) based on client profiles. However, care must be taken to ensure compliance with State aid regulations, and further awareness raising on this topic may be necessary (see also Section 2.6).

Common pricing approaches include:

- **cost-based pricing:** recovering operational and sometimes part of capital costs;
- **value-based pricing:** aligned with expected value creation, market benchmarks or intellectual property valuation;
- **revenue-sharing models:** based on a share of the users' annual revenues.

Workshop discussions highlighted that value-based pricing is particularly attractive for innovative startups and small firms: Companies that test or develop their products using technology infrastructures must typically pay a fee, which many cannot afford. By linking their service fees to the outcome of the customer's product testing (a success fee), the technology infrastructure operators can potentially increase their revenues.

Commercialising intellectual property and creating spin-offs linked to technology infrastructures can serve as additional sources of revenue. The high demand for data generated by technology infrastructures presents an opportunity to leverage the data as an intellectual asset, provided it is not commercially sensitive.

The choice of pricing strategy often depends on the technology and industrial domain. Private investors in technology-intensive sectors typically have a larger capacity to support such investments. A few operators have used their own venture funds to indirectly support startups, exchanging technology infrastructure services against shares. This type of investment changes the way operators collaborate with industry, allowing operators to share risks directly and generate royalty-based revenues.

2.5 Challenges in funding operational expenditures

Relying on competitive funding calls to cover some of the operational costs introduces uncertainty into financial planning and limits the ability of technology infrastructure operators to plan long-term. A key challenge reported by operators is that cost eligibility rules of competitive funding programmes – whether at the regional, national or EU level – only partially cover the actual costs associated with using technology infrastructures. This gap between actual and eligible costs forces many operators to rely on ad hoc internal funding.

Some research and technology organisations have suggested that the funding rates in public competitive programmes should be adjusted to better reflect the real running costs of technology infrastructures. These costs are often categorised as indirect costs and are often underestimated. One of the main barriers to including them as direct costs is the difficulty in directly allocating infrastructure usage costs to a given project. To address this, operators recommend increasing the reliance on the standard cost accounting practices of beneficiaries of competitive funding calls.

Another challenge is the unpredictability of technology infrastructure usage, which complicates long-term capacity planning. Industry reluctance to commit to long-term contracts means that most operators must rely on short-term, ad hoc agreements. This undermines stable coverage of operational cost and constrains capital investments in new or upgraded facilities.

In addition, the risk of underutilisation of infrastructures – often due to economic downturns and fluctuations in market demand – further threatens the ability of operators to cover their operational expenditure. To improve long-term sustainability, many operators adopt a diversification strategy to expand their user base across multiple application sectors.

Box 7: Diversification strategy to mitigate industry fluctuations – a case study from the aeronautics sector

A small research and technology organisation in the aeronautics sector, which was interviewed for this study, has successfully addressed market fluctuations by diversifying its activities into similar sectors, such as automotive testing. This strategic expansion included extending facilities to accommodate large vehicles – such as vans and lightweight commercial vehicles – that cannot fit into standard wind tunnels.

The strategic move was backed by a €12 million investment aimed at broadening capabilities in automotive testing, wind turbines and other low-volume industries, ensuring greater resilience against market unpredictability.

In addition to expanding its service portfolio, the organisation emphasised the importance of maintaining system reliability to reinforce customer trust and sustain long-term business.

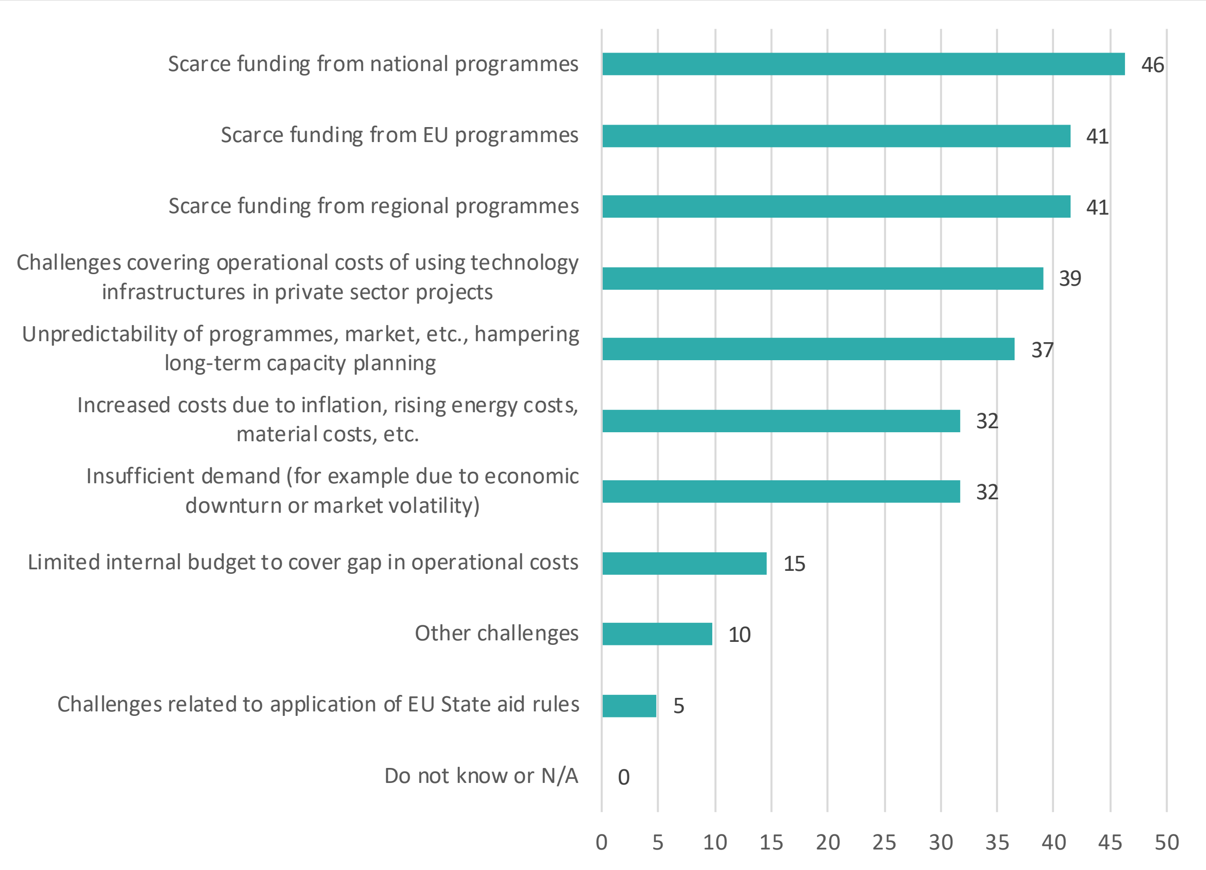
A major challenge for technology infrastructure operators is the difficulty users – particularly small and medium businesses – face in covering the full operational costs of accessing these infrastructures. Financial support is often essential to enable access, with venture-backed startups sometimes having an advantage. In contrast, mid-sized research and technology organisations frequently struggle to offer competitive pricing while maintaining financial sustainability. As a result, alternative funding mechanisms or grant-based support are essential for sustaining industry engagement (see also Section 5 on demand-stimulation programmes).

Rising operational costs further exacerbate this issue. Increasing energy prices, wages and material costs pose critical challenges, especially in energy-intensive environments such as high-performance computing centres and cleanrooms. Large-scale research and technology organisations identify energy, raw materials, and maintenance as dominant cost factors.

A small number of technology infrastructure operators also cited the implementation of EU State aid rules in their top three challenges in covering operational costs. Stakeholders consulted through interviews and workshops reported that the interpretation and implementation of these rules can influence the extent to which infrastructure activities can support industry. A key issue is the classification of certain services as economic activities under the EU State aid regulations. According to the operators, the understanding and application of the State aid rules vary significantly across technology infrastructure operators and EU countries.

