Written Submission for the Government of Canada's Pre-Budget Consultations 2024

February 2024

Quantum Industry Canada (QIC)
2100 Bloor Street West, Unit 6159
Toronto, ON M6S 5A5

www.quantumindustrycanada.ca

Contact: Lisa Lambert, lisa@quantumindustrycanada.ca

Summary of Recommendations

- **Recommendation 1: Align procurement and funding mechanisms with the quantum sector**
    a. Streamline and speed up government procurement for quantum and enabling technologies
    b. Provide government-backed purchase order financing
    c. Revise and adapt funding program criteria to quantum realities
    d. Provide support for hiring in pre-revenue quantum companies
    e. Direct pension assets to support Canada's quantum sector growth

- **Recommendation 2: Integrate National Quantum Strategy objectives with national security and other technological development goals**
    a. Strengthen national security with quantum readiness
    b. Synchronize quantum and semiconductor objectives

- **Recommendation 3: Promote global leadership and adoption of Canadian quantum technologies**
    a. Formalize a "Team Canada" quantum initiative for international impact
    b. Establish a Canada Quantum Adoption Program

- **Recommendation 4: Enhance support and infrastructure for a coordinated quantum innovation ecosystem**
    a. Expand the NQS Advisory Council to include Quantum Industry Canada
    b. Establish a coordinated Canadian quantum sandbox and testbed program
    c. Provide support for a flagship quantum data centre
    d. Enhance quantum workforce development and commercialization training

Introduction

Quantum Industry Canada (QIC), established in 2019 by industry leaders, stands as the national consortium committed to advancing Canada's quantum technology sector. As a growing community of over 45 organizations, QIC encompasses a vibrant range of entities from dynamic startups to influential global companies with a united mission to transform Canada's quantum capabilities and strengths into tangible business success and economic prosperity.

As an early quantum pioneer, Canada has cultivated a globally recognized quantum ecosystem, transitioning rapidly from academia to commercial application with significant implications for both economic growth and national security. Notably, Canada ranks second worldwide in the number of quantum SMEs, behind only the United States (per the 2023 Quantum Potential report by the Council of Canadian Academies). With projections suggesting the Canadian quantum industry could contribute $139 billion to the economy and create over 209,000 jobs by 2045, accounting for up to 3% of GDP (according to a 2020 National Research Council of Canada study), the stakes for advancing Canada’s emerging quantum sector — encompassing economic prosperity and enhancing security measures — have never been higher.

Canada’s National Quantum Strategy (NQS), unveiled last year, marked a pivotal step in charting Canada's quantum future. One year into the NQS, it's clear that its commercialization pillar in particular — crucial for economic and security benefits — is underdeveloped, necessitating immediate enhancement to keep pace with the sector's rapid evolution.

This submission presents a series of strategic recommendations aimed at refining the NQS, focusing on enhancing Canada's quantum leadership on a global scale. Our proposals are designed to foster greater economic growth and security so Canada may reap the extensive benefits quantum technology holds the potential to offer across various sectors. We advocate for a bold, cohesive approach to ensure Canada not only maintains but significantly advances its position as a quantum leader, leveraging this critical juncture to ensure that the next chapter of Canada's quantum journey is even more impactful and successful than its pioneering beginnings.

On behalf of QIC and its members, I would like to thank the Government of Canada for taking these recommendations into consideration. As steadfast allies in bolstering Canada’s quantum sector, we are eager to collaborate closely with the Government of Canada to fortify our country’s leadership in this critical and transformative field.

Sincerely,

Lisa Lambert
Chief Executive Officer

QUANTUM INDUSTRY CANADA

Recommendation 1: Align procurement and funding mechanisms with the quantum sector

A. Streamline and speed up government procurement for quantum and enabling technologies

- **Objective:** Simplify and speed up Government of Canada procurement processes to be more in alignment with, and be agile and responsive to, the unique needs of Canada's emerging quantum and enabling technologies, encouraging innovation and investment in Canadian advancements. Current procurement models, designed for mature technologies, often pose barriers to entry for innovative, homegrown quantum solutions due to their rigid requirements and lengthy timelines. By facilitating and prioritizing the procurement of Canadian quantum technologies, the Government of Canada not only fosters the growth of the domestic quantum industry, but also demonstrates a commitment to nurturing homegrown innovation. This approach sends a strong signal to the market, encouraging further investment in Canadian quantum technologies and showcasing Canada's leadership in quantum innovation on the global stage.
- **Alignment with NQS:** Streamlined government procurement processes would accelerate the transition of quantum research into scalable, commercial products and services. This approach would not only foster innovation, but also position Canada as a leading adopter of its homegrown quantum technologies, setting a global benchmark.

