

Quantum Leadership for European Competitiveness

Why Europe Needs a Combination of Strong Vision and Agile Choices – and How to Deliver It



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By Brian Paquelet Wütz, Jonathan Wareham and Ester de Nicolás Benito



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These are worrying times for the European economy. Sectors considered the pillars of competitiveness, such as pharmaceuticals, chemicals, telecommunications and the automotive industry, are being challenged by new global players. Consider the number of new molecular entities brought to market, a key indicator of competitiveness in the pharmaceutical industry. China, which was virtually absent from this landscape before 2020, surpassed Europe in 2023 and the United States in 2024.¹

This decline, however, is far from inevitable. Emerging technologies like quantum computing offer a transformative lever to reset European competitiveness through radical breakthroughs in both optimisation and frontier scientific discovery. Quantum computing harnesses the principles of quantum mechanics to perform complex computations far beyond the

capabilities of classical computers.

‘Once a far-away objective, quantum is expected to create \$1.3 trillion to \$3.5 trillion in 10-15 years.’

Once deemed a far-away objective, it is now expected to create between \$1.3 trillion and \$3.5 trillion in economic value over the next 10-15 years, driven by applications across crucial sectors for the European economy such as pharmaceuticals, materials science,

finance, logistics and energy.^{2,3} But even with its established scientific excellence, Europe risks squandering another strategic opportunity, lagging in quantum commercialisation, attracting just 5% of global private quantum funding.⁴

The upcoming European Commission proposal of a quantum act marks a chance to migrate quantum technology from a research ambition into an industrial policy commitment. Yet, despite decades of innovation strategies, Europe has repeatedly struggled to convert ambition into leadership in fast-growing markets.⁵ What will ensure that this opportunity is different and that policy choices deliver a measurable impact on market creation and growth?

Drawing on a thorough assessment of market dynamics on both the supply and demand sides, this policy brief argues that Europe has the opportunity to shape the future of the global quantum industry, provided it adopts a clear framework for prioritising and concentrating investments. As the market is still at an early stage, it’s impossible to pick winners, but spreading resources across every possible option and value chain segment is a recipe for failure. This policy brief presents a comprehensive framework for governance, resource allocation and strategic decision-making, along with recommendations to forge Europe’s quantum leadership:

1 European Federation of Pharmaceutical Industries and Associations, *The Pharmaceutical Industry in Figures: Key Data 2025* (Brussels: European Federation of Pharmaceutical Industries and Associations, 03 July 2025).

2 McKinsey & Company, “McKinsey Quantum Technology Monitor 2026: A Commercial Tipping Point,” April 2026. Page 4

3 Boston Consulting Group “Quantum Computing Is Becoming Business Ready”, May 2023.

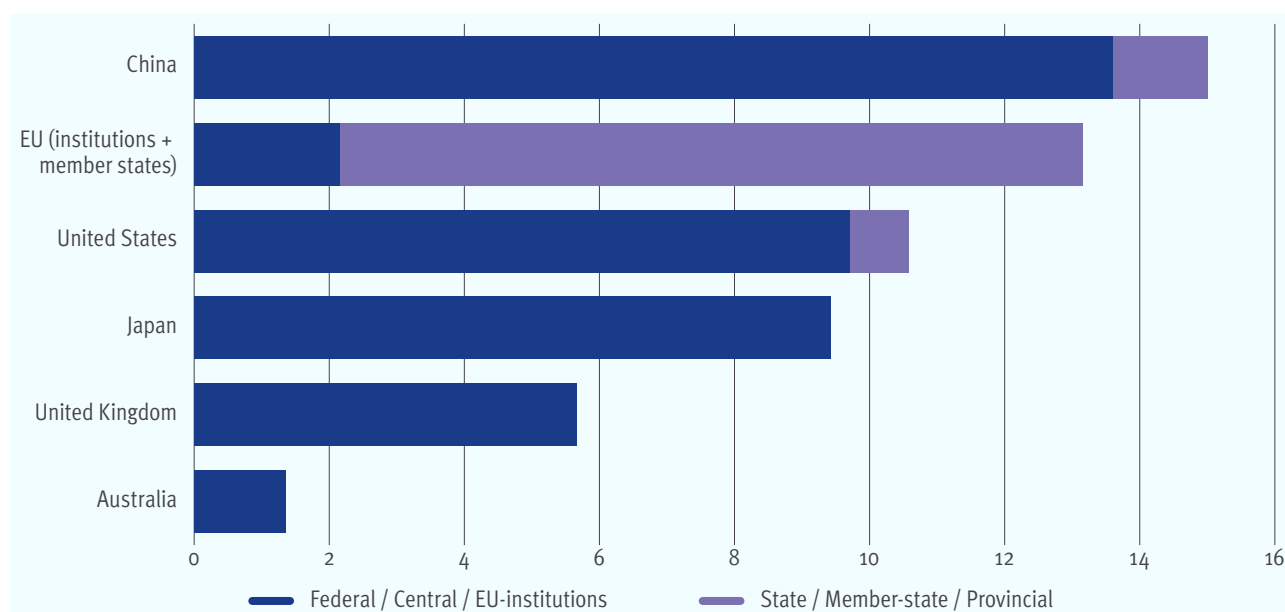
4 European Commission, “Quantum Europe Strategy: Quantum Europe in a Changing World,” *Communication of the European Commission*, COM(2025)363, 02 July 2025.

5 Mario Draghi, *The Future of European Competitiveness* (Brussels: European Commission, 09 September 2024).

1. Commit to a shared vision to mobilise public and private capital. The European Commission and the member states together have allocated public investments that are competitive at the global stage, but without intra-European coordination, these funds risk being diluted across redundant efforts.
2. Coordinate and integrate the governance of quantum, high-performance computing (HPC) and artificial intelligence. The value of quantum is limited without full integration with HPC and artificial intelligence (AI) infrastructures.
3. On the supply side, use a transparent prioritisation framework for different technological options to avoid fragmentation and duplicate efforts. Strengthening the supply side of the quantum ecosystem requires both fostering a vibrant startup landscape and supporting the emergence of pan-European integrators.
4. Stimulate quantum demand by prioritising both the quantum software/operating-system and applications layers in industries where Europe has strong competitive advantages, including pharmaceuticals, chemicals, financial services, telecommunications and energy.

