Canada's Quantum Imperative:
Securing Prosperity and Sovereignty

Submission to Pre-Budget Consultations 2025

QUANTUM INDUSTRY CANADA | INDUSTRIE QUANTIQUE CANADA

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Executive Summary: Building Canada's Quantum Advantage

Quantum is not next — it's now. Quantum technologies are moving from labs into markets and defence systems, reshaping global value chains, economic competition, and national security. Canada was an early leader, but our advantage is slipping as allies accelerate with bold industrial strategies. Without decisive action, Canadian firms risk being pulled abroad and our sovereignty weakened.

Prime Minister Carney has been clear: Canada faces a generational challenge. Rising geopolitical risks threaten sovereignty. The global trading system is undergoing its largest transformation since the fall of the Berlin Wall. Weak productivity strains public finances. To meet this moment, the Government has committed to fundamentally new approaches: developing a defence industrial policy, redefining our trade relationships, attracting world-class talent, and building the strongest economy in the G7.

Quantum speaks directly to this mandate. It is both a security capability and an economic driver, with the power to transform Canada's economy, resilience, and global position. Our firms are globally recognized but small and resource-constrained. Without stronger domestic support, they risk being absorbed into ecosystems abroad that are moving faster, with greater scale and clearer purpose. With catalytic interventions, Canada can reset its trajectory, converting early leadership into enduring advantage.

This is a nation-building mission, one that will strengthen Canada's sovereignty, generate high-value jobs, and secure our place as a trusted partner in the global economy.

Six Strategic Recommendations for Budget 2025

1. **Reboot Canada's Quantum Strategy: Make It Industry-Led and Globally Competitive**
2. **Use Defence to Drive Sovereign Quantum Capabilities**
3. **Scale Canada's Quantum Industry Growth Hub**
4. **Launch an Advanced Manufacturing Strategy for Quantum and Frontier Systems**
5. **Make Quantum a Pillar of Canada's Trade Diversification Strategy**
6. **Deliver Quick Wins to Strengthen Canada's Economy and Sovereignty**

Introduction: The Quantum Imperative for Canada

Quantum Isn't Next — It's Now

Quantum technologies are no longer a distant promise. They are here today, already reshaping markets, and rapidly being embedded into critical infrastructure, defence strategies, and economic plans. Around the world, governments understand that advanced technologies are the backbone of economic strength, national security, and geopolitical power. Prime Minister Carney has called for building the strongest economy in the G7. Canada's emerging quantum industry is integral to that ambition.

The opportunity is enormous. McKinsey estimates[1] that quantum computing, sensing, and communications together could create between USD $0.9 and $2 trillion in economic value by 2035 across just four industries: chemicals, life sciences, finance, and mobility. A study commissioned by the National Research Council[2] projects that by 2045, quantum could contribute 200,000 jobs and 3% of GDP, rivaling aerospace in scale.

Canada is well positioned: we rank first in the world in quantum companies per capita, spanning computing, communications, sensing, cybersecurity, and enabling technologies. Our companies are small but mighty, competing toe-to-toe with much larger global firms, but with far fewer resources.

Early Leadership, Now at Risk

Canada was among the first countries to recognize the strategic opportunity of quantum, making bold early bets decades ago that built one of the world's strongest research foundations and earliest commercial ventures. Those investments seeded a vibrant ecosystem and positioned Canada as a global quantum pioneer. In Budget 2021, Canada was also among the first to announce a National Quantum Strategy (NQS), with $360M in funding.

Yet our early leadership is slipping. The NQS, released in 2023, was research-led and leaned heavily on fragmented programs operating in isolation rather than a coordinated system driving toward a national vision. While it included a $169M commercialization pillar, one of its key instruments, Innovative Solutions Canada (ISC), saw cuts in 2024. Companies receiving support through ISC have

[1] McKinsey Digital. (2024). Quantum Technology Monitor.

[2] Doyletech Corporation study commissioned by the National Research Council of Canada. (2020). Socio-Economic Impact Assessment of Quantum Technologies in Canada.

faced procurement delays of 12+ months through PSPC, timelines that are untenable for startups and SMEs whose advantage depends on speed.

The NQS also assumed the creation of a new Canadian innovation and investment agency (announced in Budget 2022) to help firms commercialize. That agency has since been shelved, leaving a critical gap in Canada's toolkit.

