



Office of the Prime Minister's Chief Science Advisor
Kaitohutohu Mātanga Pūtaiao Matua ki te Pirimia

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INTERN RESOURCE: Quantum Computing - Curated list of resources

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1 General reports on the state of quantum technologies

These outline the state of quantum technologies currently.

Title: **Quantum Computing: Progress and Prospects (2019).**

Organisation: *National Academies of Sciences, Engineering and Medicine. (USA)*

Total Pages: 206

URL: <https://www.nap.edu/catalog/25196/quantum-computing-progress-and-prospects>

A summary of the state of quantum computing covering both hardware progress and application aspects. In particular it looks at the potential impacts on cyber security and possible time frames for development of quantum computers.

Title: **The quantum technologies roadmap: a European community view. (2018)**

Organisation: *European Scientists in the quantum computing and related spaces.*

Total Pages: 25

URL: <https://iopscience.iop.org/article/10.1088/1367-2630/aad1ea>

A more technical document that outlines the current progress of various quantum technologies and what challenges need to be overcome according to the scientific community. It gives 3 year, 6 year, and 10 year goals/predictions for the future.

2 Government Research Programs

Several governments have specifically allocated resources towards quantum technologies.

Title: **Quantum Technologies, Twelfth Report of session 2017-2019.**

Organisation: *House of Commons, Science and Technology Committee. (UK)*

Total Pages: 75

URL: <https://www.parliament.uk/business/committees/committees-a-z/commonsselect/science-and-technology-committee/inquiries/parliament-2017/quantumtechnologies-17-19/publications/>

An outline of progress of the UK quantum technologies research programme with strategies for improvement in its continuation.

Title: **The Quantum Age: technological opportunities. (2016)**

Organisation: *Government Office for Science (UK)*

Total Pages: 64

URL: <https://www.gov.uk/government/publications/quantum-technologies-blackettreview>

This report from the Government Chief Scientific Adviser outlines the progress of quantum technologies and opportunities for the UK within the context of the UK's quantum technologies program.

Title: Quantum Technologies Flagship Final Report. (2017)

Organisation: *High-level steering committee*.

Total Pages: 41

URL: <https://ec.europa.eu/digital-single-market/en/news/quantum-flagship-highlevel-expert-group-publishes-final-report>

A policy document on the implementation of the EU quantum technologies flagship, with an outline of the goals, structure, research agenda and governance.

Title: Advancing Quantum Information Science: National Challenges and Opportunities (2016)

Organisation: *Committee on Science and Committee on Homeland and National Security of the National Science and Technology Council*

Total Pages: 23

URL: <https://www.osa.org/en-us/corporate-gateway/publication-report/library/advancing-quantum-information-science>

A brief introduction of quantum technologies and their potential applications as well as discussion of US funding and needed improvements.

Title: National Strategic Overview for Quantum Information Science (2018)

Organisation: *Subcommittee on Quantum Information Science under the Committee on Science of the National Science and Technology Council*

Total Pages: 19

URL: <https://www.whitehouse.gov/ostp/documents-and-reports/>

A policy document on the US quantum information science program. It gives recommendations on the overall approach, funding mechanisms, industry engagement, infrastructure and national security.

Title: Federal Quantum Information Science: An Overview (2018)

Organisation: *Congressional Research Service*

Total Pages: 2

URL: <https://fas.org/sgp/crs/misc/IF10872.pdf>

A short report on the main aspects of quantum computing and the investments going into the space. It also outlines the goals of the current USA program on quantum information science.

Title: **Quantum Hegemony? Chinas Ambitions and the Challenge to U.S. Innovation Leadership (2018)**

Organisation: *Center for a New American Security*

Total Pages: 52

URL: <https://www.cnas.org/publications/reports/quantum-hegemony>

A look by an American bi-partisan think-tank at the Chinese effort in quantum technology development. It gives an account of China's ambitions and policies in the area.

3 Joint Research Centre (EU) potential policy impacts

A few reports by the Joint Research Centre on various quantum technologies as they might relate to policy.

Title: **The Impact of Quantum Technologies on the EU's future policies, Part 1
Quantum Time (2017)**

Organisation: *Joint Research Centre*

Total Pages: 40

URL: <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-researchreports/impact-quantum-technologies-eus-future-policies-part-1-quantumtime>

The report looks at the impact improved time keeping devices might have on EU policy and advocates for development of quantum networks to distribute time keeping for various applications as well as being a backup in case satellite systems fail. Other applications are also discussed.

Title: **The Impact of Quantum Technologies on the EU's future policies, Part 2
Quantum communications, from science to policies (2018)**

Organisation: *Joint Research Centre*

Total Pages: 85

URL: <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-researchreports/impact-quantum-technologies-eu-s-future-policies-part-2-quantumcommunications-science>

Quantum communication technologies potential policy implications are assessed. Quantum Key Distribution (QKD) is a major talking point along with quantum cryptography. There is a review of various countries and companies progress in the area of Quantum communications.

**Title: The Impact of Quantum Technologies on the EU's future policies, Part 3
Perspectives for Quantum Computing (2018)**

Organisation: *Joint Research Centre*

Total Pages: 153

URL: <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-researchreports/impact-quantum-technologies-eus-future-policies-part-3-perspectivesquantum-computing>

A report on a questionnaire sent to various experts in the quantum technologies community about quantum computing on a range of topics such as IT applications, technical, social and economic aspects, and the role of quantum computing.

