



Department for  
Business, Energy  
& Industrial Strategy

# Quantum Technologies and the UK National Quantum Technologies Programme

Future Sectors Quantum Team

June 2019



# Quantum for the Industrial Strategy

Quantum Technologies underpin our approach to the Industrial Strategy Grand Challenges and drive progress toward the 2.4% R&D target

## AI and Data

Quantum secure communications will ensure that data transfers are secure in the future, supporting UK leadership in AI and data

## Future of Mobility

Quantum sensors for autonomous vehicles will help us to become a world leader in intelligent mobility.

## Ageing Society

Sensing and imaging techniques may help to provide a step-change in the diagnosis of conditions such as Alzheimer's.

## Clean Growth

Quantum computing simulation will help design advanced materials for use in next generation energy products



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# Market Opportunities for Quantum

## Quantum Technologies

- Potential market to be comparable to consumer electronics manufacturing sector, worth £240bn in 2016.

## Quantum Sensing

- Potential \$10bn market for cardiography using quantum sensors (MCG).

## Quantum Communications

- Market for QKD systems is expected to reach \$2.5bn by 2022.



## The Future Sectors Team has three functions

1

### Building R&D Intensive Tech Sectors

We will create and **realise the opportunities for the UK** of new R&D intensive businesses and sectors. This year we will focus on Robotics and Autonomous Systems (RAS), and Quantum Technologies. **Coordination across Whitehall will be critical to achieve this aim**

2

### Tech Transformations

We will bring people and ideas together to identify **disruption trends** and maximise the success of tech change to start and scale businesses – we **experiment, challenge and influence across Whitehall**. This year our focus is **GovTech**. We will support high growth innovative businesses to scale in the UK.

3

### Tech Hub

We will be the place to go for the UK Tech Sector and provide a **centre of expertise on the tech sector** for BEIS across the business environment – working X-Whitehall on, for example, access to talent, access to finance, regulation, trade and investment opportunities, digital innovations supporting SMEs and university entrepreneurship





# Future Sectors Team: Quantum

We provide oversight, strategic direction and co-ordination of activities across Whitehall to support the growth of the emerging R&D intensive Quantum Technologies sector.

We are taking forward three categories of actions to support this:

## Setting the Strategic Direction

- Strategy Development
- New Governance and cross-Whitehall Group
- Mission and challenge development

## Championing Responsible Growth

- Government Demonstrators
- Proportionate safeguards
- Mentoring and business support

## Galvanising support for growth

- Ministerial engagement
- International collaboration and strategy



# UK: A world-leading Quantum nation

At London Tech Week, The Government announced **total UK investment** through the **National Quantum Technologies Programme** is set to pass the major **£1 billion milestone**, since its inception in 2014.