Meanwhile, other countries have accelerated. For example:

- The U.S. launched DARPA's Quantum Benchmarking Initiative (QBI) to accelerate performance goals and engage the world's leading quantum computing companies, including four Canadian firms.
- Last month, the EU released its Quantum Europe Strategy, which will expand upon its existing €1B Flagship (≈$1.6B) with new industrialization programs.
- In July, the UK launched a modern Industrial Strategy naming quantum a priority frontier technology, with an initial £670M (≈$1.25B CAD) committed to accelerate development and adoption, on top of its existing national strategy.
- Japan embedded quantum in its economic security strategy and, just weeks ago, reinforced this commitment with a new 50 billion yen (≈$500M CAD) investment to accelerate industrialization, expected to support 10 domestic firms.

These are not incremental moves; they are transforming global value chains, validating companies, accelerating deployment, and setting the benchmarks others must follow.

By contrast, Canada's entire commercialization effort under the NQS is smaller than what some countries are now investing in single firms — and in several cases, those single-company investments exceed Canada's entire NQS. Meanwhile, U.S. programs like QBI are propelling ecosystems forward and creating a magnetic pull that draws Canadian talent, capital, and firms south of the border. Each month of delay makes it harder to keep pace, embed in global value chains, and retain sovereign control over capabilities that will define prosperity and security.

The reality is undeniable: Canada's NQS, despite being launched only two years ago, has already fallen out of step with the sector's progress, the geopolitical environment, and the urgency of allied strategies. Our window of opportunity to course correct and seize this generational opportunity is closing.

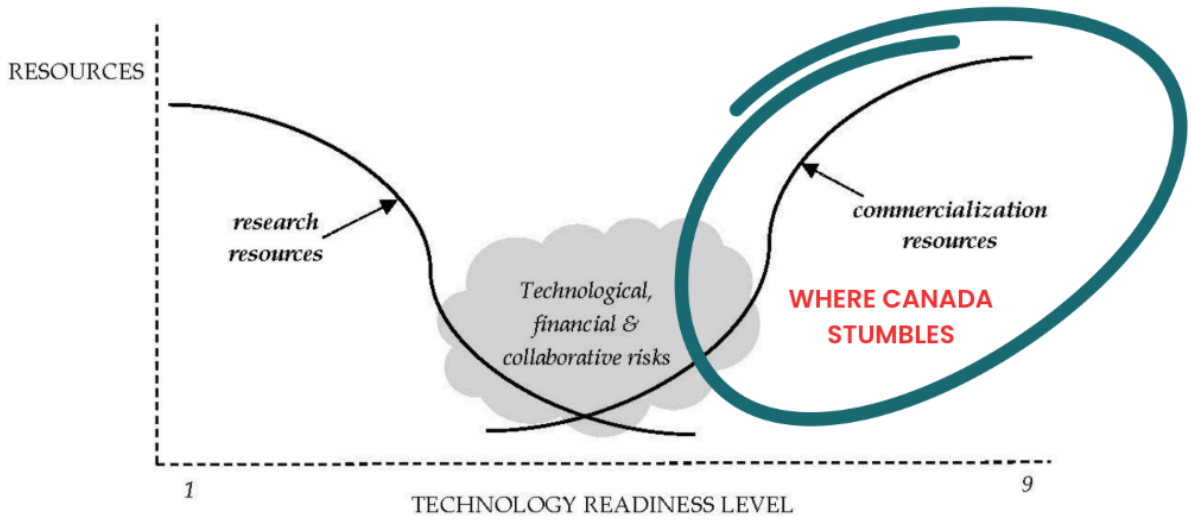
Quantum Is Not Monolithic

One of Canada's strengths is that our ecosystem spans the full spectrum of quantum technologies: computing, communications, sensing, and enabling fields such as photonics, cryogenics, microelectronics, and post-quantum cryptography. These are at different stages of maturity and TRLs: some already in or near deployment, others still emerging. This diversity is a strength, but it demands tailored policy tools that reflect different timelines, risks, and market dynamics, not a one-size-fits-all approach.

