14 June 2022

Submission to the Department of Industry, Science, Energy and Resources consultation on the National Quantum Strategy

The Australian Academy of Science (the Academy) welcomes the opportunity to respond to the Department of Industry, Science, Energy and Resources consultation on the *National Quantum Strategy issues paper*.

The Academy:

- **Highlights Australia's significant capacity in quantum research and the growing quantum industry.**
- **Recommends continued, robust, long-term support for research and development and industry development in quantum sciences**
- **Recommends a sustained, whole-of-system investment in the quantum sector to develop significant commercial, economic and strategic advantages for Australia**

The quantum context

Today, a new quantum revolution is taking place. Australia occupies a strong position in quantum sensing, quantum communication, quantum simulation and quantum computing applications. This was achieved by leveraging a first-mover advantage brought about by establishing, in the year 2000, the ARC's Special Research Centre for Quantum Computer Technology that ultimately morphed into the contemporary Centre of Excellence for Quantum Communication & Computation Technology. This strong sovereign investment has allowed a mature quantum ecosystem with considerable research talent to develop locally.

We should learn from our history, however: Australia was highly competitive in quantum research after the turn of the millennium but lost its early advantages by failing to support the transition from research to industry. Without the continued support and significant investment for fundamental research in STEM fields, and its applications, our strong position will be lost, again.

It is concerning that Australian investment is not keeping up with the rapid proliferation of quantum technology and the growth in the industry. Australia now has the slowest growth in sovereign funding out of the top 11 countries investing in quantum technology. [See: An Australian strategy for the quantum revolution]

Economic impact

Australia has a developing quantum science commercial sector, with mature quantum sensing and quantum communication technologies with well-understood pathways to commercialisation. There is also significant domestic expertise in quantum simulation and computing, technologies with longer paths to market. Support for this sector should focus on research translation, with support for research and development, startups and spinouts, and commercial expansion. Funding scales should reflect the economic importance, and disruptive potential, of quantum technologies. This is best achieved through flexible, long-term, investment that recognises the variable time scales and long-term benefits of technology development will provide the greatest advantages.

Given the importance of quantum technologies to Australia's future sovereignty, our close relationship with strategic allies should be leveraged in the fields of quantum communication and computation; the two applications with urgent national security implications. Two promising routes followed by other nations are to extend our current security partnerships (such as the Five Eyes Network or AUKUS) or develop new diplomatic arrangements with our strategic partners to foster shared, open, research between our partners whilst bringing economic prosperity to Australia.

Facilitating the Quantum R&D ecosystem

To facilitate Australia's already competitive quantum industry, policy initiatives will need to span short, medium and long timescales. Further, policy must encompass all R&D levers, as quantum technology is a field that unites fundamental and applied research to commercial solutions over widely varying timeframes.

Australia requires a systematic framework to incentivise business investment in quantum R&D and could benefit from adopting schemes in place in countries like the US and Japan. However, any incentive schemes need to consider that quantum technology is a long-term investment. For example, Japan's National Institute for Quantum Science & Technology is a strong exemplar for the Australian context, as project timeframes are often considered over a decadal, and even multi-decadal, period. This leads to close relationships between university and government research institutions and industry, and ultimately facilitates technology development. Bringing this enhanced degree of business and university/government R&D collaboration to the ARC's quantum Centres of Excellence (CQC2T, EQUS, FLEET) is a natural first step to recreating the Japanese approach.

Direct and indirect initiatives to incentivise R&D needs to be met with investment to close the STEM skills gap. As quantum technology is far-reaching, Australia needs to enhance participation in the primary fields responsible for quantum technology (physics, engineering, mathematics, computer science) as well as the peripheral fields (biomedicine, chemistry and materials science). This will require a national science, technology, engineering and mathematics skills strategy, covering fundamental and higher education, science literacy, workforce skills and talent recruitment. Improving and broadening skilled immigration mechanisms, such as the Global Talent Visa Program, will allow Australia to maximise the effectiveness and economic benefits of our quantum technology capabilities, and technology capabilities more widely.

Further, a national quantum strategy cannot be considered separately from Australia's broader science and research system. It must be seen as an integral part.

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