The Quantum Computing Market: Capital-intensive, Unconsolidated and Still Open

Figure 1. Estimated announced public funding and commitments for quantum technologies in China, the European Union and member states, the United States, Japan, the United Kingdom and Australia. Figures combine expenditure and multi-year commitments.



Per co-author instruction: amounts previously shown as hatched/shaded (US extrapolated ceiling, Australia's joint PsiQuantum split, China's disputed aggregate) are folded into the solid federal segment at face value, with no distinguishing shading. China's federal figure includes a ~\$12.6bn widely-cited but UNVERIFIABLE component — treat as indicative, not a confirmed budget line. EU figure reflects only 5 of 27 member states researched (Germany, France, Netherlands, Spain, Italy) — likely understates the true EU-27 subnational total. FX is a single illustrative snapshot, not rate-at-announcement.

With the timeline for quantum computing continuing to accelerate and the quantum act bringing quantum technologies to the forefront of policy debates, policymakers must recognise that quantum markets possess characteristics that are both complex and fundamentally different from those of other advanced technology sectors.⁶ Most notably, no qubit modality has yet established a dominant position, leaving the industry's technological trajectory highly uncertain. As discussed in Figure 5 (see page 8), at least six competing technological approaches remain under active development, each with distinct advantages, limitations and commercialisation pathways.

Consequently, although the level of capital required to scale quantum computing may ultimately rival the investments envisioned under the European chips act, the nature of that investment is considerably more uncertain. Unlike semiconductors, quantum technologies are evolving in a market where many commercially valuable applications remain nascent and unproven. However, the recent experience of frontier artificial intelligence demonstrates how rapidly uncertainty can disappear, with market leadership consolidating among a small number of firms in only a few years.

More fundamentally, it remains unclear where the critical bottlenecks in the quantum value chain will emerge. Constraints could arise in hardware manufacturing, specialised components, cryogenic systems, software, talent, infrastructure or application development. As a result, governments and firms cannot afford a wait-and-see approach. Strategic positioning, ecosystem development and the cultivation of trusted partnerships across the quantum supply chain must begin now if Europe is to secure a meaningful role in the industry's future.

Yet quantum market uncertainty has not dampened interest. Quantum computing is attracting substantial public and private capital because of its enormous economic and strategic value as a foundational technology fostering economic competitiveness, national security and technological sovereignty. For instance, global public investment is led by China with \$15.3 billion, followed by the European Union plus member states (\$13.2 billion), and the U.S. (\$10.6 billion).⁷ Hence, while the overall level of European investment in quantum

‘No European quantum company has yet closed a single funding round above \$1 billion.’

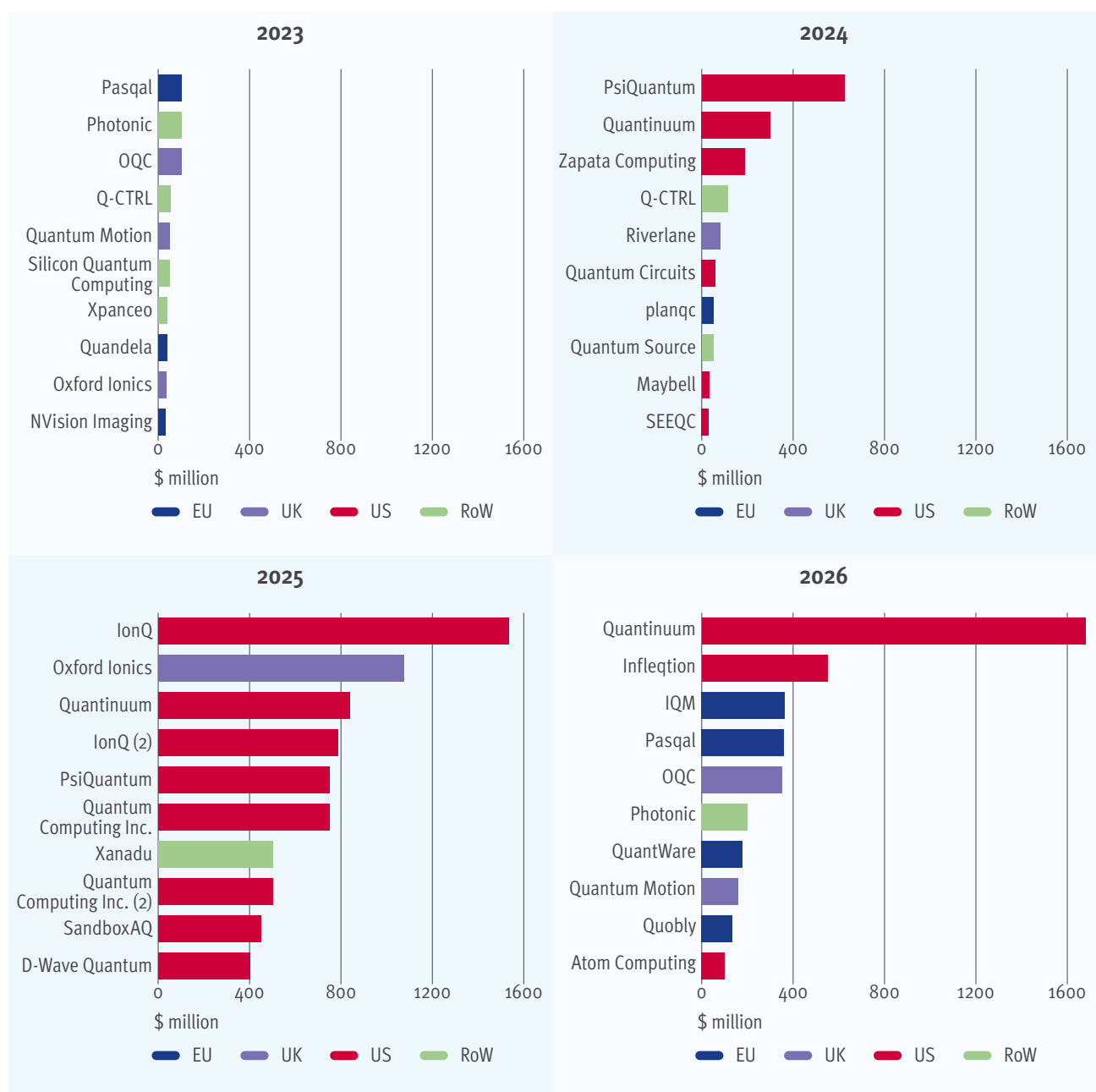
technologies is laudably substantial, the fragmented allocation of these resources risks undermining their impact. For example, figure 1 shows that less than 20% of funding is coordinated at the European level, with more than 80% originating from individual member states who are understandably incentivised to build their national quantum

ecosystems and capture returns on domestic investments. Unfortunately, this federated structure risks diluting strategic focus, slowing scale and weakening Europe's ability to compete globally.