Why Deep Tech Is Different

Quantum is deep tech at its deepest. Unlike traditional digital technologies, deep tech requires long, capital-intensive, science-driven development before commercial returns are visible. Canada has historically stumbled at the commercialization stage: strong research, but weak resources and coordination to bridge into markets. This is the "valley of death" where promising firms risk being acquired, relocating, or stalling out.

Figure 1: The Valley of Death in Deeptech Entrepreneurship



Source: Against All Odds: How Eindhoven Emerged as a Deeptech Ecosystem by A. Georges L. Romme, Systems (2022). Circle and red text added by QIC.

That is why government's role must be catalytic:

- Share risk of technology development and adoption, especially in long-horizon deep tech.
- Act as a first customer to validate solutions — critical for SMEs competing against global giants.
- Crowd in private investment by signalling confidence and long-term demand.
- Use defence as a strategic engine to create anchor demand for dual-use capabilities that strengthen Canada's sovereignty and open export opportunities.

Defence as a Strategic Engine

This is especially true in defence, one of the earliest and strongest markets for quantum. As Canada strengthens its defence posture — through NATO commitments, NORAD modernization, and Arctic sovereignty — quantum must be part of the solution. Strategic procurement and investment in dual-use technologies not only reinforce national security, but also create anchor demand that accelerates the sector and opens export opportunities.

A Nation-Building Mission

This is a nation-building mission: to ensure Canada is both quantum-ready (able to adopt and secure quantum across our economy) and quantum-enabled (developing sovereign capabilities embedded in trusted global supply chains). Canada's firms already have the ambition, speed, and agility to seize global opportunities. Our policy does not. We remain too reliant on research programs, foreign investment, and foreign procurement. This puts our sovereignty at risk.

Defining a New Future for Canadian Innovation

Budget 2025 is Canada's chance to get back on the front foot and re-establish leadership. With catalytic interventions — procurement as first customer, industry-led growth structures, and a focus on industrialization — we can shape the quantum era instead of reacting to it. Done right, this will secure sovereign capabilities, crowd in private investment, create high-value jobs, and position Canada as a trusted ally in one of the most consequential technology shifts of our time.

And this is bigger than quantum. It is an opportunity to finally address the structural blockers that have kept Canada from capturing the full value of frontier technologies. The time is now to define a new future for Canadian innovation where discovery is translated into prosperity and security at home.

Strategic Recommendations

Recommendation 1: Reboot Canada's Quantum Strategy: Make It Industry-Led and Globally Competitive

The National Quantum Strategy (NQS) laid useful groundwork, but the pace and geopolitics of quantum now demand a more catalytic and globally competitive approach: one that shifts from research excellence to commercialization and industrialization across the full stack and TRL spectrum.

Government's role must be catalytic: set direction, share risk, and unlock speed for an emerging domestic sector currently made up almost entirely of startups and SMEs. Budget 2025 should launch NQS 2.0 to ensure Canada is both quantum-ready and quantum-enabled.

Budget 2025 should:

- **Launch NQS 2.0 (industry-led, mission-oriented):** Replace fragmented programs with a cohesive and agile framework that sets measurable goals for milestones, first-of-its-kind (FOAK) deployments, procurement, exports, and domestic manufacturing. Canada must put itself back in the driver's seat, building a sovereign ecosystem less vulnerable to others' moves.
- **Integrate with defence industrial strategy:** Tie NQS 2.0 into BOREALIS and other frameworks so quantum strengthens sovereignty at home and credibility with allies.
- **Recapitalize and expand to globally competitive levels:** Recapitalize proven programs and strategically create new ones so support scales with firms as they progress through TRLs. Move from "sprinklers" to focused pools of catalytic capital large enough for industrial impact.
    - **Fix and modernize existing programs:** Adapt ISC, IDeAS, and procurement to be fit-for-purpose for SMEs. Introduce pre-procurement and milestone-based challenges with clear pull-through to procurement. Establish time-bound PSPC contracting standards to end untenable delays.
    - **Leverage procurement as a growth tool:** Identify priority areas (e.g., cybersecurity, resources, infrastructure, defence, transportation, agriculture) and use streamlined pathways to secure early contracts and global references.
    - **Quantum Sovereignty Direct Investment Vehicle:** Establish a vehicle for direct, equity-style investments in critical value-chain nodes — quantum hardware, photonics, microelectronics, cryogenics, control systems, networking, etc. Unlike loans, which cap returns at interest, direct investments create upside for Canada if

firms succeed (equity returns, stronger tax base, sovereign capacity). The downside is similar, but the strategic benefit is far greater, as Canada retains a stake in firms, IP, and industrial capacity.

