

**Written Submission for the Pre-Budget
Consultations in Advance of the 2021 Federal
Budget**

By: D-Wave Systems Inc.

August 7, 2020

Recommendation 1: That the Government of Canada, in partnership with D-Wave, develop and fund a superconducting fabrication centre in Canada to supply the domestic quantum industry and beyond.

Recommendation 2: That the Government of Canada support the adoption of quantum applications across Canada by setting targets and committing \$25 million towards these applications by 2023.

Recommendation 3: That the Government of Canada offer tax incentives to Canadian businesses using quantum technology.

D-Wave is the leader in the development and delivery of quantum computing systems, software, and services and is the world's first commercial supplier of quantum computers. A company proudly founded and based in British Columbia, D-Wave Systems Inc. is passionate about highlighting Canada's leadership in quantum computing. With a continued mission to integrate new discoveries in physics, engineering, manufacturing, and computer science among others, D-Wave is focused on breakthrough approaches to computation to help solve some of the world's most complex challenges – and the related solutions that have the potential to deliver significant social and community impact.

D-Wave is also committed to assisting with the global response to COVID-19. In order to support and augment the efforts being undertaken by governments around the world including here in Canada, D-Wave has donated access to its quantum computers to individuals engaged in research pertaining to COVID-19 mitigation and response. Our systems are unlike any others in the world and we know that access to them can enable faster computation, results generation and better and more informed decision-making, at a time when speed is everything.

As background, D-Wave's 2000Q™ system use a process called quantum annealing to search for solutions to a problem which is fundamentally different from classical computing. It harnesses the natural tendency of real-world quantum systems to find low-energy states. For quantum effects to play a role in computation, the quantum processing unit (QPU) requires an extreme, isolated environment. The closed cycle dilution refrigerator and layers of shielding create an internal high vacuum environment with a temperature close to absolute zero that is isolated from external magnetic fields, vibration, and RF signals of any form. While traditional supercomputers generate massive amounts of heat and consume massive amounts of power, the D-Wave system consumes less than 25 kW of power, most of which goes towards operating the cooling system and front-end servers.

Recommendation 1: That the Government of Canada, in partnership with D-Wave, develop and fund a superconducting fabrication centre in Canada to supply the domestic quantum industry and beyond.

D-Wave recommends the Government of Canada continue investing in the long-term growth of the country's technology and innovation industry by creating a quantum supply chain in Canada. The Canadian government should be focused on preserving Canadian intellectual property as well as its global leadership position in quantum computing. One way to continue to stake Canada's position as the international leader is by investing in a superconducting fabrication centre owned by a Canadian company and housed in Canada. D-Wave is a world leader in superconducting fabrication and by utilizing D-Wave's expertise, a federal investment in a fabrication centre would mean creating that capability within Canada. Currently, vital components needed to build quantum systems – including D-Wave's - are manufactured and purchased outside of the country due to lack of availability and capacity here in Canada. Given the volatility within the North American supply chain, sole reliance on imports to supply the quantum industry in Canada poses a risk to the quantum industry and subjects Canada to US export controls, for example.

Taking quantum investment to the next level will not only fully leverage other public and private investments already made in quantum technology but will solidify Canada's position in this space. There is also an opportunity to leverage Canadian expertise and Canadian technology to further develop superconducting fabrication expertise – not just for quantum computing but for other superconducting computation devices and applications.

Many other nations are investing heavily in quantum technology and without focused investment, Canada could lose the opportunity to remain a leader in this space. By fabricating necessary quantum hardware at home, Canada could supply the Canadian quantum market, bolster research and academic applications of the technology across the country while generating a supply chain to international markets. By doing so, Canada would create a foothold in this emerging technology market.

Recommendation 2: That the Government of Canada support the adoption of quantum applications across Canada by setting targets and committing \$25 million towards these applications by 2023.

The Government of Canada should focus on the commercialization and procurement of quantum technology which would serve both those developing quantum technology in Canada as well as provide access to those learning how to use quantum technology in the larger ecosystem.

The new Quantum Algorithms Institute (QAI), for example, will see Simon Fraser University collaborate with research universities across B.C. to devise quantum computing applications. While the Institute is a measurable step forward, a more holistic approach is needed to promote the growth of the industry. As it currently stands, the excellent research and development executed by this Institute will not have many direct outlets for application nor a pipeline for partners to collaborate. D-Wave recommends the federal government support partnerships to attract talent and support companies that will cluster and grow in the innovation corridor.

In February 2020, D-Wave announced the launch of Leap 2, the first quantum cloud service designed for developers and organizations to easily build and deploy real-world hybrid quantum applications with practical impact. In addition to live, real-time access to the D-Wave quantum system, the offering expands the Quantum Application Environment (QAE) to provide new tools and resources needed to drive development of critical business applications and put them into production.

A more direct connection with industry and innovation hubs has the potential to create globally competitive industry clusters that support many – including British Columbians - and keep quantum computing companies like D-Wave in Canada. Other jurisdictions are heavily funding quantum application programs such the U.S. Department of Energy's \$625 million funding of Quantum Information Science Information Centers and proposed \$100 million in funding for the QUEST (Quantum User Expansion for Science and Technology) program. The QUEST program aims to bring the U.S. government and academics cloud access to quantum computers directed at application development.

D-Wave recommends the Canadian government foster a commercial market for quantum in Canada that would support the research being done by QAI and others through funding a public/private program committing at least \$25 million towards the development of quantum applications for business. This investment would play a role in expanding the commercial market for quantum technology and accelerating Canada's innovation role in harnessing quantum technologies to solve complex problems of both national and global importance.

Recommendation 3: That the Government of Canada offer tax incentives to Canadian businesses using quantum technology.

To foster a commercial environment in Canada to both incorporate and apply quantum technology across various sectors, D-Wave recommends the Government of Canada provide tax incentives for companies investing in the use of these technologies.

According to the National Research Council and interviews with third-party economists, traditionally, Canada has been able to capture 4% of the global market share in a technology trade. However, it was the consensus of the interviewees that Canada's current leadership position could lead to a greater capture of the global market share for quantum technologies (closer to 8%).

It was projected that by 2030, Canada will be able to grow an \$8.2 billion quantum technology industry, employing 16,000 people and generating \$3.5 billion in returns for the government. By 2040, when quantum technology is expected to reach 50% adoption, it could grow into a \$142.4 billion industry, creating 229,000 jobs and generating \$55 billion in government returns. The Canadian economy in 2040 is projected to be \$4.2 trillion, putting quantum technology at approximately 3.4% of the economy in that year.¹

In order to grow Canada's leadership in quantum technology, enabling companies to use the technology via tax incentives will allow for the industry to grow while spurring the adoption and purchasing of quantum systems right here in Canada. The Canadian government must do everything it can to support these domestic sales, and tax incentives for companies which are jumping in as quantum users is one effective way to enable that.

¹ <https://nrc.canada.ca/en/research-development/research-collaboration/programs/economic-impact-quantum-technologies>