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National Quantum Computing Centre

The Quantum Era: Global trends and the UK's path to leadership

Dr. Najwa Sidqi
Quantum cluster manager, Harwell Campus
National Quantum Computing Centre
Business and Innovation Directorate, STFC

Harwell, 26th of February 2025

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Brief Introduction

- **Current Role:** Quantum Cluster Manager, Harwell Campus, NQCC
- **Expertise:** Quantum technologies, innovation strategy, photonics and semiconductor
- **Key achievements:** Mapping the UK's quantum landscape and contributed to national strategy reviews
- **Academic background:** PhD in Ultrafast Photonics, Heriot-Watt University

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Talk overview

- The International Year of Quantum
- Quantum initiatives around the world
- The UK quantum landscape
- Harwell Campus: A hub for quantum innovation
- Challenges and opportunities for quantum in the UK

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- **The International Year of Quantum**
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The international Year of Quantum 2025

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The international Year of Quantum 2025

INTERNATIONAL YEAR OF
Quantum Science and Technology

https://quantum2025.org/

unesco

Anne L'Huillier, who won the 2023 Nobel Prize for her work in attosecond physics, presented an overview of the early development of quantum mechanics.

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- **Quantum initiatives around the world**
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- Challenges and opportunities for quantum in the UK
- Collaboration

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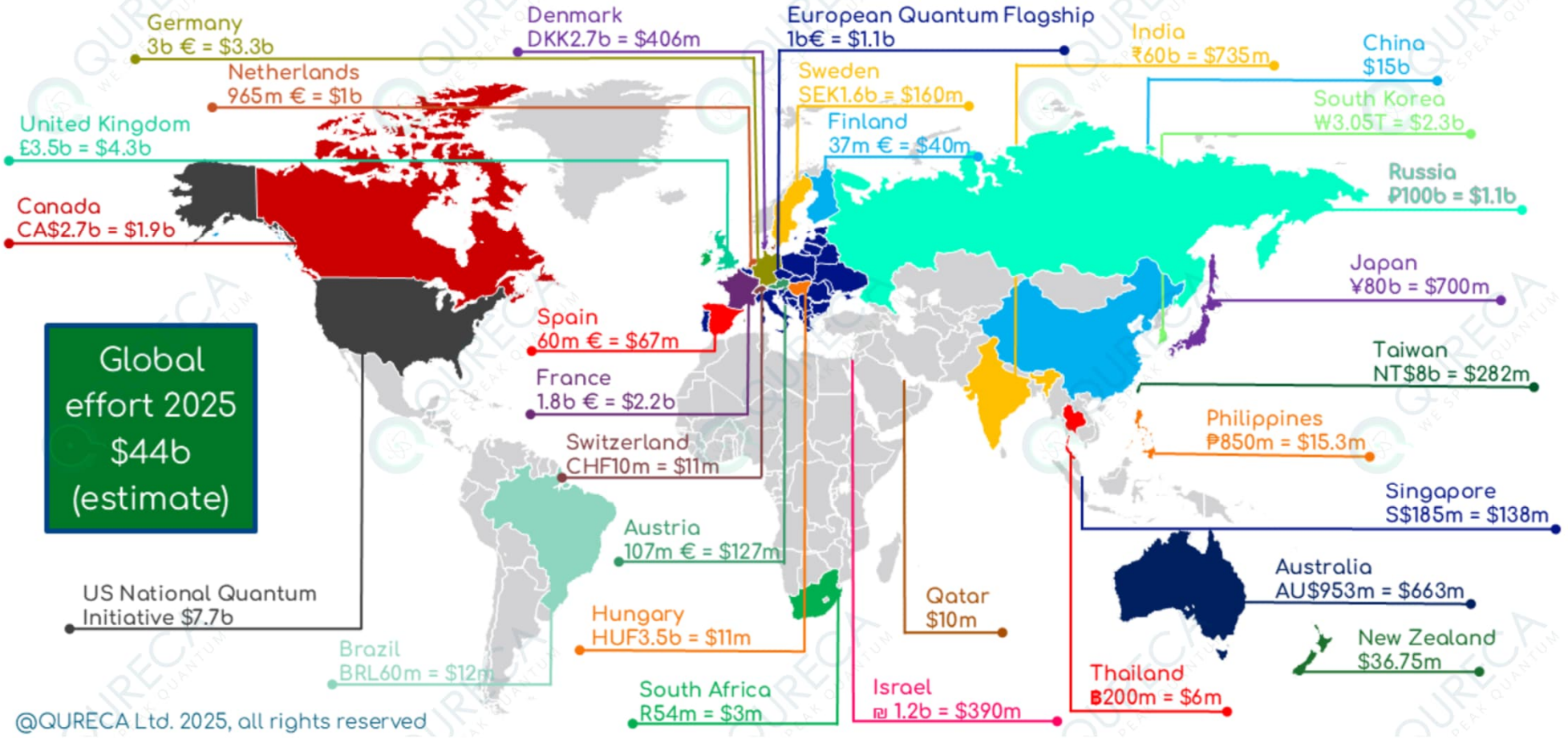
Quantum initiatives around the world