A 2020 report by the European Commission's Joint Research Centre[11] highlights that this variation stems partly from limited understanding of the legal framework and partly from cultural and administrative differences across and within EU countries. Another European Commission report on technology infrastructures[12] also recommends to "improve the clarity and legal certainty around the State aid rules applicable to technology infrastructures and to increase awareness of these rules among national authorities and stakeholders." The report proposes establishing a community of practice on State aid as part of the new technology infrastructure governance, setting up a mutual learning exercise among Member States to share good practices, and updating of the Commission's Decision Tree for State aid rules to cover the 2023 State aid provisions.

Figure 8: Challenges in covering operational costs of technology infrastructures (% of respondents)



Source: Technopolis Group (2025), survey of technology infrastructure operators.

Note: The data reflect 42 responses.

11 Kebapci, H., Wendland, B. v., & Kaymaktchiyski, S. (2020). State aid rules in research, development & innovation: Addressing knowledge and awareness gaps among research and knowledge dissemination organisations – Decision tree. Publications Office of the European Union.

12 European Commission Directorate-General for Research and Innovation. (2025). Towards a European policy for technology infrastructures – Building bridges to competitiveness. Publications Office of the European Union.

3 GREENING TECHNOLOGY INFRASTRUCTURES

Like any other business or economic activity, the establishment and operation of technology infrastructures has an impact on the environment. However, these infrastructures can also play a crucial role in enabling the development of decarbonisation or environmentally friendly technologies through the services and solutions they provide.

Green investments related to technology infrastructures generally fall into two categories: investments aimed at reducing the operational footprint of the infrastructures themselves, and those facilitating the development of decarbonisation solutions and environmental technologies, such as energy storage solutions, green hydrogen and smart grids. For both categories, the EU taxonomy for sustainable economic activities and its technical screening criteria serve as a key reference for determining what qualifies as a green investment.

3.1 Green investments to reduce the operational footprint of technology infrastructures

The operational footprint of technology infrastructures is closely linked to fixed and current assets, which together shape their environmental impact.[13] Infrastructure operators interviewed in this study highlighted the substantial investments required for to make their facilities more sustainable.

Sustainability measures for technology infrastructures such as cleanrooms include infrastructure upgrades to reduce their environmental footprint – for instance, treating and reusing wastewater and sourcing electricity from renewable energy operators with a green energy label. Some technology infrastructure operators have dedicated programmes for promoting sustainable manufacturing practices, supported by specialised sustainability groups. In addition, research and technology organisations acknowledge the importance of aligning their operations with future legislative requirements to achieve carbon neutrality within a few years. Sustainability considerations are increasingly integrated into projects and activities and are becoming a cornerstone in the strategies of many research and technology organisations.

[13] Greenhouse gas emissions associated with an organisation are classified into three scopes. Scope 1 emissions are emissions from sources that an organisation owns or controls directly. Scope 2 emissions are those that a company causes indirectly from the energy it purchases and uses. Scope 3 emissions are not produced by the organisation but result from its upstream or downstream value chain, for example by the usage of its products. Technology infrastructures typically provide services for clients; therefore Scope 3 emissions are minor.

Box 8: Green investments to reduce the environmental footprint of technology infrastructures

Investments in buildings and associated equipment and infrastructure include:

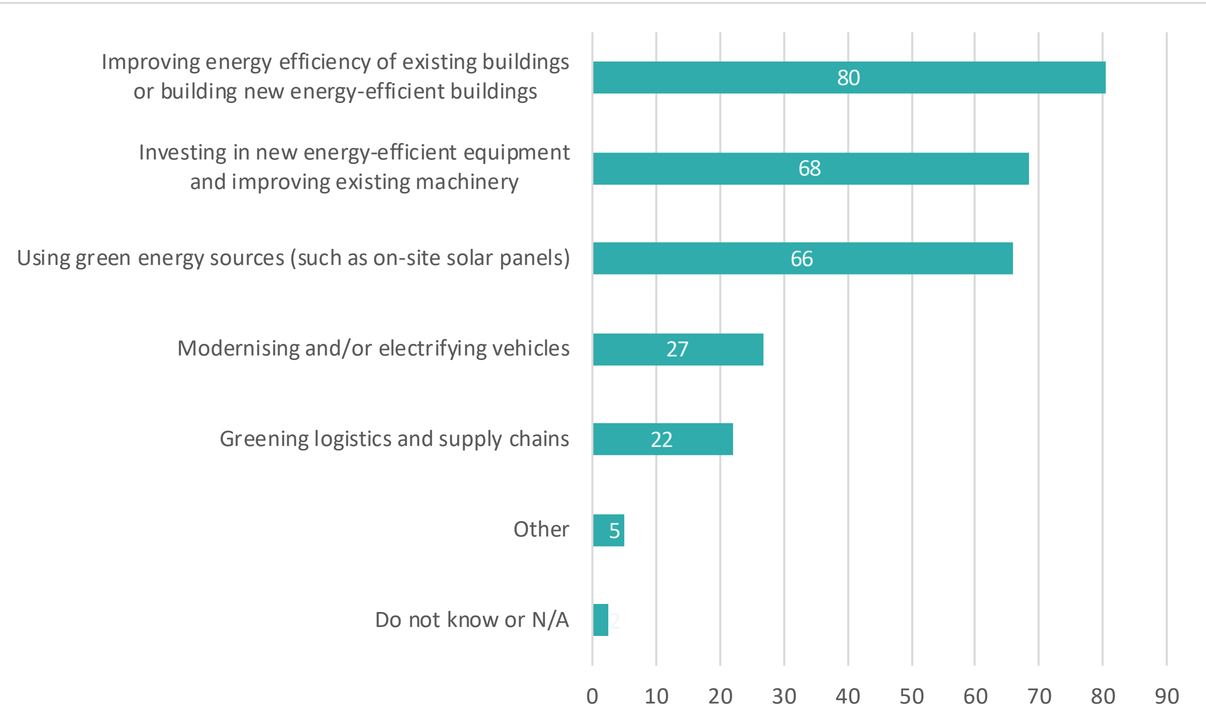
- construction of new energy-efficient buildings;
- renovation of existing buildings to improve energy efficiency;
- installation, maintenance and repair of energy-efficient equipment in buildings;
- installation, maintenance and repair of devices for measuring and controlling buildings' energy performance;
- upgrading properties to withstand climate-related risks like flooding, extreme temperatures and natural disasters.

Research equipment such as cleanrooms can have a significant environmental footprint due to high energy consumption, resource-intensive manufacturing processes and the use of materials with a high environmental impact. Reducing the environmental footprint of bespoke machinery and equipment is challenging due to their specialised design and will most likely require additional investment.

Source: Technopolis Group (2025).

Technology infrastructure operators cite energy-efficiency improvements of buildings as the top environmental sustainability priority, when deciding on infrastructure investments, followed by energy-efficient equipment and machinery and using green energy sources such as on-site solar panels. Modernising/electrifying vehicles and greening logistics and supply chain are considered less frequently.

Figure 9: Environmental sustainability factors considered when making investment decisions in technology infrastructures (% of respondents)



Source: Technopolis Group (2025), survey of technology infrastructure operators.

Note: The data reflect 42 responses.

3.2 Investment in activities to develop decarbonisation or environmental technologies

Investments in technology infrastructures can also be categorised as green based on the activities they contribute to with their service and solution offer. For example, a technology infrastructure supporting the development and pilot testing of new solar panels, or innovative technologies required to meet EU climate objectives – such as batteries and energy storage solutions, carbon capture and storage, carbon removal technologies, heat pumps, renewables, sustainable fuels, nature-based carbon sequestration solutions and alternative proteins.

