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# Written Submission for the Pre-Budget Consultations in Advance of the Upcoming Federal Budget

By:

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### Our Recommendations:

- **Recommendation 1:** That the government implement a Quantum Technology Task Force or Advisory Board in order to coordinate efforts across the whole of government to ensure Canada maintains research leadership in this strategic field of technology, and seizes as much opportunity as possible for the benefit of all citizens.
- **Recommendation 2:** That the government continue to provide funding in at least the current annual amounts for the quantum research programs at UBC, Waterloo and Sherbrooke, currently supported by the CFREF program.
- **Recommendation 3:** That the government task a national research agency like Compute Canada with the establishment of a Quantum Computing Access Centre to fund and facilitate cloud access to quantum computers for all Canadian academic researchers.
- **Recommendation 4:** That the government create a national Quantum Technology roundtable or industrial conference, to share with the Canadian private and public sectors the potential benefits of adopting quantum technologies in their organizations and facilitate connections between Canadian quantum technology providers and Canadian users or customers.
- **Recommendation 5:** That the federal government financially support the establishment of a quantum computing research institute, similar to the Vector Institute, in the Toronto area, to build upon the world-class cluster of quantum research expertise in the city.
- **Recommendation 6:** That the federal government mandate BDC to create a dedicated Quantum VC fund, to support Canadian startup companies commercializing quantum technologies.

**Background Information:**

Quantum mechanics emerged early in the last century led by the discoveries of intellectual giants like Albert Einstein, Niels Bohr and Max Planck. Although highly counter-intuitive, it has proven to be an extraordinarily accurate guide to understanding physical reality. This movement came to be known as the first quantum revolution. Its insights led to many of the technological advances that have shaped modern economies, such as transistors, semiconductors, lasers and light emitting diodes (LEDs).

We are now at the early stages of a second quantum revolution when science is moving beyond understanding quantum reality to engineering it to achieve desired outcomes. This second quantum revolution promises to unlock as many exciting new technologies and economic opportunities as the first. While quantum computing receives much attention, and is the focus of Xanadu's efforts at this time, it is only one element of the revolution's potential impact. Quantum technology is transformational, creating a wide variety of applications. Promising areas include IT security; data security; encrypted data transfer; medical imaging; navigation; satellite earth monitoring; artificial intelligence/machine learning; pattern recognition; the development of novel materials and drugs; automation; advanced manufacturing and many others.

Xanadu is a Series-A startup based in Toronto, launched in 2016. Xanadu's core products are centered around the creation of photonic quantum computers, which are currently in beta testing via cloud interfaces with researchers at US national labs. In addition to the computing hardware, Xanadu's team of more than 60 staff also develops advanced AI software tools, and quantum computing software tools, to offer complete solutions to partners and customers. For more information about Xanadu, please visit our website: [www.xanadu.ai](http://www.xanadu.ai)

**Recommendation 1: Quantum Advisory Board**

The world is at the beginning of the second Quantum Revolution, which will result in the development and deployment of revolutionary quantum technologies, based upon the scientific discoveries of the past century. Major economies of the world, including the USA, China, Japan, EU, UK and South Korea, have all identified quantum technologies as strategically important, and have adopted national strategies or frameworks. Many of them have dedicated billions of dollars of funding to quantum technology R&D and commercialization. We urge the government to create a Quantum Advisory Board or Task Force, to ensure a coherent national strategy which involves all areas of government: research, education, industry, trade, digital government, transportation, health, defence, etc.

**Recommendation 2: Continue Supporting Existing Research Centres**

Canada has a long history of nurturing world-class academic research in quantum science at our universities. The CFREF program was a welcome catalyst which solidified the international stature of the quantum research programs at UBC, Waterloo and



Sherbrooke. Many of our highly qualified team members have graduated from these programs and other Canadian universities. We urge the government to continue funding these research centers past the expiration of the CFREF program, to ensure the scientific critical mass is not dissipated, and the highly sought-after talent is not pulled away to other centers around the world.

### **Recommendation 3: National Quantum Computing Access Centre**

Our Canadian competitor, D-Wave Systems, was started in Canada nearly 20 years ago, and has yet to make significant sales or build a strong user base within Canada. At Xanadu we also find that the most ready customers for our computers are researchers in the USA, rather than in Canada, despite the strong interest from many individual professors we speak with at a number of Canadian universities. We urge the government to create a National Quantum Computing Access Centre, through Compute Canada or another similar national organization, which can centralize and coordinate the provision of quantum computing access for the Canadian academic research community. Without access to these new machines, Canadian researchers will lose their ability to innovate new algorithms and applications of this groundbreaking technology. It will be impossible to train the future workforce of quantum programmers, without access to the machines like those of D-Wave and Xanadu.

### **Recommendation 4: National Quantum Technology Roundtable**

Traditional, resource-based Canadian industries are not historically known for their innovative adoption of new technology, and the government has created many programs to encourage digitalization of manufacturing and resource industries, and also newer, cleaner technology adoption in the energy and other heavy industries. Quantum technologies in computing, communications and sensing have the potential to make exponential improvements in many industries, including: chemicals, materials, logistics, transportation, electricity grids, transit systems, wireless networks, financial portfolio analysis and optimization, remote sensing, exploration, border security, and improved communication security. We urge the government to convene national roundtable discussions, perhaps led by the NRC, to bring together the Canadian researchers and companies developing these new technologies, along with the traditional industries and government bodies of Canada who stand to benefit from adopting them, for mutual education and information sharing, roadmapping, benchmarking and strategic planning.

### **Recommendation 5: New Quantum Computing Institute in Toronto**

The University of Toronto is the leading research institution in Canada, and one of the top research universities in the world. Many world-class scientists in quantum physics, chemistry, computer science, and electrical engineering are currently part of the Centre for Quantum Information and Quantum Control (CQIQC) at the university. British Columbia has recently announced the creation of a new institute dedicated to the study of Quantum Algorithms, and we encourage the government to build upon the existing strengths of the quantum research programs at the CQIQC, through the funding of a new, world-class research institute, focussed on quantum computing. Such an institute will



leverage not only the existing quantum expertise, but also the world-class artificial intelligence and machine learning research communities in the city. The tech industry in Toronto is also the fastest growing in North America, hiring more than San Francisco or Boston. We request the government fund the establishment of a new quantum computing institute built on Toronto's 3 pillars of quantum research, artificial intelligence, and a thriving tech industry, to create a center of excellence with global impact.

**Recommendation 6: Dedicated BDC Quantum Venture Fund**

Although there is no major international firm developing and selling quantum-based technology from Canada, a number of the world's most promising start-ups are based here. Xanadu and our peer firms are now actively shaping our business models; refining our products and services; undertaking research and development; and developing networks of customers.

To date, Canadian firms like Xanadu have been successful at raising risk capital from primarily domestic funds like BDC, OMERS, Georgian Partners and Real Ventures, without having to leave the country. In order to ensure a strong "Quantum Startup" ecosystem in Canada, we request that the BDC be mandated to establish a specialist quantum technology venture capital fund. Such a fund will help ensure the ongoing creation of a whole cluster of Canadian startups in all areas of Quantum Technology, and help to keep the technologies and talent coming from our research universities within the country.

On behalf of our company, I sincerely thank you for your consideration of these recommendations, and I would welcome the opportunity to discuss them with you further.

Kind regards,

Christian Weedbrook, CEO