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Global market dynamics

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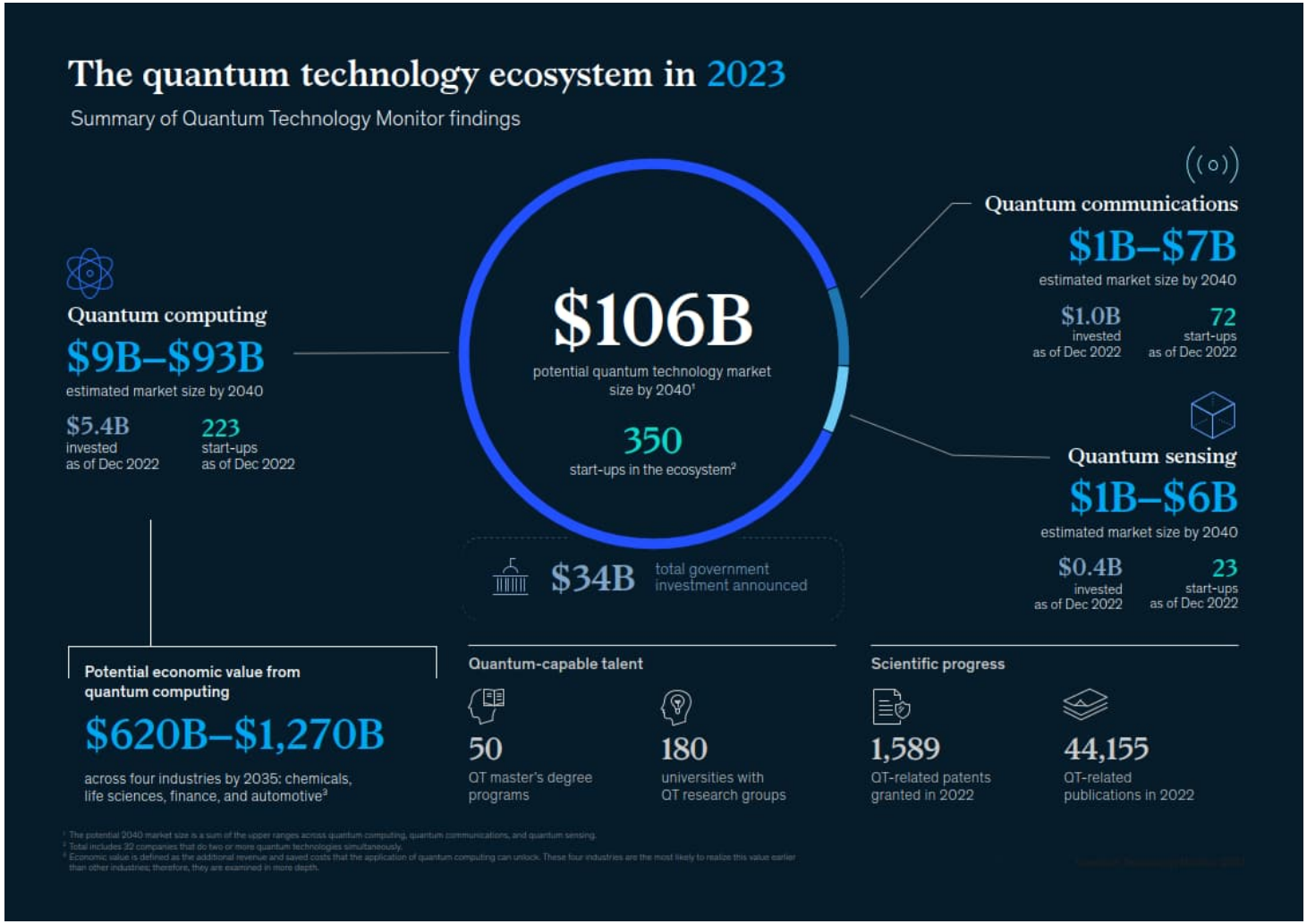

