July 2026. Technology Snapshot.

Quantum technologies in Catalonia

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya
Government of Catalonia

CataloniaConnects

ACCIÓ
Government of Catalonia

Carried out by
Strategy and Competitive Intelligence Unit of ACCIÓ

Collaboration
Digital Sector Promotion Area. Secretariat of Digital Policies

Barcelona, July 2026

Contents

Executive summary of quantum technologies worldwide

Quantum technologies are a series of emerging technologies that take advantage of the principles of quantum mechanics, a branch of physics that describes the behavior of matter at the atomic and subatomic level

QT disciplines

- Quantum computing and simulation
- Quantum communications
- Quantum sensors

Main applications

- Finance and insurance
- Civil and aerospace engineering
- Critical resources and infrastructures
- Telecommunications and cybersecurity
- Services
- Industry 4.0
- Mobility and logistics
- Pharma and health

Importance of QT

- Solving complex problems
- Powerful, advanced and much faster calculations
- More secure communications and encryption
- More powerful and precise metrology and sensors
- Process and model simulation

Boom in **quantum computing**: it is expected the next decade will see exponential growth in this discipline, between 12 and 16% year-on-year, with multi-million dollar investments and national strategies for its development worldwide.

World Market

- The global QT market could reach an estimated market value of $215 billion in 2040.
- The top countries and regions in the world in QT are the China, the United States, the EU, Canada, the United Kingdom, South Korea and Japan.

Opportunities in QT

- Solution and simulation of complex problems
- Encryption and greater security
- Sensors and metrology
- Public investment and development plans for QT
- Quantum machine learning
- Development of the value chain and ancillary industry

Challenges of QT

- Regulation and safety
- Technology development
- Error correction
- Talent
- High investments and costs
- Balance of expectations

ACCIÓ Catalonia Trade & Investment
Generalitat de Catalunya Government of Catalonia
CataloniaConnects

Executive summary of quantum technologies in Catalonia

52 companies along the value chain

30 companies more compared to 2019.

€91.4 M in turnover.

470 jobs created.

17.3% of the companies are startups.

We should highlight:

By **technological field**:

- Communication and encryption (**51.9%**)
- Quantum computing (**44.2%**)
- Applications and enabling technologies (**42.3%**)

By **sector of application**:

- Industry 4.0 (**80.7%**)
- Civil and aerospace engineering (**61.5%**)

Leading QT startups

Catalonia has leading startups at a European and global level that develop QT, mainly in the fields of **quantum computing**, **communication** and **quantum encryption**, and **quantum algorithms**.

Benchmarking Initiatives

QUANTUM FLAGSHIP · EuroQCI · QIA QUANTUM INTERNET ALLIANCE · QUANTERA · Quantum SPAIN · CUCO · QUANTUMCAT · QuIC

Attractive for research and QT development projects

Catalonia attracted **44.4% of funding for projects with a quantum component in Horizon Europe in Spain** between 2022 and Q1. 2026. and **2.7% of the total funding raised in the EU**

3.5% of the 203 technological hubs of foreign companies based in Catalonia work with QT.

Spain's first quantum computer in Catalonia at BSC, built with 100% European technology

R&D excellence

Cutting-edge technology, research and infrastructure centers

BSC Barcelona Supercomputing Center · ICFO · IFAE · ICN2 Institut Català de Nanociència i Nanotecnologia · cttc · CNM · ICMAB CSIC · i2cat · eurecat · UAB Universitat Autònoma de Barcelona · Universitat de Barcelona · UPC Universitat Politècnica de Catalunya

ACCIÓ Catalonia Trade & Investment · Generalitat de Catalunya Government of Catalonia

CataloniaConnects

1. Definition of the quantum industry

Main concepts

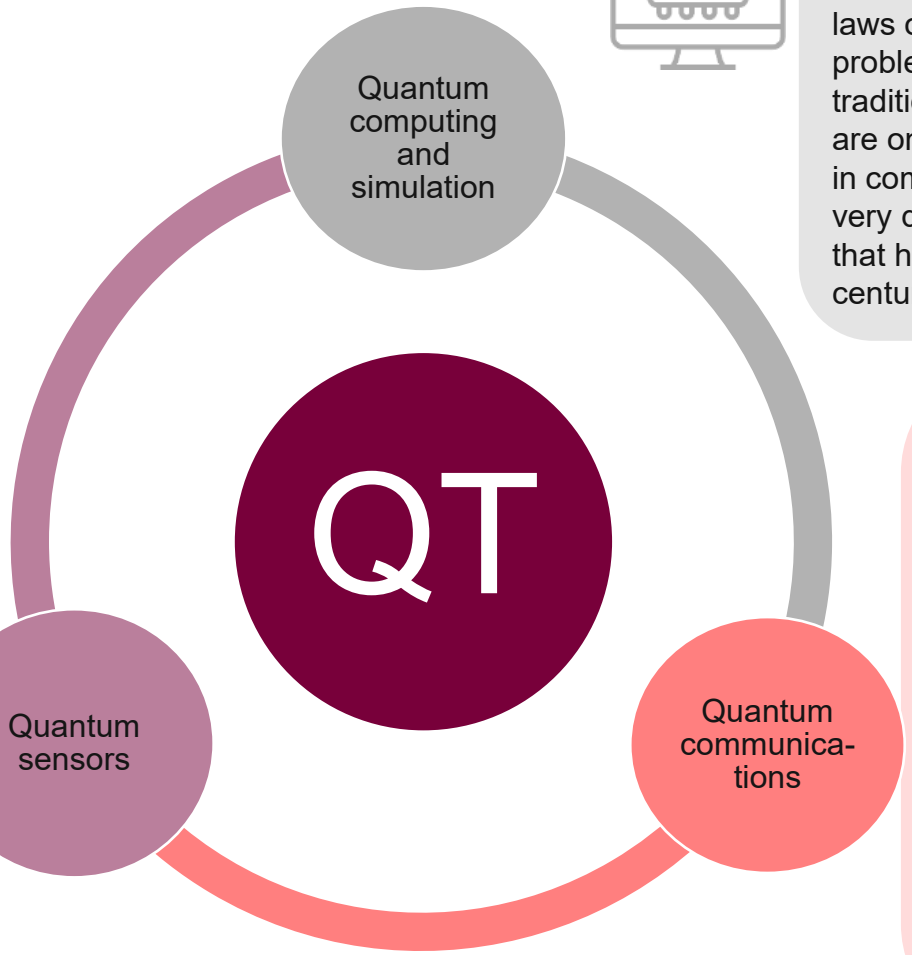
Quantum technologies are a series of emerging technologies that take advantage of the principles of quantum mechanics, a branch of physics that describes the behavior of matter at the atomic and subatomic level.

- Unlike traditional technologies, which are based on macroscopic properties, quantum technologies work with individual quantum systems that can exhibit counterintuitive properties and behavior.
- The core of quantum technologies lies in their ability to harness unique quantum effects:
  - **Overlay:** Quantum systems can exist in several states at the same time. This can allow calculations and operations to be performed in parallel.
  - **Interlacing:** Quantum particles can be correlated in ways that have no traditional analog. Two quantum particles can be entangled, so that the state of one is instantly bound to the state of the other regardless of the distance separating them. This property has applications in quantum communication.
  - **Tunnel effect:** Particles can cross energy barriers that would be insurmountable in traditional physics.

Source: own elaboration based on Quside, Oxford Insights, Australian Research Centre Quantica-Vall Mediterrània de la Ciència i les Tecnologies Quàntiques; PwC: Quantum Technology Monitor

Quantum technologies (QT)

Within quantum technology, a **quantum sensor** uses properties of quantum mechanics, such as quantum entanglement, quantum interference, and quantum state narrowing, which have optimized accuracy and overcome current limits of sensor technology. This technology detects changes in movement with great precision, including magnetic and electric fields, greatly improving the ability to measure and understand the environment.



Quantum computing is an emerging technology that takes advantage of the laws of quantum mechanics to solve problems that are too complex for traditional computers. Complex problems are ones with many variables that interact in complicated ways. These machines are very different from the classic computers that have existed for more than half a century.

Quantum communication is a field of applied quantum physics closely related to quantum information processing. It involves encoding information in quantum states of light for the transmission of information and enabling disruptive cryptography applications.

Quantum communication encompasses a wide range of technologies and applications ranging from state-of-the-art laboratory experiments to commercial reality. It has some of the most mature quantum technologies in quantum key distribution (QKD) and quantum random number generators (QRNG).

Source: the authors, based on IBM. MIT Technology review; Quside; PwC: Quantum Technology Monitor

How each quantum technology works

Quantum computing and simulation

Individual qubits can represent different states between 0 and 1 at the same time...

...making complex parallel calculations possible...

Quantum processor

Faster quantum algorithms

...allows us to write quantum algorithms that can process commands faster, saving time and resources...

