



Quantum Science in a Global Context: the Role of the UK National Quantum Programme

- Peter Knight
- UK National Quantum Technology Programme

IYQ Paris Academy Meeting
3-25

- Does not necessarily represent UK government policy



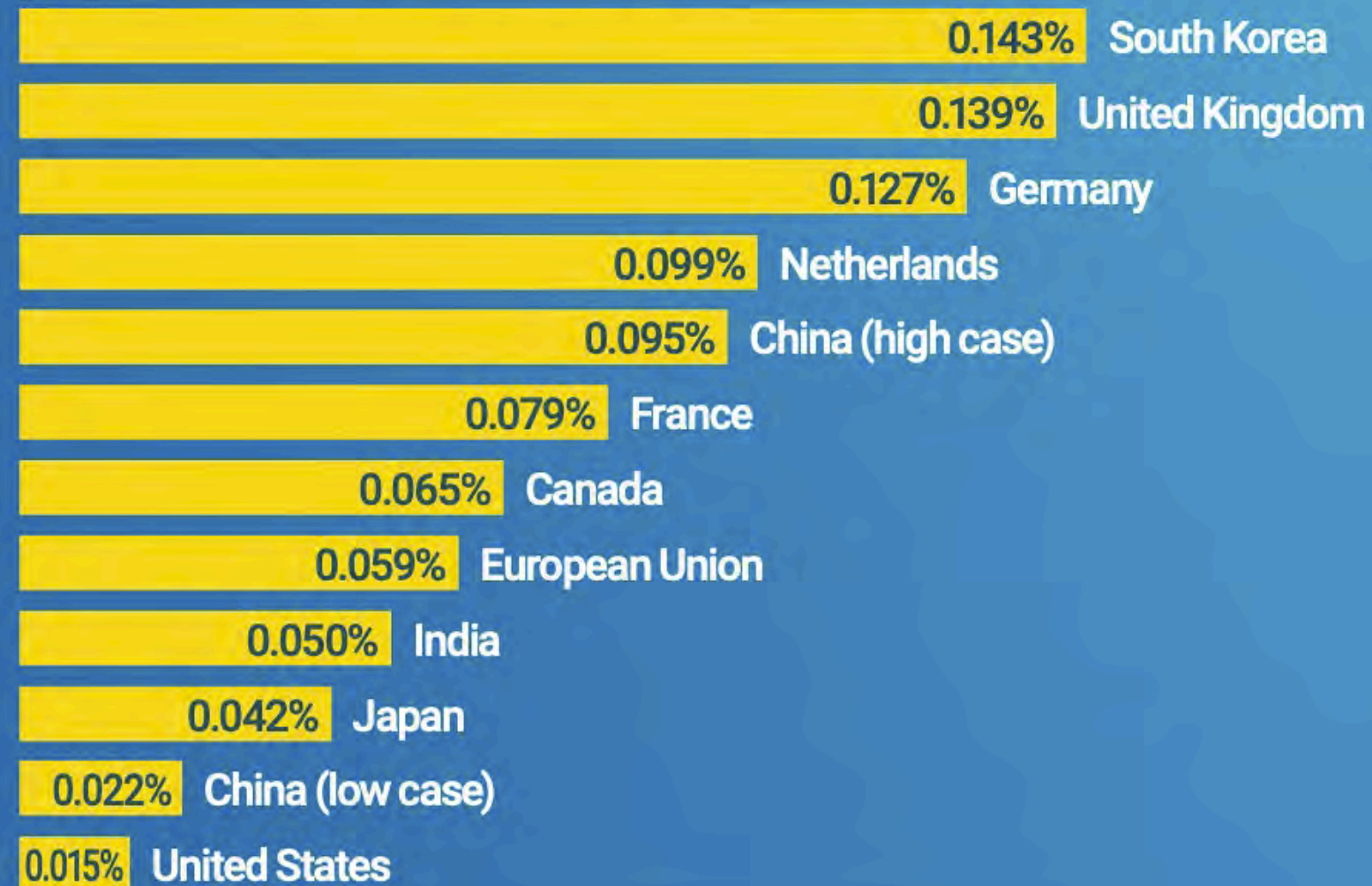
United Nations International Year of Quantum

