

Quantum Europe Strategy



QUANTUM
EUROPE
STRATEGY

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European Commission, DG CNECT

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Outlook

1. Why Quantum?
2. Quantum Technologies Flagship
3. Quantum Europe Strategy
4. Upcoming Quantum Act



Quantum = key strategic technology

- Model drugs



- Transmit data ultra-securely



- Detect cancer

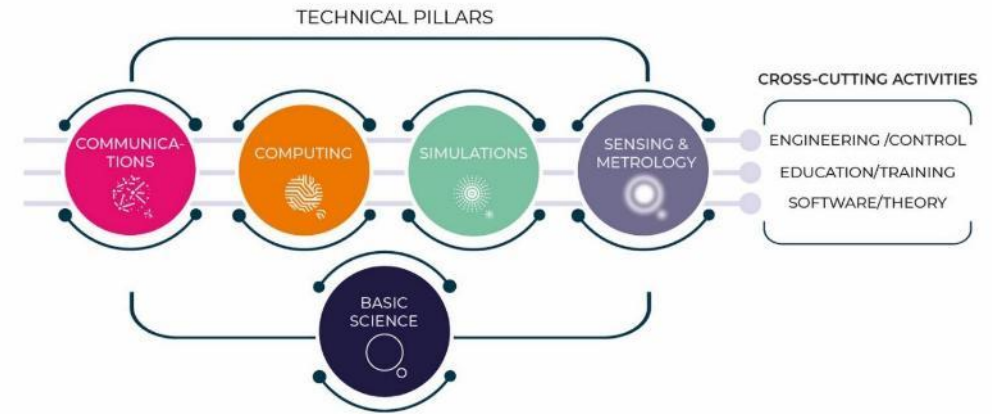
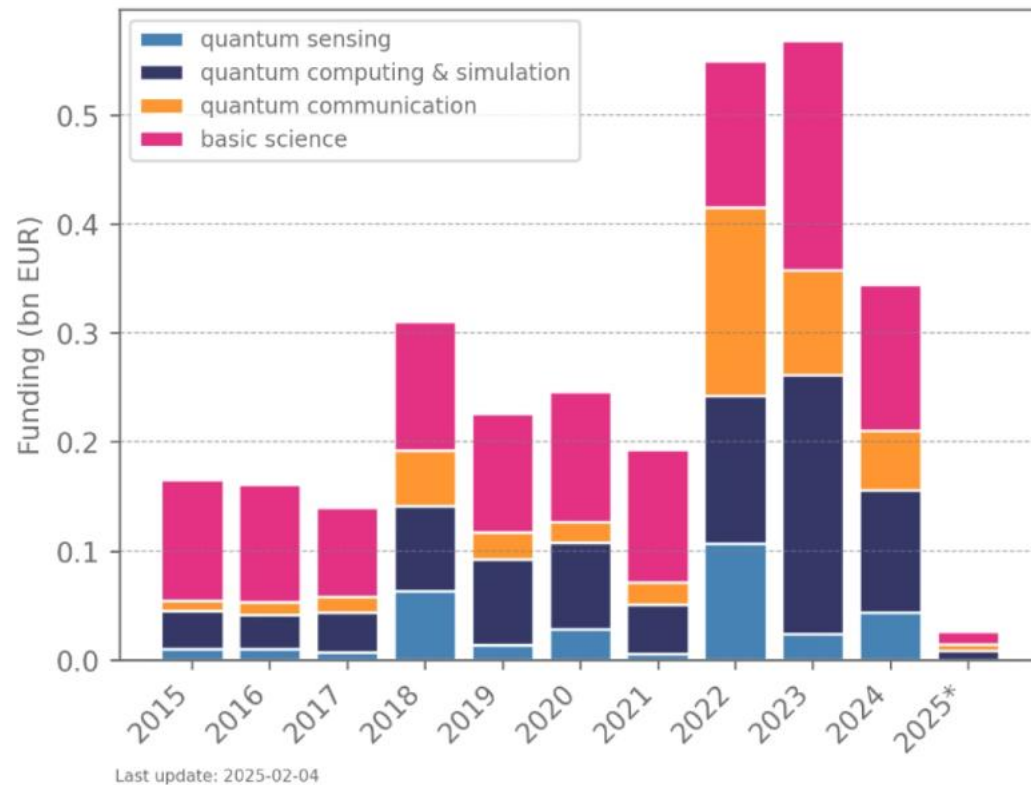