⁶ Boston Consulting Group, “Quantum Is Getting Real. CEOs Need to Shape Where It Creates Value,” June 2026. Exhibit 4 and 5.

⁷ McKinsey & Company, “McKinsey Quantum Technology Monitor 2026: A Commercial Tipping Point,” April 2026, page 44.

Figure 2. Ten largest disclosed quantum-sector capital transactions and funding packages in each year from 2023 to 2026.



The data include private funding rounds, government-backed packages, acquisitions, and public-market transactions. Source: McKinsey & Company, "McKinsey Quantum Technology Monitor 2026: A Commercial Tipping Point," April 2026 and previous years' editions.

In line with global public interest, there has been significant appetite from private capital for quantum technologies. In figure 2, we illustrate the top 10 highest private financial transactions of the quantum computing industry in years 2023-2026. There are two major observations in this graph: First, peak investments in quantum computing companies grew from \$103 million in 2023 to \$1.68 billion in 2026, which shows that quantum research and development (R&D) is consuming increased capital resources from private investors. Second, the U.S. dominates the allocation of private capital, which is facilitated by the U.S.'s single, large capital market, as well as comparatively large venture capital resources. Positively, companies from the European Union and the United Kingdom received six out of the 10

largest quantum private capital investments in 2026. However, those investments were smaller than any of the top 10 in 2025. In addition, the two largest European quantum public listings (IQM and Pasqal) took place on the NASDAQ exchange, underscoring the advantages of the U.S. capital markets.^{8,9}

The disparity in private capital points to a structural weakness that the European quantum act should explicitly target. Unlike more mature industries, the quantum value chain has yet to converge on a stable set of technologies, dominant firms or market structures. As a result, the current period represents a rare opportunity for European companies to establish strategic positions before incumbency, scale advantages and network effects become entrenched. Early movers have a disproportionate ability to shape use cases, standards and adoption that will shape the market. However, this will require a disciplined commitment to addressing two persistent challenges: scale and focus.

Quantum Processing Units Need High-Performance-Compute and Artificial Intelligence

The core part of the quantum computing value chain is the quantum processing unit (QPU), which enables a set of algorithms that are not available through classical computational machines. However, these algorithms are only optimal for a specific category of computational problems, which means that QPUs are highly specialised processors that excel at particular tasks. They are fundamentally different from traditional computers and have substantially divergent operational economics. Specifically, an often-underestimated cost of using quantum computers is the disproportionately high overhead of operations needed to overcome the performance of a classical machine.¹⁰ Consequently, the problems that quantum processing units are useful for are the most difficult problems for high-performance compute (HPC) to

solve. This means their value is working in tandem with classical HPC clusters with targeted and complementary AI workflows.

This implies that investing exclusively in quantum computing will limit its full potential: quantum needs robust

‘A quantum processor is an accelerator whose value depends on the HPC and AI systems around it.’

AI and HPC to successfully leverage the technology’s full potential. The European Union HPC joint undertaking launch in 2021 is an ambitious first step to create such an ecosystem and

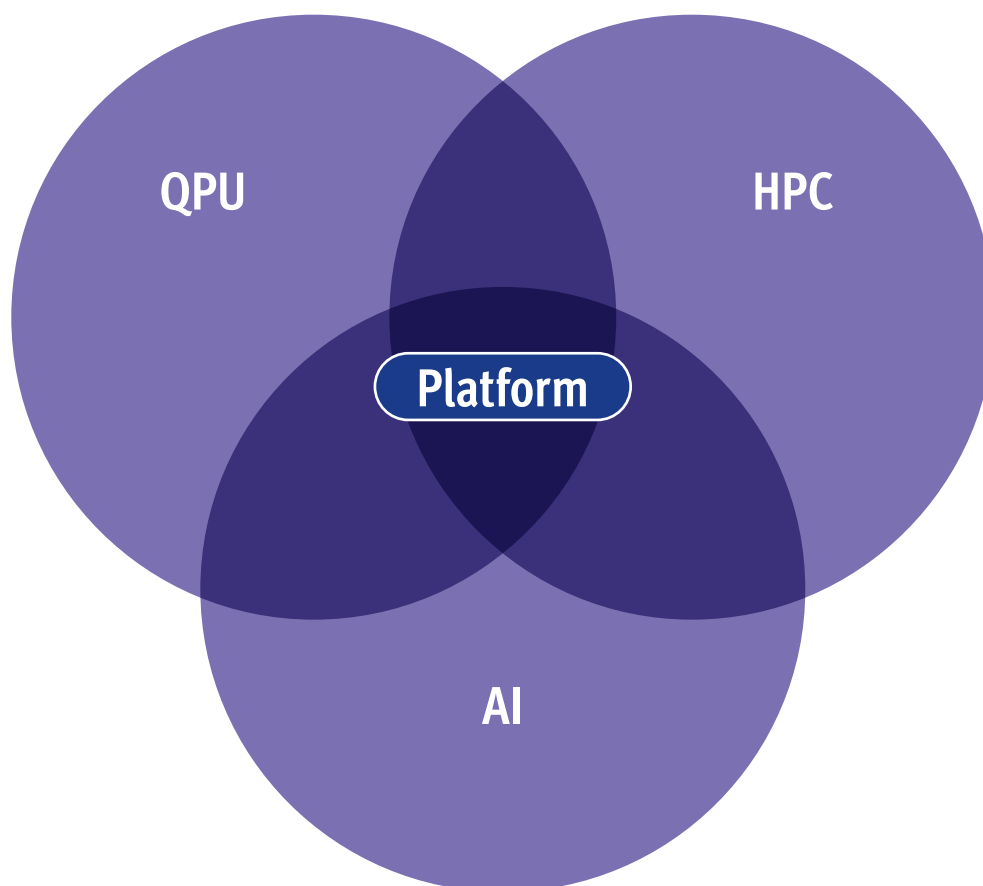
⁸ IQM Quantum Computers Plc, “IQM Quantum Computers and Real Asset Acquisition Corp. Complete the Combination; Trading in IQM’s ADSs and IQM Warrants on Nasdaq Stock Market LLC Commences on July 2, 2026,” [stock exchange release] 01 July 2026.