Source: Quantum Technology Monitor, Mckinsey and Company, 2023

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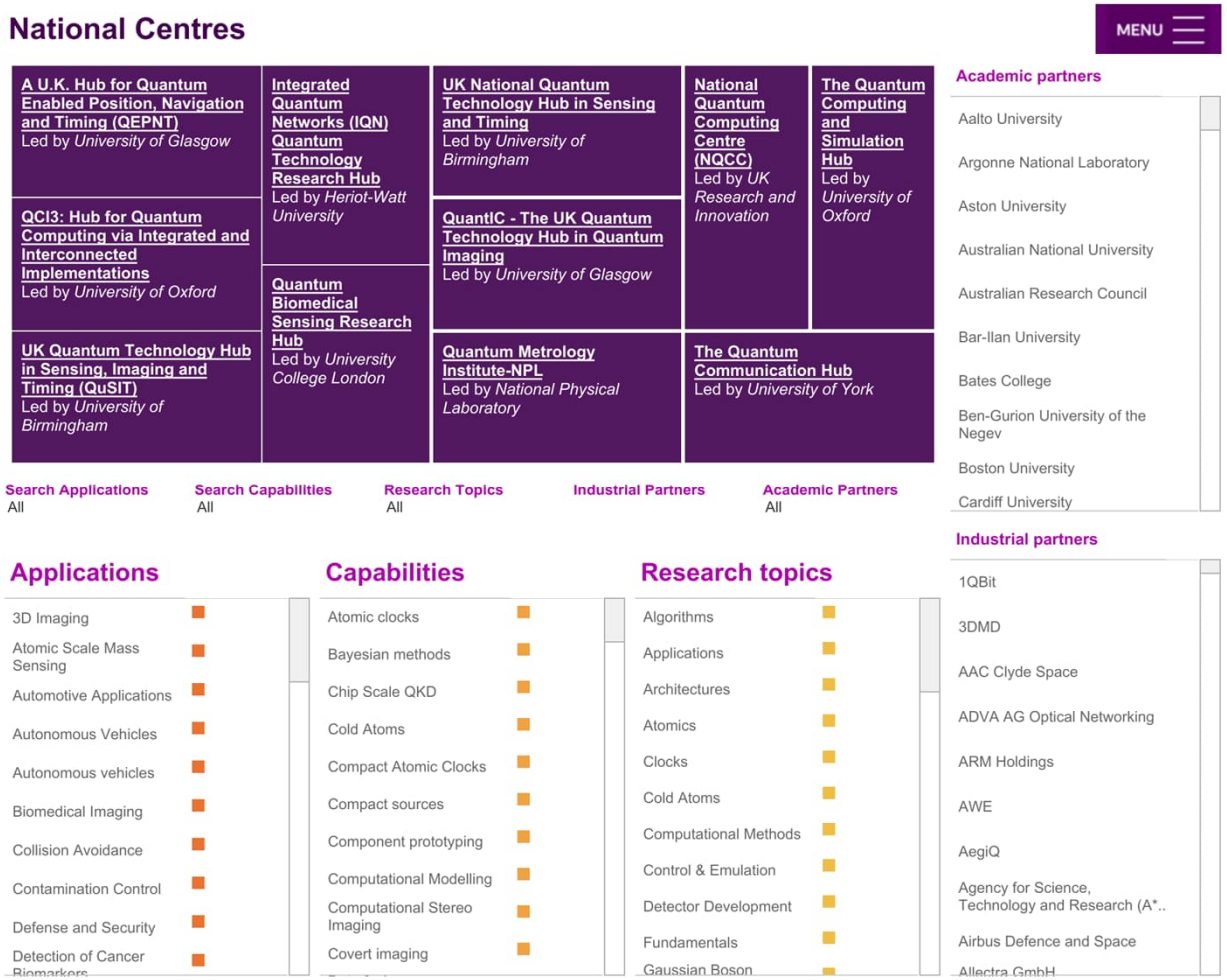
The UK quantum landscape