- The U.N. June 7, 2024 declaration: a signal for any individual, group, institution, or government to use 2025 to increase awareness of quantum science & technology. The IYQ Steering Committee plan global events, those that reach audiences unaware of the importance of QIS
- Quantum technology: a key cross-cutting scientific field of the 21st century, with tremendous impact on critical societal challenges highlighted by the U.N.'s 2030 Sustainable Development Goals, including climate, energy, food safety and security, and clean water.
- Inspire young people from all over the world to be the next generation of quantum pioneers who will use quantum science to make a positive difference in the lives of others. This International Year is an opportunity to learn more about the ways quantum science underpins the physical world around us, drives technological innovation, affects government policies, impacts the global economy, and influences art and culture.
- Any individual, group, organization, institution, or government can help aid the mission of the International Year by facilitating the creation of events or resources to improve understanding of the importance and impact of quantum.

Everyone's at
it

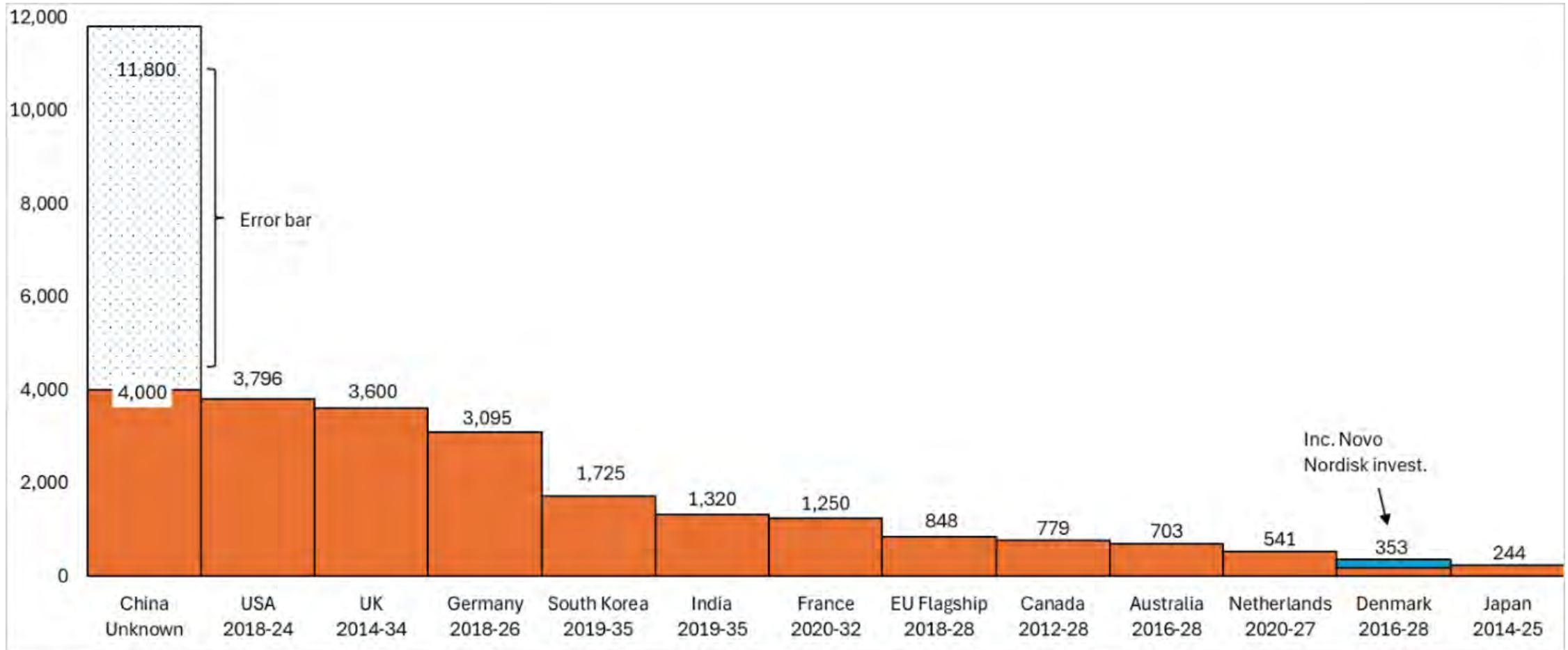
SIZING UP THE QUANTUM BET

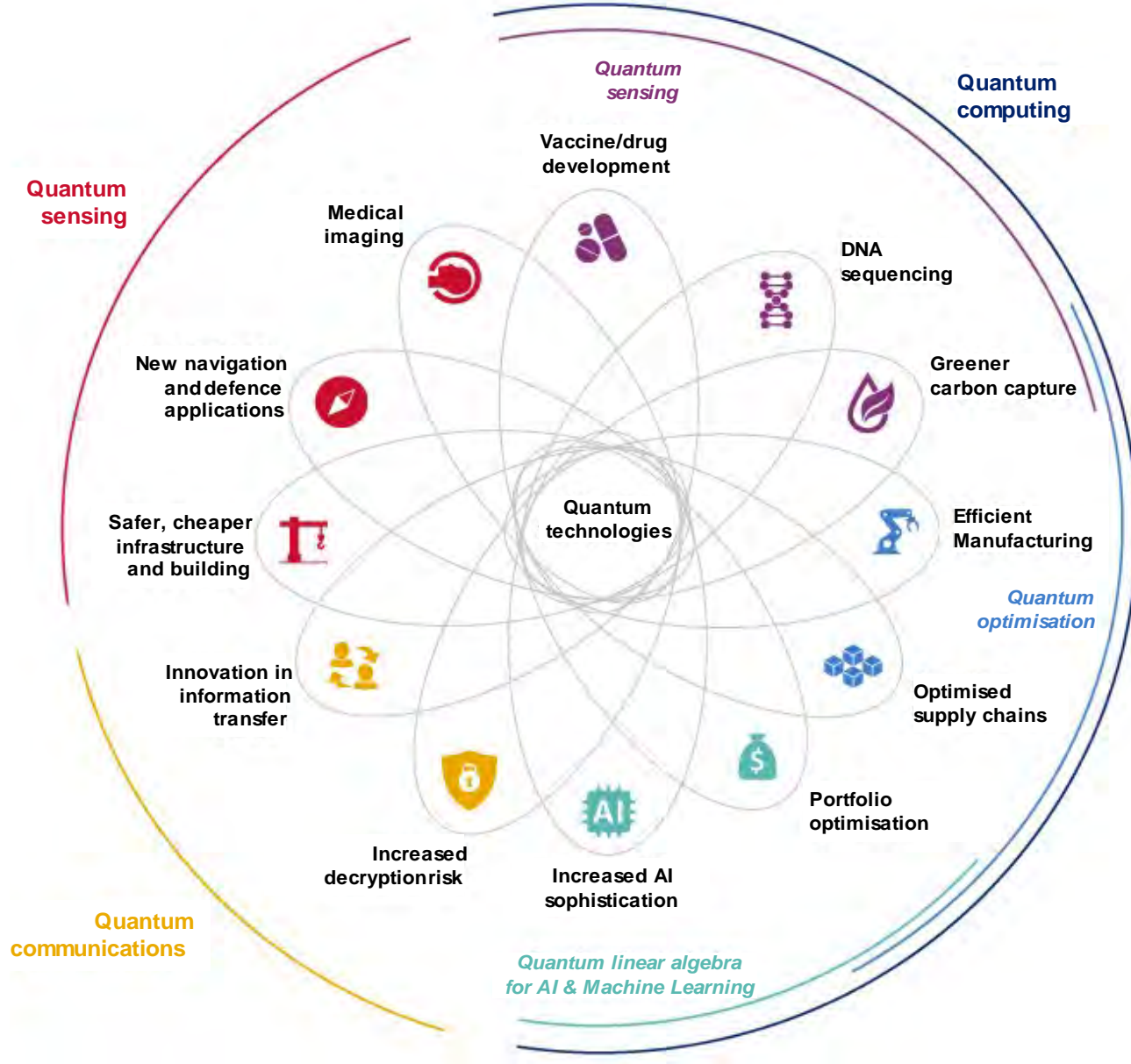
Total announced quantum public investment as share of 2022 GDP



International comparison of government commitments (GBP)

(DSIT internal analysis, Quantum Insider, 2024).



