QuIC Position Paper on the Quantum Europe Strategy

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1 INTRODUCTION

On 2 July 2025, the European Commission (EC) published the *Quantum Europe Strategy: Quantum Europe in a Changing World (COM(2025) 363)*, setting out an ambitious vision to position Europe as a global leader in quantum technologies by 2030. This *Strategy* builds on Europe's world-class research, thriving startup base, and long-standing scientific excellence, while acknowledging critical challenges: fragmented efforts across European Union (EU) Member States (MS), limited industrial uptake, and insufficient private investment. Addressing these shortcomings is essential for transforming Europe's scientific leadership into competitive industrial capacity and technological sovereignty.

The *Strategy* focuses on five interconnected areas: Research and Innovation, Quantum Infrastructures, Strengthening the Ecosystem, Space and Dual-Use Applications, and Quantum Skills. It introduces a governance framework and outlines time-bound milestones, including the extension of the European High Performance Computing Joint Undertaking (EuroHPC JU) mandate, the establishment of quantum pilot lines, and a proposed Quantum Act in 2026.

As the collective voice of the European quantum industry, the European Quantum Industry Consortium (QuIC) welcomes this *Strategy* and sees it as a pivotal moment to accelerate the transition from research to deployment. With over 200 members and affiliates across the quantum value chain, QuIC represents a unique convergence of industrial, academic, and policy expertise. This position paper reflects QuIC's recommendations for the effective implementation of the *Quantum Europe Strategy*, most specifically the importance of strategic selection and the capacity of the governing body to halt initiatives that diverge from the ultimate strategic vision. It also identifies actions necessary to ensure Europe's leadership in this transformative domain.

METHODOLOGY AND SCOPE

This position paper is the outcome of a broad-ranging consultative process within QuIC that brought together industry leaders, quantum-science specialists, and policy experts. Nearly 60 QuIC members and affiliates actively contributed through a sequence of sprint meetings held in July 2025, plus targeted discussions and written submissions. The drafting team also incorporated insights and data from earlier QuIC white papers, further extending the collective expertise on which the document stands.

To respect the EC's guidance on stakeholder engagement, the main sections of this paper were drafted by EU-headquartered QuIC members, ensuring alignment with EU perspectives and policy frameworks. Non-EU QuIC members and affiliates [1] contributed inputs during the initial brainstorming phase and their perspectives are consolidated in Chapter 7. International Perspectives.

This document is structured to mirror the EC's *Quantum Europe Strategy*, offering:

- A snapshot of the *Strategy* and its pillars;
- Critical analysis and recommendations for each strategic area, supported by specific policy recommendations;
- Identification of potential gaps and emerging themes;
- A dedicated section on international perspectives; and
- A concluding set of overarching messages aimed at guiding implementation.

Through this paper, QuIC seeks to ensure that Europe not only maintains its scientific excellence but also builds the industrial capacity, market leadership, and strategic autonomy necessary to thrive in the global quantum economy.

IMPORTANT NOTES

(1) Affiliates are Europe-based subsidiaries of companies with a controlling entity located in selected foreign countries: Australia, Canada, India, Japan, New Zealand, the Republic of Korea (South Korea), Singapore, and the United States of America.

2 REVIEW OF THE QUANTUM STRATEGIC AREAS

2.1 Quantum Europe Research and Innovation

The *Quantum Europe Strategy* outlines an ambitious Research and Innovation (R&I) framework, from foundational research to industrial deployment, with a welcome emphasis on talent development. However, to fully realise its transformative potential and deliver on Europe's strategic autonomy, the implementation strategy must address critical gaps and structural risks. Five key points are highlighted below.

The *Strategy* also announces the amendment of the EuroHPC JU Regulation to temporarily extend its remit to all quantum technologies. Although the move is sensible and generally supported by QuIC in the absence of a suitable alternative, it delegates responsibility to a body which was not conceived around quantum technologies in general. We recommend that the EC, participating MS and the EuroHPC JU rapidly onboard industry and academic experts from all quantum areas, to effectively manage the expanded mission envisaged. QuIC and its broad member base are ready to assist.

PRESERVE SPACE FOR BOTTOM-UP INITIATIVES IN THE FUTURE QUANTUM ACT

Europe's innovation pipeline requires a balanced mix of bottom-up and top-down tools. While JUs have proven effective in coordinating large-scale initiatives, their top-down nature risks overlooking and leaving unfunded early-stage breakthroughs. A reformed implementing body under the future Quantum Act must preserve space for bottom-up initiatives that enable academia, startups, and SMEs to lead projects, fostering a dynamic ecosystem where novel technologies can emerge and scale.

STRENGTHEN EU COMPETITIVENESS WITH INCLUSIVE POLICIES

Competitiveness demands inclusivity. Current JU co-funding mechanisms depend heavily on the individual political agendas of EU MS, creating asymmetries that hinder a truly pan-European effort.

The EU Quantum Act must introduce equal-opportunity measures to ensure participation across all MS, providing access to state-of-the-art infrastructure and addressing technological disparities that threaten to fragment the EU's quantum landscape.

PROVIDE ACCESS TO SPECIALISED INFRASTRUCTURE FOR EARLY-STAGE INNOVATION

Europe must secure specialised infrastructure to support early-stage innovation and prototyping that will subsequently be used in pilot lines (see Section 2.3.1. *From the lab to the fab and to industrialisation*). Access to nanofabrication facilities, cleanrooms, and cryogenic setups is critical for researchers and SMEs to increase technology readiness levels (TRLs), de-risk inventions, and develop proof-of-concepts. These activities should align with the EU Startup and Scaleup Strategy and the planned Innovation Act, ensuring that Europe's startups can scale within the single market rather than migrating abroad.

BRING USERS AND QUANTUM TECHNOLOGY DEVELOPERS INTO CLOSE CONTACT

To accelerate technology development and industry adoption, the EU Quantum Act must create platforms and incentives that bring technology developers and potential users into close, continuous dialogue. This engagement will catalyse invention disclosures and diversify use cases. The EU should adopt a more user-centric approach. For instance, the monitoring framework of the Quantum Computing and Simulation Roadmap under development should incorporate user feedback mechanisms to ensure that hardware meets real needs. The extension to all quantum technologies should be accompanied by a balanced approach that prioritises user needs and applications.

ENSURE SUPPORT FOR THE "INVENTIVE STEP" BRIDGING RESEARCH AND INNOVATION

Appropriate measures should be introduced across the EU to incentivise researchers to convert their findings into commercial innovations, and create the necessary conditions for this to happen, such as academic leaves, attractive and transparent intellectual property (IP) transfer conditions, and local accelerator programmes.

Europe cannot afford to let its scientific leadership falter at the junction of discovery and deployment. The Quantum Act must embed a coherent, inclusive, and ambitious R&I strategy to transform Europe into a global quantum powerhouse.

Policy Recommendations:

- The Quantum Act should contain dedicated policies and funding to support bottom-up R&I initiatives.
- Enable rapid early-stage innovation through access to specialised infrastructure before engaging with pilot lines.
- Foster early-stage direct collaboration between technology developers and public/industrial users to accelerate the creation and scaling of valuable quantum solutions later.

2.2 Quantum Europe Infrastructures

2.2.1 Quantum Computing and Simulation

AMBITION AND GOALS

QuIC welcomes the introduction of measurable goals in the *Quantum Europe Strategy*, such as the ambition to reach 100 error-corrected qubits by 2030. However, these goals must be tailored according to qubit modality and specified with quality key performance indicators (KPIs) such as coherence times, qubit connectivity, speed, logical qubit operation fidelity, the accessible quantum gate, or interaction set and scalability.