...and at the same time providing for solutions to and simplification of problems difficult for conventional computers, for example:

- Discovery of new drugs
- Financial derivative pricing
- Industrial process optimization

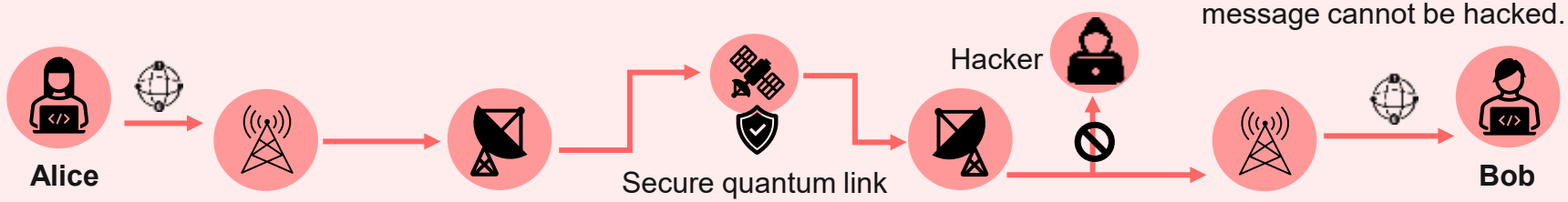
Quantum communications

1. Two people (**Alice** and **Bob**) generate and share quantum keys using QKD.

2. Alice encrypts her message using the quantum key and any conventional encryption algorithm.

3. Only **Bob**, who has access to the quantum key, can read the message.

4. When used in a provably secure cipher, such as *one-time-pad*, quantum keys guarantee that the message cannot be hacked.



Quantum sensors

Use of quantum phenomena and properties to make very precise measurements of physical magnitudes

Using quantum effects for measuring

- **Time**
- **Acceleration and rotation**
- **Gravitation**
- **Electric or magnetic fields**

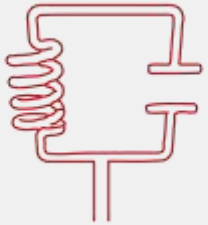
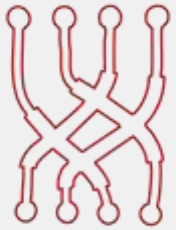
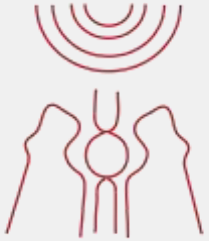
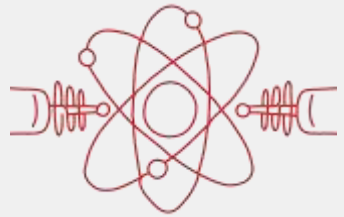
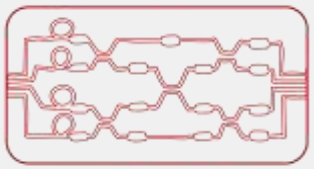
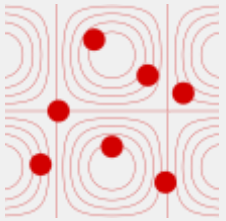
ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya
Government of Catalonia

Source: the authors, based on Capgemini

CataloniaConnects

Types of qubits (I)

Superconductor qubits		**Topological qubits**		**Nuclear spin qubits**	
Trapped ion qubits		**Quantum dot qubits**		**Neutral atom qubits**	
Photon qubits		**Diamond qubits (NV defects in diamonds)**		**Supercold atom qubits**	

Source: Own elaboration based on Quantum Microsoft, Institute for Quantum Computing, quantum computing, IBM, Google

Quantum materials

Quantum materials exhibit unique properties derived from quantum phenomena that have a significant impact on macroscopic properties. These special properties make them very interesting for new technologies, especially in quantum computing, advanced electronics, energy storage and high-precision sensors.

Superconductors	These allow the flow of electric current without any resistance when cooled below a certain critical temperature.	They are the basis for superconducting qubits, and are also used in NMR machines and particle accelerators.
Topological materials	Materials that are insulating inside but conduct electricity on the surface.	These materials are promising for topological qubits, low-power electronics, and ultrasensitive magnetic sensors.
Mott insulators	Electrons do not move freely due to electron-electron interactions, creating correlated behavior that allows the electrical and magnetic properties to be manipulated.	These are useful in advanced electronics and for energy storage.
Low-dimensional materials	Materials such as graphene show exceptional electrical conductivity and mechanical strength. These materials have unique optical and electronic properties.	Graphene is used in electronic devices, sensors and batteries. They are also being investigated for quantum circuits and photonics applications.
Time crystals	Time crystals are materials that show repetitive patterns in time, unlike conventional crystals, which have repetitive patterns in space.	Still in the research phase, time crystals could have applications in quantum memories and quantum computing.
Quantum magnetic materials	Materials that generate magnetic fields due to the alignment of the spins of their electrons.	These can be used to create quantum memories, precision magnetic sensors or in spintronics.

Source: own elaboration based on "*The physics of quantum materials", Nature; Institute of Materials Science, CSIC; Catalan Institute of Nanoscience and Nanotechnology (ICN2); Chemical Reviews. "Quantum Materials"*

Quantum algorithms

A quantum algorithm is a sequence of instructions that runs on a quantum computer and exploits the properties of quantum mechanics (such as superposition, entanglement, and interference) to perform calculations.

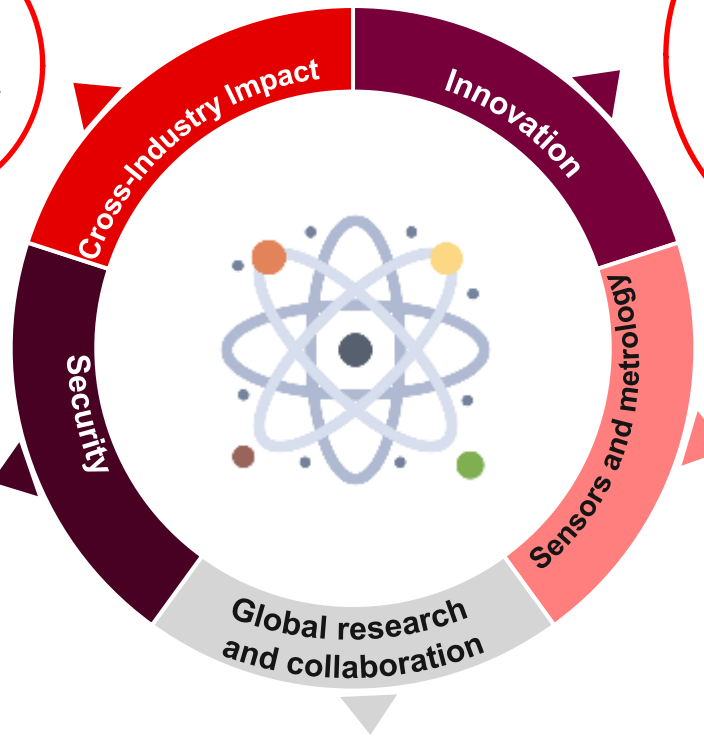
Search and information algorithms	Grover's algorithm. Used to search unsorted databases
Factorization algorithms	Shor's algorithm. Used to factor integers. It has applications in cryptography
Algorithms based on quantum simulation	These algorithms are designed to simulate complex quantum systems. They have potential applications in chemistry, materials science and pharmaceuticals.
Quantum Monte Carlo algorithms	Monte Carlo methods are probabilistic estimation techniques used in finance and statistics. Quantum computers can improve them by reducing error with fewer simulations, thus increasing efficiency.
Optimization algorithms	Variational quantum algorithms (VQA): Combine quantum circuits and traditional optimizers. Quantum adiabatic algorithms: to find the minimum energy state, the optimal solution.
Quantum machine learning	Quantum machine learning algorithms leverage the capacity for quantum processing to improve learning tasks such as classification, regression, and dimensionality reduction
Algorithms based on Quantum Annealing	Quantum annealing is a quantum computing technique specific to combinatorial optimization problems
Topological algorithms	Some algorithms use entangled, non-local quantum states to create quick-response networks using interference patterns.

Source: ACCIÓ based on quantum Microsoft; IEEE Standard; “Quantum algorithms: an overview”. Nature; Quantum Zeitgeist

Importance of QT for the industry

Quantum technologies are expected to revolutionize industries such as finance, healthcare, and manufacturing by solving complex problems, optimizing processes, and enabling new capabilities.

Quantum technologies can simulate and optimize the properties of new materials at a speed and level of complexity that far surpasses traditional computers. This has implications for industries such as materials development, chemicals, drug design, natural resource exploration, and energy production.



Quantum computing security applications may have the ability to "break" secure encryption, perform complex simulations, and analyze massive data sets to improve threat detection and decision-making. Additionally, quantum technologies enable robust cryptography, which is vital for improving data and communications security in various industries.

Quantum sensors provide extremely precise measurements that improve the performance of devices in sectors such as medical diagnostics, high-precision navigation or civil engineering.

Quantum research is a global endeavor, with countries and organizations investing significantly in its development. Collaboration and cooperation in this field are crucial in order to drive innovation and address potential security implications.