https://iuk-business-connect.org.uk/programme/quantum-landscape/



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The National Quantum Technologies Programme

GCHQ

NPL National Physical Laboratory

[dstl] The Science Inside

Ministry of Defence

Innovate UK

Engineering and Physical Sciences Research Council

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The National Quantum Technologies Programme

- Quantum Technology Hubs
- Building national capabilities
- Research
- Driving commercialisation and industrialisation
- National Quantum Strategy Missions
- Skills

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The UK National Quantum Strategy(2023)

- By 2033 we will maintain our top 3 position in the quality of our quantum science publications, whilst increasing the volume of our research publications.
- By 2033, we will have funded an additional 1000 postgraduate research students in quantum relevant disciplines
- By 2033 we will have bilateral arrangements with 5 further leading quantum nations, based on substantive collaborative work programmes
- By 2033, the UK will have a 15% share of global private equity investment into quantum technology companies.
- By 2033, the UK will have a 15% share of the global quantum technologies market.
- By 2033, all businesses within key relevant sectors of the UK will be aware of the potential of quantum technologies and 75% of relevant businesses will have taken steps to 12 prepare for the arrival of quantum computing.
- The UK will be a global leader in establishing global standards for quantum.

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The National Quantum missions

Mission 1: By 2035, there will be accessible, UK-based quantum computers capable of running 1 trillion operations and supporting applications that provide benefits well in excess of classical supercomputers across key sectors of the economy.

Mission 2: By 2035, the UK will have deployed the world's most advanced quantum network at scale, pioneering the future quantum internet.

Mission 3: By 2030, every NHS Trust will benefit from quantum sensing-enabled solutions, helping those with chronic illness live healthier, longer lives through early diagnosis and treatment.

Mission 4: By 2030, quantum navigation systems, including clocks, will be deployed on aircraft, providing next-generation accuracy for resilience that is independent of satellite signals.

Mission 5: By 2030, mobile, networked quantum sensors will have unlocked new situational awareness capabilities, exploited across critical infrastructure in the transport, telecoms, energy, and defence sectors.

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Harwell Innovation Clusters

North West Space Cluster

HealthTec Cluster

Sci-Tech DARESBURY

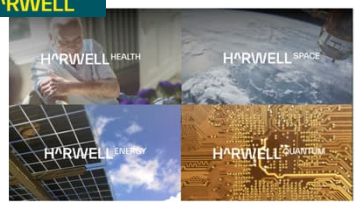
Digital Tech Cluster

North West Health Tech Cluster hosted at Sci-Tech Daresbury

Digital Tech Cluster hosted at Sci-Tech Daresbury

North West Space Cluster hosted at Sci-Tech Daresbury

HARWELL



Harwell Space Cluster

Harwell Health Cluster

Harwell Energy Cluster

Harwell Quantum Cluster

Image © STFC John Dawson

UKRI Science and Technology Facilities Council

Innovation Clusters

>305 Organisations in total participating in Clusters

>5150 Jobs supported across the Clusters

£1.4B Private investment attracted by Cluster organisations

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The Quantum Cluster

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National Quantum Computing Centre:
QC readiness, training, applications and sector engagement