The EU taxonomy is a valuable reference tool for determining whether investments qualify as green, offering clear guidance on the classification of professional, scientific and technical activities that contribute to climate and environmental objectives. For example, the Climate Delegated Act defines close to market research as "research, applied research and experimental development of solutions, processes, technologies, business models and other products dedicated to the reduction, avoidance or removal of greenhouse gas (GHG) emissions (RD&I) for which the ability to reduce, remove or avoid GHG emissions in the target economic activities has at least been demonstrated in a relevant environment, corresponding to at least Technology Readiness Level (TRL) 6." Further qualitative criteria include the following requirements:

- Research and solutions are linked to and enable activities that contribute to climate and environment objectives (as outlined in the EU taxonomy).
- Research and solutions improve the environmental performance of technologies (for example, lifecycle greenhouse gas emissions or circularity) compared with the best commercially available technologies, or lead to significant advantages, such as lower cost and improved technological and economic feasibility to facilitate scaling up.

4 FINANCIAL INSTRUMENTS TO SUPPORT TECHNOLOGY INFRASTRUCTURES

4.1 Using financial instruments for funding

The use of financial instruments to support technology infrastructures remains relatively limited. Most operators interviewed for this study reported not having used financial instruments from national or international financial intermediaries to finance past capital expenditure. Only a few indicated partial reliance, with such instruments covering up to 20% of their historical capital spending. In contrast, some operators have used financial instruments from local commercial lenders to finance more than 80% of their capital expenditure, and one operator reported that a local non-commercial (promotional) financial intermediary financed 40-60% of their capital investment.

Interviews also revealed a small number of successful cases where financial instruments were effectively applied. However, a substantial proportion of operators (60%) either did not consider financial instruments as being applicable to their organisation or did not know whether their organisation had engaged with such tools. This suggests an institutional preference for traditional public grant-based funding models highlights a potential knowledge gap about financial instruments. Operators highlighted the limited availability of financial instruments tailored to their needs; concerns over indebtedness and financial risk; and regulatory/legal restrictions as the most prevalent barriers in accessing financial instruments (see Section 4.2 for more details). The limited use of financial instruments is not linked to the high cost of capital (high interest rates) in the current business cycle, thus a lower cost of borrowing would not necessarily lead to higher uptake.

Box 9: Examples of technology infrastructures using financial instruments

RISE – SEEL Swedish Electric Transport Laboratory: SEEL is a joint venture between RISE Research Institutes of Sweden and Chalmers University of Technology, with each holding 50% ownership of the legal entity managing the technology infrastructure. SEEL successfully combined cash reserves and grant funding with debt financing. The debt was raised to diversify funding sources and comply with State aid rules and was enabled by two factors: 1) parent company guarantees from RISE and Chalmers, which – along with the joint venture's assets – provided security for the loans, and 2) long-term (typically five to ten years) user commitments, offering predictability in future cash flows.

RISE – AstaZero: Owned by RISE Research Institutes of Sweden, AstaZero was funded using a similar structure as SEEL: a mix of cash reserves, grants and debt instruments. Co-financing from industrial partners with longer-term user commitments helped provide security to the lenders.

VITO: VITO services a corporate loan from a Belgian commercial bank that financed an on-site geothermal plant. The plant supplies heat to VITO's operating facilities, reducing the firm's utility costs, and also functions as a technology infrastructure. This €5 million loan with a tenor exceeding ten years is the only financial debt VITO has ever incurred.

Eurecat: Eurecat has a long-standing relationship with Spanish commercial banks, accessing general purpose credit lines for its investments. Its ability to take on financial debt is supported by its stable financial position, with annual EBITDA of approximately €4 million, which is the basis of its repayment capacity.

4.2 Barriers to using financial instruments

Despite their critical role in supporting innovation and industrial competitiveness, technology infrastructure operators face various barriers – structural and behavioural – that restrict their access to diversified and sustainable financing. Insights from interviews and survey responses in this study highlight four key obstacles that collectively hinder the use of financial instruments to fund technology infrastructures (Figure 10).

Figure 10: Four key obstacles to using financial instruments to fund technology infrastructures

Cultural factors
- Risk aversion
- Limited experience with financial instruments
- Bias in favour of research and non-profit operations

General financial standing
- Low debt repayment capacity
- Over-reliance on internal reserves
- Limited collateral value of illiquid assets

Governance and legal issues
- Financial autonomy
- Dual nature of public-private orientation
- Internal accounting
- Perception of State aid rules

Cash flow generating capacity
- Pricing models that do not capture all costs
- Unpredictable demand patterns
- Weak counterparty credit quality

Source: Technopolis Group (2025).

A. Business culture factors

One of the most significant barriers to financing innovation in technology infrastructures is a set of entrenched attitudes and norms within research and technology organisations and their shareholder institutions:

- **Risk aversion**: Shareholders and executives of many technology infrastructure operators prefer low-risk, non-repayable grant funding as the primary – and often sole – funding model for technology infrastructures. This limits openness to exploring alternative finance options.
- **Limited experience and expertise with financial instruments**: Financial managers within technology infrastructure operators often lack experience with structuring and managing financial instruments.
- **Bias in favour of not-for-profit operations**: Because technology infrastructures have traditionally been part of the research domain, many in the industry continue to view their activities as research-focused rather than commercially driven. This perception can hinder the development of bankable business cases.

B. Governance and legal issues

- **Restricted financial autonomy**: As public entities, many research and technology organisations are subject to legal or policy constraints that limit their ability to take on financial liabilities such as debt. In some cases, the organisations are simply not permitted to borrow or issue guarantees.
- **Dual nature of public-private orientation**: The hybrid public-private mission of research and technology organisations as technology infrastructure operators – serving policy objectives and industrial clients – can result in unclear business strategies or underdeveloped commercial services.
- **Internal accounting practices of technology infrastructure costs/revenues**: Some operators do not treat their technology infrastructures as distinct cost or profit centres, making it difficult to assess the true financial performance or investment needs of individual infrastructures. This undermines transparency and the ability to attract targeted financing.

- **Interpretation of EU State aid rules**: The technology infrastructure operators consulted in this study perceive the interpretation of EU State aid rules as limiting their flexibility to adopt business-driven models (see Section 2 for more details).