    - **Develop a National Quantum IP Strategy:** Ensure Canadian firms can protect, retain, and commercialize intellectual property domestically, while securing freedom to operate globally.
    - **Canadian response to DARPA QBI:** Swiftly launch a made-in-Canada initiative to counter U.S. pull while scaling domestic firms and advancing Canadian interests. Elements could include FOAK deployments, direct investments, and procurement.
- **Sustain research with purpose:** Continue strong investment in basic and applied research, aligned to the industrialization and commercialization goals of NQS 2.0.

Recommendation 2: Use Defence to Drive Sovereign Quantum Capabilities

Defence is among the earliest and strongest markets for quantum, and one of the most strategic. Few countries have sovereign capabilities, making Canada's contributions especially valuable. As we strengthen our posture through NATO, NORAD, and Arctic sovereignty, Canada's defence and security must be quantum-ready and quantum-enabled.

Defence demand has historically scaled transformative technologies, from semiconductors to GPS to the internet. Quantum will be no exception.

Fixing Canadian defence procurement is table stakes; without reform, even well-designed initiatives will stall.

Budget 2025 should:

- **Make Canadian industry a core partner:** Establish mechanisms to treat Canada's SMEs and scale-ups as core delivery partners through trusted-vendor frameworks, joint R&D, capability roadmaps, and rapid procurement pathways.
- **Establish a Defence-Quantum Capabilities Lab:** Launch an accelerator to move technologies from development to deployment, bringing together Canadian innovators, DND, CAF, PSC, DRDC, NRC, CSA, ISED, system integrators, investors, and allies. The Lab would validate and de-risk dual-use technologies via pre-procurement, milestone funding, and procurement pull-through. This could be an arm of BOREALIS.

    - A similar model could also be applied in a civilian context (e.g., health, natural resources, finance, critical infrastructure), giving Canadian firms broader opportunities to validate and scale solutions beyond defence.
- **Use defence as an anchor market:** Make defence procurement a first customer for Canadian capabilities in sensing, secure communications, post-quantum cryptography (PQC), and computing. This directly supports NATO goals, NORAD modernization, and allied procurement needs, embedding Canadian solutions in allied systems to deliver both sovereign resilience and export wins.
- **Leverage Canadian solutions to advance PQC migration:** Prioritize Canadian firms where possible to strengthen sovereignty in critical security infrastructure and advance the Government of Canada's PQC transition roadmap.

Recommendation 3: Scale Canada's Quantum Industry Growth Hub

Quantum Industry Canada (QIC) was founded in 2019 as a grassroots, industry-led coalition to mobilize Canada's quantum sector. The 2023 NQS investment of $1.5M was a successful pilot that delivered strong ROI. This modest support enabled QIC to hire dedicated staff and establish itself as a platform for coordination, commercialization, and international engagement. It proved the value of a national hub to strengthen public–private collaboration, align industry, and drive sector growth.

That funding is now coming to an end, just as economic, defence, and security priorities for quantum are intensifying. For an emerging deep tech sector, this kind of support is critical: government provides the stability, credibility, and scale needed to accelerate development. In a strategic sector moving as quickly as quantum, Canada cannot afford fragmentation or slow coordination. A well-resourced Growth Hub would be the connective tissue linking government, industry, academia, investors, and allies — accelerating industrialization, adoption, and securing Canada's role as a trusted global leader. Other countries are already moving; Quantum Australia is one example.

QIC has already become a globally respected organization with a strong domestic and international network, trusted relationships across industry and government, and a clear pulse on the sector's rapid evolution. Canada must build on this momentum and scale the pilot into a platform capable of delivering sustained national impact.

Budget 2025 should:

- **Scale QIC into a fully resourced national Growth Hub** to:
    - **Support industry success and inform smarter decisions** by addressing common gaps, facilitating access to resources, and providing government and industry with clear insights into capabilities, opportunities, and risks.
    - **Build early domestic and international commercial pathways** for both commercial and dual-use/defence applications, expanding the ecosystem through strategic partnerships and trusted networks.
    - **Promote Canada's capabilities and opportunities** to national and global stakeholders, highlighting strengths in both economic and dual-use security domains to attract customers, partners, talent, and investment.