RAL Space: Quantum communication, satellite QKD, cold atom sensors, gravimeters

ESA: Satellite QKD, Quantum sensing and quantum computing

SAT Catapult: Quantum communication, Satellite QKD

Quantum startups:Element6, Redwave Labs, Nu Quantum, Infleqtion, Finchetto, Applied Quantum Computing, Open Quantum, TreQ, Quantopticon, QuERA

aegiq
Infleqtion
oxford ionics
ORCA COMPUTING
QUANTUM MOTION
QuEra Computing Inc.
rigetti

Testbeds delivery partners

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The Quantum Cluster: mission and goals

Mission: Advance the development and adoption of quantum technologies for socio-economic growth

Goals:

- Convening stakeholders and building meaningful collaborations around quantum technologies
- Developing useful applications of quantum technologies
- Supporting businesses and technology scale up.

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The National Quantum Computing Centre

- Collaborative programme between EPSRC and STFC:

£93m initial 5-year investment(2020)

£41m programme acceleration(2023)

- Addressing the challenges of scaling quantum computing
- Driving user adoption and economic value through the SPAR**Q** programme

Science minister unveiling the NQCC Plaque in October 2024

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UKRI National Quantum Computing Centre

SPARQ Programme

Access	Expertise	Networking	Skills
Access to quantum computing resources	Technical expertise and applications support	Networking, workshops and hackathons	Skills development and learning resources

- Support the discovery and development of use cases and applications for quantum computing
- Enhance quantum computing literacy and programming skills
- Build a UK quantum computing user community through knowledge exchange and networking

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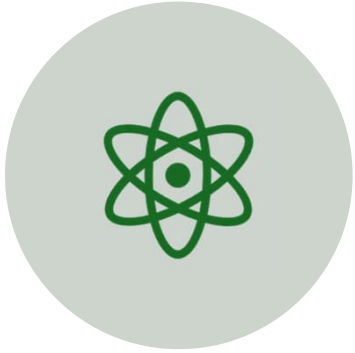
Scaling quantum technology

WHY DOES IT MATTER



THE KEY CHALLENGES IN SCALING QUANTUM

COLLABORATION OPPORTUNITIES: THE QUANTUM CLUSTER

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Scaling quantum technology: why does it matter?

- Enabling complex quantum science for real-world applications.
- Bridging the gap between theoretical potential and practical utility.
- Supporting advancements in industries like healthcare, energy, and space

Photo credit NQCC

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Scaling quantum technology: the key challenges

- Addressing hardware limitations
- End user engagement and ecosystem building
- Innovation support and funding
- Bridging the gap between system development and integration in real world applications