C. General financial standing of technology infrastructure operators

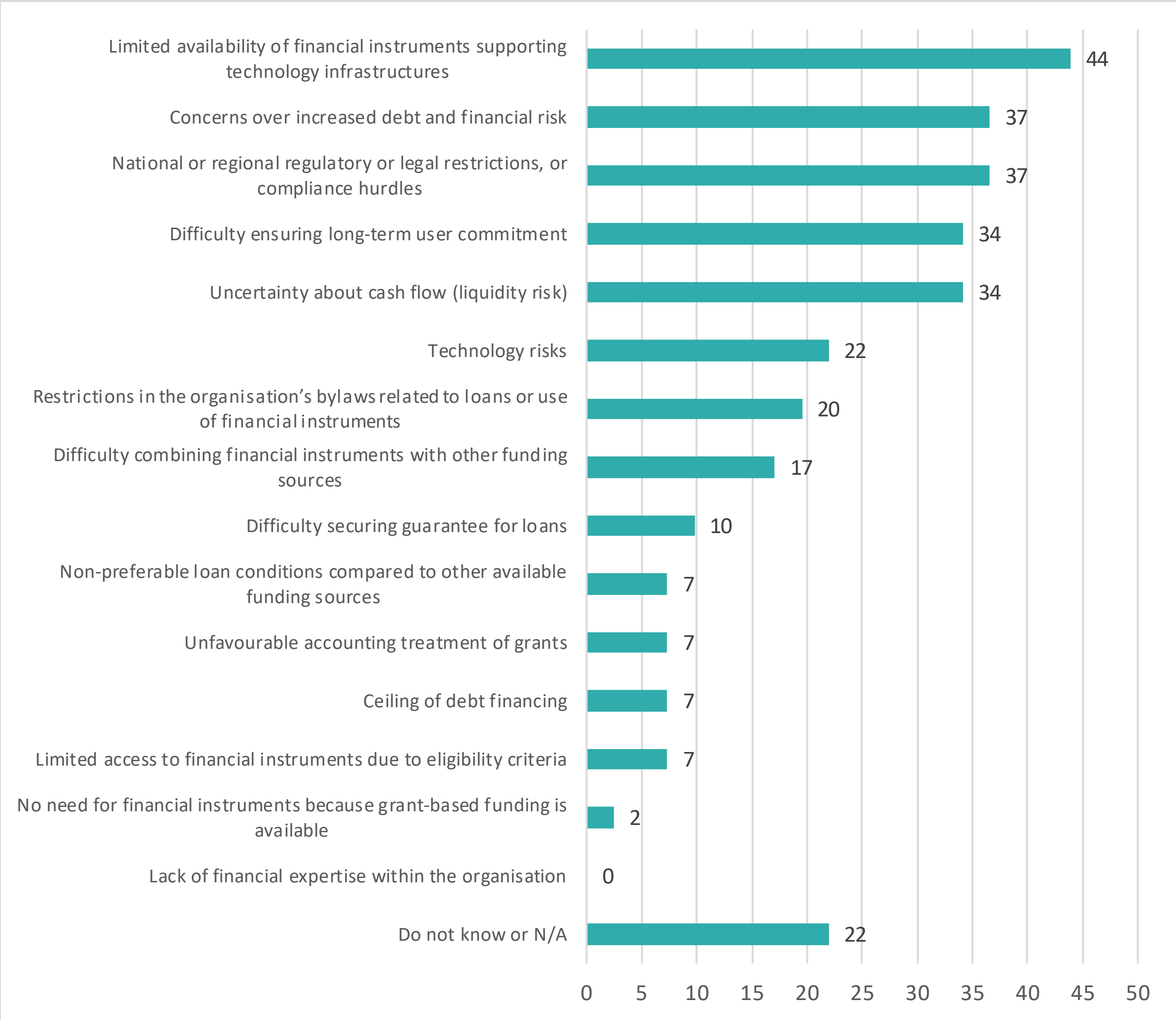
- **Low debt repayment capacity**: Most operators are close to the break-even point, relying on a mix of competitive grants and operating revenues. Only a few generate consistent operating surpluses or earnings before interest, taxes, depreciation and amortisation (EBITDA) margins high enough to support servicing of financial instruments.
- **Overreliance on internal reserves**: Research and technology organisations typically do not issue equity capital or distribute dividends. Instead, their capital base grows through retained reserves. However, overreliance on internal reserves limits the ability of these organisations to scale quickly or match equity-based co-financing requirements.
- **Limited collateral value**: The physical assets of technology infrastructures – such as specialised testing equipment or demonstration platforms – are often highly specific and illiquid (not easily converted to cash), offering limited value as collateral in traditional lending scenarios.

D. Cash flow generating capacity

- **Cost-based pricing models**: Most technology infrastructures operate under pricing schemes that aim to recover a portion of the capital and operational expenditures, without capturing the full value of their services. Attempts to raise fees are often resisted out of concern that higher prices would suppress demand, particularly among small and medium users.
- **Unpredictable demand patterns**: Many technology infrastructures face fluctuating annual utilisation rates, making it difficult to forecast and realise stable revenues, which weakens business cases for investment and undermines financial planning.
- **Weak counterparty credit quality**: Technology infrastructures that primarily serve small and medium businesses are exposed to elevated counterparty risk due to clients' limited financial capacity and lack of willingness or ability to commit to multiyear service agreements.

The relative importance of the financing barriers described above can vary by country, industrial sector and type of technology infrastructure operator.

Figure 11: Barriers to using financial instruments (% of respondents)



Source: Technopolis Group (2025), survey of technology infrastructure operators.

Note: Technology infrastructure operators were asked to select their top three barriers for using financial instruments. The data reflect 41 responses.

Lack of tailored financial instruments for technology infrastructures

The barriers identified in this study underscore the distinctive nature of technology infrastructure operators, which often combine public mandates with market-facing activities, operate under complex governance structures and deliver specialised services with long-term capital needs. Financing such entities is inherently different from financing traditional businesses and therefore calls for dedicated, fit-for-purpose financial approaches.

The operators consulted highlighted the limited availability of financing instruments specifically tailored to the needs of technology infrastructures as a major challenge. This indicates that technology infrastructure operators are open to considering non-grant financing, provided that such instruments are appropriately structured to reflect their operational models, risk profiles, dual public-private missions and specific technology infrastructure cases.

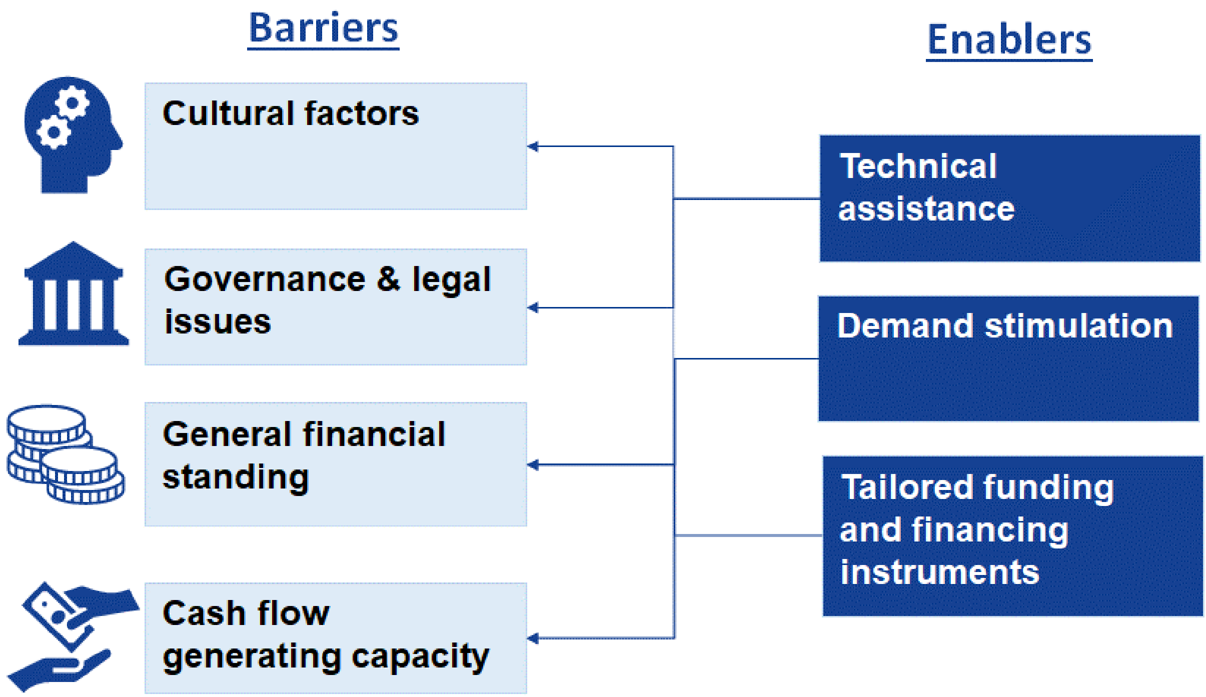
Three key enablers

Based on the findings, three critical enablers have emerged to address the identified barriers and improve access to finance for technology infrastructures:

- **Demand-side interventions:** Strengthening market prospects and improving the financial sustainability of technology infrastructures by stimulating demand from industry – particularly small businesses – and increasing the purchasing power or commitment capacity of their users.
- **Tailored financing instruments:** Providing fit-for-purpose funding solutions that align with the diverse business models and financial characteristics of technology infrastructures, taking into account their varying levels of maturity, revenue generation potential and investment cycles.
- **Technical assistance:** Overcoming cultural barriers, governance limitations, and institutional risk aversion, while also enhancing the bankability of technology infrastructures through improved business planning, financial management and investment readiness.