B. Provide government-backed purchase order financing

- **Objective:** Offer low-interest purchase order (PO) financing solutions that can be deployed quickly to flow at the pace of business and alleviate financial constraints for quantum and enabling technology startups, supporting them to scale and compete globally. Such a government-backed mechanism would alleviate the cash flow constraints often faced by startups, enabling them with the necessary financial support to scale operations and meet the demands of important contracts that are crucial to their commercial success. It's important that these solutions be inclusive and available to early-stage and growth companies alike.
- **Alignment with NQS:** This initiative directly supports the NQS's aim to develop and attract critical talent and investment within Canada's quantum sector. By providing financial stability, government-backed PO financing would encourage sustained growth and innovation, supporting Canadian quantum companies to compete on a global scale.

C. Revise and adapt funding programs to quantum industry realities

- **Objective:** Revise the eligibility criteria and application processes in key funding programs, such as Innovative Solutions Canada (ISC) and the Industrial Research Assistance Program (IRAP), making them more inclusive and tailored to the unique needs of Canada's quantum startups and scaleups. This includes addressing current thresholds, such as minimum revenue requirements that often exclude early-stage quantum companies, and adapting programs to accommodate the unique Technology Readiness Levels (TRLs) and longer R&D phases characteristic of quantum projects. Streamline reporting requirements to reduce the administrative burden on quantum companies, enabling them to focus more on innovation and less on paperwork. Furthermore, increase funding allocations to adequately support the expanding needs of Canada's quantum sector, ensuring ample resources are in place to catalyze innovation and growth within this critical, high-potential industry.
- **Alignment with NQS:** Simplifying applications and increasing funding directly support the NQS's aim to accelerate the development of quantum technologies, ensuring Canada's quantum ecosystem is robust and globally competitive. By making enhanced funding more accessible and aligned with the development cycles of quantum technologies, Canada can bolster its position as a global leader in quantum innovation by both ensuring that Canada's quantum capabilities translate into economic prosperity, and by maintaining a competitive edge in the rapidly evolving global quantum landscape.

D. Provide support for hiring in pre-revenue quantum companies

- **Objective:** Introduce funding mechanisms that enable pre-revenue quantum and enabling technology startups to hire and retain essential non-technical staff, such as executive, business development, marketing, and administrative professionals. These roles are critical for building the business and operational capabilities necessary for commercial success. This could be done by expanding on an existing program, like NRC's IRAP.
- **Alignment with NQS:** Supporting the growth of quantum companies through targeted hiring aligns with the NQS's talent pillar by ensuring that startups have the comprehensive teams needed to bring innovations to market. This holistic approach to talent development is key to translating quantum research into economic gains.

E. Direct pension assets to support Canada's quantum sector growth

- **Objective:** Amend the mandate for the Canada Pension Plan Investment Board (CPPIB) and other federal public sector pension plans to not only invest for low-risk, financial return, but also prioritize investments in Canada's innovative sectors, including quantum startups and scaleups. This strategy aims to increase domestic pension fund investments in these areas from less than 2% to 5%, integrating long-term economic growth alongside traditional financial return objectives. Such a shift towards

high-potential quantum technologies will significantly improve the funding environment for Canada's quantum sector, drawing on the UK's recent policy change as a successful precedent.

- **Alignment with NQS:** Leveraging pension funds to invest in quantum innovation directly supports the NQS's goal of securing Canada's position as a global leader in quantum technologies. This initiative would provide a needed boost in domestic funding, encouraging the development and scaling of globally competitive Canadian quantum companies.

Recommendation 2: Integrate National Quantum Strategy objectives with other national security and technological development goals

A. Strengthen national security with quantum readiness

- **Objective:** Focus on improving the integration of quantum readiness into Canada's national security, cybersecurity, and infrastructure strategies to protect against emerging quantum threats, and enhance defence mechanisms. Adopting quantum-safe cybersecurity protocols and leveraging quantum technology advancements will safeguard Canada's critical infrastructure and support sophisticated security and defence solutions. This initiative also aligns with Canada's NATO commitment to invest 2% of GDP in defence, strategically utilizing quantum technologies to boost national security and infrastructure resilience.
- **Alignment with NQS:** Aligning quantum readiness with national security strategies reinforces the NQS's goals of promoting economic growth and ensuring national security through quantum innovation. This ensures Canada's preparedness for quantum-era challenges, supporting the NQS's vision for a secure, technologically advanced Canada, and fulfilling international defence commitments.