2. The world quantum market

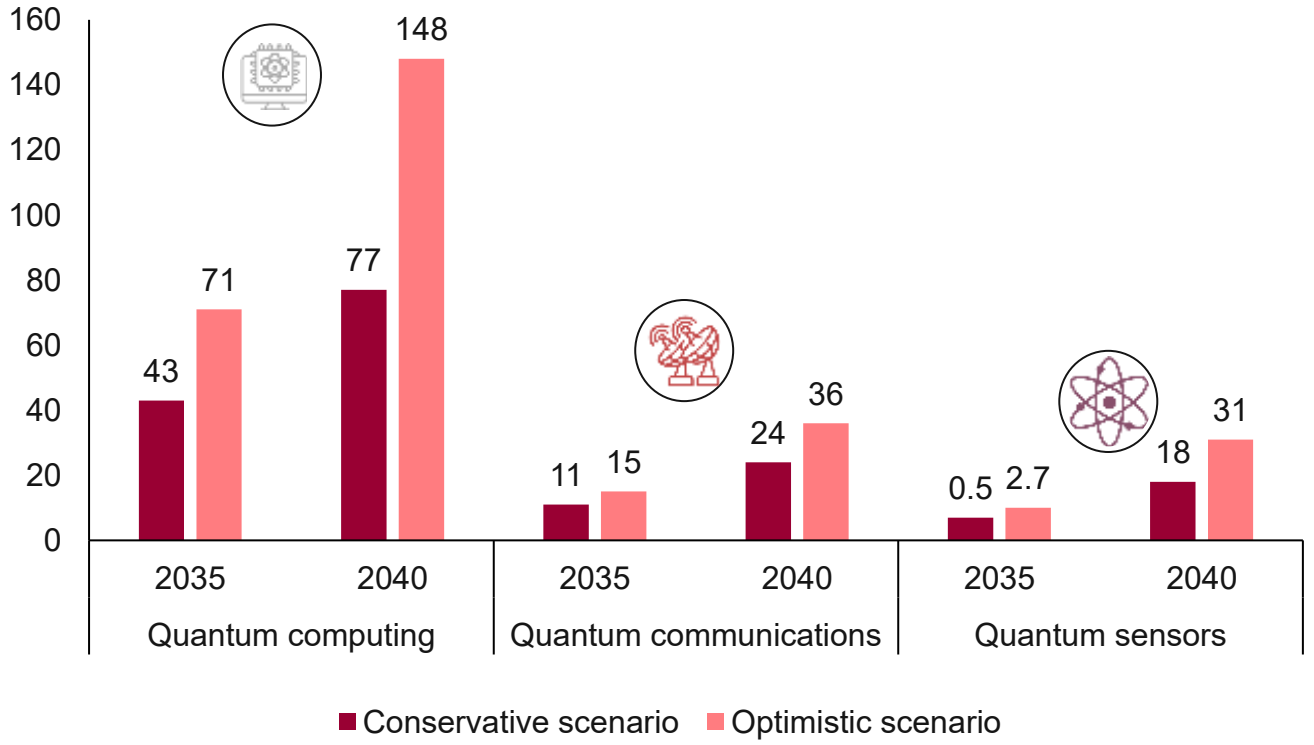
Quantum Technologies (QT) Market

The **global QT market could reach an estimated market value of $215 billion by 2040**. Quantum computing could reach a market value of $148 billion, quantum communications $36 billion, and quantum sensors $31 billion, all in an optimistic scenario.

- QT will grow progressively in the coming years given the increasing demand for high-performance computing, the risk of cyberattacks and potential applications for a wide variety of industries, such as health, communications, chemistry and pharmaceuticals, banking, financial services and defense, where it can optimize processes, handle large data volumes of data, and respond to complex problems unsolvable by conventional computers.

Market value of quantum technologies in 2035 and 2040

(conservative and optimistic scenarios, in billions of dollars)



Source: Quantum Technology Monitor (April 2026), McKinsey

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya Government of Catalonia

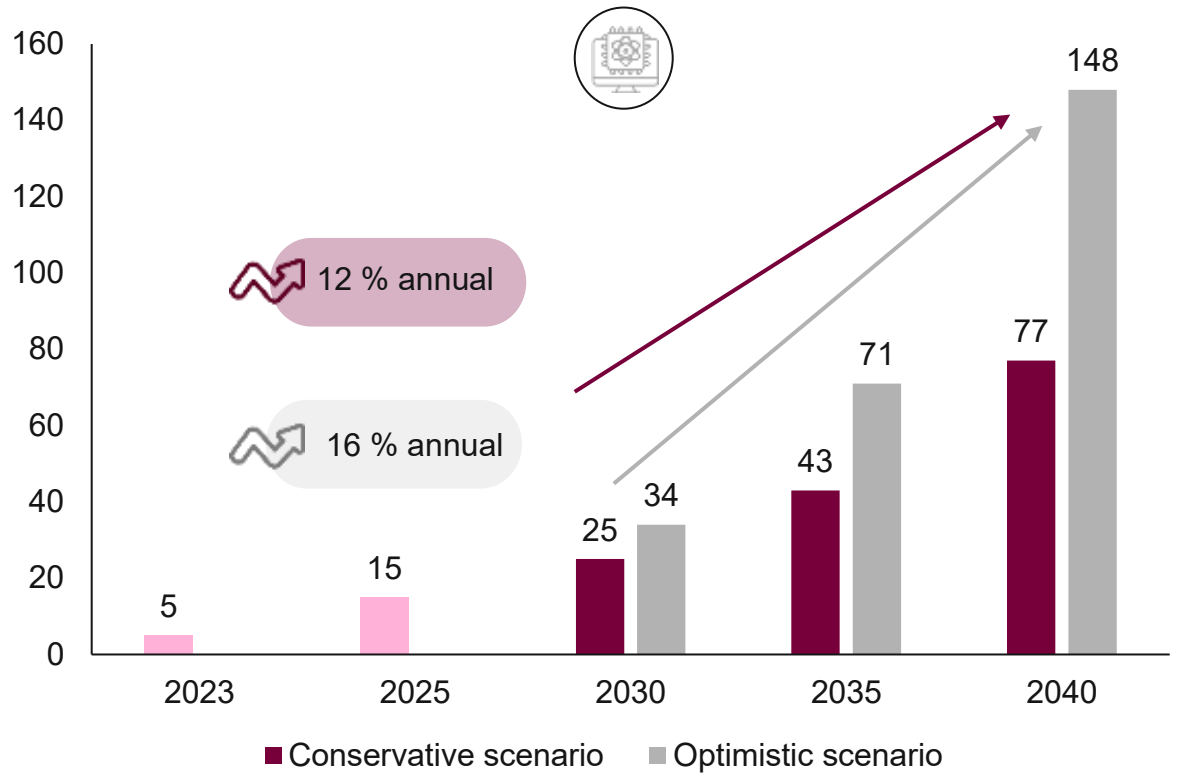
CataloniaConnects

Quantum computing market

Quantum computing is the segment of TQ that is expected to grow the most. It is expected to reach a market value of $148,000 million by 2040, in an optimistic scenario. This is the TQ that is receiving the most capital investment, due to the high expectations of applicability in multiple sectors that are expected to be obtained.

- Quantum error correction, proposals and demonstrations by large companies in TQ are accelerating the adoption of large-scale fault-tolerant quantum computing.
- It is expected that in the next 5 years quantum computing may surpass classical computing for the performance of some tasks. Most experts in the sector believe that the technology is evolving faster than previously thought and that the first computer with a quantum advantage could already be available by 2028.
- Experts in the sector warn that a "bottleneck" similar to what has happened with AI may occur, and that is that due to the rapid growth of technology there is no time to adapt to it, and the skyrocketing demand leads to unleashed competition worldwide in production and resources. So much so, that the question of where quantum computers are developed and manufactured has become increasingly important, as states have recently begun to enact controls to limit the capabilities of the quantum computers they export.
- Quantum computing in the cloud has great potential, given the good acceptance by companies. QaaS (Quantum-as-a-Service) services have great potential for growth.

Quantum Computing Market Value 2023-2040 (in billions of dollars)



Source: Quantum Technology Monitor (April 2026), McKinsey

Main regions of relevance in the world

At a global level, leadership in the development of quantum technologies (QT) is expected to continue to be led by the Americas, Asia and Europe, with countries such as China, the United States, South Korea and Canada standing out.

Asia

It has established itself as a leading region in patents and is becoming a leading hub around TQ

China stands out in public investments for the development of QTs; Many global researchers are from this country, and it has an innovative startup ecosystem. Japan excels in computing and sensor development, South Korea in quantum communications, and Taiwan and China in semiconductor development. Singapore boasts an emerging university quantum hub. India is strongly committed to developing national talent in quantum computing.

America

Leader in quantum computer commercialization and startup investments

North America will remain one of the main developing regions for TQ, with the United States and Canada standing out as the main developers of commercialized quantum computers, and attracting investment rounds in quantum startups.

Europa

Public investment and rapid adoption of TQs by companies

Europe is consolidating itself as a powerful region in research, public investment and public-private projects for the development of QTs. Countries such as France, the United Kingdom, Germany or the Netherlands stand out in public investment programs and the rapid adoption of TQ by startups. Switzerland also has leading companies in communication and computing.

Note: the order of presentation is not indicative of any ranking

Sources: McKinsey i the Quantum Insider

Leading global companies in Quantum Technologies

With a presence in Catalonia

Note: partial illustrative image

Sources: McKinsey, Statista i Forbes

Global success stories in TQ

IBM presented in 2024 the "Heron", a new quantum processor (399 qbits) that can be interconnected in different systems in a modular way according to the customer's needs; Heron has made it possible to reduce errors, increase the number of gates and increase the number of qbits for each quantum computer thanks to the module docking system. IBM broke the 1,000 qbit barrier with its "Condor" processor. In 2025 it began to develop the "Flamingo" range that will exceed 1,000 qubits per module.