Together, these enablers can form the basis for a more effective and inclusive financing ecosystem for technology infrastructures in Europe. The following sections present recommendations in each of these areas.

Figure 12: Barriers and enablers to using financial instruments to support technology infrastructures



Source: Technopolis Group (2025).

5 RECOMMENDATIONS

Based on the findings of this study, **three key recommendations** are proposed to address the identified barriers and expand the funding for technology infrastructures:

1. **Stimulate and facilitate access to technology infrastructures** for startups and small businesses by expanding the use of demand-side support instruments (for example, innovation voucher schemes, access schemes) at the EU, national and regional levels.
2. **Explore blended financing instruments** that suit technical infrastructure business models combining grants with loans or equity under the Horizon Europe research and innovation framework programme. This would help unlock and mobilise private sector investment in technology infrastructures.
3. **Establish a technical assistance programme** to address three critical needs:
   - raising awareness among technology infrastructure operators and non-specialised investors;
   - providing advisory services for structuring technology infrastructure projects;
   - building a pipeline of technology infrastructure projects attractive to non-specialised investors.

Together, these recommendations will create a more effective and inclusive financing environment for technology infrastructures in the European Union.

5.1 Access to technology infrastructures through demand-side instruments

Robust and sustained demand for services is essential to the viability of technology infrastructure business models and is often a decisive factor in their ability to attract financing. Strong demand from industry (startups, small and medium businesses, mid-caps and larger firms) ensures sustained utilisation and predictable cash flows, reducing financial uncertainty.

However, for many businesses – especially small and medium firms and startups – the high cost of accessing these facilities (including training, maintenance and regulatory compliance) is a significant barrier. This challenge is amplified by financial misconceptions about differentiated pricing models, highlighting the need for dedicated support schemes[14] that facilitate access to technology infrastructures for small firms and scaleups. Demand-side support instruments include innovation vouchers, access programmes, innovation loans and tax credits.

Box 10: Examples of innovation vouchers

Innovation vouchers are small grants provided by governments to support small and medium-sized enterprises in accessing external expertise and knowledge needed to innovate and improve their products and services.[15] [16] These vouchers have proven effective in fostering technological advancement across various sectors by lowering the risks associated with innovation and facilitating access to specialised services, technologies and infrastructures.

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[14] European Commission: Directorate-General for Research and Innovation. (2025). User needs for technology infrastructures – Analytical report. Publications Office of the European Union.

[15] For more information, see OECD STIP.

[16] European Commission Directorate-General for Communications Networks, Content and Technology. (2019). Voucher schemes in Member States. A report on the use of voucher schemes to promote innovation and digitization.

Innovation vouchers encourage small businesses and public organisations to seek out new partnerships and collaborations and facilitate the sharing of ideas and expertise. In addition, they can help create a culture of innovation within small and medium firms, encouraging them to embrace new ideas and technologies and to take risks in pursuit of new opportunities.

Innovation vouchers typically provide small funding amounts that can be used to support the costs of various services, such as access to technology infrastructures, other technology and business advisory services and other forms of knowledge-based support. Typically, they offer funding amounts ranging from €3 000 to €130 000, with average cost coverage exceeding 50-60%.[17] They vary in scope, implementation processes and objectives, and can be tailored to specific needs and operational frameworks.

Under Horizon Europe, the Financial Support to Third Parties (FSTP), also known as cascade funding, enables consortia to receive EU funding and redistribute it to targeted beneficiaries through open calls or prizes. FSTP is employed when final recipients are not identified at the proposal stage, streamlining the process of including new partners. These third parties enter into contracts with consortium beneficiaries to undertake defined activities without being direct beneficiaries of the main project.

FSTP funding is capped at €60 000[18] and supports a wide range of activities, including adoption or development of digital innovations; pilots, experiments and demonstrations within specific technological frameworks; and use of technology infrastructures by startups, scaleups, small firms and mid-caps.

Source: Technopolis Group (2025).

Box 11: Innovation loans

Loan financing for companies engaged in research and innovation projects can also support the use of technology infrastructures by covering associated operational costs. These types of loans, often referred to as innovation loans, are typically targeted at small firms, to bridge the gap between research and commercialisation. For example, in France, Bpifrance is proposing innovation loans to support pre-commercial technological development. And in the United Kingdom, the government is offering innovation loans for R&D projects through UK Research and Innovation. In both cases, eligible costs for the loans include capital equipment and access to technological platforms and infrastructures, provided they are used in the innovation project for which the loan was granted.[19]

Source: Technopolis Group (2025).

The recommendation to support technology infrastructure access through demand-side funding instruments involves three approaches:

- **Expanding the use of targeted funding mechanisms**

Increase the availability of grant programmes and innovation vouchers at the EU, national and regional levels, by explicitly including access to technology infrastructures within their eligible scope. These mechanisms should have simple rules, be easy to access and typically offer funding between €20 000 and €150 000, as suggested during workshop consultations in Warsaw. Existing schemes could be linked to technology infrastructure

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17 European Commission Directorate-General for Research and Innovation, Viscido, S., Coroler, E., & Moreno, C. (2024). Policy landscape supporting technology infrastructures in Europe – Final report. Annex I, EU report. Publications Office of the European Union.

18 European Commission. (2025) Good practices for implementing financial support to third parties (FSTP) in EU grants.

19 European Commission Directorate-General for Research and Innovation, Viscido, S., Strauka, O., Coroler, E., Pupelytė, A. et al. (2024). Policy landscape supporting technology infrastructures in Europe – Final report. Annex II, Case studies. Publications Office of the European Union.

networks in specific technology areas. Raising awareness about these programmes and their accessibility conditions would also be beneficial.

- **Promoting innovation loans and reimbursable grants**

Broaden the use of financial instruments such as innovation loans and reimbursable grants that specifically support the use of technology infrastructure facilities and services. Reimbursable grants – where incurred costs are reimbursed upon successful application – can complement innovation vouchers.

- **Facilitating cross-border access through EU-level cascade funding**

Strengthen the use of Financial Support to Third Parties (FSTP) schemes to support cross-border access to technology infrastructures. This could include increasing the funding cap from €60 000 to €150 000. Additionally, technology infrastructure services should be better integrated into existing EU funding initiatives such as the European Innovation Council and the Horizon Europe research and innovation framework programme.[20]