Recommendation 4: Launch an Advanced Manufacturing Strategy for Quantum and Frontier Systems

Quantum is not only about software: it requires physical systems. Few countries have meaningful quantum capabilities; fewer still have quantum manufacturing capabilities. Canada could strategically position itself to do this, and we already have a head start with strengths in photonics, cryogenics, and compound semiconductors. But moving from promise to leadership requires a kick to the next iteration.

A capital-efficient advanced manufacturing strategy would strengthen both quantum and classical frontier technologies, from AI compute to secure communications. With targeted investment, Canada can build globally relevant industrialization capabilities that deliver outsized ROI while reinforcing sovereignty and supply chain resilience.

Budget 2025 should:

- **Launch the development of a National Advanced Manufacturing Strategy oriented around quantum** to advance key capabilities in both quantum and classical advanced technologies, including:
    - **Ensuring Canada owns strategic parts of the manufacturing base**, especially those critical to sovereignty and alliance resilience.

- **Investing in pilot lines, scalable production, and integration capacity** for enabling components like cryogenic control electronics, photonic interconnects, and advanced packaging.

Recommendation 5: Make Quantum a Pillar of Canada's Trade Diversification Strategy

Quantum is a strategic capability, and trade policy must treat it as such. Few countries have sovereign quantum capabilities; Canada can be a trusted dual-use partner to allies who need these technologies. At the same time, sovereignty does not mean solitude: quantum supply chains are evolving, complex, and impossible for any one company or country to dominate. Canada must secure its place by working with allies while building niches where we are indispensable.

Quantum should be a pillar of Canada's trade diversification strategy. As we deepen relationships beyond the U.S., quantum offers Canada a way to bring unique value to Indo-Pacific, European, and other allied markets. And we need to keep in mind: when the Government of Canada procures from Canadian SMEs, it sends a powerful signal globally: validating our firms and strengthening their credibility with international buyers and partners.

Budget 2025 should:

- Make **quantum a priority in Canada's Trade Diversification Strategy.**
- Extend trade agreements and digital partnerships to support **business opportunities**, procurement reciprocity, and standards alignment — not just research collaborations.
- Expand **Team-Canada quantum missions** to key markets, building on successes under the NQS, GAC, and NRC-IRAP, often with QIC as a partner.
- Expand support for Canadian industry to shape **international standards**.

Recommendation 6: Deliver Quick Wins to Strengthen Canada's Economy and Sovereignty

Alongside bold measures, there are simple, high-impact steps government can take immediately. These are low-cost, low-risk — and in some cases even cost-saving — yet they send a powerful signal that Canada is serious about being the best place in the G7 to build and scale a quantum firm. Taken

together, these quick wins amplify the catalytic interventions above and reinforce Canada's economy, sovereignty, and global credibility.

Government should:

- **Fast-track immigration for quantum talent:** Quantum is powered by people, and expertise is scarce. Fast-tracked immigration pathways once helped Canada lead in telecoms; they can do the same for quantum.
- **Future-proof digital infrastructure:** Integrate quantum and quantum-safe solutions into new data centre and HPC investments so Canada's sovereign compute infrastructure strategy reflects the convergence of HPC, AI, and quantum — all areas of Canadian strength.
- **Cut program bottlenecks:** Establish clear service standards so firms access support at the pace of business, not bureaucracy.
- **Promote Canada's quantum sector:** Encourage ministers and senior officials to highlight Canada's strengths in quantum at home and abroad, building investor confidence and international credibility.
- **Build government literacy:** Provide training for public servants on quantum's strategic importance and applications. QIC can support this effort.
- **Modernize tax credits:** They won't fix a bad environment, but they make a good one better. Other G7 peers are moving here; Canada must keep pace.

About Us

Quantum Industry Canada (QIC) is the country's business-led consortium, uniting nearly 70 quantum companies and strategic partners to accelerate the growth of Canada's quantum sector. We are dedicated to turning Canada's quantum excellence into strategic advantage and commercial success by supporting industry, building commercial pathways, and fostering collaboration at home and abroad. QIC strengthens the foundation of a resilient quantum economy, one that advances Canada's security, prosperity, and global leadership.
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