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Australian Academy of Science submission on the National Quantum Strategy consultation paper

The Australian Academy of Science welcomes the opportunity to comment on the Consultation Paper *Australia's quantum advantage* for the National Quantum Strategy. The Consultation Paper is a good foundation for the Strategy. Further work on tightening the objectives to reflect the specific circumstances of quantum technologies would be advantageous.

The Academy:

- Suggests a stronger conceptualisation of quantum technologies targeted by the Strategy would enable the targeting of quantum-specific initiatives
- Urges recognition that a robust funding model and strategy is required to achieve the quantum workforce objective

[Need for stronger quantum definition and narratives](#)

Consideration needs to be given to the Consultation Paper's definition and use of 'quantum technologies'. An overemphasis on quantum computation may mean Australia fails to engage sufficiently with other quantum technologies or emerging areas of interest (such as quantum materials or quantum optics). At the same time, a definition that is too broad has disadvantages—many principles and applications of nuclear physics could be included under a broad definition of 'quantum technologies'. A robust framework could also reflect the hierarchy of advantages that exists in Australia; it appears Australia has the greatest capability and/or opportunity in quantum computation, followed by quantum networking and quantum sensing.

Additionally, the Strategy should give greater prominence to the importance of interdisciplinarity. Developments in quantum science are leading to new quantum technologies and applications, for instance in medical and/or biological fields. There is an opportunity to recognise this potential and develop frameworks for supporting it.

The Consultation Paper suggests that initiatives under Objective 1 could include increasing awareness of Australia's quantum ecosystem. The Academy supports this and suggests that developing and publicising case studies of successful quantum technology initiatives would help deepen awareness. Furthermore, these case studies should highlight areas where Australia has or should have an advantage in quantum technologies. For instance, quantum technologies are currently used for mining exploration, which is of special interest to Australia given our abundant mineral resources and the Australian Government's interest in expanding critical mineral supply chains.

[A quantum workforce requires a larger academic base](#)

Achieving the workforce objectives of the National Quantum Strategy will require a robust funding model and strategy. If the research base in Australia is not expanded, there will not be workforce capacity to achieve the desired growth in training or research translation.

The Academy strongly supports the suggestions in the Appendix under 'Talent pipeline to support the quantum industry' and suggests they be brought into the main document. In addition to these suggestions, partnerships with universities and TAFE/vocational education providers for quantum-ready graduates must also consider quantum upskilling and training for technicians and professionals in allied technical fields (such as manufacturing or system engineering) and end-user fields (such as computer science, chemistry, medical sciences, or financial services).

Recognition in the Consultation Paper of the importance of inclusion and diversity in the quantum industry is welcome. The Strategy should align with the findings of the review of STEM pipelines currently underway, led by the Department of Industry, Science and Resources.

Support for quantum research and commercialisation should be awarded on a strategic basis

Careful consideration should be given to determining principles for who is awarded public funding attached to the National Quantum Strategy. The Academy welcomes the recognition of the need for 'patient capital'. Funding should be broad, inclusive, and scalable. It should be designed to build truly national capabilities by bringing research communities together rather than encouraging an overly competitive atmosphere and use Australian Government procurement to help build domestic capability.

The Academy welcomes the Consultation Paper's consideration of creating a healthy environment for the development, commercialisation and use of quantum technologies. The Strategy should include a much greater emphasis on creating an environment that supports easy start-up creation. There should also be a much stronger emphasis on initiatives under this objective to assist translation so that start-ups avoid the well-documented challenges of fully realising commercial opportunities.

Fundamental research & allied technical support are important and inextricably linked

Fundamental research and allied technical support are strongly linked and strong support for both will be critical to achieving the objectives of the Consultation Paper. A model for funding ongoing allied technical support for research efforts is required, particularly:

- **Software engineering** to support both theoretical software & applications development as well as experimental control systems development
- **Electronics engineering** to support building complex quantum hardware and control systems
- **Manufacturing and fabrication expertise** to support experimental hardware and nanofabrication

Quantum computing infrastructure requires high performance computing

The Strategy should recognise the importance of high-performance computing (HPC) as a necessary component of enabling access to world-leading quantum infrastructure (Objective 2). At this stage of quantum computing development, conventional computing is still required for emulation and design. Additionally, as quantum applications are developed and scaled up, Australia will still require HPC capacity to support this in addition to the current role of HPC.

Quantum applications should receive greater emphasis

To address the Objectives proposed in the Consultation Paper, particularly 3, a National Quantum Applications Institute should be established to recognise and drive the development of quantum algorithms, control protocols, applications, and related opportunities, with a strong recognition of the importance of theory and algorithms development. Designing, benchmarking and optimising quantum applications and algorithms that can be licensed to run on hardware globally could represent a substantial opportunity for Australia.

To discuss or clarify any aspect of this submission, please contact Mr Chris Anderson, Director Science Policy at Chris.Anderson@science.org.au.