Google is driving quantum computing through its Google Quantum AI unit. Google has developed the innovative 105-qbit quantum chip "Willow", which has enabled exponential error reduction, has superior computing power, and makes quantum computers more reliable; Google also develops innovative quantum algorithms to solve practical problems. The company will invest billions of dollars to launch a quantum computer in the coming years that can perform error-free calculations.

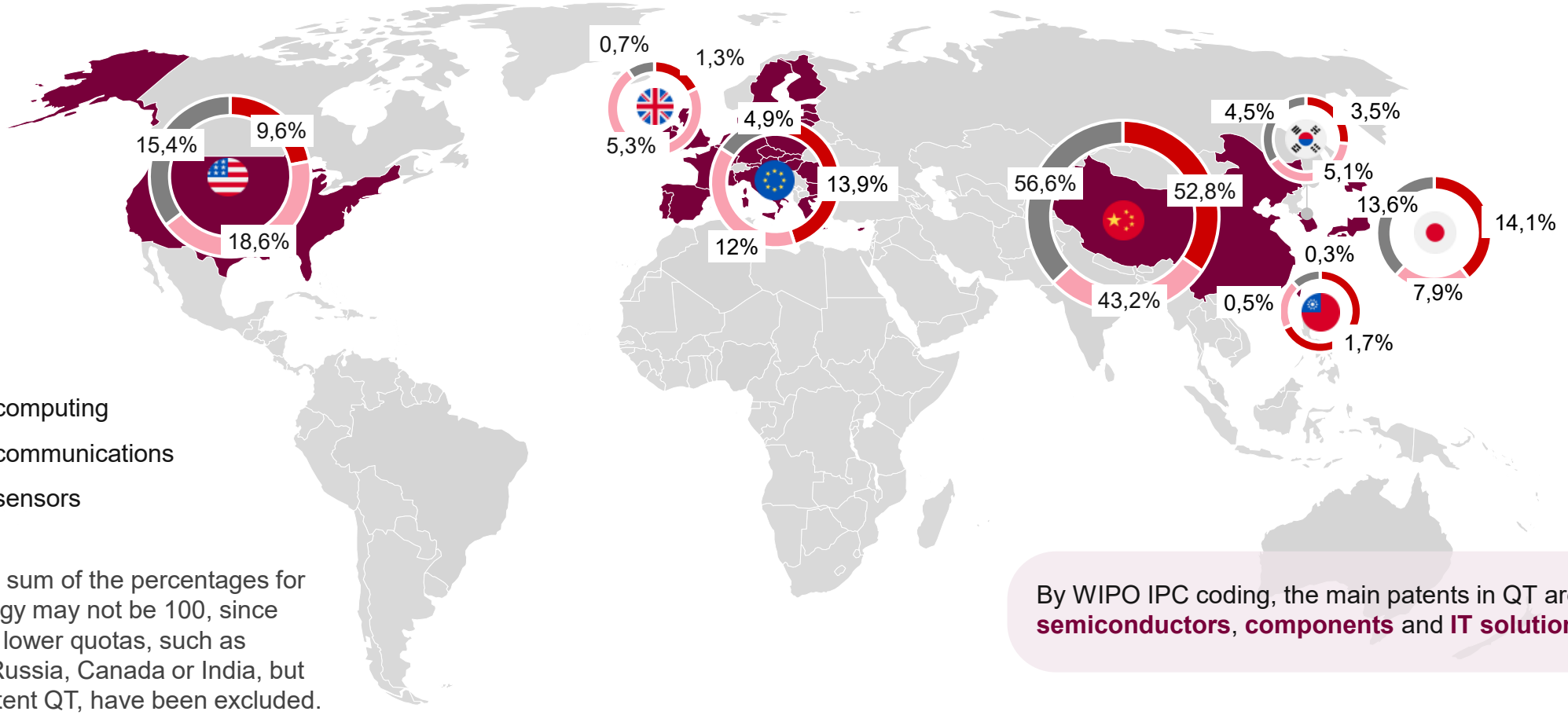
Fujitsu has the International Quantum Center, a reference center in quantum computing focused on promoting the adoption of TQ in all areas. Fujitsu develops quantum hardware, with a 64-qbit prototype for research. He collaborates with Rikken on superconductor technology and with TU Delft on a diamond spin quantum computer. He has created mpiQulacs, a quantum emulation software and participates in the Tenet project of density matrices. It has launched Digital Annealer, a technology applied to combinatorial optimization.

Microsoft is advancing quantum computing with Azure Quantum by integrating hardware, AI, supercomputing, and hybrid systems that coordinate CPUs and QPUs. With milestones such as the Majorana 1 topological chip and the record of 24 logical qbits intertwined with Atom Computing, the platform reduces processing errors to facilitate scientific experimentation through a software-as-a-service (SaaS) model. It collaborates with Quantinuum to make this transition, integrating hybrid tools in the cloud.

Sources: McKinsey, the Quantum Insider, the Wall Street Journal, Google Quantum AI, Microsoft i Fujitsu

3. Intellectual property and scientific production

Share of global patents by quantum technology and country or region (2000-2022)



- Quantum computing
- Quantum communications
- Quantum sensors

Note: the total sum of the percentages for each technology may not be 100, since countries with lower quotas, such as Switzerland, Russia, Canada or India, but which also patent QT, have been excluded.

By WIPO IPC coding, the main patents in QT are in **semiconductors**, **components** and **IT solutions**.

Main global companies that patent:

本源量子 ORIGIN QUANTUM · IBM · Microsoft · AT&T · tsmc · SAMSUNG · Google · SK telecom · HUAWEI · SEL

Sources: Statista (2022) and WIPO

ACCIÓ Catalonia Trade & Investment

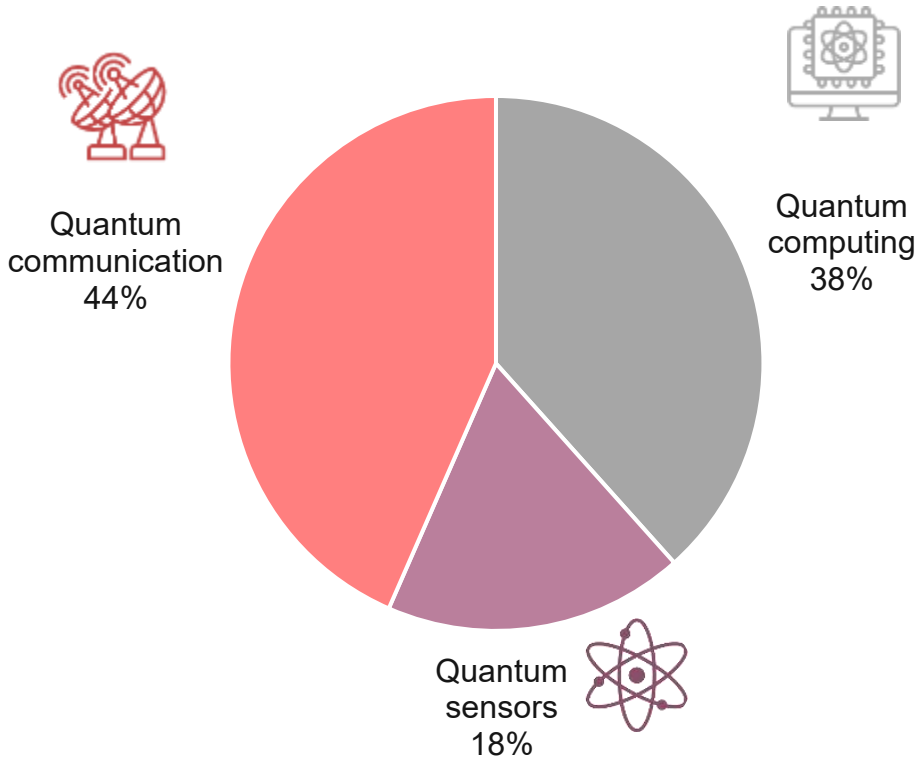
Generalitat de Catalunya Government of Catalonia