- Observe underground



→ competitiveness, digital sovereignty, economic security

European Commission funding



Over the past five years, the EU and MS have invested more than EUR 11 billion in quantum technologies

<https://qt.eu/funding-opportunities/>

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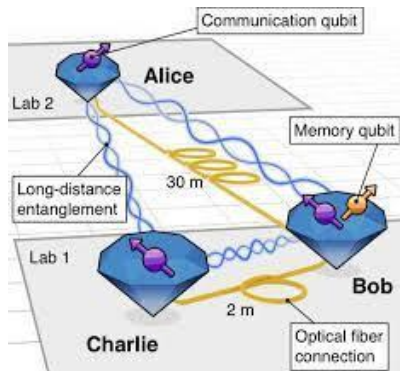


Quantum Flagship

Success stories from ramp-up phase (2021)

Communication

World's first 3 node network and full stack multi-processor quantum network, state-of-the-art quantum repeater link



Computing

World record entanglement 24 qubits, 50 qubits prototype, 2 online quantum computers

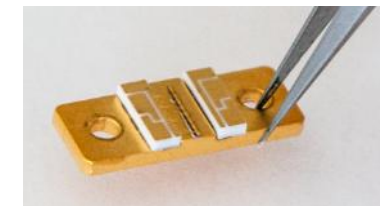


25 qubit chip processors with world-leading capabilities, global breakthrough in quantum error correction



Simulation

Atomic-based programmable quantum simulators, demonstrated practical quantum advantage (>200 qubits)



Quantum Flagship

Success stories from ramp-up phase (2021)

Also:

- Quantum sensing & metrology
- Software & applications
- Skills, patents, start-ups
- ...