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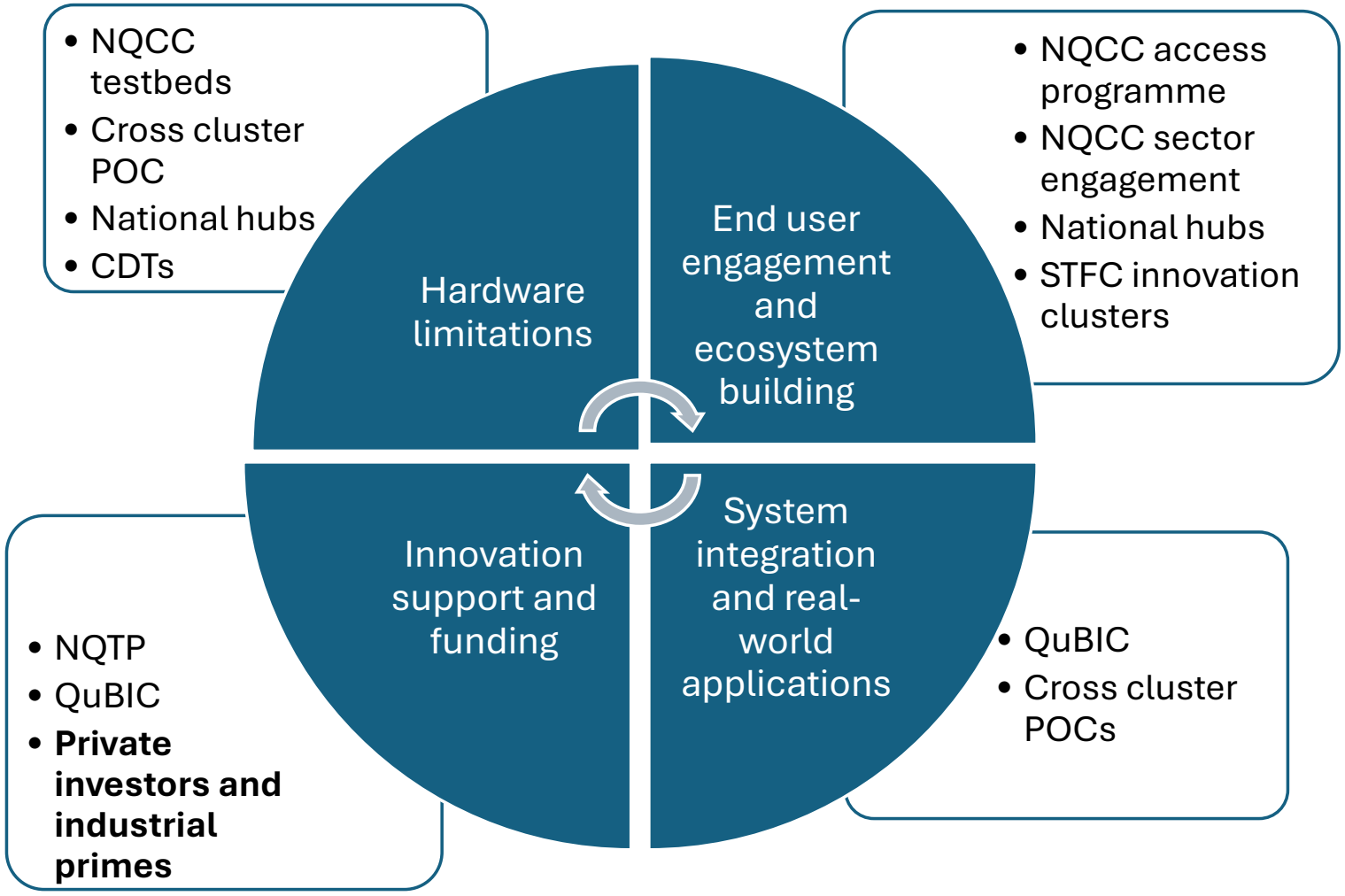
Scaling quantum technology: The quantum cluster



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Opportunities for quantum in the UK: What's next?

- The national missions in computing, sensing and computing
- Addressing key challenges to tech scalability
- Exploring cross-sector opportunities
- Training schemes to build hand on skills for quantum technologies

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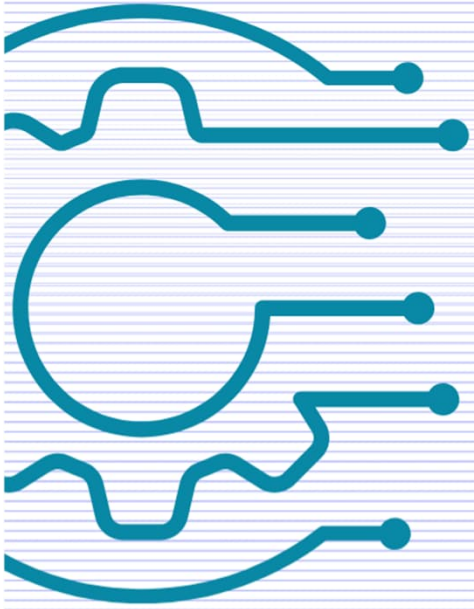
CERN | QUANTUM TECHNOLOGY INITIATIVE

CERN Main Auditorium



QUANTUM TECHNOLOGY CONFERENCE

QT4HEP

20-24 January 2025