B. Synchronize quantum and semiconductor objectives

- **Objective:** Launch a strategic dialogue among Canada's semiconductor and quantum industries' key stakeholders to uncover and capitalize on synergies for shared growth. This effort aims to align development goals and technological progress of both sectors, fostering an ecosystem where semiconductor advancements enhance quantum technology development, and vice versa. Recognizing the pivotal role of semiconductors in quantum technology development, this concerted effort seeks to improve coordination, drive efficient investment, and bolster Canada's global competitiveness in these critical technological domains. Additionally, it will consider alignment with other enabling technologies, like photonics, ensuring a comprehensive approach to innovation that supports the interconnected nature of these sectors.

- **Alignment with NQS:** Synchronizing Canada's semiconductor and quantum objectives reinforces the NQS's ambitions to drive innovation, boost economic competitiveness, and achieve technological leadership globally. This approach ensures semiconductor advancements are fully leveraged to propel quantum technology forward, reflecting the NQS's emphasis on integrated technological development. Moreover, this alignment promotes efficient resource allocation and investment in research and development, crucial for achieving the NQS's vision of Canada as a powerhouse in both quantum and semiconductor technologies. Collaboration around these sectors, including related enabling technologies, positions Canada to make significant strides in quantum innovation, enhancing national economic growth and establishing a prominent role in the future of global technology.

Recommendation 3: Promote global leadership and adoption of Canadian quantum technologies

A. Formalize a "Team Canada" quantum initiative for international impact

- **Objective:** Enable a unified, national effort to promote and amplify the international profile of Canada's quantum industry, enhancing its role in international trade, exports, and collaborations. This "Team Canada" approach would leverage the collective strengths of government, academia, and industry — including organizations like QIC — to present a cohesive front on the world stage. With government backing, QIC is ready to spearhead this initiative, drawing on its extensive network and expertise to foster global partnerships, increase market access for Canadian quantum technologies, and position Canada as a quantum leader internationally. Initiatives like the Netherlands' Quantum Delta NL is a model Canada can look to for inspiration.
- **Alignment with NQS:** This concerted effort aligns perfectly with the NQS's ambition to secure Canada's leadership in the quantum sector on a global scale. By harmonizing and amplifying the quantum sector's efforts to promote Canadian quantum technology onto the international scene, this initiative underscores Canada's significant contributions to the quantum field and its vital position in the global supply chain. It supports the NQS's vision of harnessing Canada's quantum capabilities for worldwide influence, ensuring that Canadian quantum innovations are not only globally recognized, but also integral to the advancement of quantum technology across borders. This approach amplifies Canada's quantum achievements, facilitating international collaboration and investment, and opening new avenues for Canadian quantum technologies in global markets.

B. Establish a Canada Quantum Adoption Program

- **Objective:** Launch the Canada Quantum Adoption Program (CQAP), inspired by the national reach of the Canada Digital Adoption Program (CDAP), to boost quantum readiness across government and among Canadian businesses. CQAP should aim to facilitate the seamless adoption of Canadian quantum technologies, thereby boosting operational efficiency, security, and innovation. The program should serve to connect Canadian quantum technology developers with industry adopters, effectively addressing market barriers for streamlined adoption. Through targeted support, resources, and training, CQAP would help accelerate the integration of quantum technologies, showcasing their strategic benefits. It would also help prepare businesses for quantum integration, ensuring Canadian industries are equipped to capitalize on quantum advancements. With government support, QIC is well positioned to lead CQAP, leveraging its network and access to expertise to promote a quantum-informed business ecosystem across Canada. Moreover, the government should implement strategic incentives to promote the early adoption of Canadian quantum solutions in the public private sector. This proposal aligns with the Council of Canadian Academies' *Quantum Potential* report, which underscores the importance of demand-side strategies for the advancement of Canada's quantum sector.
- **Alignment with NQS:** CQAP aligns with the NQS's focus on the commercialization and widespread application of quantum technologies. By facilitating the adoption of quantum innovations, CQAP directly supports the NQS's objective to transform quantum research into economic success, positioning Canada's public and private sectors at the forefront of the quantum revolution. This program embodies the NQS's vision for a quantum-ready economy, preparing Canadian enterprises with both the technologies and the strategic know-how essential for excelling in the quantum era.