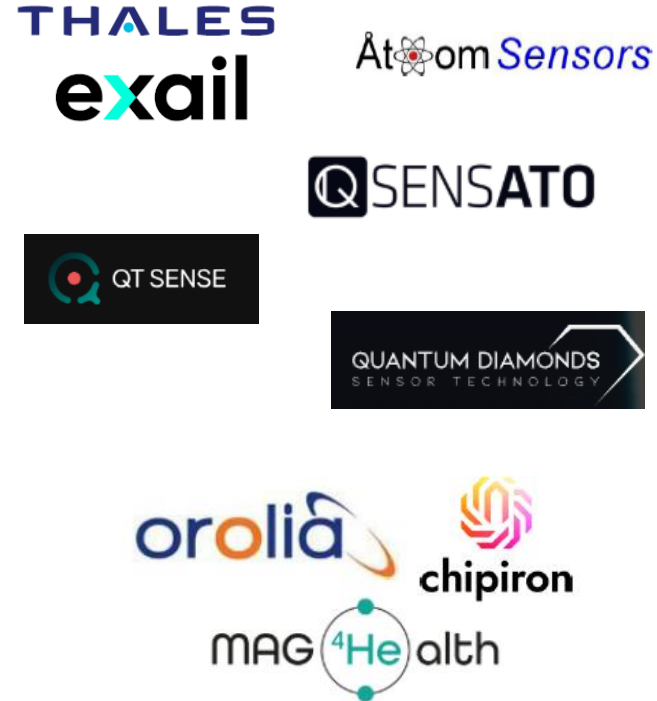


Some EU quantum companies

Quantum computing



Quantum sensing

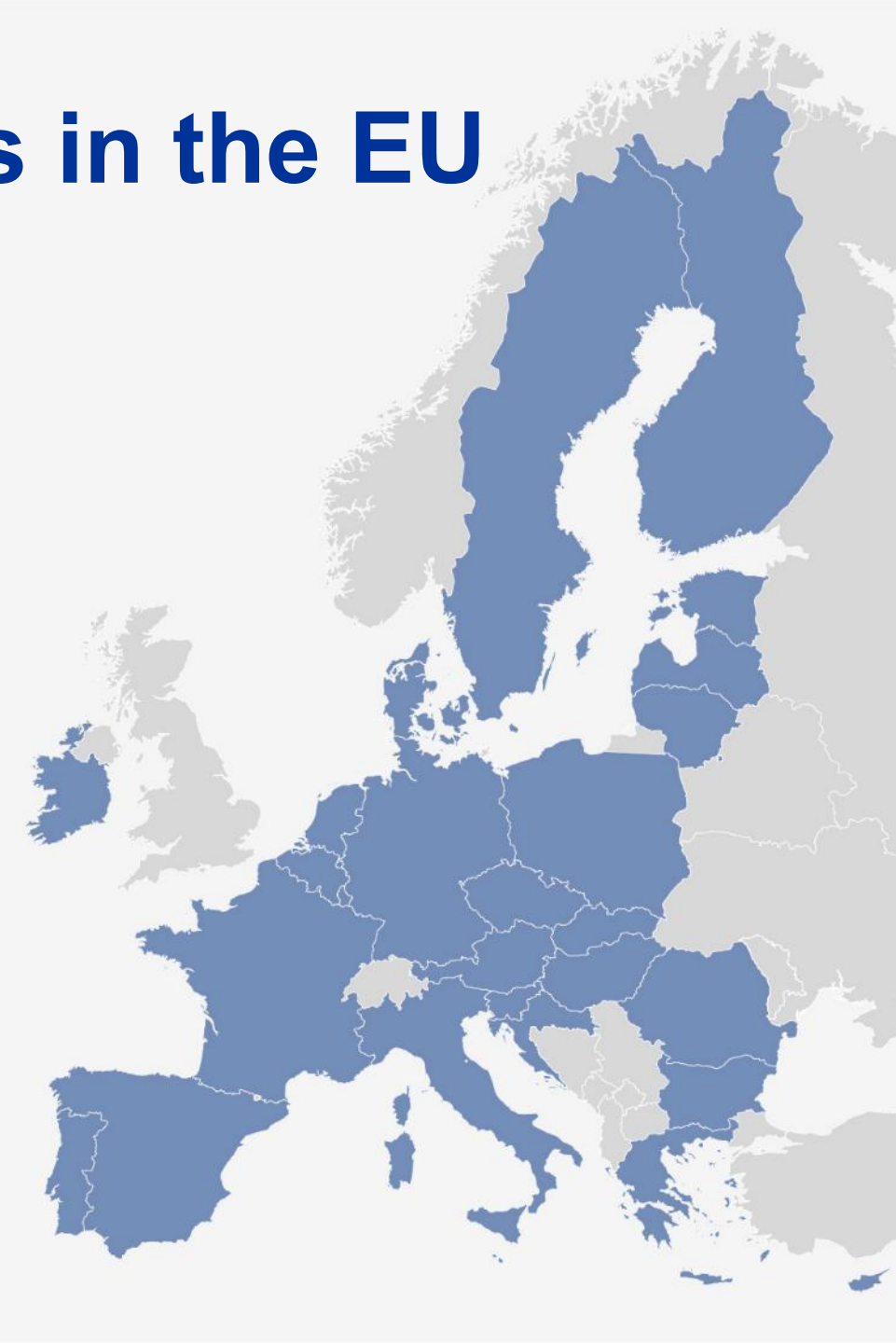


Quantum communication



National quantum strategies in the EU

- **Austria**: Quantum Austria (2021)
- **Denmark**: National Strategy for Quantum Technology (2023)
- **Finland**: Quantum Technology Strategy (2025-2035)
- **France**: Plan Quantique (2021)
- **Germany**: Handlungskonzept Quantentechnologien (2023)
- **Ireland**: Quantum 2030 (2023)
- **Italy**: Strategia Italiana per le Tecnologie Quantistiche (2025)
- **Luxembourg**: Quantum Strategy (2025)
- **Netherlands**: Nationale Agenda Quantum Technologie (2019)
- **Romania**: Strategia Națională pentru Tehnologii Cuantice (2024-2029)
- **Spain**: Estrategia Nacional de Tecnologías Cuánticas (2025-2030)
- ...
- Others in preparation: Belgium, Czechia, Greece, Hungary, Latvia, Lithuania, Poland, Portugal, Sweden (as of August 2025)