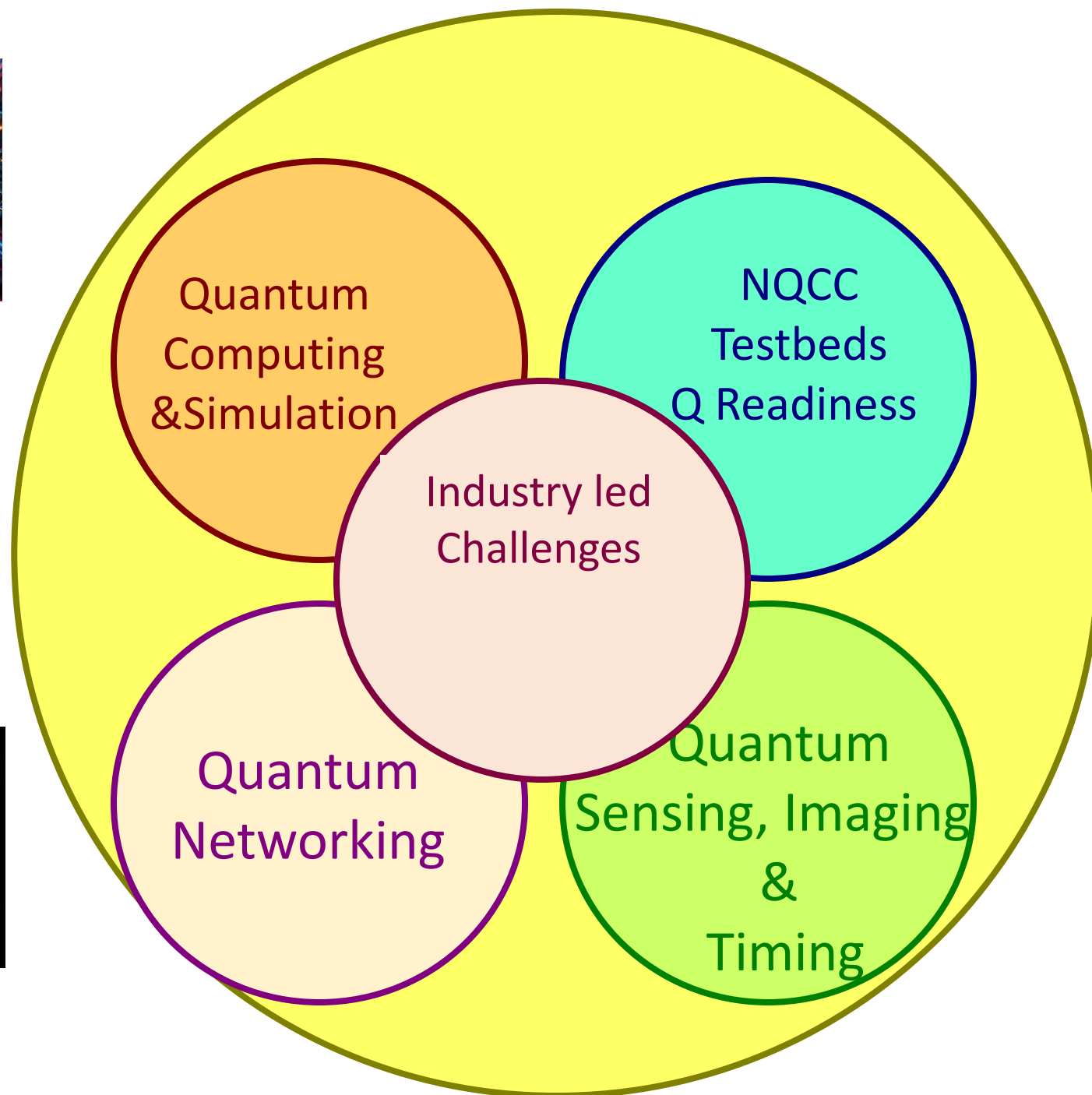
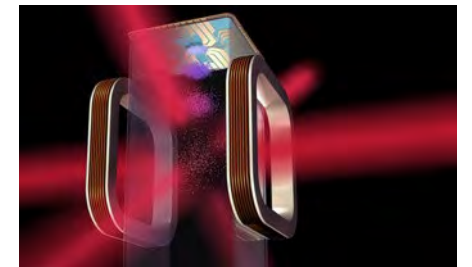
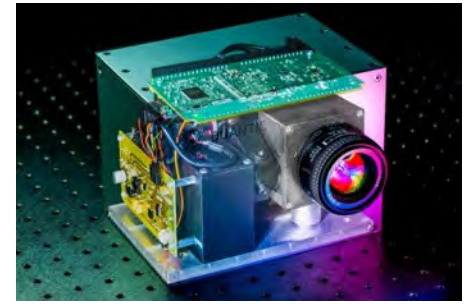
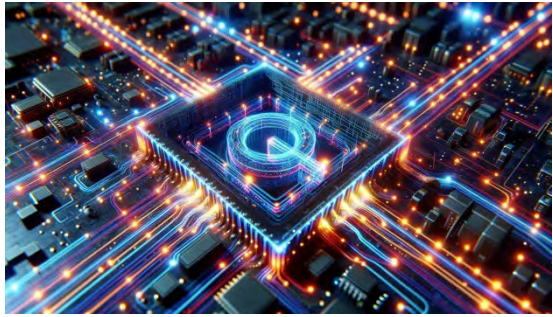