5.2 Exploring new opportunities for financial instruments to fund technology infrastructures

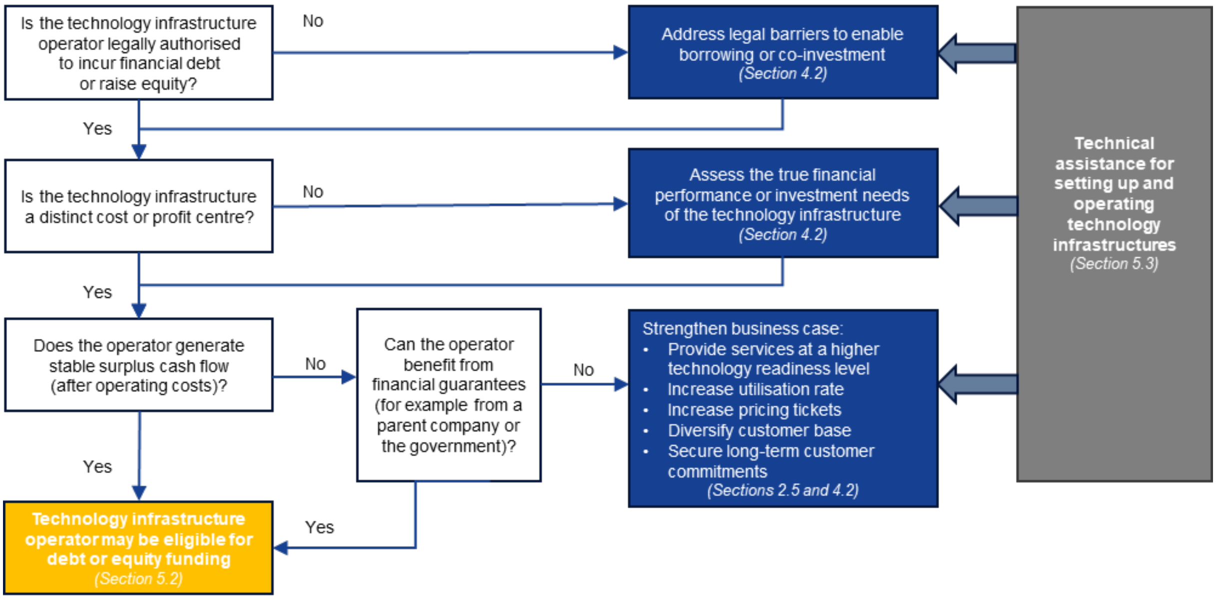
The lifecycle of a technology infrastructure typically encompasses planning and construction, operation, and eventual upgrade or repurposing before decommissioning. These stages may overlap or run in parallel, but the infrastructure generally remains operational for many years and requires significant development in advance. Stable, long-term investment is essential to maximise benefits for industry, public and private funders, and to ensure lasting socioeconomic impact.

However, many infrastructures operate in fragmented and short-term funding environments, which pose risks to their sustainability. While grants will remain the primary source of funding for most technology infrastructures, it is proposed to explore long-term financing solutions, such as debt or equity instruments, leveraging EU resources (including grants and guarantees) to address sustainability challenges. These solutions would be enabled by new operating and pricing models.

This shift, however, requires meeting certain prerequisites (as illustrated in Figure 13) and would be supported by a dedicated technical assistance programme (see Section 5.3), aimed at strengthening financial stability and bankability – particularly through adjustments in pricing and business policies.

[20] European Commission Directorate-General for Research and Innovation. (2025). Towards a European policy for technology infrastructures – Building bridges to competitiveness. Publications Office of the European Union.

Figure 13: Eligibility assessment for debt or equity funding



Source: Technopolis Group.

This section explores two potential proposed financial instruments tailored to the needs of technology infrastructure operators:

- **Blended debt instrument**: Designed for mature technology infrastructures with diversified client bases, strong industry partnerships and the ability to generate cash surpluses. The objective of this instrument is to introduce financial leverage, thereby expanding the capital base and enabling larger-scale or more predictable investment cycles.
- **Blended equity instrument:** Targeted at dynamic, commercially oriented technology infrastructures that offer high value-added services and have the potential to capture a share of the economic value they help create under an equity-for-service operating model.

5.2.1 Blended debt instruments

The instrument aims to catalyse capital from the financial sector – resources that are currently underutilised or inaccessible to technology infrastructure operators. By engaging financial institutions, the instrument can unlock greater investment capacity and promote capital efficiency.

The instrument would combine public grants with debt financing provided by selected financial intermediaries, such as national promotional banks or commercial lenders. Its key structural features include:

- **Blended instrument:** Co-deployment of grants and investment loans tailored to the specific investment and business profiles of technology infrastructure operators.
- **Guarantee scheme:** An EU backed credit guarantee provided to financing institutions to cover part of the credit risks (construction, operation, demand, upgrade, decommissioning), thereby improving the loan terms and conditions.

The blended instrument would be implemented under a segmented approach aligned with the investment needs, business models and financial capacity of technology infrastructure operators:

- **Grant-only:** Intended for technology infrastructures at an early stage of development or those that do not meet the minimum bankability criteria and are not structured in a way that would attract commercial financing.

- **Loan component:** Available in addition to the grant for more mature technology infrastructure operators that meet minimum bankability criteria as assessed by financial institutions. These operators typically manage infrastructures with high-technology readiness levels, offer fee-for-service activities (such as certification or large-scale demonstrations), and have a diverse customer base, long-term user collaborations and strong industry ties. As a result, they cover a large share portion of their operating costs through industrial users and can generate more stable, predictable revenue streams.

Besides conventional long-term loans, potential new debt financing solutions could be introduced to pre-finance multiyear industry co-investment arrangements (replacing upfront industry contributions), with support also extended to current and anticipated subscription agreements or revenue streams (such as access and services), and medium-term service contracts with key clients (such as industrial users and public agencies). These new financing solutions are increasingly available to support "infrastructure as a service" platforms and business models.

This blended instrument draws similarities with the European Innovation Council (EIC) Accelerator programme (which combines grant and blended investment components) and the Connecting Europe Facility (CEF) Transport – Alternative Fuels Infrastructure Facility (AFIF). However, the key distinction lies in the nature of the blended debt financing together with EU credit enhancement to address technology infrastructure bankability challenges.

The instrument would use a **programmatic approach** – a structured method for managing multiple projects or processes – which brings together public grant agencies, EU institutions and financial intermediaries. Key recommended design elements include:

- Predefined eligible costs that closely match technology infrastructure business models and types of investments;
- Streamlined procedures to reduce the administration burden and accelerate funding disbursement;
- Scalable financing volumes, suitable for multiyear and multiphase investments in technology infrastructures.

Integration and sequencing of grant and loan components

Further assessment is recommended for coordinating the grant and loan components of the instrument – particularly for application, appraisal, disbursement and monitoring procedures. Ideally, funding for both components should be accessed through a single application process, ensuring a streamlined experience for infrastructure operators and reducing the administrative burden. Effective implementation will require harmonised procedures and ongoing coordination between the grant provider and the lending institution throughout the project lifecycle.

5.2.2 Blended equity instruments

For a select group of technology infrastructure operators, equity-type instruments can complement public grant funding. These instruments are designed to mobilise third-party equity capital in exchange for a share in the proceeds and the value generated through a portfolio of equity-for-service type agreements with access users. The capital raised can be used for the establishment, expansion, or upgrade of technology infrastructures.

A defining feature of this approach is the ability to implement innovative pricing strategies that capture a share of the value created for technology infrastructure users. These pricing arrangements offer equity-type returns without diluting user ownership. Potential revenue streams include:

- **standard usage fees**, such as pay-per-use charges or subscription-based access models;
- **success-based pricing**, including repayable deferred usage fees, royalty agreements, licensing arrangements, or success fees tied to the commercial success of user-developed technologies;

- **sponsorships and long-term service agreements** with anchor clients, providing predictable income and strong strategic partnerships.

Equity instruments are particularly well-suited to technology infrastructures that:

- offer high value-added services to industry clients;
- have the capacity to capture a portion of the value they help generate;
- primarily serve users with lower technology readiness levels;
- demonstrate high growth potential through increased service uptake or market expansion.

By adopting a value-based revenue-sharing model, technology infrastructures aligns their financial interests with those of their users, enabling participation in the upside generated by supported innovations. This approach not only enhances recurring income streams but also builds a scalable portfolio of shared-growth partnerships, thereby strengthening the infrastructure's equity valuation. The accumulation of such venture type exposures positions the technology infrastructure as an attractive opportunity for investors seeking diversified, innovation-driven returns.

Implementing an equity instrument requires a market-driven operating model that prioritises commercial viability and growth. For most technology infrastructure operators, this represents a significant departure from traditional publicly funded, cost-recovery models. The entrepreneurial, performance-based approach necessitates a rethinking of governance, financial strategy and service delivery – placing greater emphasis on value creation, risk-taking, venture partnerships and investor engagement.