Global funding landscape



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Quantum Europe Strategy



Shaping Europe's digital future

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POLICY AND LEGISLATION | Publication 02 July 2025

Quantum Europe Strategy

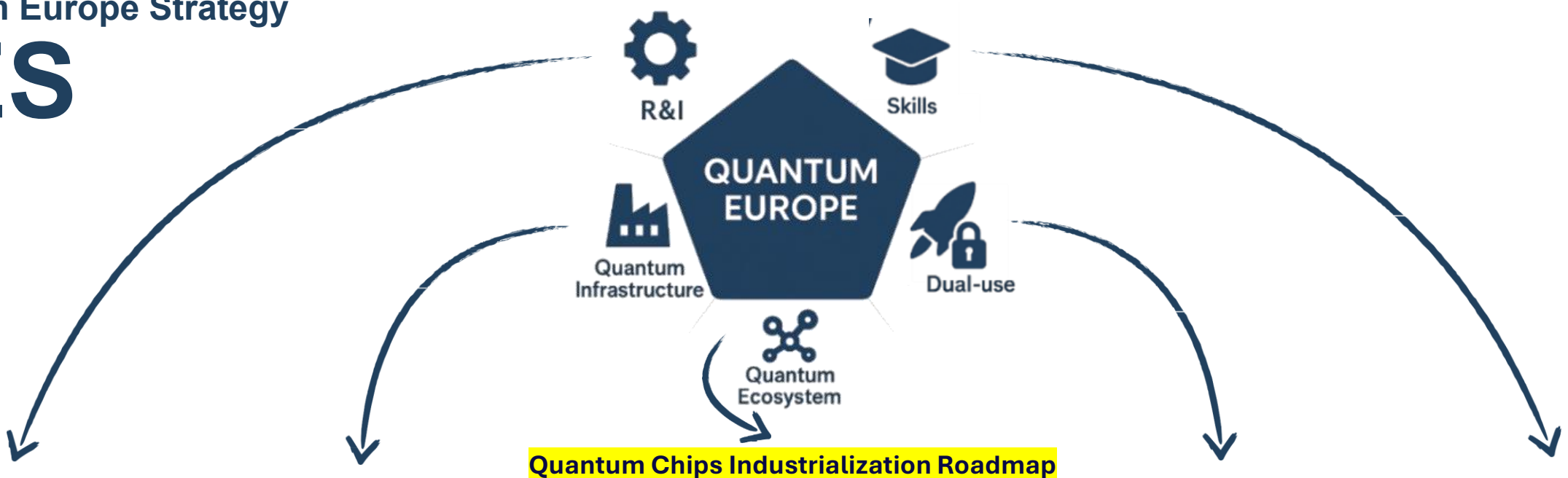
The European Commission has adopted a Quantum Strategy to position Europe as a global leader in quantum by 2030.