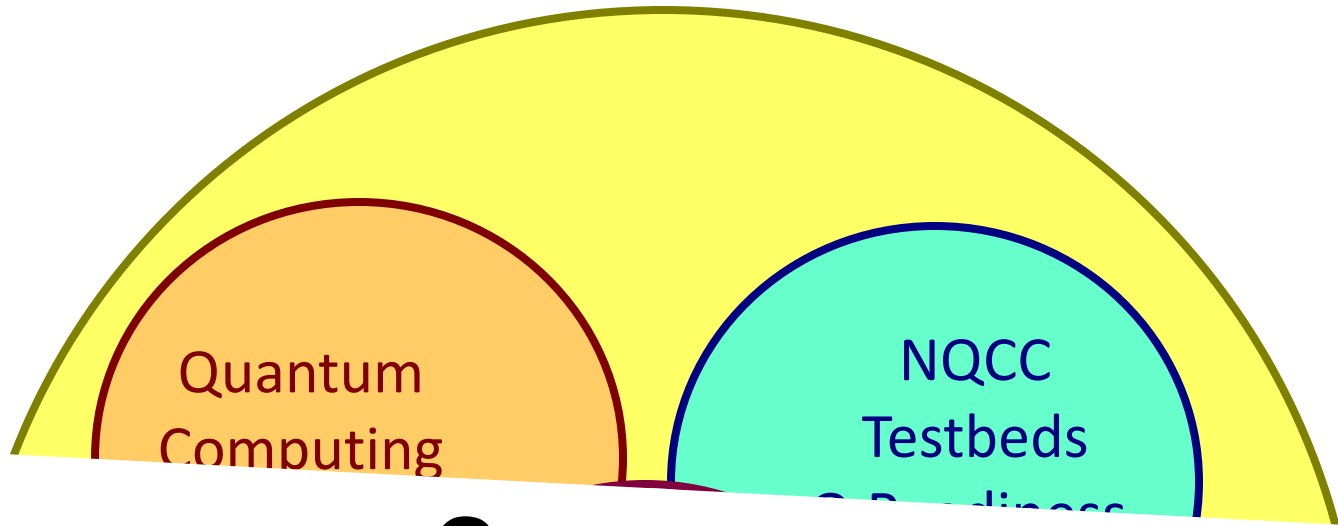
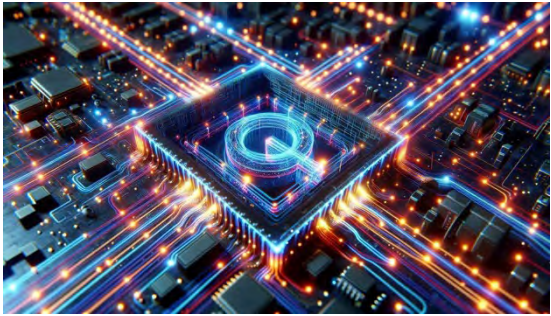
GROWING THE ECONOMY WITH TRANSFORMATIVE SOCIETAL BENEFITS