5.3 Technical assistance and awareness raising

Stimulating the demand for access to technology infrastructure facilities and services (see Section 5.1) and introducing new financial instruments (see Section 5.2) will not be sufficient unless technology infrastructure operators are equipped to understand and use these alternative funding sources. To address this need, it is recommended that the European Commission establish an advisory hub for technology infrastructure investments, with three core objectives:

- **raising awareness and building knowledge** among technology infrastructure operators and non-specialised investors about alternative funding models;
- **supporting operators** in structuring and de-risking investment projects;
- **building a pipeline** of projects that appeal to non-specialised investors.

Awareness raising and knowledge dissemination

To improve understanding of funding models and financial instruments, the advisory hub would:

- **Develop and distribute knowledge materials** – such as case studies, fact sheets and handbooks – on technology infrastructure funding models and the use of financial instruments. These resources would build on this report and studies commissioned by the European Commission.
- **Organise targeted workshops** for technology infrastructure operators and non-specialised investors on topics such as:
    - developing business cases for technology infrastructure investment;
    - assessing investment viability;
    - designing pricing strategies for infrastructure services;
    - enhancing access for small and medium businesses.

Advisory services for technology infrastructure operators

To support the development of viable investment projects, the advisory hub would offer:

- **training workshops and peer mutual learning exercises** focused on structuring technology infrastructure projects to attract investment and financing.
- **technical assistance** for specific investment projects, addressing all the key elements of a robust business case (as detailed in Box 2, Section 1.2), including:
    - identifying potential investors and crafting compelling business cases;
    - defining market strategies and developing innovative business models (such as royalty-based or subscription-based membership models).
    - establishing pricing strategies that generate revenue – from cost-based pricing (covering operational, maintenance, depreciation and capital costs) to value-based pricing (based on intellectual property valuation, user success or market benchmarks).

Building a pipeline of technology infrastructure projects

To help connect operators with potential investors, the advisory hub would:

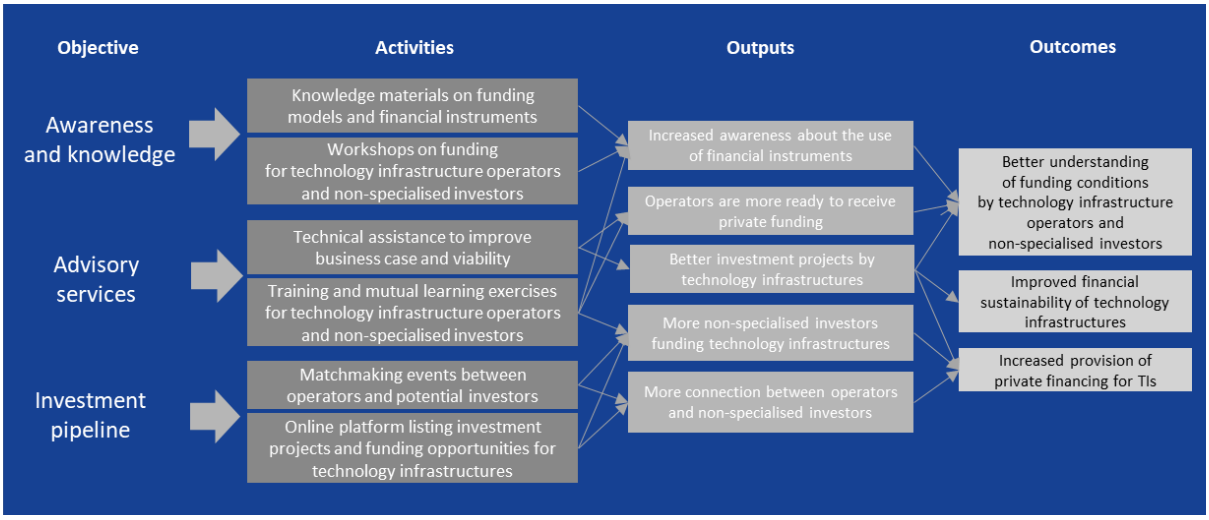
- organise matchmaking events between technology infrastructure operators and non-specialised investors (national promotional banks, commercial banks, seed and venture capital funds, corporate funds);
- set up an online platform showcasing investment-ready technology infrastructure projects and detailing available funding opportunities, including grants, financial instruments and blended instruments.

Expected outcomes

The advisory hub would deliver three key outcomes:

- Improved understanding among operators and non-specialised investors of the relevance and conditions for using financial instruments in technology infrastructure investment;
- Better bankability of specific technology infrastructure projects;
- Increased third-party funding raised by technology infrastructure operators.

Figure 14: Advisory hub for technology infrastructure investments: Logical framework



Source: Technopolis Group (2025).

APPENDIX A – METHODOLOGY

The findings summarised in this report build upon a mix of qualitative and quantitative data collection and analysis methods:

- Scoping interviews and exchanges were conducted with European stakeholder organisations (EARTO, CESAER), research and technology organisations and technical universities as part of the project scoping process. These interviews enabled the study team to refine the data collection tools and adjust the funding gap analysis ranges accordingly.
- A survey was distributed to all members of the CESEAR and EARTO networks and additional technology infrastructure (TI) operators identified in the list of technology centres from the European Monitor of Industrial Ecosystems, which is a European Commission project. The survey gathered data from technology infrastructure operators on investment requirements, estimated funding availability and funding sources. In addition, the survey explored barriers to using financial instruments to support technology infrastructures in Europe and opportunities for adapting existing instruments or creating new ones to meet the needs of infrastructure operators. The survey received 60 responses, of which 43 were fully completed.
- Targeted interviews with 32 technology infrastructure operators were used to gain in-depth knowledge about funding sources, current funding gaps and alternative financing options.
- Two international case studies – Norway and the United States – were developed to explore the funding models of technology infrastructures and supporting instruments in those countries, identifying good practices and highlighting similarities and differences with the European Union.
- A bankability questionnaire was created and used in the screening process of specific technology infrastructure investment cases, providing a preliminary assessment of their potential for financing and supporting the development of a bankable project pipeline.
- Two workshop sessions were held during the conference "Technology Infrastructures: A Strategic Asset for European Competitiveness", in Warsaw on 6-7 May 2025. The two workshops, which were organised to validate and expand on the study's findings, were titled "Building business cases to secure TIs' long-term funding needs" and "Scaling TIs' funding mix and multiplying funding sources: barriers and opportunities to enhance TI's access to additional finance."

APPENDIX B – INTERNATIONAL BENCHMARK CASES

Investments in technology infrastructures: Norway case study

This case study explores investment needs and funding challenges for technology infrastructures in Norway, based on desk research and interviews with four key institutions: SINTEF, NORCE, NOFIMA and NTNU. The analysis highlights their capital and operational expenditure patterns, funding sources, investment gaps and limited use of financial instruments.

Key institutions: SINTEF is a multidisciplinary research and technology organisation with 2 200 staff and over 100 laboratories. NORCE is an independent research organisation operating in areas such as energy and climate. NOFIMA is a public-private food research institute, and NTNU is Norway's leading university for science and technology. These four institutions represent a cross-section of Norway's applied research landscape and are instrumental in operating and upgrading national technology infrastructures.

Capital expenditure investment and funding: Annual capital investments in technology infrastructures vary from €2-10 million for the research and technology organisations up to €100-200 million for NTNU. Capital expenditure is primarily funded through internal reserves and competitive public programmes, particularly from the Research Council of Norway. These funds are used to develop testing labs, pilot plants, cleanrooms and research centres across multiple disciplines, often in collaboration with industry or academia.

Capital expenditure funding challenges: A key challenge is the lack of dedicated public funding streams for technology infrastructures, particularly those that fall outside the scope of traditional research infrastructure funding. Research and technology organisations report difficulty in co-financing large-scale technology infrastructure projects, even when industry support is secured, due to legal requirements and eligibility criteria. Rapid technological change demands frequent upgrades, straining long-term planning, and investment gaps, which are often equal in size to actual investment, highlight structural underfunding.