⁹ Pasqal Holding SA and Bleichroeder Acquisition Corp. II, “Pasqal and Bleichroeder Acquisition Corp. II Complete Business Combination,” [press release] 27 August 2026.

¹⁰ Torsten Hoefler and others, “Disentangling Hype from Practicality: On Realistically Achieving Quantum Advantage,” *Communications of the ACM*, 66(5), 82-87. 2023.

accelerate scientific discovery through selected HPC clusters.¹¹ A successful consequence of the Euro HPC joint undertaking is that startups regularly emerge out of the HPC sites across Europe. Nevertheless, most of the value capture in quantum computing will happen through Europe's industrial players deploying quantum solutions at scale towards greater scientific discovery, operational efficiency and innovative services. Realising the full potential of quantum computing requires that the combined quantum–HPC–AI stack be available for commercial deployment across European industries.

Figure 3. Schematic drawing of the three main ingredients for a flourishing quantum ecosystem: AI, HPC and QPUs.

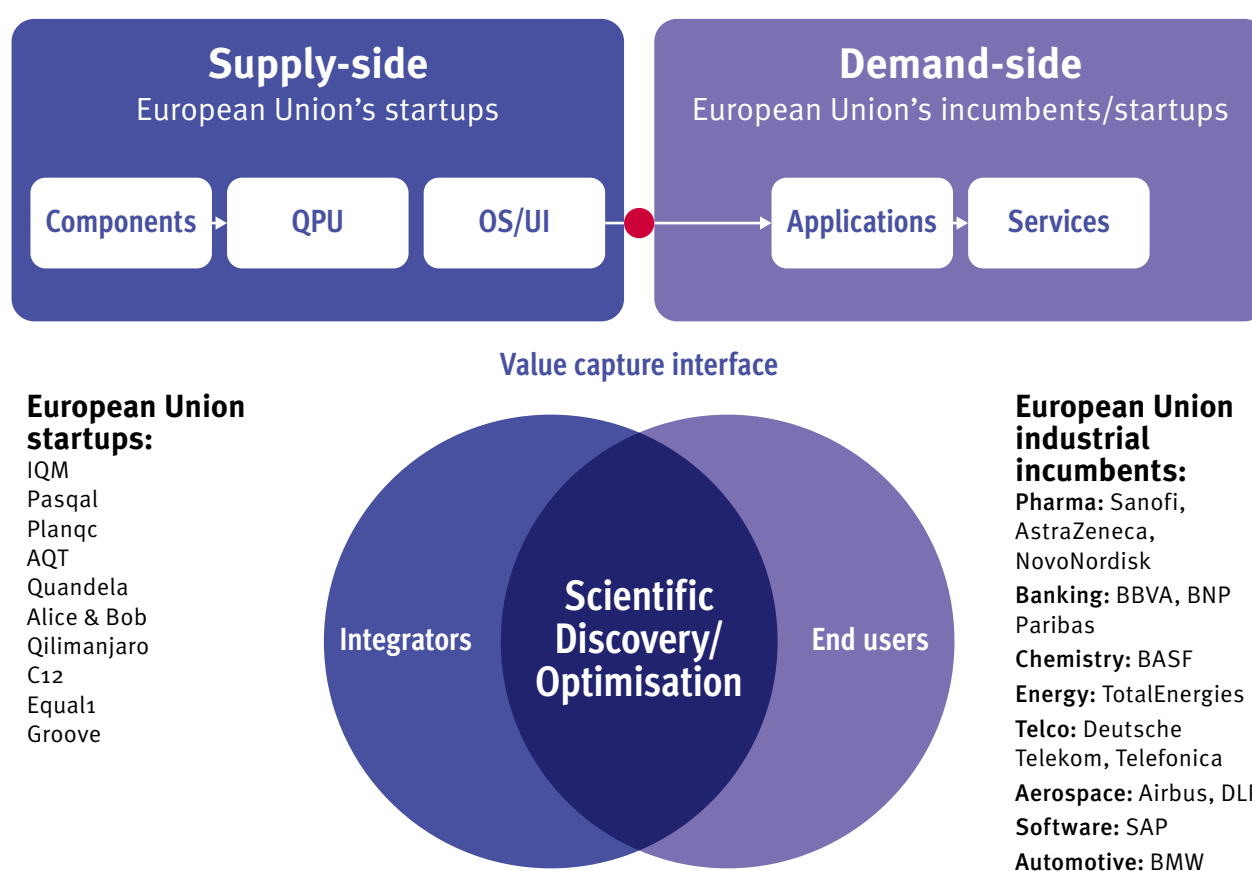


¹¹ Council of the European Union, "Council Regulation (EU) 2021/1173 of 13 July 2021 on Establishing the European High-Performance Computing joint undertaking and Repealing Regulation (EU) 2018/1488," *Official Journal of the European Union*, L 256, 19 July 2021, pp.3–51.

The Value Capture Interface: A Critical Part of the Quantum Value Chain

The quantum computing value chain spans specialised startups and Europe's largest industries across a five-step value chain: Components, Quantum Processing Units, Operating System/User Interface, Applications and Services. The first three represent technological capabilities on the supply side, where the last two reflect industrial solutions on the demand side. The red dot between the supply and demand side indicates the value-capture interface between supply and demand. This is the most critical part of the value chain as this is where the solution of supply-side integrators needs to match the needs of the industry incumbents.

Figure 4. Schematic of the quantum computing value chain. The value chain consists of 5 layers. Components, QPU, OS/UI, Applications and Services.



In the European Union the first three layers are dominated by startups and the last two layers are predominantly occupied by industry-specific incumbents. The red dot marks the value capture interface where industry specific knowledge meets quantum capabilities.