<https://digital-strategy.ec.europa.eu/en/library/quantum-europe-strategy>

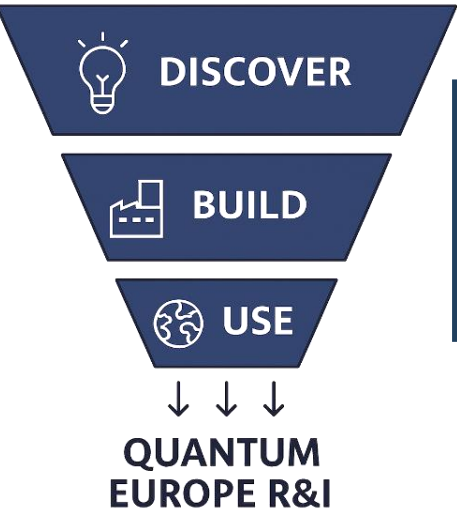


Quantum Europe Strategy

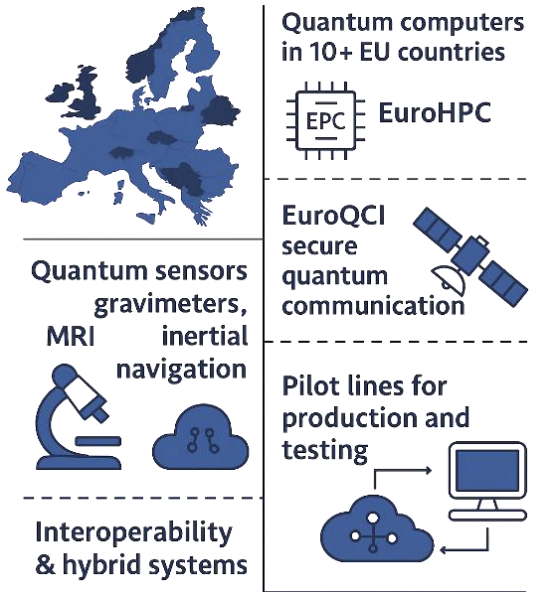
QES



FROM LAB TO MARKET



SCALING QUANTUM CAPABILITIES



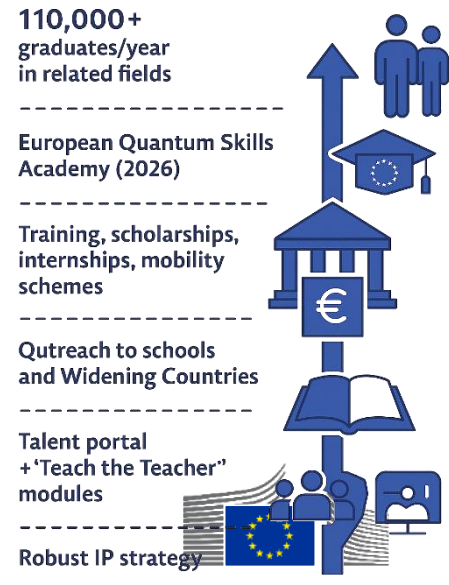
GROWING EUROPE'S QUANTUM ECONOMY



STRATEGIC AUTONOMY IN SPACE, SECURITY & DEFENCE



A QUANTUM WORKFORCE FOR THE FUTURE



High diversity of quantum chips

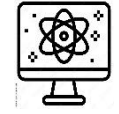
And diversity and synergies of different quantum pillars →



QUANTUM
SENSING



QUANTUM
COMMUNICATION



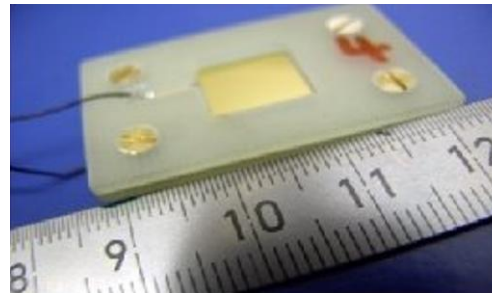
QUANTUM
COMPUTING

quantum chip technology tailored to meet the specific qubit requirements for computing, sensing, and communication, ensuring optimal performance for each application.

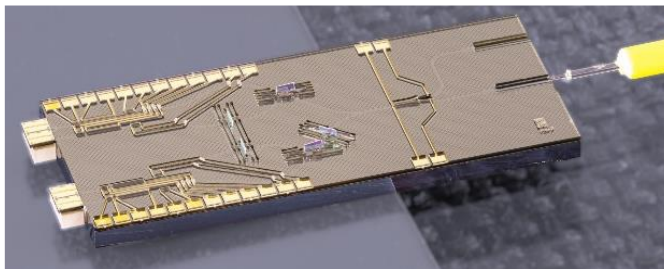
Examples of EU expertise, capability and products



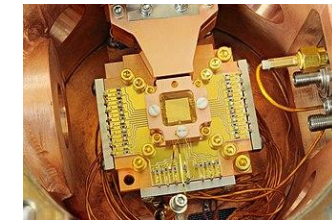
Computing: **Superconducting qubits** and parametric amplifier (for control and readout of qubits)