CataloniaConnects

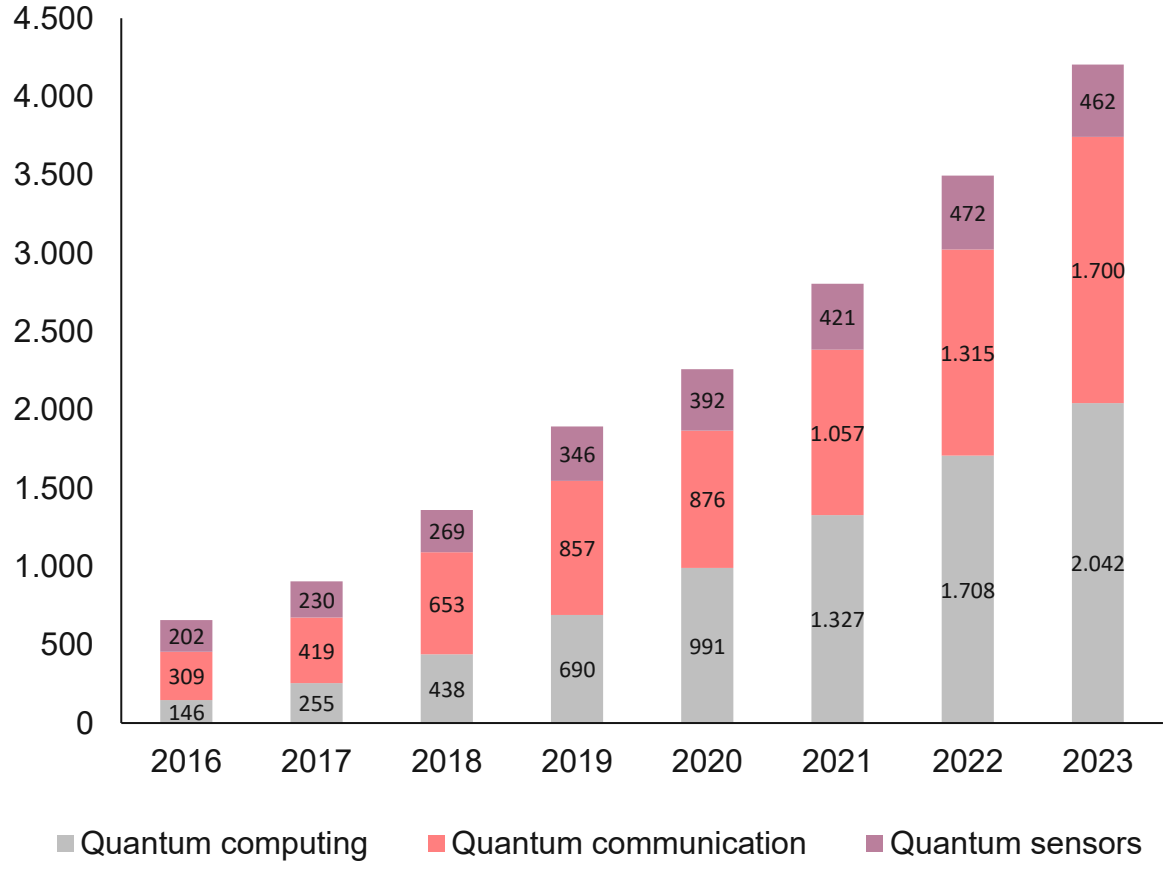
Patents

- Quantum computing and quantum communication generate more interest than sensors

Patents by segments (total 2016-2023)



Evolution of the number of patents by segments



Font: A Portrait of the Global Patent Landscape in Quantum Technologies. Feb 2026. QUIC

4. Initiatives in the world, Europe and Spain in QT

International and European initiatives (I)

Quantum computing and simulation | Quantum communication and encryption | Quantum sensors

Quantum Economy Network

Global network of the World Economic Forum to promote quantum technologies, foster responsible governance and integrate them into the economy. The priorities are sustainability and security.

Quantum Europe Strategy

EU strategy to position Europe as a global benchmark in quantum technologies. It aims to develop quantum infrastructures, boost research and establish a resilient ecosystem in TQ.

CERN Quantum Technology Initiative

Initiative to move forward quantum computing, detection and communications applied to high-energy physics. It collaborates with IBM Q-Network and other international initiatives.

European Chips Act

The European Chip Law aims to establish a European ecosystem of semiconductor industry and research. With an expected allocation of €15.8 billion, it also foresees the development of quantum chips.

European Declaration on Quantum Technologies

Agreement between EU Member States to jointly promote quantum technologies, with the aim of turning Europe into a global "quantum valley".

Quantum Internet Alliance

European project to build a global quantum Internet. It develops full-stack technology with advanced nodes and repeaters. Its goal is to make the quantum Internet a reality by 2030.

International and European initiatives (II)

Quantum computing and simulation | Quantum communication and encryption | Quantum sensors

EuroQCI, European Quantum Communications Infraestructures

European network of secure quantum communications. It seeks to strengthen cybersecurity, protecting sensitive data and critical infrastructure. This project has the collaboration of two Catalan partners.

Quantum Secure Networks Partnership (QSNP)

The Quantum Secure Networks Partnership (QSNP) aims to create a sustainable European ecosystem in quantum cryptography and communication, to contribute to European sovereignty in cybersecurity.

European Quantum Industry Consortium (QuIC)

Industrial association to coordinate the development of quantum technologies in Europe. It focuses on promoting industrial competitiveness, standardization and collaboration with European institutions.

QuantERA

European funding network for research in quantum technologies. Promotes transnational calls to develop advanced quantum computing, detection and communications systems.

Quantum Flagship

European project endowed with €1 billion to lead in quantum computing, communications and detection. It seeks to reduce external dependence and strengthen the European technological ecosystem.

European High Performance Computing Joint Undertaking (EuroHPC JU)

The EuroHPC JU aims to develop a European network of supercomputers and quantum computers at the service of companies and scientific research.

Initiatives in Spain (I)

Quantum computing and simulation | Quantum communication and encryption | Quantum sensors

CUCO Project

CUCO
COMPUTACIÓN CUÁNTICA EN INDUSTRIAS ESTRATÉGICAS

Spanish national project financed with Next Generation EU funds and funds from the Ministry of Science and Innovation, with public-private participation.
It is mainly focused on the development of quantum computing in Spain.

Quantum Spain

Quantum SPAIN

Initiative promoted by the Ministry of Economy and Digital Transformation and coordinated by the Barcelona Supercomputing Center. It has an initial allocation of €22 million for the establishment of the first quantum computing ecosystem in Spain and southern Europe, interconnecting various supercomputing infrastructures to put them at the service of science and artificial intelligence (AI).

Spanish strategy in quantum technologies

The Spanish Strategy for Quantum Technologies aims to strengthen the Spanish quantum research and research ecosystem and boost the TQ market in Spain. Public investment of €808 million and a total mobilization of public-private funds of €1,500 million are expected. The financing of infrastructure and the use of TQ in industrial applications will be encouraged.

Initiatives in Spain (II)

Quantum computing and simulation

Quantum communication and encryption

Quantum sensors

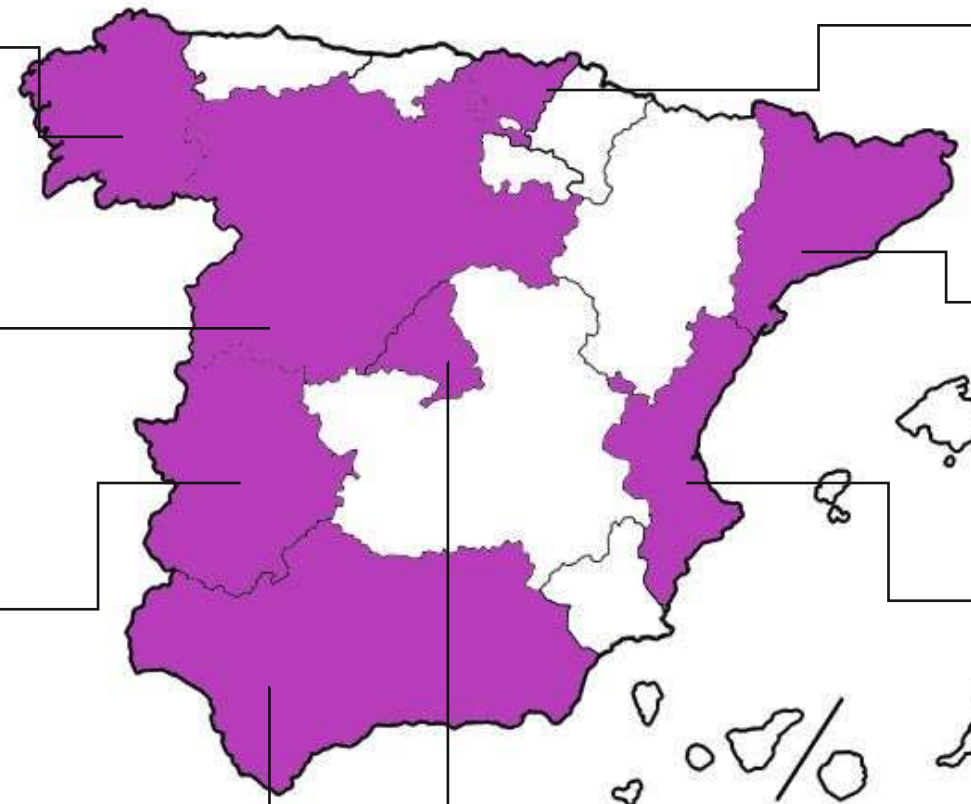
PERTE Aeroespacial

Strategic Project for Economic Transformation Recovery with an expected allocation of €4,533 million until 2025 and which is focused on the growth of the aerospace sector.
It has €125 million for the development of quantum infrastructure, software, and hardware, mainly communications with QKDs.

PERTE Chip

Strategic Project for Economic Recovery and Transformation with a planned allocation of more than €12 billion for the development of the semiconductor and microelectronics industry. €40 million is expected to be mobilized for the development of quantum chips.