Quantum Technology	Predicted market size by 2040
Computing	\$45-131 bn
Communications	\$24-36 bn
Sensing	\$1-6 bn

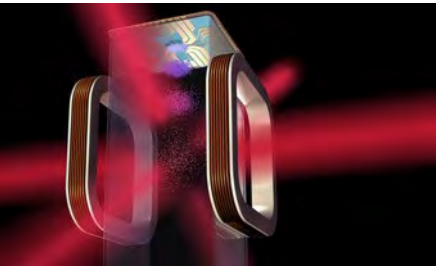
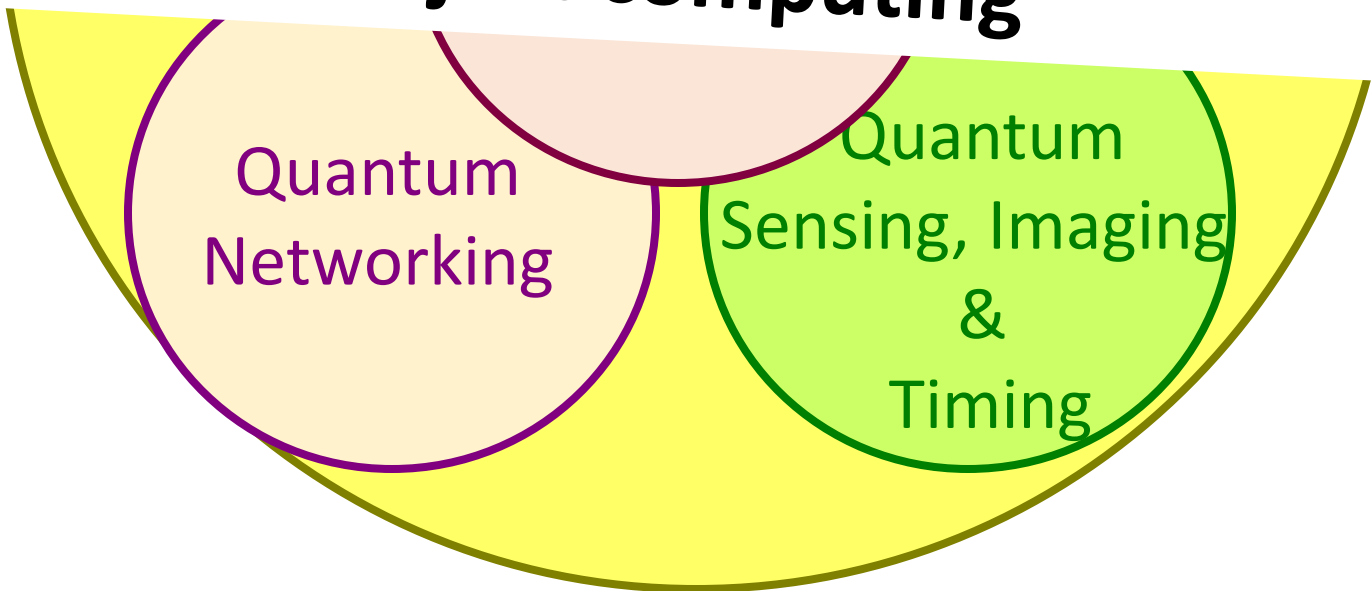
The potential economic value from quantum computing in 2035 is predicted to be between \$0.9 - 2 trillion across major end-user sectors (chemicals, life sciences, finance, and mobility).

