



Australian Government

Chief Scientist

DR CATHY FOLEY AO PSM

**COMMERCIALISING QUANTUM GLOBAL 2023
CONFERENCE**

Australia's expertise and offering in quantum

**Thursday 18 May 2023
London, UK**

I'm sorry I wasn't able to join you in person in London, but I'm pleased to be able to deliver this message at a very timely moment for us in Australia. As you know, we have decades of patient investment and fundamental research in quantum science in Australia. As a result, we have built strong expertise and deep international relationships that are part and parcel of our quantum ecosystem. We have a number of home-grown start-ups and quantum companies that work hand in hand with our research sector on near-term applications in exciting areas, and longer-term quantum possibilities, including quantum computing. Just this month, the Australian Government released a National Quantum Strategy, which is designed to ensure we capitalise on these foundations and drive these quantum technologies forward with speed, energy, as well as with our ambition.

When I was an early career physicist in the 1980s, my research into superconducting quantum interference devices, or SQUIDs - which is one application of quantum physics - was seen as niche and possibly not that useful outside the lab. So it is incredible for me that what was once seen as only great physics is now integral to the Australian Government's agenda to build a stronger economy and create sustainable, well-paid jobs, as well as creating new technologies that will have an extraordinary impact on society. I am anticipating an explosion in understanding and capability across medicine, materials science, climate science, and so many of the sectors that will attract the attention of all of us over the coming decades. You don't need me to tell you that quantum technologies will be nothing short of transformational.

It may be surprising for you to note that Australia has had its finger on the quantum pulse since 1959 when Richard Twiss and Alex Little published the first paper on time-correlated photons. And since 2002, we have invested in quantum research with sustained combined public and private investment to the order of \$1 billion. It has been successful because of this patient public investment in basic research, the lure of world-leading educational institutions and some unique Australian skills and know-how.

The Australian National Quantum Strategy recognises the importance of commercialisation opportunities, having robust infrastructure, developing a skilled workforce, having clear standards and most importantly, community trust. Australia wants to be well-positioned to capitalise on the research that is making its way out of the lab. Our relatively newly developed entrepreneurial spirit is generating new start-ups and attracting major companies to set up here. Our vision for quantum in Australia is that by 2030, Australia is recognised as a leader in the global quantum industry, and quantum technologies are integral to a prosperous, fair and inclusive Australia. The strategy has five themes – looking at investment, the infrastructure needed, growing the workforce, developing the standards and ethics, and considering that this is an inclusivity opportunity – not something for just a few.

I want to talk about two of these themes in more detail today. We all know that no one country can deliver the quantum opportunity alone. We need thriving research and development that builds on collaborations of smart people working together across the different boundaries of institutions and jurisdictions – both locally and internationally. We need to create something that can be invested in, and we need cases and applications of quantum technologies. The Australian Strategy has lots of

case studies that bring the quantum capability alive. Some home-grown, commercially available, or almost ready to be commercialised capabilities are here now, such as: quantum sensors that detect underground water leaks without digging, lowering costs and actively monitoring for leaks; early-stage quantum computation optimising supply chains and public transport; and using quantum optimisation to enable increased energy density of batteries, supporting the energy supply transition to renewables.

We have 28 quantum-focussed companies in Australia, consisting of 22 start-ups and six multinationals with Australian operations working on quantum. But there's more to be done. We know this sector faces the challenge of attracting more early-stage patient capital. We have to strengthen coordination to connect ideas and solutions to businesses and investors. We need to demonstrate that quantum technologies actually do improve commercial outcomes and address currently intractable challenges. We need quantum researchers and businesses to demonstrate their strengths and attract investment. And we need to support the near-term demonstration of market-ready products and solutions, as well as the long-term applications for the relevant industries.

Australia has a small domestic market and a smaller pool of venture and non-dilutive capital. This means that quantum companies must access overseas markets and investment as well as attracting quantum businesses to set up in Australia, such as Inflection did recently. As I mentioned, we are focussed on making sure Australia is investor ready – and I've been pleased to see the investments that the global quantum firms are making. Last year, Google partnered with four Sydney universities as part of its Digital Future Initiative, a \$1 billion investment in Australia's digital economy, championing Australian-made technology.