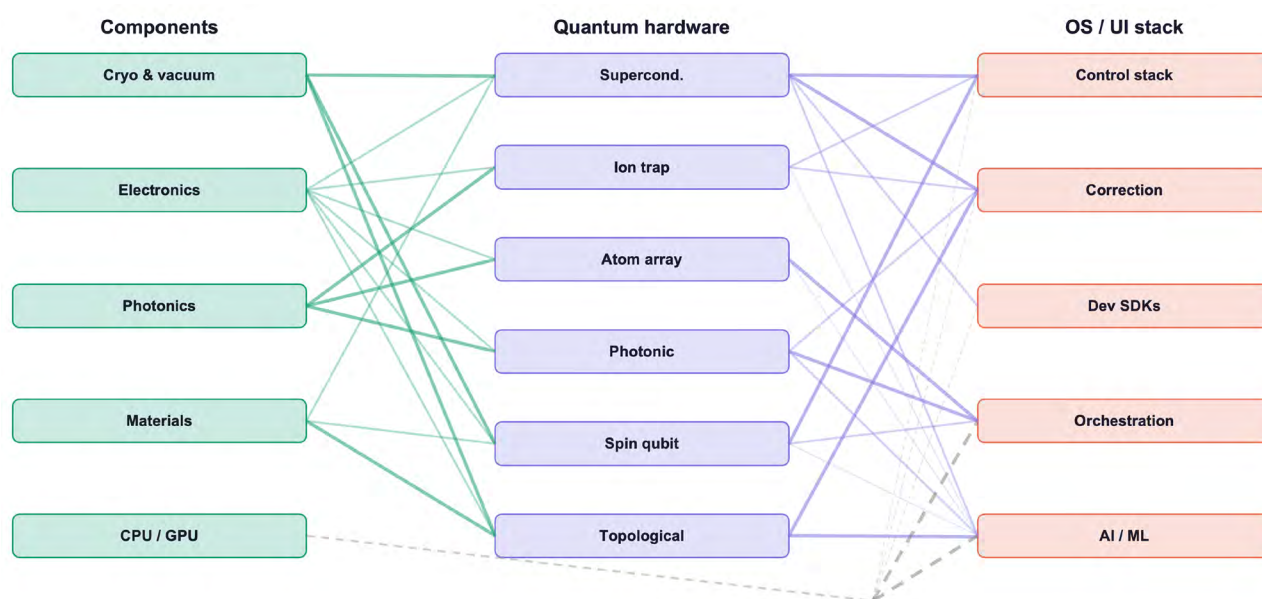
The lower section of Figure 4 illustrates the value-capture interface within the quantum ecosystem, highlighting the intersection between QPU integrators and end users across the two principal application domains: scientific discovery and optimisation. The figure also maps key actors in the European quantum landscape, including both providers of quantum computing capabilities on the supply side, primarily startups and organisations on the demand side, mostly incumbent firms along with new ventures conducting quantum pilots. This

indicates an asymmetry between the supply and demand of the European quantum market: the supply side is driven predominantly by startups developing core technologies and capabilities, while value realisation on the demand side is concentrated among large incumbent firms in industries such as pharmaceuticals, chemicals, finance and manufacturing. This creates an inherent tension between the two groups. Quantum startups face pressure to generate revenue, achieve scale and deliver returns to investors, whereas incumbent firms must carefully allocate resources among competing strategic priorities, including the ongoing wave of AI-driven transformation. As a result, successful value creation and capture in the quantum ecosystem require distinct policy and market interventions on both sides of the value chain. Supporting technology developers alone will be insufficient if industrial adoption remains limited; equally, stimulating demand without a competitive supply base risks transferring value creation outside Europe. Effective quantum policy must therefore address the specific needs and incentives of both producers and users of quantum technologies.

The Supply Side: Coordinating Complexity and Fragmentation

Figure 5 focuses particularly on the supply side, showing the six quantum hardware modalities (middle column) and the dependencies of each modality on both upstream, enabling technologies (components, left column) and downstream deployment technologies (OS/UI, right column), highlighting both the complexity and fragmentation along the value chain. To add complexity, CPUs and GPUs are crucial components but feed into the OS/UI part of the supply chain. This high-dimensional parameter space raises several important considerations.

Figure 5. Detailed mechanics of the supply-side comprising three layers: components, quantum hardware, and OS/UI.