Market forecasts from McKinsey Tech Monitor April 2024





Quantum Technologies Not just computing



UK £1.1BN INVESTED SINCE 2014: NEW MODEL OF WORKING TOGETHER



Department for
Science, Innovation
& Technology

Research

44% of spend



- **World-leading research:** 3rd globally for quality and impact, several world firsts and university spinouts
- **Broad set of capabilities:** strengths across all quantum technologies and the supply chain

Innovation

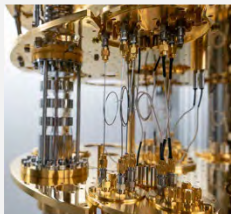
25% of spend



- **High-levels of private investment:** 2nd globally for attracting private investment
- **Thriving business community:** 2nd globally for number of quantum companies, 180 businesses and research organisations collaborating

Infrastructure

22% of spend



- **Facilities to support early research and development** including testing and assurance capabilities pioneered through the National Physical Laboratory, Boulby Underground Lab and the National Quantum Computing Centre to accelerate scaling and readiness

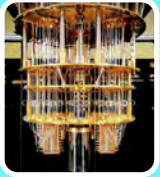
Skills

9% of spend



- **Trained over 570 PHDs since 2014** through a variety of programmes such as centres for doctoral training and doctoral studentship schemes
- **Apprenticeships programme** to train engineers to join the quantum workforce

Quantum Hubs and Missions at scale



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.



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



By 2030, every *NH'S Trust will benefit from quantum sensing-enabled solutions*, helping those with chronic illness live healthier, longer lives through early diagnosis and treatment.



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

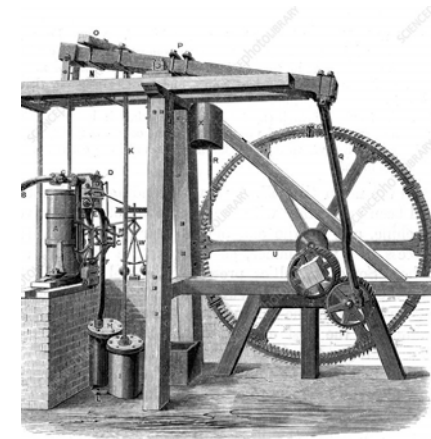


By 2030, *mobile, networked quantum sensors will have unlocked new situational awareness capabilities*, exploited across critical infrastructure in the transport, telecoms, energy, and defence sectors.

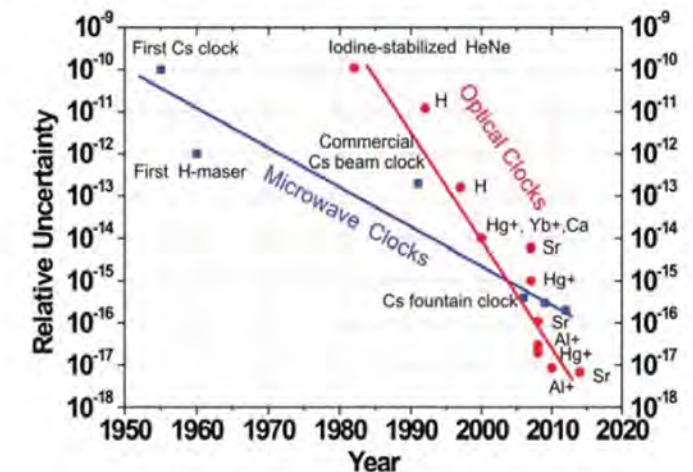
And 5 new Research hubs aligned with these 5 missions

Metro networks -Distribution of timing

- “During the late 1870s, a network of pipes was installed beneath the streets of Paris – not for carrying water, or sewage or gas, but for the distribution of TIME. Underground steam engines pulsed regular bursts of compressed air through the pipes, delivering the exact time of a mother clock to other clocks all over the city. As the pipes belched, the city’s clocks ticked...*”.
- Now we can distribute time around the world from atomic clocks
- Redefine the second
- Economic Resilience and GNSS



Improvement in optical atomic clocks



Messages for today

- Key foci:
 - Great research turning into economic and societal benefit
 - The international picture of rapidly increasing interest and investment
 - Major UK push on Quantum Technology (not just computing!) reflecting our increased ambition: be bold with 10 years support
- Questions to bear in mind for today:
 - Where should we focus efforts for fast and valuable outcomes?
 - How do we scale up? Patient capital, government as an early customer,
 - How best to maintain pipeline of talent and increase public engagement
 - Avoidance of hype: we need help to defeat nonsense