4 Commercial Aspects

Title: The Commercial Prospects for Quantum Computing (2016)

Organisation: *Networked Quantum Information Technologies*

Total Pages: 48

URL: <https://nqit.ox.ac.uk/content/commercial-prospects-quantum-computing>

This presents a list of companies with interest in quantum technologies as well as those that have directly invested with the monetary amount where available. A patent analysis is also presented.

Title: Patent analysis of selected quantum technologies (2019)

Organisation: *Joint Research Centre*

Total Pages: 24

URL: <https://ec.europa.eu/jrc/en/publication/patent-analysis-selected-quantumtechnologies>

Patents in the field of quantum computing and quantum communications technology are analysed by company, country and year. The report gives a picture of which countries and companies are the main players.

Title: Quantum gold rush: the private funding pouring into quantum start-ups (2019)

Organisation: *Nature*, News Feature

Total Pages: 3

URL: <https://www.doi.org/10.1038/d41586-019-02935-4>

A brief discussion on an analysis of investing for quantum technology. The feature explores the geography of investing and patent applications.

5 Post-Quantum cryptography

Title: **Report on Post-Quantum Cryptography (2016)**

Organisation: *National Institute of Standards and Technology*

Total Pages: 15

People: National Institute of Standards and Technology.

URL: <https://csrc.nist.gov/publications/detail/nistir/8105/final>

The threat of quantum computing for current cryptography methods is discussed. Potential new methods which are "Quantum safe" are outlined and NIST indicates their intention to begin calling for proposals on new cryptography standards that are quantum safe.

Title: **Post-Quantum Cryptography Standardization (Website)**

Organisation: *National Institute of Standards and Technology*

URL: <https://csrc.nist.gov/Projects/Post-Quantum-Cryptography/Post-QuantumCryptography-Standardization>

The NIST website has links for all their ongoing efforts towards developing quantum safe cryptography standards.

Title: **Quantum Safe Cryptography and Security. An introduction, benefits, enablers and challenges (2015)**

Organisation: *European Telecommunications Standards Institute*

URL: <https://www.etsi.org/technologies/quantum-safe-cryptography>

A white paper from ETSI that gives a broad view of how the cyber security space would be compromised by a large scale quantum computer. Different solutions for dealing with this are covered and the vulnerabilities of current security protocols are discussed.

Title: **Quantum-Safe Cryptography (Website)**

Organisation: *European Telecommunications Standards Institute*

URL: <https://www.etsi.org/technologies/quantum-safe-cryptography>

The ETSI website has links to various white papers on quantum-safe cryptography as well as updates to ongoing work and events.

6 Research Organisations

Title: **Centre for Quantum Computation and Communication Technology (Website)**

Organisation: *Centre for Quantum Computation and Communication Technology*

URL: <http://www.cqc2t.org>

The website for an Australian research centre of excellence in quantum computing and communications. It has links to their latest news, events and research.

Title: **Institute for Quantum Computing (Website)**

Organisation: *University of Waterloo*

URL: <https://uwaterloo.ca/institute-for-quantum-computing/>

The Institute for Quantum Computing (IQC) is a scientific research institute at the University of Waterloo.

7 Quantum Computing Simulators and Cloud Quantum Computing services

Title: **IBM Q (Website)**

Organisation: *IBM*

URL: <https://www.research.ibm.com/ibm-q/>

The website IBM's quantum computing business. You can learn about quantum computing and play with their 5 qubit simulator, as well as gain access to their cloud quantum computing service.

Title: **D-Wave (Website)**

Organisation: *D-wave Systems*

URL: <https://www.dwavesys.com/home>

D-Wave systems website where they offer cloud quantum computing services. There is also some material on what applications can run on the D-Wave computer.

Title: **Quantum Computing Playground (Website)**

Organisation: *Google*

URL: <http://www.quantumplayground.net/#/home>

A browser-based application where you can program a simulation of a quantum computer with up to 22 qubits.

8 Other

Title: **Assessment of the Future Economic Impact of Quantum Information Science (2017)**

Organisation: *Institute for Defense Analyses Science and Technology Policy Institute*

Total Pages: 133

URL: <https://www.ida.org/-/media/feature/publications/a/as/assessment-of-thefuture-economic-impact-of-quantum-information-science/p-8567.ashx>

A long report on quantum information science and its different areas as well as the current investment and progress by both industry and governments.

Title: **Quantum computers: The next supercomputers, but not the next laptops (2018)**

Organisation: *Deloitte*

URL:

<https://www2.deloitte.com/insights/us/en/industry/technology/technology-media-and-telecom-predictions/quantum-computing-supremacy.html>

A technology consulting style of article by Deloitte on quantum computing. It predicts how the market will grow and advises businesses to get involved early.

Title: **MIT Technology Review: Quantum Computing (Website)**

Organisation: *MIT Technology Review*

URL: <https://www.technologyreview.com/computing/quantum-computing/>

A section of the MIT Technology Review website dedicated to quantum computing news.

Title: **Quantum Computing Report (Website)**

Organisation: *Quantum Computing Report (Doug Finke, Managing Editor)*

URL: <https://quantumcomputingreport.com>

A website which collates news and other resources about quantum computing.

Title: **Think Beyond Ones and Zeros, Quantum Computing. Now.)**

Organisation: *Accenture*

URL: <https://www.accenture.com/nz-en/insight-quantum-computing>

A report by the consultancy firm Accenture on quantum computing. It briefly describes and discusses potential applications of quantum computing.