QuIC proposes these aspects be further elaborated in the Quantum Computing and Simulation Roadmap planned for 2026. The monitoring framework should track not only technical KPIs but also market- and ecosystem-centric metrics, such as the costs per qubit, number of commercial quantum users and lead market growth. This could then feed into Quantum Grand Challenges with business-oriented KPIs, in effect a European analogue to the Quantum Benchmarking Initiative (QBI)[2] (see Section 3.1. *The Main Implementation Components of the Quantum Europe Strategy*).

QuIC also welcomes the proposal to expand the number and capacity of EuroHPC-based quantum computing systems. The aim should be to increase the quality and capacity of the European infrastructure in general, by upgrading and diversifying existing sites as well as installing new systems with improved capabilities. In the near term, the EU should continue to embrace diverse but interoperable quantum modalities and computational paradigms. Soon, however, in the next industrialisation stage, the EU should focus on a narrow set of quantum computing architectures and platforms, selected by independent experts based on competitive, performance-based assessments.

Finally, QuIC supports the hybridisation of quantum with high-performance computing (HPC) and AI factories. However, the integration of cloud-based access models requires further development. The upcoming Quantum Computing and Simulation Roadmap should address not only hardware but also software modularity, algorithmic development, and interoperability with classical infrastructures. Creating a platform that offers quantum accelerators together with artificial intelligence (AI) will enable industry adoption of leading European technology by commercial end users through EU-backed incentives.

IMPORTANT NOTES

[2] DARPA, (2024) "Quantum Benchmarking Initiative (QBI)," programme summary, 2024. Available at: https://www.darpa.mil/research/programs/quantum-benchmarking-initiative

MADE IN EUROPE

An ideal "Made in Europe" full-stack quantum computer would use only European-made parts. At the same time, governments and the industry sector must remain open to best-in-class available technologies, even if they come from outside the EU. A balanced approach is therefore recommended (see Section *4. Review of the International Cooperation*). In supporting home-grown components, focus should be placed on scalable and cost-effective control and readout electronics, cryogenic technologies, quantum interconnects, and advanced photonic solutions building on the strong position of European industry.

The EU must ensure that publicly funded quantum hardware is accessible via well-documented and stable application programming interfaces (APIs) based on common standards. Such a policy would directly support the *Strategy's* emphasis on modularity and interoperability, and the creation of a European software stack with internationally recognised standard interfaces.

SOFTWARE AS A STRATEGIC AREA

To ensure the full commercial impact of Europe's quantum computing and simulation solutions, the *Quantum Europe Strategy* should incorporate a dedicated strategic area focused on Application Software Development (see Section *2.6. Quantum Software and Algorithms*). This area should systematically explore and identify quantum algorithms capable of delivering real business value by outperforming classical methods in solving core mathematical problems across domains. It should also offer support to middleware and workflow orchestration tools that simplify the integration of quantum and classical computing resources, as well as including activities to develop scalable error correction methods.

Policy Recommendations:

- Define clear and ambitious goals based on performance-centric KPIs per qubit modality, as well as a set of ecosystem-centric KPIs.
- Embrace the diversification across qubit platforms in the near term and develop a transparent framework to select the best quantum computing solutions for industrialisation.
- Invest directly in the critical parts of the European value chain, in the quantum hardware as well as in other components of the quantum stack.
- Define a dedicated strategic area focused on software development.

2.2.2 Quantum Communications

The field of Quantum Communications, as detailed in the *Quantum Europe Strategy*, includes both the European Quantum Communication Infrastructure (EuroQCI) and the Quantum Internet. For both themes, AI is expected to play a critical role in ensuring reliable and secure quantum networks. Examples include fault detection, route optimisation in Quantum Key Distribution (QKD) networks and, for the Quantum Internet, automatic network management and quality-of-service improvements as these systems scale beyond the lab.

Certification and standardisation of technology are acknowledged throughout the *Quantum Europe Strategy*, but they are especially relevant for quantum communications, where they are essential for interoperability and security assurance. EU-wide certification and standards in quantum communications can help avoid fragmentation of the EU supply chains. They are necessary prerequisites for the EU to become competitive in quantum communications on the global stage.

EURO-QCI

The successful deployment of a secure quantum communication infrastructure in Europe requires a coordinated strategy centred on QKD networks, supported by complementary approaches such as post-quantum cryptography (PQC).

To date, independent recommendations and roadmaps have been developed for QKD and PQC. QuIC recommends the formulation of common and aligned migration timelines for both QKD and PQC. This would enhance acceptability and coherence across public and private sectors. Public procurement is rightly highlighted as a strategic enabler. EU institutions should take a leading role by acting as early adopters in real operational environments and supporting the migration to quantum-safe communication solutions by critical infrastructure operators.

Investment in space-qualified components for quantum-optical payloads, such as entangled photon sources, quantum detectors, and laser systems, is also crucial to enable satellite QKD and quantum entanglement distribution with satellites. Strengthening initiatives like SAGA [3] would foster synergy with aerospace stakeholders, and at the same time could accelerate deployment and reduce technological risks.

QUANTUM INTERNET

The Quantum Internet represents a fundamentally different objective from QKD networks, aiming not merely to exchange keys securely, but also to transmit and process quantum information across interconnected quantum systems. The difference between the Quantum Internet and QKD and the expected use cases should be made clearer, acknowledging that development of the Quantum Internet will follow a longer and more research-intensive timeline than QKD networks. A mature Quantum Internet will require significant advances in crucial technologies that are still at low TRLs, including quantum memories, quantum repeaters, and scalable entanglement distribution systems.

Policy Recommendations:

- Define a clear and coordinated timeline for QKD and PQC adoption to guide migration across public and private sectors.
- Prioritise investment in space-qualified components to enable secure satellite-based quantum communications, and scale existing initiatives in partnership with the aerospace sector.
- Strengthen the role of certification and standardisation as core pillars of the *Strategy* to ensure interoperability, support market uptake, harmonise European supply chains, and enhance the EU's competitive edge.
- Highlight and support AI solutions for both QKD networks and the Quantum Internet.

2.2.3 Quantum Sensing

Europe is uniquely well-positioned to lead the global race in quantum sensing and metrology, an already relatively mature quantum area. Building on the success of the Quantum Flagship, the EU now has a narrow but decisive window to convert its scientific excellence into industrial, economic, and strategic advantage.

A BROADER, FUTURE-PROOF TECHNOLOGY PORTFOLIO

We commend the *Quantum Europe Strategy* for deploying a network of quantum gravimeters and establishing a pilot infrastructure for quantum magnetic resonance imaging (Q-MRI). However, we recommend to broaden the *Strategy* to cultivate all leading quantum sensing platforms—defect-centre diamonds (nitrogen vacancy (NV) centres), Rydberg atoms, atomic interferometry, optically pumped magnetometers (OPMs), and integrated quantum photonics—while staying open to disruptive paradigms yet to emerge.

IMPORTANT NOTES

(3) European Space Agency. (2024). Satellite Advanced Global Architecture (SAGA). Available at: https://connectivity.esa.int/sites/default/files/2024-10/saga-satellite-advanced-global-architecture-2014.pdf

Quantum sensing transformative development should:

- Reshape civilian markets—from early detection of degenerative diseases via Q-MRI magnetocardiography and magnetoencephalography through quantum magnetometers, to climate-change mitigation through quantum gravimetry, and real-time structural-health monitoring with portable interferometric gravimeters.
- Deliver decisive dual-use benefits (see Section *2.4. Space and Dual-use Quantum Technologies*)—GPS-free positioning, navigation & timing (PNT) with quantum accelerometers, gyroscopes, and clocks; underground and underwater asset detection with quantum magnetometers; and unrivalled radio frequency (RF) spectrum awareness with Rydberg-atom sensors. These capabilities are strategically vital for European defence, aerospace, and space autonomy.
- Create foundries and testbeds for quantum sensing—these will be key to bridging research and real-world deployment. Foundries will ensure scalable, high-quality fabrication of quantum devices like NV-diamond chips and photonic circuits, while testbeds will offer operational environments to validate and benchmark these devices. Together, these foundries and testbeds will drive innovation and adoption.