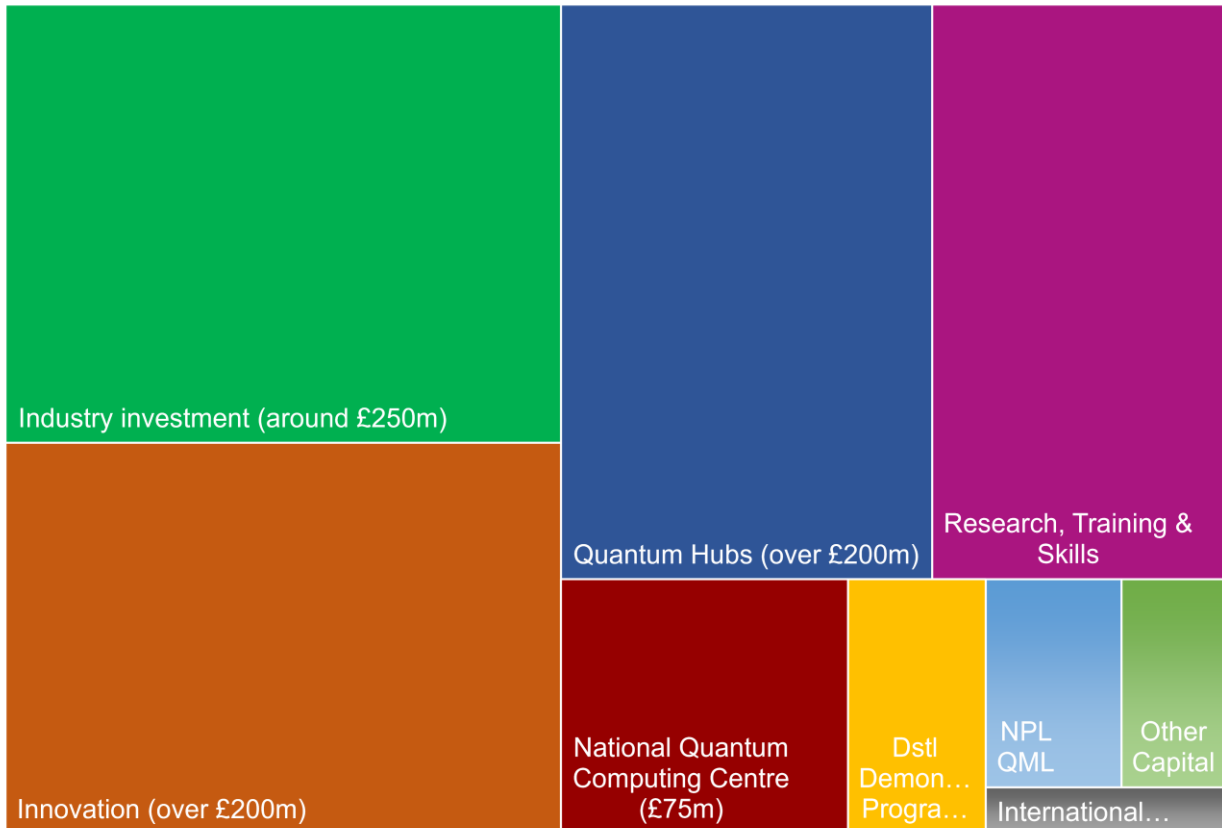


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# National Quantum Technologies Programme (NQTP)



## Total UK £1 billion investments and commitments

- Technology development through the four Hubs, NPL and the NQCC
- Innovation funding to support commercialisation and demonstration.
- Research, skills and training



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# International comparisons

Major current & proposed international funding programmes outside of the UK:

Country/Region	Investment	Details
China	\$10bn	An existing Chinese Hefei mega-project in quantum computing and communications (completing in 2020).
US	\$1.3bn	The US National Quantum Initiative Act (H.R. 6227) from 2019-2023
EU	€1bn	A 10 year European flagship programme announced in 2018.
Germany	€650m	A 2018-2022 Framework Programme to stimulate quantum technologies development and commercialisation.





# UK Quantum spinouts

- **M Squared Lasers:** a world-leading SME in Quantum optic systems – sales are due to reach nearly £20m this year and conducts around 60% of business in USA.
- **River Lane Research:** Quantum software company – recently announced £3.2m seed funding.
- **KETS Quantum Security:** a Quantum communications company – over £2m raised so far.



# International Partnerships: Quantum Comms in Space

- UK STFC's RAL Space and the Singapore Centre for Quantum Technology (CQT) are working together on an innovative small satellite (Qubesat) mission to pioneer quantum communications technology in space.
- Both UK and Singapore governments have each invested £5m on this mission with a view to accessing a potential new market in ultra-secure communications, set to be worth USD \$15 billion