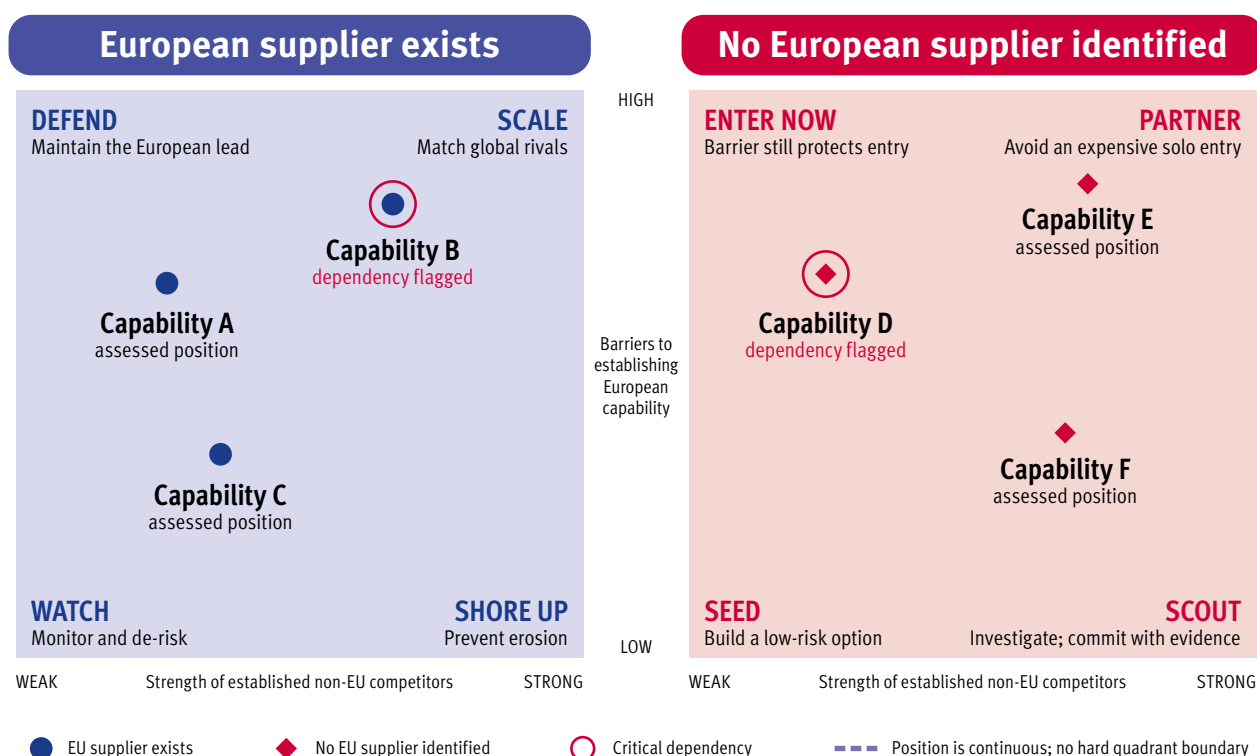


Components feed into both the quantum hardware layer and OS/UI stack as they are critical parts to operate the subsequent layers in the value chain. In turn, Quantum hardware feeds into the OS/UI stack because there are modality-dependent considerations like all-to-all connectivity, gate times, and qubit fidelity that affect how the OS/UI needs to be designed. Dependencies of individual parts of the value chain are indicated through a connecting line. Dependencies are numerous, require highly specialised knowledge and often require significant capital expenditure. Therefore, trying to own every part of the supply side of the value chain is risky.

First, Europe already has capabilities across most parts of the quantum value chain, but its competitive position and ability to scale vary considerably by segment. Public support should therefore not be spread evenly across the entire stack. It should concentrate on areas where European suppliers have credible technological strengths and a realistic path to global scale. In segments where Europe has only a marginal presence, established non-European competitors are strong, and barriers to entry are high, attempting to recreate an indigenous capability may be prohibitively expensive and divert capital from stronger European players. In these cases, partnership with, or sourcing from, trusted best-in-class providers may be the more effective strategy.

Figure 6 translates this principle into a resource-allocation framework. First, it determines whether a credible European supplier exists. Where one does, the strength of established non-European competitors and the barriers facing new entrants indicate whether the European position should be defended, scaled, monitored or reinforced. Where no European supplier exists, the same factors indicate whether Europe has a credible opportunity to enter, should preserve a lower-cost option or should partner with an established provider rather than pursue an expensive standalone entry.

Figure 6. Framework for resource allocation within the European Union, following a four-step logic.



First, a binary observation on European Union/non-European Union current supplier is done. From there we identify different actions as a function of competition and barrier to entry. Finally, a circle indicates whether a critical dependency has been raised, which automatically triggers an assessment of whether the action indicated by the graphs needs to be revised.

A critical-dependency review then determines whether the default result should be overridden. The review is triggered where a component or service is essential to the operation, security or value capture of the broader quantum–HPC–AI stack and supply is concentrated, lacks a qualified substitute or could not be replaced within an acceptable period following disruption. Triggering the review does not automatically require Europe to build the capability itself. The appropriate response may instead include supplier diversification, interoperability and portability requirements, long-term access or continuity commitments or strategic co-investment. Targeted European capacity-building should be reserved for cases where these measures cannot adequately manage the dependency.

Second, overlap across the value chain presents both costs and benefits. User-interface providers often maintain applications teams, while QPU companies build their own software development kits, error-correction capabilities and control stacks; specialist startups also focus on individual layers such as software development kits and operating systems. Competing approaches can preserve technical option value and improve product performance while the technology remains immature, but persistent duplication can spread limited public funding too thinly. Public support should therefore use transparent benchmarks, progressive stage gates and sunset criteria to distinguish productive competition from repeated investment in approaches that do not demonstrate technical or commercial progress. Shared pre-competitive infrastructure and interoperable interfaces can also reduce fixed costs without narrowing the field prematurely. The Quantum Industry Consortium (QuIC) has suggested several European Union-level governance mechanisms that the European Commission should consider.¹²

‘Public support should use transparent benchmarks, progressive stage gates and sunset criteria.’

Third, the architectural layer between the operating system and user interface constitutes the traditional focal point of vendor lock-in; the European Commission should seek to mitigate this risk. As an opportunity, these layers represent the sectors of the value chain where entry barriers are still low and the main resource is talent, a strength of the European Union. This highlights the importance of talent in the European quantum act that is necessary to strengthen the software/interoperability layer.

Fourth, the quantum industry is evolving quickly, and as a consequence, the dominant modes of value capture are likely to change over time. For example, today, QPU companies spend large amounts of capital expenditure to acquire the necessary components for qubit control and cryogenic equipment. The cost of a state-of-the-art quantum machine today is in the order of tens of millions of euros, which largely benefits components suppliers and QPU providers.¹³ However, value might shift towards later stages of the value chain once the industry matures. This argument reemphasises the need for a governing body that coordinates across digital policy acts and is equally attentive to how the industry and its individual players evolve and mature.

¹² European Quantum Industry Consortium, “Position Paper on the Quantum Europe Strategy,” August 2025, page 20

¹³ EuroHPC joint undertaking, “Inauguration of Euro-Q-Exa: Expanding the European Quantum Computing Infrastructure,” [press release] 12 February 2026.

To summarise, it is crucial for the quantum act to leverage the technological strengths of European players, nurturing the supply side to build out large-scale European integrators. Simultaneously, there is an opportunity to seek partnerships in sectors where Europe lags and avoid ineffective investment. At this stage, controlling the entire quantum value chain is implausible; purposeful, targeted industry support will nurture European quantum capacities and allow the European Union to shape the quantum future from its strongest positions.

Quantum Demand: Two Use Cases with Distinct Risk and Return Profiles

On the demand side, industrial applications are the primary value driver of the emerging quantum computing market. It is the incumbent companies of different industries that will experience outsised benefits from quantum technology, and it is therefore important to leverage their decades of expertise and allow industry to develop solutions most beneficial to them. Quantum computing broadly enables two types of computing paradigms that operate

with different time scales and industrial mechanics: optimisation and scientific discovery.

‘Quantum computing enables two industrial paradigms: optimisation and scientific discovery.’

First, optimisation affects industries like logistics, financial services, telecommunications and energy.