Classical sensors continue to play a prevalent role in many areas. The goal is to deploy quantum devices where their unique precision yields decisive advantages and new value chains.

FROM LAB CURIOSITY TO FIELD-DEPLOYABLE SYSTEMS

As part of the EU Quantum Sensing Roadmap, an initiative endorsed by QuIC, Europe must move beyond component-level research toward engineered, system-ready platforms. Priority activities should include:

- Modular architectures and quantum-classical interfaces allowing plug-and-play integration with existing infrastructure, scalable sensor networks, and real-time data processing optimised by AI and machine learning.
- Portability and ruggedisation to ensure reliable operation outside controlled laboratories, including miniaturisation, power optimisation, and environmental hardening. .
- Full-stack support, from quantum-grade materials (e.g., isotopically pure diamond, ultra-cold atom sources) to device packaging, control electronics, and application-layer software. As quantum sensors move from the lab to real-world applications, standardisation is essential to allow certification, benchmarking, and seamless, widespread industry adoption.

Quantum sensing represents one of Europe's most promising opportunities to achieve technological sovereignty, dual-use innovation, and sustained economic growth. Strategic, coordinated investments today will ensure Europe leads, not follows, in this critical domain.

Policy Recommendations:

- Launch a time-bound European Quantum Sensing Flagship to invest in sovereign full-stack platforms, prioritising room-temperature technologies such as NV-diamond systems, Rydberg atoms, OPMs, and atomic interferometry.
- Mandate "system-ready" performance characteristics (modularity, portability, ruggedisation, and quantum-classical electronics) in every major EU-funded quantum sensing project.
- Create at least two European quantum sensing foundries and testbeds to provide shared pilot line fabrication, materials supply, and validation—serving academia, startups, SMEs, and prime companies.

- Launch cross-sector "Industrial Upgrade" pilot programmes pairing quantum sensing innovators with automotive, aerospace, energy, and pharma leaders to solve high-value measurement challenges and demonstrate rapid ROI.
- Integrate dual-use governance early, ensuring that export-control, security, and ethical frameworks evolve in lock-step with technology maturation as detailed in Section *2.4. Space and Dual-use Quantum Technologies.*

2.3 The Quantum Europe Ecosystem

2.3.1 From the lab to the fab and to industrialisation

Europe stands at a decisive intersection: while our scientific excellence and vibrant quantum startup ecosystem are undeniable assets, they will not automatically translate into industrial leadership unless Europe takes urgent, coordinated action. The transition from lab-scale quantum prototypes to large-scale manufacturing requires a strategic, European-level response.

The EU's current investments in quantum pilot lines under the Chips Act are an important starting point. However, six pilot lines at €40–50 million each are insufficient to establish globally competitive industrial capabilities. Europe cannot afford a fragmented approach; it must identify the most promising quantum technologies and commit at scale to their industrialisation. QuIC supports the proposal of a Quantum Chips Industrialisation Roadmap, coupled with a stronger Chips Act 2.0, to provide the clarity and resources needed for the European industry to lead.

A bold demand-side strategy is equally critical. Advance purchase agreements by EuroHPC, the European Space Agency, and critical infrastructure operators, contingent on performance thresholds, would send strong market signals and provide the revenue certainty needed for multi-billion-euro investments in EU-based quantum foundries (see Section *2.3.3.*

Investing in quantum startups and scaleups). Without such measures, Europe risks falling behind the US and China, whose firms benefit from integrated capital markets and strategic state support.

Europe must chart its own course toward developing fault-tolerant quantum devices, rather than replicating approaches taken by the US or China. To do so, it is essential to strengthen and accelerate Europe's competitive advantage through IP and expertise in quantum architectures and algorithm design.

Protecting and valorising this European IP must become a priority, including funding mechanisms to support patent maintenance beyond project lifetimes. Otherwise, there is a real danger of seeing critical IP lost or acquired by non-European actors.

Standardisation is another area where Europe must lead, not follow. The *Quantum Europe Strategy* announces the development of a European Quantum Standards Roadmap to be published in 2026. QuIC endorses the idea. The roadmap would provide direction toward reliable testing and specifications, interoperability, quality, and security across quantum systems and accelerate industrialisation and market uptake. The roadmap should define clear EU policies and funding to support the active participation of technical experts from industry in European and international standardisation bodies. It should use the CEN-CENELEC Joint Technical Committee 22 (JTC 22) roadmap [4] as a technical input. In this way, Europe can ensure its interests and values are reflected in quantum solutions adopted worldwide.

Finally, Europe must cultivate a quantum entrepreneurial culture within academia. Applied research calls should allocate funding to explore commercial applications, and local incubators should be integrated to provide business mentoring. These steps are vital to creating a pipeline of startups capable of scaling innovative quantum solutions within Europe.

IMPORTANT NOTES

(4) CEN-CENELEC. (2023). Standardization roadmap on quantum technologies (Release 1). CEN-CENELEC. Available at: CEN-CENELEC Joint Technical Committee 22 (JTC 22) roadmap

The time for incremental measures has passed. Europe must now act with strategic ambition and structured policy to ensure it does not become merely a customer of foreign quantum technologies, but a global leader in their design, manufacture, and deployment.

Policy Recommendations:

- Accelerate the quantum market through pre-commercial procurement (PCP): Public institutions as anchor customers help to bridge the gap from research to commercialisation and boost private investment by generating early revenue.
- Leverage the planned Quantum Chips Industrialisation Roadmap to assess progress across platforms and launch a significantly more focused and well-funded Chips Act 2.0 to scale up the industrialisation of Europe's most mature quantum chip technologies. Dedicated funding for quantum SMEs based on a competitive selection process should be proposed in the roadmap.
- Create "Quantum Systems Foundries": in addition to pilot lines for chips, the EU needs to invest in dedicated facilities for industrial-scale integration of quantum systems to enable deep-tech SMEs to scale up assembly, packaging, and rapid testing of integrated quantum devices.
- Launch the European Quantum Standards Roadmap in 2026, as announced, and introduce incentives that will encourage European quantum startups, scaleups, and other stakeholders to participate in European and international standards development activities. There should be an emphasis on close collaboration with European standardisation bodies and support for the promotion and adoption of standards representing European interests.

2.3.2 Strengthening and scaling up the emerging European quantum ecosystem

To secure Europe's leadership in quantum technologies, the EU must act decisively to build a resilient, competitive, and inclusive quantum ecosystem. This requires strengthening IP protection, fostering industry adoption, harmonising and simplifying regulations, and ensuring that innovation translates into commercial and societal impact across all EU MS.

The Quantum Act must embed political commitments to defend European quantum IP against infringement and allocate dedicated funding within Horizon Europe and the Chips and EuroHPC JUs to support patent filings beyond the lifetime of research projects, particularly for European and US patents. Furthermore, procurement policies should evolve to enable participants to retain full IP rights, incentivising innovation and ensuring that value remains within Europe. Finally, the EC should support the development of European-owned quantum cloud platforms, linking public procurement to European IP and value creation. This will support experimentation, early adoption, and long-term technological sovereignty in the quantum services layer.

To accelerate industry uptake, the EC should support Quantum Competence Clusters (QCCs) in MS—these would be designed to provide quantum education and facilitate access to quantum solutions, while fostering use-case development. The QCCs would also help to lower technical barriers for SMEs. Examples like BasQ (the Basque Quantum initiative), BIQAIN (Bizkaia Quantum Advanced Industries), and the Quantum Application Lab (a Dutch consortium) should serve as guides.

Developing the existing Qu-Test infrastructure into a continent-wide industry-led quantum test network with a common interface will be critical. Shared facilities for sensing, metrology, and benchmarking would lower entry barriers for SMEs and encourage cross-sector innovation.