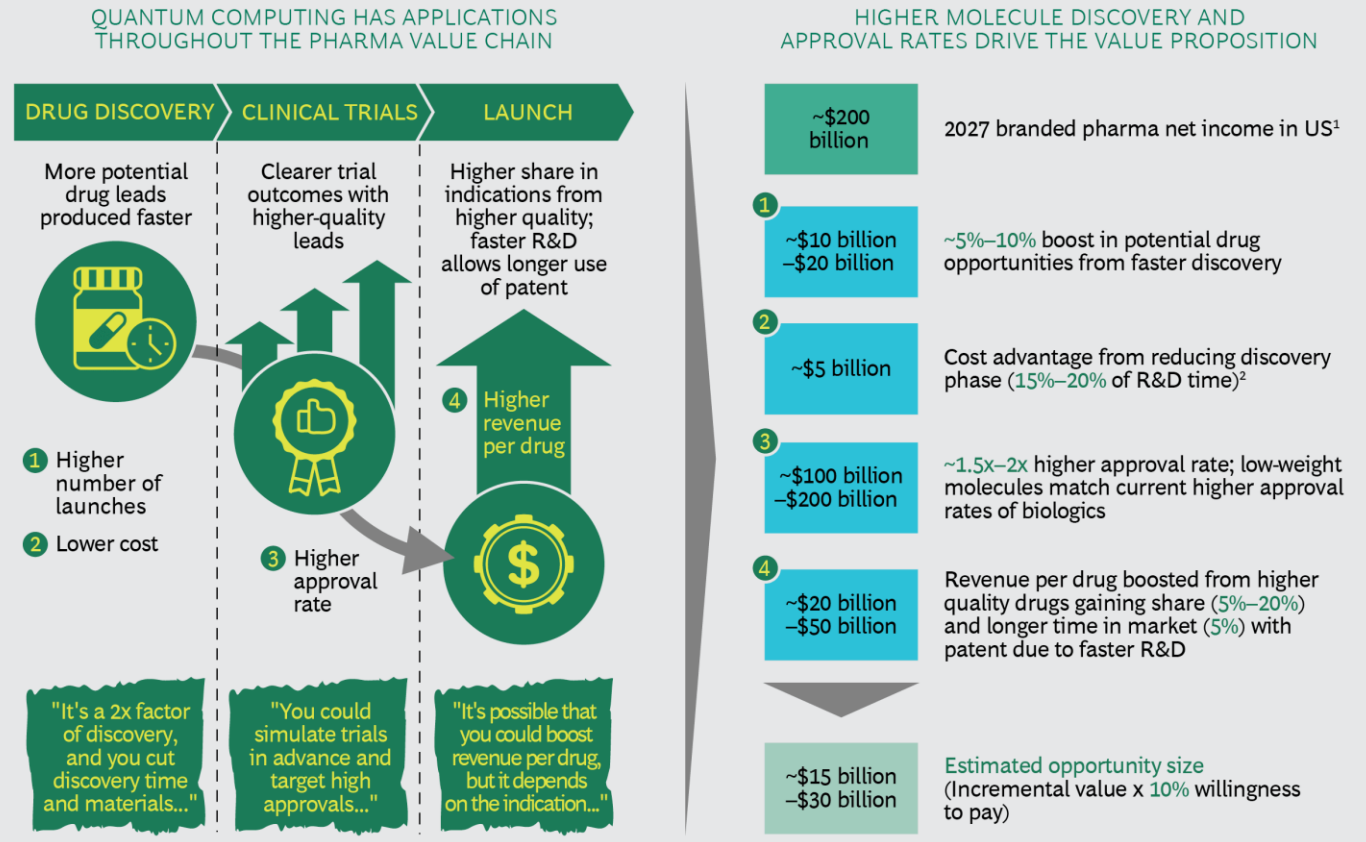


# Quantum Computing

Many end users from the following sectors are now engaging directly with quantum computing companies or academic institutions:

- Banking and Financial systems
- Defence and Aerospace
- Transport and Logistics
- Healthcare and Pharma

## EXHIBIT 2 | Complex Molecule Discovery in Pharma R&D Could Be a \$15 Billion to \$30 Billion Market Opportunity



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Source: BCG, May 2018



# Demonstrator Programme: Quantum for Government

How can HMG be an early adopter of Quantum?

- Gravity sensors for infrastructure
- QKD for secure communication
- Accelerometers for navigation



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