Optimisation problems today have some traction in hybrid quantum-classical computing architectures, where the quantum processing units tackle hard subroutines and classical systems work on the remaining problems. Typically, this class of problems encompasses computational problems that are well understood, but leverage quantum computing at specific points in computing workflows where it excels to realise targeted speed and efficiency gains. At industrial scale, even small, validated efficiency improvements can create substantial value, although the magnitude depends on the specific use case and operational cost base. The central challenge is to manage economic trade-offs effectively, ensuring that investments generate near-term value for individual firms while accelerating the maturation of industry-wide cost structures needed to secure Europe’s long-term competitiveness in quantum technologies on both the supply and demand sides.

Second, the quantum advantage in scientific discovery comes from solving computational problems that were too complex and intractable with classical computers; in other words, to expand the frontiers of scientific discovery, creating entirely new knowledge and products. This is particularly germane in chemistry-intensive industries such as pharmaceuticals/ biotech, oil and gas, and materials engineering, where the computational costs of exploring the entire conformational space of chemical reactions are far beyond the limits of classical HPC. The main ambiguity of scientific discovery is that the advances come as more step-like, punctuated events, compared to the more gradual improvements of optimisation-class problems. For example, even if a pharmaceutical company would discover another blockbuster drug such as Wegovy (GLP-1 receptor agonist), it takes time to obtain regulatory approval, ramp up production, and scale distribution. In addition, the exact horizon of novel drug discovery is uncertain, and risks of failure (e.g. adverse effects) are always present.

Generally speaking, the scientific discovery class of quantum computing problems is higher-impact and higher-risk, with longer, uncertain timelines. The benefits are very difficult to forecast because they emerge as discoveries rather than efficiencies; social returns may be enormous but uncertain. In this respect, appropriate policy interventions more closely resemble support for basic science or space exploration than more traditional industrial policy.

Problem Class	Do's	Don'ts
Optimisation	Accelerate industrial productivity and create early demand for European quantum solutions in hybrid QPU-HPC pilots that are embedded in live production workflows. Structure demand-side research grants as outcome-linked with tangible results. Deploy industry testbeds, co-investment programmes, tax incentives for adoption, public-private partnerships, challenge-based R&D accelerators, sectoral demonstration projects.	Don't view as a moonshot, the value of optimisation problems comes from compounding smaller efficiency benefits at scale. Evaluating projects only on breakthrough potential; neglecting small efficiency gains that scale across entire industries. Don't silo optimisation into R&D but deploy it where it is needed throughout operations and services at industrial scale.
Scientific discovery	Expand Europe's scientific and technological frontier. Patient and risk-tolerant funding instruments. Advances are step-like rather than continuous. Instruments to accelerate product development need high failure tolerance across the portfolio. Pair QPU/algorithm teams directly with domain scientists in the pharma/chemistry incumbents. Require an industrial scale-up partner as a funding condition. Patient and risk-tolerant funding instruments: Mission-oriented funding, long-duration R&D grants, translational research programmes, public research infrastructure, regulatory agility for novel products.	Don't apply near-term return-on-investment metrics. Don't let it get crowded out by faster payback optimisation projects competing for the same budget. Don't evaluate programmes using conventional industrial productivity metrics.

In terms of quantum adoption, Europe is in fact leading in some verticals.¹⁴ There is, therefore, a real chance to foster demand, which in turn will also increase returns along the entire value chain. Such demand-side quantum programmes require focus on organisations serious about developing quantum solutions as evidenced by concrete investments in financial and human capital. For instance, around one-third of companies' quantum efforts allocated more than \$10 million to quantum computing initiatives in 2025, with 7% allotting more than \$50 million.¹⁵ These budgets flowed mostly to use-case and application development, integration with existing tech stacks and internal capability building.

A common policy argument is that Europe lacks risk-tolerant venture capital for quantum startups. While access to growth capital remains important, this diagnosis is incomplete. Europe's greatest strategic advantage is not the number of quantum startups it can create, but the concentration of globally competitive industrial incumbents in sectors such as pharmaceuticals, chemicals, energy, aerospace, telecommunications and advanced manufacturing. Public investment should therefore focus less on subsidising quantum suppliers directly and more on helping these industries solve high-value problems with quantum-enabled solutions. This includes molecular simulation and target identification for pharmaceuticals and biotechnology; the development of more efficient catalysts, batteries, fertilisers and advanced materials for the chemical industry; grid balancing, transmission planning and renewable-energy integration for energy systems; innovation in hydrogen, carbon-capture and energy-storage technologies; and improved materials, logistics, process optimisation and engineering design across the aerospace and defence sectors. A stronger focus on stimulating demand for quantum technologies in Europe would not only accelerate adoption but also help create world-leading quantum system integrators.

Because those quantum system integrators need lead customers as much as they need grants and venture capital, the European Union should deploy demand-side instruments such as challenge-based procurement programmes, mission-oriented funding calls, matched-funding schemes requiring industrial co-investment and milestone-based demonstration grants tied to measurable industrial outcomes. Public support should be organised around strategic industrial challenges rather than individual technology vendors, requiring consortia composed of a quantum provider, an industrial incumbent, and a EuroHPC/HPC centre to collaborate on clearly defined use cases and deliver demonstrable industrial value. Eligibility for funding should be determined by measurable European benefit rather than strict European Union-origin requirements across every technology layer, with selection criteria rewarding European hosting and access, participation by European industry and research institutions, workforce and supply-chain development, retention of economic and intellectual-property spillovers, security and continuity commitments, and interoperable interfaces. At the same time, trusted best-in-class components from international suppliers should remain eligible where excluding them would increase costs and delay deployment, consistent with applicable procurement rules and the European Union's international commitments. By funding the solution of high-value industrial problems rather than attempting to pick technological winners, the European Union can simultaneously strengthen industrial competitiveness, stimulate demand across the quantum value chain, accelerate

¹⁴ McKinsey & Company, "McKinsey Quantum Technology Monitor 2026: A Commercial Tipping Point," April 2026, page 15.

¹⁵ McKinsey & Company, "McKinsey Quantum Technology Monitor 2026: A Commercial Tipping Point," April 2026, Exhibit 3.

commercialisation, foster globally competitive European integrators and improve the effectiveness of scarce public resources.