To complement this, the EU should launch "Quantum Adoption Vouchers"—a high-impact mechanism to subsidise first pilot projects linking end users and EU-based quantum startups—empowering QCCs to act as co-funding hubs for these initiatives.

Public-private collaboration must be reinforced through flagship demonstrators and open challenge calls that connect industry needs with quantum providers. This approach should extend beyond core hardware to include enabling technologies, design architectures, software development, and manufacturing capabilities. Europe's excellence in semiconductors demonstrates that targeted support can create globally competitive supply chains—this momentum must now extend to quantum technologies.

Finally, the EU should support access to APIs, AI-powered interfaces, and open-source tools, enabling companies to experiment with quantum sensing, computing, and communication without requiring deep technical expertise (see Section *2.2.1. Quantum computing and simulation*). A user-centric procurement and monitoring strategy, incorporating systematic feedback loops, will ensure that hardware and applications meet real-world needs and drive early adoption.

Policy Recommendations:

- Lay out a European Quantum IP strategy that emphasises the creation and monetisation of patents, with dedicated funding for patent protection and political support in infringement cases.
- Support the creation of QCCs across the EU to impart quantum knowledge and facilitate access to quantum solutions for early adopters, and to drive the commercial adoption of quantum systems.
- Develop Qu-Test into an industry-led European quantum test network, ensuring open access and common standards.
- Launch "Quantum Adoption Vouchers" and co-funding schemes through QCCs to de-risk early adoption and strengthen market traction for EU startups.
- Establish best practice public procurement policies, enabling startups to participate and ensuring companies retain full rights to their IP and knowledge.

2.3.3 Investing in quantum startups and scaleups

The EC seeks to mobilise significant private and public funds to support the growth and competitiveness of European quantum startups and scaleups [5]. While several instruments exist [6], certain key gaps remain and must be addressed to ensure Europe's leadership in quantum technologies.

EXPANDING THE POOL OF CAPITAL AVAILABLE

The EU must act on the Competitiveness Compass [7] and the Letta Report [8] to simplify and deregulate its single market. It must avoid instruments that deter investment due to complexity or bureaucratic incompatibility.

Current EU instruments cannot match the scale of late-stage rounds seen in the US and China. The Scaleup Fund plans to support deep-tech scaleups with €20 billion. QuIC proposes the creation of a complementary €2 billion per year through a "Quantum Sovereignty Growth Fund", co-financed by the European Investment Bank (EIB) and leading EU pension funds, with fast-track decision-making to rival US investor speed.

There are real barriers to achievement of the capital markets union. The EC should adjust regulation (e.g., the Solvency II regime) to allow and incentivise pension funds and insurers to allocate a higher

IMPORTANT NOTES

(5) European Commission. (2025). EU startup and scaleup strategy (SWD). Directorate-General for Research and Innovation. Available at: https://research-and-innovation.ec.europa.eu/document/download/8f899486-6e4e-48df-8633-9582375f41eb_en?filename=ec_rtd_eu-startup-scaleup-strategy-swd.pdf
(6) Key EU instruments: European Innovation Council (EIC) Accelerator; Scale-up Europe Fund; InvestEU (Strategic Technologies window); measures under the Savings & Investments Union; forthcoming Framework for IP Valuation (2027).
(7) European Commission. (2025). Competitiveness compass. Available at: https://commission.europa.eu/topics/eu-competitiveness/competitiveness-compass_en
(8) Letta, E. (2024). Much more than a market. Brussels: European Council. Available at: https://www.consilium.europa.eu/media/ny3j24sm/much-more-than-a-market-report-by-enrico-letta.pdf

percentage of capital to emerging technology sectors, especially sectors considered critical for the economic security of Europe—the Commission Recommendation (EU) 2023/2113 identifies "four technology areas which it considers highly likely to present the most sensitive and immediate risks related to technology security and technology leakage, namely Advanced Semiconductors, Artificial Intelligence, Quantum Technologies and Biotechnologies" [9]. The Recommendation further stresses that "*Quantum technologies have a vast potential to transform multiple sectors, civil and military, by enabling new technologies and systems that make use of the properties of quantum mechanics*". In addition, the EC could explore new regulated investment products for retail investors who have an appetite for high-risk, high-reward emerging fields such as quantum technologies —for example, Exchange-Traded Funds (ETFs) structured to comply with the EU's Undertakings for Collective Investment in Transferable Securities (UCITS) framework.

ALIGNING STAKEHOLDER INCENTIVES & MAKING EUROPE GLOBALLY COMPETITIVE

Investors need a clear route to exit. This may involve mergers and acquisitions (M&As), including with non-European players. The EC and EU MS must be mindful of these investor needs and proactively cultivate attractive conditions for intra-EU M&As.

Furthermore, the EU must consolidate its quantum value chain to de-fragment its market and create greater European competitiveness against rival foreign firms on the global stage.

Initial public offerings (IPOs) in European stock markets could support the growth of European quantum prime companies and drive investment, but conditions in Europe must be improved. The EC Listing Act goes some way towards addressing concerns, although certain bureaucratic hurdles remain.

Europe also has a real disadvantage vis-à-vis the US in its lack of liquidity and, on a more practical level, analyst coverage.

Additionally, tax incentives for founders and investors in deep tech should be introduced and harmonised across the EU. With the right conditions, additional private capital and talent from around the world (see Section *2.5. Quantum Skills*) could be drawn to Europe's quantum tech sector.

Finally, QuIC urges the EC to involve industry experts and investors in future development phases of the *Strategy* and Quantum Act and to adopt their recommendations. We also stress that an EU-wide 28th regime, with uniform implementation across the bloc, is of crucial importance for the competitiveness of startups and scaleups

Policy Recommendations:

- Create strong entry and exit pathways: (i) make the 28th regime a single, lean, digital-first, EU-wide legal framework for companies with common rules across the EU; (ii) anchor at least 10% of IPO free floats for 24 months to enhance liquidity and investor confidence through the Scaleup Fund and so make EU stock listings more competitive with US exchanges (iii) create pan-EU tax incentives for quantum investments to augment the influx of private capital and draw talent to the EU quantum tech sector.
- De-risk investment and expand access to capital: (i) deploy strategic anchor contracts and advanced public procurement across key European sectors (e.g., space, finance, pharma, energy defence) that allow pre-ordering and milestone-based pilot deployments from EU quantum startups and scaleups (ii) establish a €2 billion/year Quantum Sovereignty Growth Fund, co-financed by the EIB and leading EU pension

IMPORTANT NOTES

(9) European Commission. (2023). Commission Recommendation (EU) 2023/2113 of 3 October 2023 on critical technologies for the Union's economic security. Official Journal of the European Union. Available at: (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ%3AL_202302113)

funds (iii) adjust prudential regulation (such as Solvency II) to incentivise pension funds and insurers to allocate more capital to high-risk, high-reward quantum sectors (iv) develop retail investor-friendly products (e.g., UCITS-compliant quantum ETFs) to broaden investment sources.

- Enhance market competitiveness: (i) streamline and fast-track intra-EU M&As and cross-border activities to overcome fragmentation and encourage consolidation and scaling (ii) set up a fund to support intra-EU M&As for an EU Quantum Tech Stack (iii) create an EU-backed Quantum Analyst Pool to provide investment-grade data.

2.3.4 Strengthening the security of the supply chain

ESTABLISHMENT OF AN EU QUANTUM SUPPLY CHAIN BOARD

The EC conducts an EU-wide Quantum Technology Risk Assessment to address strategic dependencies and vulnerabilities in the quantum value chain. QuIC proposes establishing a permanent EU Quantum Supply Chain Board, led by relevant Directorates-General with input from key quantum stakeholders, including QuIC on behalf of the European quantum industry. The Board's mission would be to balance European supply chain resilience with access to global components. It should identify critical components and suppliers, perform risk assessments, and update the Critical Components List regularly. The Board should publish an annual Quantum Supply Chain Action Plan, support existing European assets, address vulnerabilities with rapid-response tools, and align activities with quantum-for-defence undertakings like the NATO Transatlantic Quantum Community.