Recommendation 4: Enhance support and infrastructure for a coordinated quantum innovation ecosystem

A. Expand the NQS Advisory Council to include Quantum Industry Canada

- **Objective:** Broaden the composition of the NQS Advisory Council to include QIC who can help give voice to the diverse range of companies and technologies from within and across the quantum sector. This would ensure that the Advisory Council benefits from a wider array of perspectives and experiences, facilitating the development of policies and initiatives that are responsive to the needs of Canada's quantum sector.
- **Alignment with NQS:** Expanding the Advisory Council to include QIC can help enhance the Council's capacity to guide Canada's quantum sector towards global leadership by ensuring that the strategy is informed by insights from across the quantum industry. This approach fosters greater collaboration between government and industry, and

supports the NQS's overarching goals of fostering innovation, commercialization, and economic growth within Canada's quantum sector.

B. Establish a coordinated nationwide Canadian quantum sandbox and testbed program

- **Objective:** Launch a coordinated, nationwide quantum sandbox and testbed program with state-of-the-art infrastructure to advance the development, testing, and refinement of diverse quantum technologies across Canada. This initiative would strategically use and augment the unique capabilities and infrastructure of facilities like The Quantum Colaboratory and its affiliated centres, CMC Microsystems, C2Mi, TRIUMF, the Canadian Photonics Fabrication Centre, and the Numana testbed, among others, to support the accelerated development of a wide array of quantum technologies. Envisioned to both leverage existing assets and introduce new resources where necessary, this program seeks to ensure a coordinated and comprehensive approach to expediting the development of quantum technologies. By creating a versatile and open collaborative environment, the program would speed up the progression and application of quantum solutions, efficiently addressing critical challenges and advancing Canada's position in the global quantum landscape.
- **Alignment with NQS:** This initiative directly supports the NQS's commercialization pillar by creating practical pathways for quantum research and capabilities to transition into market-ready technologies and services. It enhances Canada's quantum ecosystem by integrating existing resources with new infrastructure, accelerating technology development and deployment. This strategic approach boosts economic growth and cements Canada's global quantum leadership, embodying the NQS's vision for innovation, competitiveness, and technological advancement.

C. Provide support for a flagship quantum data centre

- **Objective:** Establish a flagship quantum data centre that will serve as the national nexus for quantum computing research, innovation, and commercialization. This could be done via public-private partnership to pool resources, expertise, and investments. This state-of-the-art facility is envisioned to be an inclusive and open ecosystem, facilitating greater access to Canadian quantum computers. It would accommodate the spectrum of quantum computing technologies being developed by Canadian companies such as quantum gate-modelling, quantum annealing, and hybrid applications. By integrating such a centre with business accelerators, workforce development programs, and public outreach initiatives, the centre could play an integral role in catalyzing the entire lifecycle of quantum technology development — from ideation to market. It would not only showcase Canadian quantum achievements but also actively facilitate the development, testing, and deployment of quantum applications, ensuring that Canada remains at the forefront of quantum innovation.

- **Alignment with NQS:** The flagship, national quantum data centre, with its advanced infrastructure, aligns with the NQS's goals of fostering research and development, attracting and retaining talent, and supporting the commercialization of quantum technologies. It would significantly contribute to advancing Canada's position as a global quantum leader.

D. Enhance quantum workforce development and commercialization training

- **Objective:** Bolster the development of nationally coordinated quantum education and training programs in partnership with universities, colleges, and trusted training providers, tailored to the needs and growth of Canada’s quantum industry. These programs aim to equip Canadians with essential skills in quantum technologies and readiness, while highlighting Canadian quantum innovations. An emphasis should also be placed on training quantum entrepreneurs via venture studios, incubators, and accelerators with deep quantum expertise, such as CDL-Quantum, ACET, and QVStudio, to accelerate the commercial success of Canadian innovations. These efforts aim to democratize quantum education, ensuring it is accessible across Canada and cultivating a workforce adept in both emerging quantum technologies and quantum-safe practices. By building on, and expanding, existing initiatives, the government can fortify the talent pipeline, crucial for the quantum sector's growth and the wider innovation economy.
- **Alignment with NQS:** This initiative directly supports the NQS’s goal of building a quantum-skilled talent pool, crucial for both technological development and national security. Collaborating with educational institutions and the quantum industry to incorporate advanced, Canadian-developed quantum technologies and security measures into the curriculum ensures that graduates are ready to contribute to the quantum sector immediately. By providing a consistent supply of well-trained professionals, this effort not only advances Canada's quantum technology sector but also enhances the nation's cybersecurity position against quantum threats. It exemplifies Canada's strategic approach to leveraging quantum research for economic gain and establishing global leadership in quantum technology.