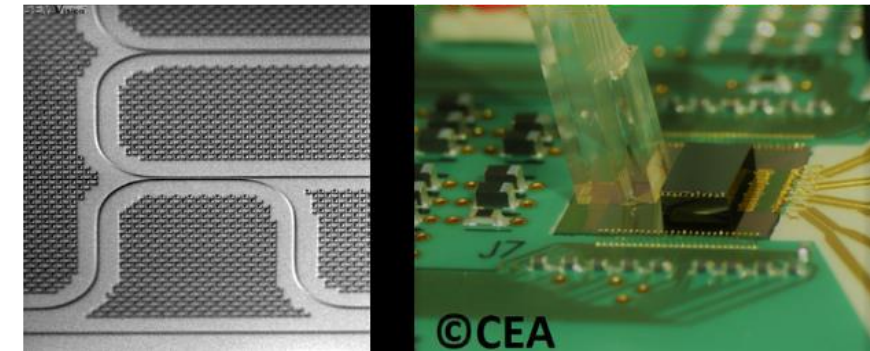
Sensing/Communication/Computing: Diamond growth, defect implantation (**NV-Center**), characterization



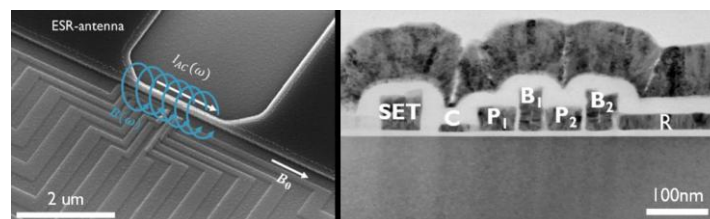
Communication: Polarization coding **BB84 transmitter PIC**



Computing/Sensing: (Left) **Trapped ions Paul trap**, (Right) **Chip ion trap**



Communication/Computing: (Left) SEM view of a **silicon photonic circuit** for entangled photon generation (Right) Packaging of **photonic integrated circuits** with fiber array and electronic chip on top



Computing: **Silicon spin qubit** cell with ESR manipulation unit: top view (left) and cross-section (right)

Maturity of manufacturing technologies

Technology Platform	Communications	Computing/Simulation	Sensing & Metrology
Superconducting	Cryogenic temperature	Leading in quantum processors and annealers	metrology and magnetic field sensors
Photonics	Room temperature, QKD over long distances	Room temperature, challenges in noise reduction	research for applications like LIDAR
Semiconducting	Potential in integrated quantum circuits	Spin qubits are promising for scalable quantum computers	Used in high-resolution and sensitive detectors
Trapped Ions	Room temperature, main focus on computing	high-fidelity qubits with long coherence times	precision measurements but require complex setups
Diamond	Main focus is on sensing applications	Studied for use as robust qubits	High-precision sensors at the nanoscale
Neutral Atoms	Experimental stage for secure communication	Promising results, challenges in scalability and error correction	Mature applications, e.g. atomic clocks, interferometers

The Roadmap to industrialisation

...From pilot lines to industrialization

Quantum chips are not standalone products, their industrialization depends:

1. Quantum Enabling Technologies → essential to scale quantum chips
 - a. Cryogenics, control electronics, packaging, interconnects, etc., determine yield, reliability and cost
 - b. How to define them & how to link them with the Quantum Pilot Lines?
2. Quantum Design → required for manufacturable and usable chips
 - a. Systematic architectures and co-design are needed for reproducibility, scalability, etc.
 - b. What are the quantum-specific design tools & how to include them in the European Design Platform?

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Why a Quantum Act now?

Quantum technologies are moving from **science to strategic deployment**

Europe must act now to turn its research leadership **into industrial capacity, trusted deployment and economic security**

Global race is accelerating

The US, China & other major economies are scaling public & private investment faster than in Europe



SMEs struggle to scale-up & access late-stage finance

Europe remains fragmented & slower in translating breakthroughs into deployments



Quantum is now a security & competitiveness file

Quantum will affect computing, secure communications, sensing, defense, critical infrastructures & industrial leadership



The Quantum Act will provide a comprehensive legal framework to bring quantum to the next level

It will align EU and MS action, support **industrialization**, **create demand**, and **secure critical quantum value chains**