Operational expenditure funding and challenges: Operating expenditures are substantial, estimated at €6-10 million annually for research and technology organisations and over €50 million for NTNU. These costs are typically covered through user fees and internal reserves. Unlike capital expenditure, public funding for operational expenditure is more limited, and research and technology organisations face difficulties in recovering full costs from users, especially small and medium businesses. Operational revenue is also volatile, and the use of State aid-compliant funding models is perceived to add administrative burden and limit flexibility in pricing and service delivery.

Use of financial instruments: The use of financial instruments such as loans is limited. SINTEF has some experience but cites challenges such as risks of indebtedness, collateral constraints, technology risk and the unpredictability of user demand. NORCE, NOFIMA and NTNU are either constrained by regulatory frameworks or have no active interest due to conservative financial management, unstable revenues or legal limitations on borrowing in public institutions.

Lessons learned: Like their European peers, Norwegian research and technology organisations face similar funding challenges and structural underinvestment in technology infrastructures and growing capital expenditure and operational expenditure funding gaps. While competitive public funding remains essential, more flexible, long-term mechanisms – such as dedicated technology infrastructure funding and financing instruments – are needed. The Norwegian Catapult Programme is a noteworthy concept that supports small and medium businesses in accessing technology infrastructures. Financial instruments could have a role if barriers around risk, regulation and institutional capacity are addressed.

Box 12: NORCE’s Ullrigg Test Centre – a profitable infrastructure

The Ullrigg Test Centre was established in the early 1980s to support the development of the oil and gas industry, particularly for drilling in major horizontal gas fields. Over time, it has been instrumental in advancing technologies that contributie to Europe's energy supply.

Initially funded by the Norwegian Research Council, Ullrigg has evolved into an attractive site for industry-led technology trials. Its sustained demand and consistent utilisation – averaging around 80% – have made it a profitable venture (operated by NORCE as separate profit centre). Ulrigg’s clients are large international companies with high profit margins.

The infrastructure is considered unique, with global relevance. According to NORCE, replicating Ullrigg’s model with other infrastructures would be difficult.

Investments in technology infrastructures: US case study

This case study explores investment needs and funding challenges for technology infrastructures in the United States, drawing on desk research and interviews.

Key institutions

The US government has funded and shaped R&D through a combination of independent agencies, federal departments and state-level funding mechanisms. This investment has been instrumental in advancing scientific research and innovation and maintaining the country's leadership in various scientific and industrial fields (for example, defence, space, energy).

Key agencies include:

- **National Science Foundation**, which supports fundamental research across all scientific and engineering disciplines;
- **National Aeronautics and Space Administration**, responsible for aerospace research and space exploration;
- **Department of Commerce,** particularly through the National Institute of Standards and Technology, which establishes measurements and technology standards for US industries;
- **Department of Defense** which funds defence-related R&D, including cutting-edge research projects managed by the Defense Advanced Research Projects Agency (DARPA) in fields such as AI and quantum technologies;
- **Department of Energy** which oversees national laboratories and funds energy-related research.

While the term "technology infrastructures" is commonly used in the US context, interviews revealed that "R&D infrastructures" or "innovation infrastructures" are often used interchangeably and are more closely aligned with technology infrastructures as defined in the European context.

Capital expenditure investment and funding

Quantifying the total capital expenditure investment in technology infrastructures was beyond the scope of this study. However, recent legislative initiatives, such as the CHIPS and Science Act, have significantly increased funding for key agencies such as the National Science Foundation, the Department of Energy Office of Science and the National Institute of Standards and Technology. These increases have bolstered operational budgets and enhanced infrastructure investment capabilities.

Funding from the CHIPS Act has also contributed to the development of specific R&D programmes, including the National Science Foundation Engines and the Regional Technology and Innovation Hubs. These programmes indirectly support R&D and infrastructure development. Based on interviews and available data, capital expenditure funding for R&D infrastructure comes from a mix of federal, state and private sources.

Box 13: US Department of Energy's 7th Clean Energy Manufacturing Innovation Institute

Established in 2014, Manufacturing USA was introduced as a strategic response to global economic shifts that saw advanced technology supply chains moving overseas – posing a risk to US leadership in advanced manufacturing. These shifts threatened to leave new technologies stranded in the laboratory never reaching commercialisation.

Since its inception, Manufacturing USA has expanded into a network of 18 innovation institutes, supported by the US departments of Commerce, Defense and Energy. Each institute operates as a public-private partnership with a distinct technology focus, yet all share the common goal of securing the future of US manufacturing.

In addition to driving innovation, these institutes also support technology infrastructures, for example with EPIXC, the US Department of Energy's 7th Clean Energy Manufacturing Innovation Institute. Focused on industrial decarbonisation and electrification, EPIXC works to improve factory cost-efficiency, integrating advanced heating technologies and providing workforce training to facilitate industry-wide adoption.

To establish the economic viability of electrified process heating, systems-level demonstrations are essential. EPIXC supports this effort through specialised testbeds available to industry and institutional partners. Operating on a five-year cycle with the possibility of renewal, EPIXC receives federal funding matched by contributions from industry and state partners.

As a non-profit organisation, EPIXC serves as a platform for de-risking stakeholder innovations, fostering collaboration and providing access to unique facilities that fill critical gaps – especially where no viable alternatives exist. This ensures that essential technological capabilities remain accessible to industry partners.

Operational expenditure investment and funding

Operational funding for technology infrastructures in the United States varies across institutions but usually involves hybrid models combining public, private and user-based contributions.

Use of financial instruments

In recent years, the Department of Energy and the Department of Defense have introduced loan programmes to support technologies that have reached higher levels of maturity (technology readiness level 7 to 9), but face challenges in accessing the capital necessary for large-scale deployment.

The Department of Energy Loan Programs Office plays a pivotal role in bridging this gap by offering loan guarantees and direct loans to accelerate the commercialisation of innovative clean energy, advanced transportation and tribal energy projects. As of 2024, the Loan Programs Office had closed 14 loan deals and advanced 15 others, focusing on high-impact projects like the first fully integrated silicon-based solar manufacturing facility. These loans offer competitive, commercial-style debt with flexible structures to projects considered too risky for traditional lenders.

Complementing these efforts, the Department of Defense's Office of Strategic Capital was established to support critical defence-related technologies by developing financial products modelled on commercial capital markets. The Office of Strategic Capital identified a significant gap – not in the R&D phase but in pre-scaling and production – where emerging companies struggle to access capital. In response, the Office of Strategic Capital introduced a direct lending programme offering loans ranging from $10 million to $150 million, with long repayment periods and flexible amortisation. These loans are tailored to the needs of companies at technology readiness level 8 to 9 and are designed to finance equipment and scale up production facilities in sectors deemed vital to US national security under the FY2024 National Defense Authorization Act.

Together, these evolving federal loan initiatives reflect a strategic shift in US industrial policy – targeting scaleup financing, not just innovation funding, and addressing the "valley of death" for mature technologies poised for commercial deployment.

Looking ahead, agencies like the Department of Commerce are being encouraged to explore advanced financing mechanisms for large-scale infrastructure, including space-based initiatives. This points to a broader movement towards government-enabled financing ecosystems that de-risk high-technology readiness level innovation at scale.

These loan programmes primarily target technologies at higher technology readiness levels, supporting infrastructure and activities close to production or commercial deployment. While the programmes may contribute to infrastructure development, their focus is not on early-stage or research-oriented technology infrastructures. Instead, they are designed to scale up mature technologies ready to enter the market.

As such, these instruments are complementary but distinct from grant funding mechanisms that support R&D efforts and lower technology readiness level testbed environments typically found in university or federal laboratory settings.

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