Quantum Hubs in Spain



Galícia

Qmio · CESGA · FUJITSU · OQC

Castella i Lleó

SCAYLE Supercomputación Castilla y León · Q-CAYLE Comunicaciones Cuánticas

Extremadura

COMPUTAEX · CénitS · LUSITANIA

Andalusia

Agencia Digital de Andalucía

País Basc

|Basque⟩⟨Quantum|

BIQAIN · IBM · Microsoft

Catalunya

Barcelona Supercomputing Center · ICFO · ALBA · CNM · CSIC · ICN2 · IFAE Institut de Física d'Altes Energies

País Valencià

Generalitat Valenciana · GVA NEXT

Madrid

MadQ-CM · CeSViMa · UPM · CSIC · redi madrid · Telefónica

Sources: BasQ, Galicia Quantum Technologies Hub and Government of Catalonia

5. Opportunities, challenges and trends in quantum technologies

Opportunities and challenges stemming from QT

Opportunities

- Solution and simulation of complex problems
- Sensors and metrology
- Development of the value chain and ancillary industry
- Encryption and greater security
- Public investment and development plans for QT
- Quantum machine learning

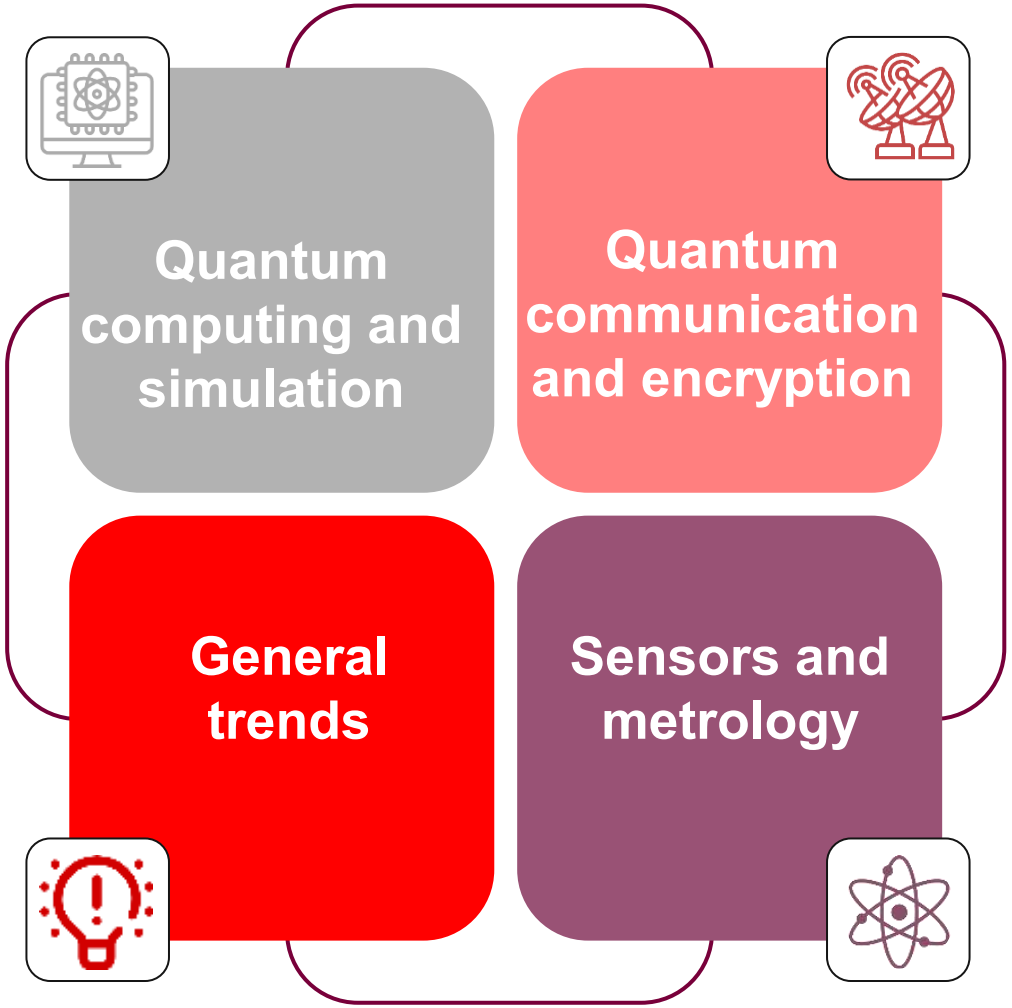
Challenges

- Technology development
- Regulation and safety
- High investments and costs
- Balance of expectations
- Error correction
- Talent

Source: ACCIÓ, based on interviews.

Trends in the field of QT

- Scalability
- More efficient quantum algorithms
- New qubits
- Quantum error correction
- Integration with traditional computing
- Quantum as a Service (QaaS)



- QKD deployment
- Quantum networks
- Quantum repeaters
- Spatial quantum communication
- Quantum random number generation (QRNG)
- Integration with traditional communication infrastructures

- Standards, protocols and certification
- Public and private investment
- Economic, ethical and social impact
- Control and management systems
- Quantum materials
- AI + QT symbiosis

- Greater sensitivity
- Miniaturization
- New areas of application
- Integration with other technologies
- New quantum platforms
- Noise and stability

Source: ACCIÓ based on Quantum flagship, Ionq, MIT, ICFO, Boston Consulting Group, CENELEC, interviews with experts

6. Scope of application and SDGs

Scope of application of QT (I)

	Pharma and health	Industry 4.0	Mobility and logistics	Finance and insurance
Quantum computing and simulation	• Development of new drugs and vaccines • Genetic treatments • Personalized medicine and accelerated diagnosis (Early disease detection) • Research	• Optimization of value chains • Material design • Chip manufacturing and design • Digital twinning for processing large data volumes	• Route optimization • Traffic optimization • Autonomous driving • Reduced latency and response time thanks to quantum computing • More efficient supply chains and return logistics	• Risk analysis • Fraud detection • Optimization of investment portfolios • Financial modeling
Quantum communications	• Patient data security • Digital health	• Securing industrial secrets and data • Securing production against cyberattacks	• Securing urban traffic management and public transport networks	• Securing banking and financial transactions • Encryption of messages and banking data
Quantum sensors	• Biomarkers • Enhanced testing (e.g., MRIs) • Drug simulation • Thermometers and barometers	• Sensors to design and test new materials and molecules • Sensors to measure and mitigate emissions in production processes	• Sensors to test the performance of automobiles • Sensors to monitor and predict vehicle maintenance	• Sensors for post-disaster terrain analysis and quantifying damage and risks for insurers

Sources: MIT, Dealroom, Databrick, European Commission and IEA

Scope of application of QT (II)

	Telecommunications and cybersecurity	Civil and aerospace engineering	Services	Critical resources and infrastructures
Quantum computing and simulation	• Quantum processors in Data Centers • Real-time data processing through quantum algorithms	• Complex calculations in the areas of fluid dynamics, finite element simulations, aerodynamics and flight mechanics	• Improved customer experience thanks to advanced data processing • Predicting “traffic” in stores and preventing theft through the processing of customer movement data • Optimization of last-mile logistics and deliveries	• Weather forecast • Network optimization and leak detection • Improved development of new fuels and more efficient energy storage systems • Optimization solar panel production
Quantum communications	• QKD encrypted communication systems • Quantum encrypted code generators • Optimization of time and latency thanks to the convergence of QT and 5G and 6G (long term)	• Encryption systems and secure communications for flight platforms and airlines	• Quantum messaging and encryption services	• Securing energy networks against cyberattacks
Quantum sensors	• Atomic clocks for GPS • Quantum LiDAR • Quantum radars	• Sensors for aerospace and naval engineering • Metrology for the design and testing of aircraft models • Improvement of navigation and positioning systems • Sensors for underwater detection	• Quantum sensors integrated into commercial devices	• Sensors for the design of new electronic circuits • Quantum simulators for advanced battery design

Sources: MIT, Dealroom, Databrick, European Commission, Inside Quantum Technology, Airbus, Utimaco, NTT Data IET and IEA

QT and Sustainable Development Goals

QT can help **achieve** the **Sustainable Development Goals**, due to its **cross-industry nature**. The impact of quantum technologies is expected to be substantial and transformational, and use cases abound across many industries, ranging from optimization to machine learning, simulation, precision sensing, and security.

The **Sustainable Development Goals (SDGs) are the United Nations' master plan to achieve a sustainable future for all by 2030.** Quantum technologies can contribute to the achievement of most of the areas essential for the attainment of the sustainable development goals. Contribution to the SDGs can take place in the following fields:

7. Quantum technologies in Catalonia

Mapping the quantum technologies in Catalonia

52 companies

+30 companies*

91.4 million euros

470 jobs

53.8% are SMEs.