SUPPLY CHAIN MONITORING AND EARLY WARNING SYSTEMS

The *Quantum Europe Strategy* rightly calls for supply chain risk assessments and monitoring. We propose to detail the assessments and monitoring mechanism further, such as a real-time monitoring and early warning capabilities into the Chips JU and pilot line procurement. This would involve requiring pilot lines to enter a bill of materials assessment with supplier origin data, alternatives, and delivery lead times into a secure EU database. This data would be used to develop geopolitical and natural hazard risk alerts for managers of funding programmes and address potential over-regulation risks that could harm supply chains.

PROMOTION OF "MADE IN EUROPE" COMPONENTS

To foster European autonomy in components, the EC should invest in quantum chip pilot lines to scale up EU production (see Section *2.3.1. From the lab to the fab and to industrialisation*). Additionally, the EC should incentivise EU critical component providers (e.g., in photonics, cryogenics, semiconductors) to integrate quantum use cases into their roadmaps. Finally, EU-sourced alternatives for critical raw materials should be prioritised.

SUSTAINABILITY AND RISK MANAGEMENT

Sustainability is only indirectly mentioned in the *Strategy* through emphasis on energy-efficient quantum computing and sovereign supply chains. We recommend more emphasis on sustainability, including the integration of circular economy principles and resource reuse into quantum manufacturing pilot lines. The *Strategy* should encourage lifecycle impact assessments and promote redundant or backup production lines for essential components, particularly those with known sourcing risks (see Section *6. Sustainable Quantum Development*).

SUPPORT FOR EXPORT CONTROLS AND STRATEGIC PARTNERSHIPS

The *Quantum Europe Strategy* recognises the impact of third-country export controls on EU interests and wants to support industry partnerships to improve EU autonomy and mitigate risk. The creation of a centralised Quantum Export Control Advisory Service, coordinated by relevant Directorates-General, would aid startups to better navigate the complex cross-border regulation environment and anticipate restrictions. Finally, the EU should foster partnerships with like-minded countries (see Section *4. Review of the International Cooperation*) to diversify the quantum supply chain for components unavailable in the EU while supporting the emergence of local manufacturers.

SECURITY CERTIFICATIONS

The *Strategy* mentions the development of pre-certification testbeds for QKD and integration with the European Union Agency for Cybersecurity (ENISA)'s quantum-safe cryptography work, as well as compliance with defence-grade security and cybersecurity protocols (see Section *2.2.2. Quantum communications*). We recommend expanding support for component-level certification, including cryogenic systems, sensors, control electronics. Specifically, we would encourage aid for startups with security audits and certification of quantum devices and components under common EU frameworks, so that these could be used in public procurement and defence applications.

Policy Recommendations:

- Establish a Quantum Supply Chain Board: Create a body to identify critical components and suppliers, publish an annual action plan, and support European assets in the global quantum supply chain.
- Supply chain monitoring and early warning systems: Integrate real-time monitoring and early warning capabilities into the Chips JU and pilot line procurement.
- Promote "Made in Europe" components: Incentivise EU tech ecosystems to integrate quantum use cases, prioritise EU-sourced alternatives, and develop dual-track approaches.
- Support for export controls and strategic partnerships: Establish a Quantum Export Control Advisory Service, facilitate co-manufacturing partnerships, and foster partnerships with allied countries.
- Security certifications: Expand support for component-level certification schemes and provide funding for security audits and certifications of quantum devices and components.

2.4 Space and Dual-use Quantum Technologies (Security and Defence)

Quantum technologies are rapidly emerging as a transformative force in the security and defence landscape. Quantum computing enables breakthroughs in data processing and logistics optimisation, supporting information superiority by providing new software-defined services to commanders on the battlefield. Quantum sensing enhances intelligence, surveillance, and reconnaissance (ISR) through ultra-precise detection and environmental awareness. Quantum-secure communication ensures the confidentiality and resilience of mission-critical information.

Integrating these technologies into defence systems presents a structural challenge. Defence platforms typically follow long development cycles and remain in service for decades, while quantum technologies follow rapid iteration cycles, often driven by small, agile innovators. Bridging this gap requires a coordinated and forward-looking strategy. To address this, the following actions are essential:

- Standardise interfaces between quantum cores and enabling technologies (hardware, software, algorithms) to ensure modularity and interoperability.
- Adapt defence supply chains, designs, and operations to accommodate new performance requirements and integrate specialised quantum suppliers.
- Educate and equip defence engineers to design systems that effectively incorporate quantum components.
- Conduct regular military exercises and test campaigns to validate quantum technologies under operational conditions.

At the European level, a unified and strategic approach is critical. The EU must act cohesively to ensure strategic autonomy and resilience in quantum technologies. This entails:

- Aligning national and international defence roadmaps to create a coherent European strategy.
- Fostering collaboration among academia, SMEs, and established defence and aerospace industries, leveraging initiatives such as the European Defence Fund (EDF) and NATO's Defence Innovation Accelerator for the North Atlantic (DIANA).
- EU-wide facilitation of academic research for defence-related quantum innovation through education, funding, and access to secure facilities and protocols.
- Balancing open and closed collaboration models, ensuring innovation is not prematurely restricted while safeguarding strategic interests.
- Implementing agile procurement mechanisms to support both startups and established companies in bringing quantum solutions to market.
- Monitoring and encouraging IP development to maintain European competitiveness in the quantum domain.

Space is a particularly promising domain for quantum technologies. Secure communication, navigation, sensing capabilities, and exploration of space can be significantly enhanced through space-based quantum systems. To realise this potential, the EU should:

- Promote international collaboration, including public-private partnerships and joint ventures between academia and industry.
- Invest in national and European testbeds, including both ground-based and orbital demonstrators.
- Integrate quantum space technologies into national and EU-level space planning and capability development.

Finally, the adoption of quantum technologies for security and defence must be guided by a clear and actionable roadmap. This includes:

- Developing a migration timeline for PQC and QKD.
- Supporting SMEs through workshops on understanding and navigating the defence landscape, coordinated with leading defence companies/suppliers.
- Encouraging agility in company operations to keep pace with evolving threats and technological advances.

Policy Recommendations:

- Foster the demonstration of quantum capabilities through pilot projects and real-world use cases in defence environments, and a continuous improvement cycle based on these demonstrations/tests.
- Provide access to open testing infrastructures to accelerate innovation and dual-use validation.
- Augment the impact of defence spending in quantum by de-fragmentising procurement processes and enforcing single market rules.
- Remove cross-border barriers to cooperation among dual-use quantum companies and encourage joint procurement of dual-use quantum solutions.
- Create a continent-wide defence sandbox with budget to pay for trials to encourage the military from across MS to experiment with quantum technologies.

2.5 Quantum Skills

Europe's quantum vision depends on its capacity to convert scientific excellence into an industry-ready workforce. Section 2.5 of the *Quantum Europe Strategy* acknowledges this need and proposes, inter alia, a *virtual European Quantum Skills Academy (2026)*, talent mobility and fellowship schemes, an apprenticeship pilot, and EU-wide skills competitions. QuIC welcomes these directions, but identifies three structural risks:

- Under-scoped budget: €10 million for the Academy appears insufficient compared with previous EU programmes on digital skills.
- Curriculum/industry mismatch: Shortages are most acute in quantum-adjacent domains—software engineering, control electronics, photonics integration—where teaching capacity is thinnest.
- Talent attrition: Lengthy visa processes and uncompetitive early career packages prompt PhD graduates to leave for better-paid positions abroad; fast-track visa solutions and retention incentives are therefore critical.