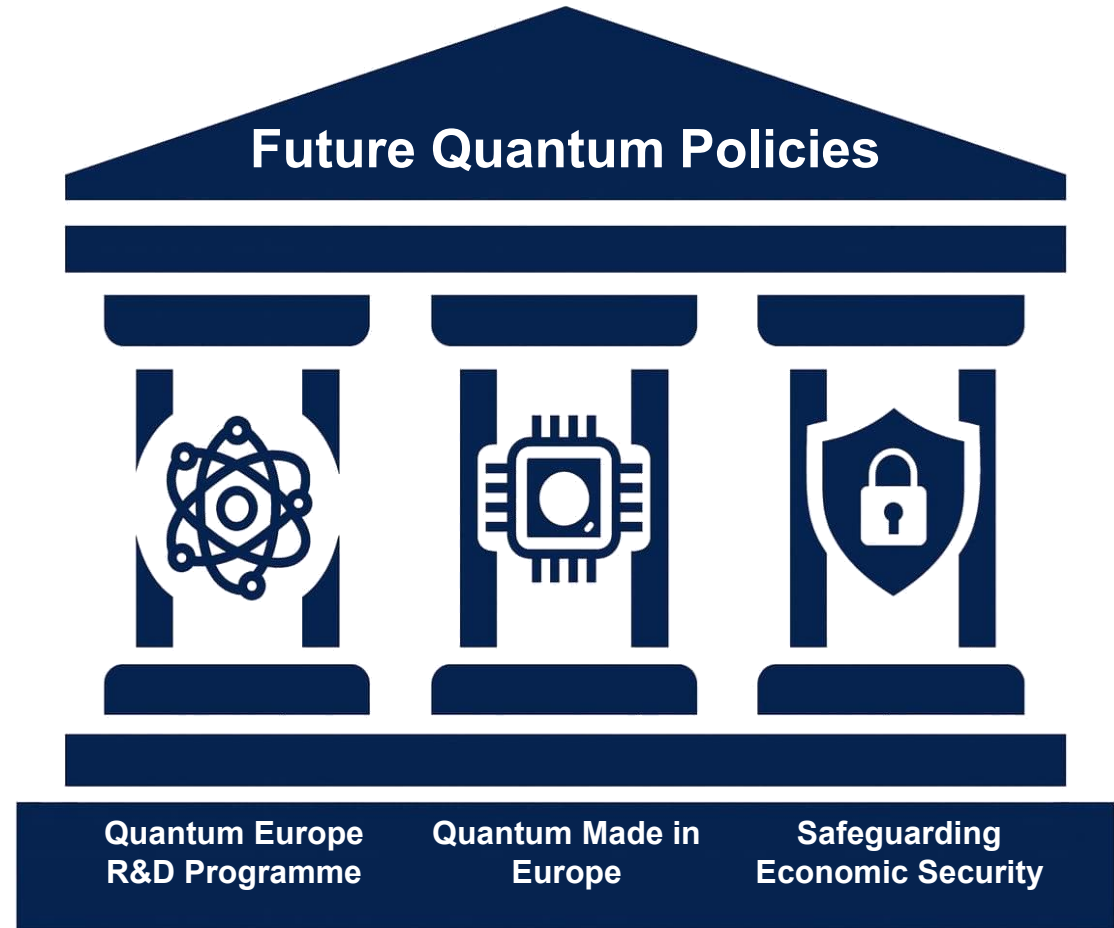


Development ideas



Key challenges still to address

- Difficulty to industrialize and scale
- Lack of coordination at EU level
- Strong global competition
- Risk of hostile takeovers
- Supply chain vulnerabilities
- Weak demand
- Security & defence
- ...



Development ideas: 3 pillars



1) Quantum Europe R&D Programme

→ Enable EU-level governance, infrastructures, talents

Key: overcome fragmentation

2) Quantum Made in Europe

→ Move from lab to fab: industrial competitiveness

Key: support companies' scaling-up

3) Safeguarding Economic Security

→ Strengthen supply chains & digital sovereignty

Key: protect critical technologies & remove dependencies



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Thank you for your attention !



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