We are also focussed on deepening international cooperation through the AUKUS and QUAD groupings, and other bilateral arrangements. For example, AUKUS has an initial focus on quantum technologies for positioning, navigation and timing, with plans to integrate emerging quantum technologies in trials and experimentation over the next three years. We have a range of collaborations beyond our borders. For example, the Centre for Quantum Software and Information at the University of Technology Sydney is working with DARPA in the US on its quantum benchmarking program. The program assesses the performance of quantum computing algorithms and applications and will create new tools and techniques to measure progress towards transformational quantum computational challenges.

Australia is also a founding partner of the Entanglement Exchange, a multinational portal for highlighting international exchange opportunities for students, postdocs and researchers in quantum information science. Just as we have seen with the Internet and the first wave of digital technologies, quantum capabilities won't recognise borders. International collaborations are critical to getting the settings right, maximising the potential at speed and scale, and ensuring we don't leave people behind. In Australia, we are investing in quantum through programs such as the Australian economic accelerator – a new \$1.6 billion stage-gated grant program dedicated to funding translation and commercialisation. We also have the \$15 billion National Reconstruction Fund, of which \$1 billion is earmarked for critical

technologies such as quantum. This fund provides finance such as loans, guarantees and equity to drive investments.

These are just two examples of the spectrum of programs providing support across the value chain, from fundamental science to commercialisation. The aim of these programs is to help Australia develop our quantum talent pipeline and accelerate collaboration while delivering economic outcomes. Australia is a federation of eight states and territories. Our strong quantum foundations include capabilities and engagement across all of them. Australian state and territory governments recognise the benefits of quantum technologies. They are driving efforts to grow research, to grow businesses and to attract international investment. Our national approach ensures these efforts are harmonised and complementary.

The second theme I want to focus on is Australia's uncompromising determination to build a trusted, ethical and inclusive quantum ecosystem. Quantum technologies present near-boundless opportunities, but these opportunities must serve the interests of Australian society and contribute to our national wellbeing. The Australian public is increasingly aware of the ethical and societal implications of technological advances. We should not presume an enthusiastic embrace of quantum technologies; we must build a social licence. To do this we must have principles for responsible development and use. We want the culture of our quantum ecosystem to be one where quantum researchers and developers have a sound basis to develop technologies that are aligned to Australian values and protect human rights. In adopting this approach, Australia can cement itself as a responsible technology developer, creating a strong brand which attracts international companies and investors – something we are proud of.

Standards for quantum technologies will be important for providing Australians and the world with the confidence they are being developed and deployed in a way that is trusted, secure, and to their benefit. Technology standards, underpinned by trusted measurement, will foster the growth of this sector. It will create a competitive supplier market, giving industry the confidence to adopt new technologies and ensure global interoperability. Standards will provide the consistency as well as the opportunities Australian companies are seeking as they develop and reap the benefits of this technology.

To maximise the opportunities from quantum, we must also push for greater inclusion and diversity. Already, we've seen global issues with accidental bias within AI training, and the unintended consequences if left unchecked. The development of quantum technologies must come with the development of a diverse workforce. This is the most effective safeguard against such bias. We must pursue measures to lift the participation of women, First Nations peoples and other underrepresented groups. The quantum opportunity is immense for all of us, and it's moving with incredible speed.

In the 40 years of my career, the field of quantum has risen from niche physics to being a driver of the global innovation powerhouse. In another 40 years, the sky is the limit. Australia is absolutely committed to being a leading part of the quantum rising tide. We have the history, the skills and world class start-ups and partner companies. We are strongly connected globally, and we welcome international

partners to join us on achieving our ambition. Australia's quantum ambitions are high, and our vision is clear. Australia's National Quantum Strategy is a big step forward in building a quantum economy. I can't wait to see the leaps of innovation and discovery that this new quantum revolution has in store for us.