Accordingly, QuIC advocates a shift from education supply to workforce outcomes, built on four priorities:

GIVE THE ACADEMY AN INDUSTRY-FIRST MANDATE

Beyond consolidating existing EU projects, the Academy should act as a brokerage platform where companies co-design modules and trigger rapid updates when skills requirements change. It should support on-the-job training for professionals to adapt their skill set to the quantum sector, such as helping "traditional" programmers transition to quantum-specific programming theory and practice.

DEVELOP MULTIDISCIPLINARY, "QUANTUM-ADJACENT" CAREERS

Programmes must target computer science, electronics, cryogenics, and business skills alongside quantum physics. Joint European Credit Transfer and Accumulation System (ECTS) Master/PhD curricula in *Quantum Engineering*—co-taught by physics, computer science, and engineering faculties—should be encouraged, and should incorporate strong entrepreneurship and communication components.

SCALE UP PRACTICE-CENTRED FELLOWSHIPS AND SABBATICALS

QuIC supports the planned apprenticeship and Researchers-in-Residence pilots but with the need for IP to be owned exclusively by host companies to be commercialised. Further, we propose reciprocal sabbaticals that place lecturers in industry (and vice versa) to expand teaching capacity and transmit real-world expertise.

ATTRACT AND RETAIN GLOBAL TALENT

A streamlined, EU-wide fast-track visa mechanism plus a *Quantum Retention and Relocation* Grant for graduates who commit a minimum number of years to EU quantum companies would close the most acute gaps highlighted by industry.

QuIC position

The *Strategy* sets the right objectives, but without greater, industry-driven investment, simplified mobility rules, and explicit retention levers, Europe may find it is training talent for its competitors. QuIC stands ready to co-design curricula, host apprentices, and advise on implementation.

Policy Recommendations:

- Increase the Academy budget and ring-fence funds for hands-on, industry-integrated modules.
- Introduce an EU fast-track visa channel and a Quantum Retention and Relocation Grant to keep top graduates in Europe.
- Accredit multidisciplinary Master/PhD programmes in Quantum Engineering under a joint ECTS label and embed entrepreneurship & communication training.
- Expand apprenticeship/fellowship pilots into mandatory, paid industry rotations, and introduce lecturer-in-industry sabbaticals to grow teaching capacity.
- Publish an annual Quantum Skills Scorecard (placements, diversity, salary, mobility) and make future Academy funding contingent on measurable improvement.

2.6 Quantum Software and Algorithms

To secure Europe's long-term technological sovereignty and leadership in deep tech, the EU must elevate quantum software and applications to a dedicated pillar in its *Quantum Europe Strategy*—alongside hardware and enabling technologies, as has already been highlighted in Sections *2.2.1. Quantum computing* and simulation and *2.3.1. From the lab to the fab and to industrialisation*. It is of the utmost importance to strengthen quantum software in Europe, and not to be left trailing behind the US and China in the quantum software race, as has already happened in other computational fields. Unlike in other fields, Europe has a competitive edge in quantum software:

its vibrant ecosystem of startups and firms is developing superior quantum, quantum-inspired and hybrid algorithms as well as co-design tools and sector-specific solutions. The current framework prioritises research and infrastructure, which underrepresents where quantum computing will generate its true economic and industrial value: through software (including algorithms and applications).

Software is the key enabler: it translates quantum capabilities into tangible outcomes for industries like pharma, logistics, finance, and energy. Software enables hardware-agnostic design and deployment, accelerates industrial adoption, and can also support the development of superior European quantum hardware—making it a strategic multiplier across the stack. Without accessible and scalable software, even the best hardware remains unusable.

Crucially, quantum computers can only outperform classical tools in specific problem classes whose full scope remains unknown. Continued industrial enablement to close these gaps is essential to unlock the full potential of quantum. Accordingly, identifying problem areas, assessing whether quantum solutions are feasible and effective, and aligning funding instruments for industrial adoption must now become a strategic priority. Industrial adoption should also be supported through training programmes to equip industry professionals with the specialised skills needed for quantum algorithm programming (see Section *2.5. Quantum Skills*).

At present, too little attention is placed on quantum software, with investments locked in academic or hardware-centric areas. By placing software at the centre of its quantum strategy, the EU can build a self-sustaining ecosystem, empower its hardware sector through joint development with quantum software companies, and position European industry as a global leader —not a follower—in applied quantum innovation. To achieve this, QuIC members propose the following policy recommendations to nurture an agile, interoperable ecosystem and drive impact, innovation, and sovereignty.

Policy Recommendations:

- Fund industrial adoption and use cases: Support SMEs and corporations in identifying quantum-suitable problem classes and exploring applications through targeted funding and pilot projects to drive lead market creation.
- Align with national strategies: Ensure EU quantum software programmes complement national software initiatives (e.g., Germany's "Hightech Agenda", France's quantum strategy) to avoid duplication, foster interoperability, and amplify high-impact activities.
- Launch quantum software Grand Challenges: Create QBI-style competitions focused on strategic industrial applications, with phased, milestone-based funding to boost practical software development and industry-startup collaboration (see Sections *2.2.1. Quantum computing and simulation* and *3.1. The Main Implementation Components of the Quantum Europe Strategy* for the rationale behind a QBI-style Grand Challenge).
- Leverage EuroHPC and emulators: Reserve EuroHPC capacity for software development and for joint software/hardware projects; support classical emulators as essential tools for algorithm development, testing, and integration with real hardware.
- Build a scalable European software stack: Develop a modular software stack with standardised, open interfaces—spanning from applications to qubit control—and promote developer-friendly environments that integrate classical and quantum programming. Wherever possible, integrate existing available components: there is no need to reinvent the wheel.

3 REVIEW OF THE STRATEGIC IMPLEMENTATION FRAMEWORK FOR QUANTUM EUROPE

3.1 The Main Implementation Components of the Quantum Europe Strategy

Effective implementation requires instruments and governance that can make timely, market-relevant decisions. The structure must be able to allocate or withdraw support based on progress and avoid redundancy across EU MS. A lean, EC-led entity (e.g., a task force or mission board) with delegated authority should be established. This body should include experts from industry and academia with experience in scaling, integration, and commercialisation, to ensure that execution is guided by both scientific and market assessments.

Public procurement must become a core market-shaping tool. Existing use cases (e.g., QKD for secure communications, quantum sensing for infrastructure monitoring, and quantum-ready HPC) are already deployable through EU instruments. Procurement should also target enabling infrastructure (e.g., fibre for QKD) and support uptake by public anchor customers.

The *Quantum Europe Strategy* should align with the procurement process coordinated by the European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW). It should also encourage adoption of innovation-ready criteria, forward-commitment mechanisms, and pilot-scale coordination via Joint Undertakings (JUs) or European Research Infrastructure Consortia (ERICs). A dedicated "Quantum-Ready Procurement Framework" should be explored to align technical readiness levels with procurement eligibility.

The Grand Challenge model is a useful driver. Clear technical and market-based KPIs are needed to carefully select leading solutions. For example, quantum computing progress should be assessed on system performance and readiness for integration, not just qubit counts.

Timelines and benchmarks should reflect the modality-specific development curves and enable redirection of resources if milestones are not met. First steps towards this goal have been made with the EU Quantum Flagship KPIs.

Project funding must reflect industrial relevance at all stages. Project deliverables should target key elements of future commercial exploitation: IP strategy, standardisation contributions, or pilot line readiness. The lifecycle approach should link research and applications. We recommend developing specific KPIs to monitor progress towards these objectives.

Finally, gaps in participation across EU MS must be addressed. This includes better support for cross-border knowledge transfer, targeted engagement of enabling technology providers (e.g., photonics, cryoelectronics), and involvement of adjacent sectors (e.g., aerospace, telecoms) in integration initiatives. These measures will help expand the EU quantum supply chain and reduce dependency on non-EU components.