Recommendations to Scale European Quantum Computing

The European Union enters the quantum era with a rare combination of assets: world-leading science, sovereign industrial customers in sectors poised for outsized quantum impact and the European quantum act, which incentivises growth in a key technological asset. What the European quantum ecosystem lacks is not science, absolute funding or talent, but the connective tissue that turns these core capacities into globally competitive companies. This requires integrated AI/HPC/quantum infrastructure rather than three siloed programmes, mechanisms that help specialised firms scale and collaborate across a diversified supply chain, and demand-side quantum programmes that encourage large enterprise customers to adopt quantum in production workflows. Europe boasts a proud history of major scientific and deep-tech development, but too often the resulting economic value has accrued elsewhere. The European quantum act is an opportunity to build on Europe's existing strengths and commercialise its quantum capabilities at scale.

‘In terms of quantum adoption, Europe is leading in some verticals.’

We translate the foregoing analysis into four high-level recommendations.

- 1. Commit to a shared vision to mobilise public and private capital.** Public and private capital are both needed to create a flourishing European quantum ecosystem, but exhibit distinct functions in scaling the technology. The European Union and its member states together have allocated public investments that are competitive at the global stage, but without intra-European coordination, these funds risk dilution across redundant investments. Conversely, a coordinated and focused effort will foster a European quantum ecosystem capable of generating significant long-term gross domestic product (GDP) impact. As public investment de-risks emerging technologies, private capital steps in to finance further scaling and commercialisation. Yet while the U.S. has already seen quantum funding rounds surpass \$1 billion, Europe remains comparatively undercapitalised. The challenge, and opportunity, for the European Union is therefore to create the market conditions that attract and mobilise private investment at scale, allowing it to complement public funding.
- 2. Build the AI/HPC/Quantum ecosystem by coordinating across policy acts and the entire value chain.** The quantum act, the chips act, the EuroHPC regulation and the AI continent plan currently operate as parallel instruments with partly overlapping objectives and separate governance.¹⁶ The hybrid AI/HPC/QPU computing model requires that they be

¹⁶ See European Parliament and Council of the European Union, “Regulation (EU) 2023/1781 of the European Parliament and of the Council of 13 September 2023 Establishing a Framework of Measures for Strengthening Europe’s Semiconductor Ecosystem and Amending Regulation (EU) 2021/694 (chips act),” *Official Journal of the European Union*, L 229, 18 September 2023; Council of the European Union, “Council Regulation (EU) 2021/1173 of 13 July 2021 on Establishing the European High Performance Computing Joint Undertaking and Repealing Regulation (EU) 2018/1488,” *Official Journal of the European Union*, L 256, 19 July 2021, pp.3–51; European Commission, “AI Continent Action Plan,” *Communication of the European Commission*, COM(2025)165, 09 April 2025;

treated as a single programme. Concretely, the EuroHPC quantum-hosting sites should be the physical anchor of the ecosystem, equipped with integrated QPU, HPC and AI infrastructure under coordinated stimulus.¹⁷ The chips joint undertaking quantum pilot lines should be operationally linked to those sites rather than developed in parallel, and the classical layers, such as HPC orchestration and AI frameworks, should be designed for multi-vendor interoperability rather than sovereign duplication of stacks.¹⁸ Delivering this coordination is itself a substantial commercialisation and organisational task, which requires expertise in industrial economics, cross-act integration, vertical strategy and procurement design. This expertise in the current advisory bodies (the quantum flagship senior advisory board, the quantum coordination board, the new high-level advisory board established alongside the 2025 quantum Europe strategy) should be emphasised in its composition, either through dedicated seats on the existing bodies, or through a parallel commercialisation advisory committee that reports into the same governance structure.

- 3. Build pan-European integrators by facilitating consolidation.** The current six qubit modalities require specialised components and operating systems. They currently compete for European public funding through a potpourri of funding vehicles: the chips act pilot lines, the upcoming European quantum act, funding from the European Innovation Council, the European Innovation Fund, the European Investment Bank and national quantum strategies scattered across 27 member states. The risk to manage here is not the success of any specific modality, but *intra-modality duplication*: multiple, sub-scale European startups pursuing the same modality with overlapping technical approaches, each individually too small to compete with U.S. or Chinese pure-plays of the same kind. The quantum act should establish a coordinated funding track that preserves modality-level diversity at the European level, actively facilitates consolidation within each track among startups whose technical approaches overlap and extends, where possible, the integration boundary to the adjacent modality-specific supply chain. We suggest the assessment of supply-side investments through a dedicated supply-side framework. Its purpose is to provide the European Commission with transparent guidance for supply-side investments, identifying scale gaps relative to global competitors and revealing intra-European duplication efforts.
- 4. Use demand-side stimulus to nurture quantum computing solutions, with dedicated tracks for optimisation and scientific discovery.** Across both classes of computation, stimuli should match the scale at which incumbents are already committing internally. For optimisation problems, stimuli should be outcome-linked and benchmarked against the state-of-the-art KPIs deployed at industrial scale, allowing efficiency gains to compound. For scientific discovery, stimuli should be structured patiently and tolerate high failure rates, since advances in scientific discovery problems are often punctuated and step-like, yet nominally greater. As such, short-term ROI metrics risk overshadowing the long-horizon and colossal potential that justify public quantum investments in the first place. Across both tracks, stimuli should be sized to match the scale of incumbent industrial outlays, synchronising procurement mechanisms with industrial investment cycles. Since Europe already leads in several quantum verticals, this stimulus strategy will convert demand-side

¹⁷ The European High Performance Computing Joint Undertaking, “Our Quantum Computers”, accessed 20 September 2026.

¹⁸ European Commission, “Quantum Europe Strategy: Quantum Europe in a Changing World,” *Communication of the European Commission*, COM(2025)363, 02 July 2025.

strength into a concrete revenue path for European suppliers where Europe has its greatest quantum potential.

Looking ahead, the quantum act's success will not be visible immediately after its deployment in 2027. It will first be evident well beyond 2030. The fundamental question is whether Europe can develop globally competitive quantum integrators that are deeply rooted in its industrial economy and able to compete on equal footing with their American and Chinese counterparts. Failing that, Europe risks once again finding itself supplying skilled researchers and innovators to foreign competitors, while exercising regulatory authority over domestic markets whose key technologies and commercial champions are based in the U.S. and China. The infrastructure to deliver the first outcomes exists in Europe today. The policy choices that determine which outcomes scale are being made now.

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