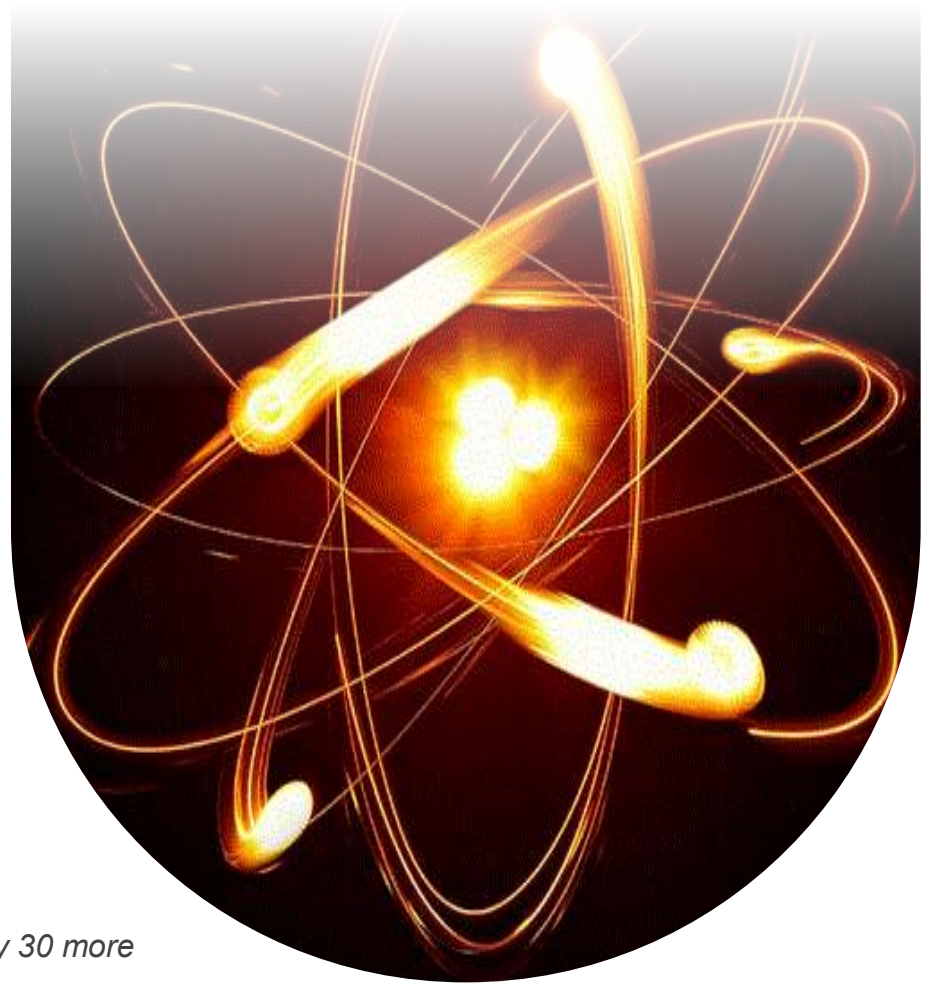
32.7% are less than 10 years old.

17.3% are startups.

13.5% invoice more than €1 million and **2%** over €10 M.

21.2% are exporters.

In terms of developed technology, the most important companies are dedicated to **communication/encryption** (**51.9%**), **quantum computing** (**44.2%**) and **developing enabling applications and technologies** (**42.3%**), and by application sector, the most important is **Industry 4.0** (**80.8%**) and applications in **civil and aerospace engineering** (**61.5%**)**.



** With respect to the data from the 2019 mapping, the total number of companies has grown by 30 more companies.*

***Companies may be classified for more than one technology and sector of application.*

Source: ACCIÓ (company data; turnover and number of employees in 2024-2025)

Outstanding companies of the TQ in Catalonia (I)

By area of technological specialization

Computing

Telefónica, KEYSIGHT TECHNOLOGIES, QILIMANJARO, IBM, Microsoft, Capgemini, SAP, amazon, Atos, oesia, Google, Infineon, Menlo Systems, CISCO, ARQUIMEA, Entanglement Partners_>, THALES, Quside, FUJITSU, DevsHealth, MULTIVERSE

Communication/Encryption

KEYSIGHT TECHNOLOGIES, Quside, luxquanta, sener, IBM, Microsoft, Capgemini, T Systems, Google, Infineon, CISCO, ARQUIMEA, THALES, SATELIOT, Telefónica, oesia, INDRA GROUP, cellnex, scAlai, ORACLE, QuantumKnowledge, WAVE, TOSHIBA, orange

Sensors /Metrology

KEYSIGHT TECHNOLOGIES, Capgemini, MULTIVERSE COMPUTING, ARQUIMEA, RADIANTIS, THALES, FUJITSU, SENSATO, qurv

Simulation

KEYSIGHT TECHNOLOGIES, QILIMANJARO, Quside, Google, ARQUIMEA, FUJITSU, RADIANTIS, Atos, APERON Intelligence, Pharmacelera, zymvol

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya Government of Catalonia

Enabling applications and technologies

Telefónica, cellnex, QILIMANJARO, gmv, accenture, IBM, Microsoft, SAP, qurv, Quside, ayesa, amazon, Air Liquide, Atos, Google, Infineon, CISCO, ARQUIMEA, SATELIOT, APERON Intelligence, luxquanta, nvision, FUJITSU, grupo aia, Ideaded

Algorithms /QAI

Telefónica, QILIMANJARO, Microsoft, Quside, amazon, Atos, Google, Infineon, FUJITSU, CISCO, ARQUIMEA, scAlai, Entanglement Partners_>, APERON Intelligence, Pharmacelera, zymvol, DevsHealth, MULTIVERSE COMPUTING, grupo aia

CataloniaConnects

Empresas destacades de les TQ a Catalunya (II)

By sector of application

Note: Application sectors according to those that appear on the companies' websites.

Health and Pharma

Industry 4.0

Mobility and logistics

Finance and insurance

Telecommunications and cybersecurity

Resources and infrastructures

Services

Civil and Aerospace Engineering

Consulting

Agents of the TQ ecosystem in Catalonia

Source: ACCIÓ

CataloniaConnects

Location of TQ development companies in Catalonia

- Most of the quantum technology companies in Catalonia are concentrated in the Barcelonès area. By counties they are distributed between Barcelonès, Baix Llobregat, Vallès Occidental and Vallès Oriental.
- By municipalities the distribution would be as follows: Barcelona (with **34** companies out of the total), Castelldefels (**6**), L'Hospitalet de Llobregat (**2**), Badalona (**1**), Sant Adrià del Besòs (**1**), Terrassa (**1**), Cornellà de Llobregat (**1**), Cerdanyola del Vallès (**1**) and Parets del Vallès (**1**).

County	No. of companies	% of total
Barcelonès	38	73%
Baix Llobregat	8	15%
Vallès Occidental	4	8%
Vallès Oriental	2	4%
Total	**52**	**100%**

Source: ACCIÓ

Quantum talent in Catalonia

Access to the institution's website

Catalonia has a specialized training offer that responds to the challenges of quantum technologies and prepares highly qualified professionals in this emerging field. Some of the country's leading companies are the result of research in the centres of excellence that offer talent in the country.

Degrees

Catalonia has a range of bachelor's degrees in STEM (Science, Technology, Engineering, and Mathematics) areas of knowledge, oriented towards quantum technologies and taught by the following universities:

UAB Universitat Autònoma de Barcelona · Universitat de Barcelona · upf. Universitat Pompeu Fabra Barcelona · Universitat Ramon Llull · UPC Universitat Politècnica de Catalunya BarcelonaTech · Universitat Rovira i Virgili · Universitat de Lleida · Universitat de Girona

Master's degrees and postgraduate courses

- Màster en Ciència i Tecnologia Quàntiques / **Master in Quantum Science and Technology**

  Master in Quantum Science and Technology Barcelona

  - coordinated effort by:

    Universitat de Barcelona · ICCUB · UPC · UAB Universitat Autònoma de Barcelona · ICFO · BSC Barcelona Supercomputing Center · IFAE Institut de Física d'Altes Energies · ICN2 Institut Català de Nanociència i Nanotecnologia

- Postgrau en **Enginyeria Quàntica**

  UPC Universitat Politècnica de Catalunya BarcelonaTech

Courses and training

- Basic Course in **Quantum Computing**

  TalentQ

- **Quantum** Science and Technology **Training Platform**

  Catalonia Quantum Academy

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya Government of Catalonia

Catalan spin-offs in quantum technologies and the centre from which they come

ICFO

KEYSIGHT · Qnami · Qnami · SENSATO · Quside · qurv · RADIANTIS · luxquanta

BSC Barcelona Supercomputing Center · IFAE Institut de Física d'Altes Energies · ICN2 Institut Català de Nanociència i Nanotecnologia

QILIMANJARO QUANTUM TECH

APERON intelligence

Source: Government of Catalonia

CataloniaConnects

Catalonia, leader in Horizon Europe quantum research projects in Spain

Quantum Projects in Catalonia (2022-1Q. 2026)

53 projects

€40.9 million

2.7% of the EU total
44.6% of the total in Spain

Catalonia attracted **44.6% of Horizon Europe funding for projects with a quantum component in Spain** for the period 2022-1Q 2026 and **2.7% of the total in the EU**.