Policy Recommendations:

- Embed innovation-oriented procurement tools, enabling early public-sector adoption through performance-based and pre-commercial models.
- Ensure structured coordination across the DGs CONNECT, RTD, GROW, and FISMA (the DGs for communications networks, R&I, markets & enterprise, and financial systems), so that procurement, finance, and infrastructure tools are mutually reinforcing.
- Involve industry directly in implementation governance, particularly in the design of investment and procurement mechanisms.
- Link project funding to industrial pathways, ensuring alignment with infrastructure deployment, system integration, and scaleup readiness throughout the lifecycle.

4 REVIEW OF THE INTERNATIONAL COOPERATION

In the *Quantum Europe Strategy*, the EC outlines the need for balance between protecting European interests and know-how, promoting European quantum technologies internationally, and partnering with trusted partners. QuIC supports this vision for a balanced approach.

We recognise that the EU has already signed trade agreements and digital partnerships with like-minded countries and regions worldwide, but more can and must be done: EU MS should completely ratify agreements to fully enable high-end industries in the EU, such as the quantum technology sector, to benefit from close-knit and open trade relationships abroad; digital partnerships should be augmented to include not only collaboration in quantum research (low TRLs) but also industry-industry partnerships (higher TRL development and deployment); in addition, international agreements and partnerships should ensure the mutual recognition and protection of IP rights. All in all, the EU and its MS must do more to help European quantum businesses reach foreign markets.

QuIC agrees with the EC that Europe must strengthen its participation in the development of international standards. For this reason, the EC and EU MS must allocate appropriate financial provisions to support the involvement of technical experts from companies in European and international standardisation development organisations. Standards must be built on a strong foundation of facts and data, extensive technical discussions, and committed advocacy with peers over a long period of time. The EU must plan significant, long-term engagement on standardisation to ensure its values and interests are reflected in quantum technology solutions and adopted worldwide. Failure in this area will cause foreign values and interests to become the sole norm in quantum technologies, including in Europe.

Success in international cooperation starts at home. The *Strategy* rightly highlights the need for close alignment between EU MS and the EC to establish a coherent framework in international cooperation. QuIC recommends a European Quantum Coordination Office (*see Section 5. Review of the Governance Framework*) as the vehicle through which to define and maintain this framework.

Policy Recommendations:

- Extend trade agreements and digital partnerships to support business-level opportunities in quantum technologies, not only research relationships.
- Encourage more and longer-duration funding for technical experts from companies to successfully develop internationally recognised standards.

5 REVIEW OF THE GOVERNANCE FRAMEWORK

The *Quantum Europe Strategy* rightly states that strong and inclusive governance at EU level is essential to successful implementation of the *Strategy*. It further emphasises that involvement of all MS and all quantum stakeholders is essential. Two governance instruments are introduced: the High-Level Advisory Board and a structured cooperation framework with EU MS.

HIGH-LEVEL ADVISORY BOARD

To advise on the implementation and deployment of the *Quantum Europe Strategy*, the EC has established a High-Level Advisory Board. In its starting form, it is composed of Nobel-decorated European quantum scientists and technology experts but does not include industry representatives. The absence of an industry voice is striking since the *Strategy* is dominated by the EU's ambition to champion the commercial development and use of quantum technologies.

QuIC believes strongly that the direct participation of industry in the High-Level Advisory Board is essential to successfully achieve the objectives of the *Strategy*. We recommend adding permanent industry seats. As a non-profit association with a broad European membership across the quantum value chain, including end-users, QuIC is keen to help and well-positioned to offer an unbiased industry perspective on all dimensions of the *Quantum Europe Strategy* and upcoming Quantum Act, as this document demonstrates.

EUROPEAN QUANTUM COORDINATION OFFICE

QuIC previously recommended the creation of a European Quantum Coordination Office (EQCO) as an organ to coordinate national and EU-level quantum strategies, and to facilitate joint R&I projects and programmes on quantum technologies. The EQCO would feature representatives of EU MS and the EC, as well as key quantum stakeholders, including from the EU quantum industry. The proposal of a "structured cooperation framework with the EU MS" neatly aligns with QuIC's recommendation.

The EQCO should focus on all five strategic areas listed in the *Quantum Europe Strategy*. QuIC underscores the importance of EU-wide alignment on:

- The Quantum Europe ecosystem (*see Section 2.3. The Quantum Europe Ecosystem*): strengths, gaps and dependencies in the quantum technology sectors across the EU should be understood and addressed. EU MS must also work closely to accelerate the development and adoption of competitive European commercial quantum solutions. Initiatives such as Grand Challenges and competitive acquisition programmes, including for EU collective defence purposes (see below), are positive and endorsed by QuIC. But EU MS must go further: they must foster M&As within the EU to encourage the emergence of European champions that can compete on the global stage.

- Dual-use quantum technologies (*see Section 2.4. Space and Dual-use Quantum Technologies*): requirements for use of quantum technologies in defence should be aligned and harmonised across the EU. To support the emergence of dominant EU solutions, MS must foster a single market for best-in-class "Made in Europe" solutions.

  In addition, a unified, EU-wide framework for export controls of dual-use quantum technologies is imperative. Fragmented oversight creates vulnerabilities and loopholes that non-EU actors could exploit to acquire sensitive quantum technologies.

The *Quantum Europe Strategy* is dense in ambitions. It is essential that through appropriate governance, the EC and EU MS collectively rise to the level of these ambitions and provide the fertile conditions for Europe to be a global powerhouse in industrial quantum technologies.

Policy Recommendations:

- Add industry representatives to the High-Level Advisory Board. As a non-profit, EU-wide industry association, QuIC offers itself to support the EC and EU MS.
- Establish an EQCO to align national and European quantum strategies and coordinate efforts to achieve the ambitions of the *Quantum Europe Strategy*.

6 SUSTAINABLE QUANTUM DEVELOPMENT

The EC's *Quantum Europe Strategy* rightly positions the EU to become a global leader in quantum technologies by 2030, emphasising scientific excellence and the translation of research into commercial and societal value. However, the *Strategy* should also include societal dimensions such as sustainability, circularity, and the social responsibility of quantum technology development.

At this pivotal inflection point, the decisions made in Europe will define the long-term trajectory of the industry. The addition of sustainable development considerations at this stage will minimise the risk of replicating unsustainable development patterns of previous industrial revolutions, which have directly contributed to environmental and social challenges we face today.

Embedding circularity into the quantum value chain will significantly increase material efficiency and reduce dependence on non-European sources, thereby enhancing the security, resilience, and sovereignty of Europe's quantum ecosystem. Identifying critical material dependencies through early alignment with the EU's Critical Raw Materials Act (CRM Act) and investing in solutions to close these loops must be a strategic priority. We have noted elsewhere in this paper that achieving these objectives will require dedicated funding mechanisms, coordinated policy support, and collective action across stakeholders.

Quantum technologies hold transformative promise in areas such as climate mitigation and energy transition. Development of these technologies is reliant on critical raw materials, energy-intensive cooling infrastructure, and complex electronics. We need to acknowledge that these carry an environmental footprint that, though small compared to other industries, must not be overlooked. As awareness of climate action and sustainable innovation deepens, the imperative is clear: quantum must be built responsibly from the very beginning.

Responsible quantum development must extend beyond environmental protection to encompass the ethical, legal, and societal implications.

It is essential to align quantum development with the UN SDGs to ensure innovation that serves humanity, upholds shared values, and addresses global challenges. To avoid a "quantum divide", R&I must be not only rapid and innovative, but also inclusive, equitable, and accessible.

The climate crisis is not a future concern but a present reality. While quantum may one day contribute to solving it, the opportunity and responsibility now lie in ensuring the quantum developmental path aligns with climate goals, resource efficiency, and societal good. We must not miss this moment to shape quantum as a sustainable, inclusive, and future-proof industry in line with legislation such as the EU Green Deal and the CRM act, as well as national legislation of the MS.