Startups i empreses catalanes receptores:

Kilimanjaro Quantum Tech · Quside · luxquanta · Satelliot · Qureca · qurv

11 institutions

ICFO · UPC · UAB Universitat Autònoma de Barcelona · IFAE Institut de Física d'Altes Energies · Universitat de Girona · CRG Centre for Genomic Regulation · BSC · i2cat · ICIQ Institut Català d'Investigació Química · Universitat de Barcelona · ICN2 Institut Català de Nanociència i Nanotecnologia

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya
Government of Catalonia

Source: Horizon Europe

CataloniaConnects

Oxford Quantum Circuits lands in Barcelona

The British company **Oxford Quantum Circuits** (OQC) **has chosen Barcelona to install its new quantum computing center**, which will become the largest facility of its kind in southern Europe and plans to create more than 200 highly qualified jobs.

- This centre for the research, development and manufacture of next-generation quantum technologies will be integrated into the city's ecosystem, collaborating with local universities and research centres. OQC's decision consolidates the Catalan capital as a European hub of reference in deep tech and high-performance computing, adding to existing public capital infrastructures such as the Barcelona Supercomputing Center (BSC-CNS).
- The new plant will be dedicated to the R+D and manufacture of quantum computers to respond to the growing demand for this technology in sectors such as AI, finance, health and energy.
- The company, which emerged as a spin-off of the University of Oxford, will invest €92 million in this project, reinforcing the positioning of Barcelona and Catalonia as strategic players within the European quantum and innovation ecosystem

Sources: Government of Catalonia and Barcelona City Council

New Qilimanjaro quantum computer at BSC

The BSC inaugurates its third quantum computer, **EuroQCS-Spain**, in the renovated chapel of Torre Girona.

- The new computer, co-financed by the European Commission and the Government of Spain with an investment of 9.8 million euros, adds new capabilities to supercomputing and European quantum computing by presenting an analogue coding technology, complementary to the quantum system previously installed at the BSC.
- With the development of the chip and software made entirely in Spain by Qilimanjaro Quantum Tech, this third quantum computer maintains the commitment of BSC, the Government of Spain and EuroHPC to achieve technological sovereignty with the installation of 100% European technology.
- With this incorporation, **MareNostrum 5 becomes one of the first supercomputers in the world to combine classical computing** (with general-purpose and accelerated partitions) **and digital and analog quantum computing** (**with 3 quantum computers**: the two quantum computers installed by the Quantum Spain project and the Secretary of State for Digitization and Artificial Intelligence (SEDIA) and the latter, respectively).

Font: BSC

Quantica – Vall Mediterrània of Quantum Science and Technologies

The Government of Catalonia has promoted **"Quantica – Vall Mediterrània of Quantum Science and Technologies",** an initiative that proposes the creation of an ecosystem that supports research, development and innovation (R+D+I), the training, attraction and retention of talent, industrial exploitation, and creation of new companies in this knowledge field, with the overarching aim of turning Catalonia into a global technological hub in quantum technologies.

Coordination: ICFO

Lines of action

- **Infrastructures**
- **Talent**
- **Research**
- **Industry**
- **Education**
- **Alliances**

Quantum Technologies Council of Catalonia, made up of important figures from the academic, business and institutional spheres, with the function of advising the Government on policies aimed at promoting quantum technologies, proposing actions and coordination measures, and creating the necessary space for debate with the sector of these technologies in Catalonia and with civil society.

Source: Government of Catalonia

Quantumcat

Quantumcat, the quantum technologies hub of Catalonia

This hub aims to promote and transfer discoveries at the laboratory level to the market, through industrially viable implementations and applications. This initiative addresses three main problems:

- Promoting high-potential technologies: it fosters the industrial deployment of high-potential technologies through specific research collaborations.
- Facilitating dissemination at the community level: it shares successful deployment and innovation strategies.
- Carrying out outreach: it organizes networking events and workshops for academic and industrial audiences, encouraging the discussion of experiences and collaborations, as well as the sharing of knowledge about success stories and use cases.

QUANTUMCAT

Projects

Quantum computing

Quantum communication

Quantum detection

Quantum simulation

QUANTUMCAT includes leading research institutions in Catalonia and relevant industrial stakeholders in this field. Catalonia is already home to several research groups and companies (startups) pioneering quantum technologies. One of the biggest challenges is to transfer discoveries from the research laboratory to the industrial domain

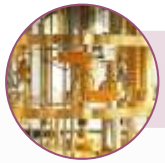
Source: Quantumcat

Infraestructures de les TQ a Catalunya

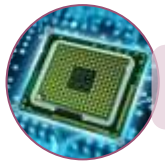

QuantIA Lab


QRecerca


BCN-INNOFab


Annealer Quilimanjaro


QSense


QPICs


PixEurope i PhotonChip


Anell quàntic de Collserola


MareNostrum-Ona


6GquCryptoLab

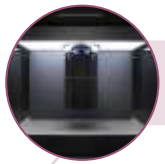

QSunset


QInifnity


QUltrasens


QSpace


Plataforma SiN Photonic


QDemo


Quíone

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya
Government of Catalonia

Source: Government of Catalonia

CataloniaConnects

Catalonia, an ecosystem in quantum effervescence

Local business ecosystem

52 companies, an increase of 30 companies in 6 years

Turnover of **€91.4** million

Excellence in R+D

Research within the framework of Horizon Europe

BSC · ICFO · UPC · UAB Universitat Autònoma de Barcelona · IFAE Institut de Física d'Altes Energies · CRG Centre for Genomic Regulation · i2cat · ICIQ Institut Català d'Investigació Química · Universitat de Barcelona · ICN2 Institut Català de Nanociència i Nanotecnologia · Universitat de Girona · Qilimanjaro · Quside · luxquanta · SATELIOT · QURECA · qurv

Infrastructures, research and development

1. QPICs
2. BCN-INNOFab
3. Qilimanjaro
4. Quíones
5. QUltrasens
6. QInfinity
7. Qsunset
8. Anell quàntic de Collserola
9. QuantIA Lab
10. MareNostrum-Ona

Barcelona Supercomputing Center · Quantum SPAIN

Spain's first quantum computer in Catalonia built with 100% European technology

Impuls institucional

Institucions tractores de referència

Barcelona Supercomputing Center · ICFO · IFAE Institut de Física d'Altes Energies · ICN2 Institut Català de Nanociència i Nanotecnologia · cttc Centre Tecnològic de Telecomunicacions de Catalunya · CNM · CSIC · ICMAB · CSIC · i2cat 03 23 · eurecat

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya Government of Catalonia

CataloniaConnects

DAFO of QT in Catalonia

Strengths

- Powerful entrepreneurial and business ecosystem
- Leading university basic science and QT research sector
- Government and society's commitment to QT
- Facilitating and critical infrastructures in the region, such as the BSC and ICFO

Weaknesses

- Lack of talent, training and specialization in this knowledge area
- High development costs and lack of public funding in QT
- The commercial viability of some applications is still distant
- Lack of industry committed to the development of QT

Opportunities

- Global expansion, potential market
- Specialization in specific areas of the QT value chain
- Research, innovation and leadership in projects and initiatives
- Creation and development of solutions for different economic sectors

Threats

- Emerging technology. Uncertainty in applications
- International competition. Many countries are developing QT strategies
- Regulatory uncertainty
- Security risk

Sources: ACCIÓ and La Vanguardia

8. Success stories in Catalonia

Success stories on Catalonia

The **BARCELONA SUPERCOMPUTING CENTER (BSC)** houses one of the 6 European quantum supercomputers and the supercomputer of the Quantum Spain project.

The **INSTITUTE OF PHOTONIC SCIENCES (ICFO)** is at the forefront of innovation and research in QT in Catalonia.

QILIMANJARO, spin-off of the BSC, IFAE and the UB, a leader in quantum computing in Catalonia.

QUSIDE, ICFO spin-off, at the forefront of encryption and quantum applications for cybersecurity.

LUXQUANTA, ICFO spin-off that offers cybersecurity solutions based on quantum cryptography.

SENER develops quantum satellite communications with funds from PERTE Aeroespacial.

The **IMB-CNM** participates in quantum chip development projects and fosters the commercialization of QT

The **QUDICE PROJECT** develops quantum key distribution (QKD) in satellite networks.

QOLLSEROLA will be the deployment of the quantum cybersecurity network in Barcelona and its metropolitan area.

PHOTONCHIP, the development and scalability of photonic chips in industry

QUÍONE, quantum machine capable of detecting individual atoms in a strontium gas.

6GQUCRYPTOLAB, quantum key distribution (QKD) testing scenario

Acknowledgements

Interviews with companies and institutions

We would like to sincerely thank all participating institutions for their generosity, both for their time and for sharing their valuable knowledge

BSC

FUJITSU

Google

IBM

ICFO

luxquanta

Microsoft

QILIMANJARO QUANTUM TECH

Quside

Generalitat de Catalunya
Departament d'Empresa i Treball
Secretaria de Polítiques Digitals

Thank you

Passeig de Gràcia, 129
08008 Barcelona

accio.gencat.cat
catalonia.com

@accio_cat
@Catalonia_TI

linkedin.com/company/acciocat/
linkedin.com/company/invest-in-catalonia/

More information about the sector, news and opportunities:
https://catalonia.com/key-industries-technologies/technologies/quantum-technologies-in-catalonia

ACCIÓ Catalonia Trade & Investment

Generalitat de Catalunya
Government of Catalonia

CataloniaConnects