Policy Recommendations:

- Integrate sustainability and responsibility into EU quantum programmes through environmental and social impact assessments; draw up guidelines on maximising resource efficiency.
- Align material use with the CRM Act by supporting circular design, recovery systems, and reducing dependence on unsustainable and insecure sources.
- Ensure equity and accessibility by promoting inclusive participation, reducing regional gaps, and strengthening quantum education to prevent a "quantum divide".
- Support energy-efficient infrastructure by incentivising low-carbon quantum labs and aligning development with the EU Green Deal and national climate targets.
- Advance "Quantum for Good" initiatives by prioritising applications that directly address global challenges (e.g., climate, health, energy) and align with the UN SDGs.

7 INTERNATIONAL PERSPECTIVES

QuIC members and affiliates from non-EU countries applaud Europe's ambition in quantum technologies and understand that achieving these ambitions will be reliant on careful evaluation of how organisations from non-EU countries can influence and access programmes developed by the EU. The non-EU QuIC members welcome the intention to expand international cooperation with like-minded countries.

The United Kingdom (UK), Switzerland and other non-EU neighbours are not explicitly mentioned in the *Quantum Europe Strategy*. As like-minded neighbours, we would like governments from non-EU countries and the EU to cooperate more closely on quantum technologies. Neighbouring European countries, like those in the EU, have strong capabilities and expertise in quantum technology, as well as sharing common challenges. For instance, the UK's National Quantum Strategy calls for significant investment in the quantum sector, including in defence applications, a point of convergence with the *Quantum Europe Strategy*. Closer cooperation would benefit and strengthen all European countries, including the EU.

Here, we outline areas where the EU could seek better alignment with neighbouring European countries, and other like-minded partners from around the world.

TARGET TIMELINES AND GLOBAL ALIGNMENT

The EU's objective of achieving thousands of error-corrected qubits per platform by 2035 is a significant milestone. However, other international programmes, such as DARPA's QBI and the UK's national quantum strategy, have set comparable targets for 2032–2033. Aligning timeline ambitions with international benchmarks may help ensure the EU remains a competitive force in the global quantum landscape.

The development of quantum standards is an international activity, and standards are negotiated. Collaborating with associated MS early in standards development will strengthen the EU's position.

CLARIFY PARTICIPATION OF ASSOCIATED COUNTRIES AND THE TERM "EUROPEAN"

Several non-EU countries remain deeply integrated into Europe's quantum ecosystem via Horizon Europe and other mechanisms. However, the eligibility of non-EU quantum users and providers fluctuates greatly across EU initiatives. Clear guidance on the eligibility of associated countries to participate in infrastructure, pilot lines, and strategic procurements would help reduce uncertainty and enhance alignment with trusted international partners.

COMPLEMENT AND AUGMENT EU QUANTUM PROCUREMENT SCHEMES

The EU's use of public procurement to deploy quantum systems at HPC centres is a notable strength and differentiator for Europe. These mid-scale systems play a valuable role in building user skills, validating hardware, and supporting early industrial applications. To complement this, the EU could also adopt long-term procurement models, like the proposed Grand Challenge for the multi-year development of utility-scale, fault-tolerant quantum computers. This would give companies the security to plan more ambitiously and develop technology at scale.

In addition, the *Strategy* emphasises procurement of EU-made technologies. While this approach supports domestic capacity-building, it may reduce access to globally leading solutions. In contrast, initiatives in the US (e.g. DARPA QBI) and the UK have adopted more open procurement frameworks that allow for participation from global vendors, including those based in Europe. Adopting a similarly flexible approach, where appropriate, could support innovation and accelerate progress. We recommend giving priority to EU suppliers but to allow for procurement of technology from like-minded countries if this demonstrably improves the quality of our QT products.

BROADEN PILOT LINE FOCUS

The *Strategy* refers to new pilot lines to support quantum chip production. While this is a critical step, scalable fault-tolerant quantum systems will also require complementary developments such as improved software solutions, decoding chips for quantum error correction, cryo-compatible control systems, and integration infrastructure for hybrid systems. Establishing pilot lines or targeted funding calls that include wider systems/components and underpinning technologies would strengthen Europe's ability to deliver full-stack quantum computing platforms.

In addition, the *Strategy* observes that the cost of accessing technology for chip manufacturing is high for many organisations. Allowing organisations from EU-associated countries to access pilot lines will help increase demand, reduce costs, and enhance the EU's competitiveness. Likewise, where EU-associated countries can offer expertise that is not available within EU MS, allowing these countries to participate in pilot lines would be advantageous for the EU community.

Finally, not all quantum platform technologies are likely to succeed commercially. A strategic approach is essential to ensure prudent use of public funds. While the proposed Quantum Chips Industrialisation Roadmap offers value, it might not fully account for future developments. To steer investments effectively, the Roadmap should be regularly revised to match emerging needs and concentrate resources.

MUTUAL ACCESS TO TESTBEDS

Access to testbeds is crucial for advancing technological development. Collaborating on mutual access to a wider range of testbeds, with countries outside the EU, would be highly beneficial for European organisations and strengthen the EU's technological leadership.

8 CONCLUSION

Quantum technologies represent a once-in-a-generation opportunity for Europe to secure a position of global leadership in a critical technology. The *Quantum Europe Strategy* provides the right ambition and first steps towards a coherent policy framework to achieve this goal. The 2028 – 2034 Multi-annual Financial Framework proposed by the EC also sets the right financial priorities, namely digital technologies and Europe's tech sovereignty. Achieving this ambition will however require significant investments and depend on fast, coordinated, and decisive implementation.

To bridge the gap between the ambition and today's starting point, and to foster the emergence of European commercial quantum champions on the global stage, Europe must:

1. Crowd-in private capital through de-risking mechanisms, focused public procurement, and incentives for lead users;
2. Translate scientific excellence into industrial strength in all quantum fields (incl. quantum software), supported by scalable infrastructures, harmonised, sustainable and secure supply chains, and an agile regulatory environment;
3. Develop sovereign capabilities in key areas, including quantum chips, hardware and software platforms, and enabling technologies;
4. Lead in global standards and benchmarking, leveraging Europe's influence to shape interoperability and security frameworks; and
5. Invest in people, fostering a skilled and mobile workforce through targeted education and talent-retention initiatives.

This position paper articulates the quantum industry's priorities and actionable recommendations to operationalise the Commission's vision. The *Quantum Europe Strategy* defines Europe's success on its ability to translate scientific excellence into industrial leadership on the global stage. To achieve success, the EC must develop mechanisms to prioritise winning technologies and companies based on technological and market-driven KPIs. Further, the EC must include the voice of the European quantum industry in all relevant decision and advisory bodies, including the High-Level Advisory Board. QuIC stands ready to work with EU institutions, MS, and the broader quantum community to deliver on these ambitions and lay the foundations of the upcoming European Quantum Act. By acting collectively and strategically, Europe can turn the promise of quantum into tangible societal and economic benefits, reinforcing its competitiveness, security, and technological sovereignty for decades to come.

9 CONTRIBUTORS

Contributors are listed in alphabetical order. An asterisk (*) indicates a lead role during the creation of the QuIC Position Paper.

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10 ABOUT QUIC

The European Quantum Industry Consortium (QuIC) is a non-profit industry association, founded in 2021, dedicated to the growth of the commercial QT sector. QuIC operates as a collaborative hub throughout Europe, bringing together hundreds of SMEs, large corporations, investors, RTOs, and academic institutions, to build a strong, vibrant ecosystem. Together, members of the association address topics of common interest, such as standardisation, intellectual property, trade, and workforce development.

Today, QuIC is part of the coordination and support action of the Quantum Flagship – a European project, which aims to make Europe a dynamic and attractive region for innovative research, business, and investments in this field.

More information: www.euroquic.org