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## Innovation Policy Briefing

# Quantum innovation depends on diversified startups investments, say experts

The Liberal government unveiled its \$360-million National Quantum Strategy on Jan. 13 to support the growth of quantum sciences and technologies in Canada.

BY JESSE CNOCKAERT

To promote innovation in Canada's emerging quantum technology industry, the Liberal government should prioritize smaller funding announcements to help a greater number of startup companies navigate "the valley of death," according to quantum industry experts.

"[The Liberal government] should be looking at spreading their ability to help many more companies, instead of big, massive amounts to a few big companies," said Bruno Couillard, co-founder, CEO and chief technology officer of cybersecurity company Crypto4A. "I would hope that the implementation and the distribution of the money will be such that instead of helping nine companies with \$40-million each, they will go around and spread that money to ensure the small and medium enterprises ... all get to partake into this strategy."

The Liberal government unveiled its \$360-million National Quantum Strategy on Jan. 13 to support the growth of quantum sciences and technologies in Canada. The strategy commits \$141-million for basic and applied



Innovation Minister François-Philippe Champagne says Canada is 'at the forefront ready to lead' in the quantum technologies sector. *The Hill Times photograph by Andrew Meade*

Quantum Strategy and support made-in-Canada technology so Canada remains a world leader for decades to come," Innovation Minister François-Philippe Champagne (Saint-Maurice-Champagne, Que.) said in the press release.

Daniel Oblak, an assistant professor for the Institute for Quantum Science and Technology at the University of Calgary, told *The Hill Times* he agrees that smaller funding announcements spread out across a larger number of quantum technology companies might be prudent. He argued that innovation could be best served by funding startup companies that "don't have the whole machinery going."

"Startups and innovators, they need to get through the valley of death," he said. "It's not easy at any level to take things out of a university setting ... It becomes a lot of extra work to take on these entrepreneurship and innovation tasks."

Oblak said he has no major issues with the National Quantum Strategy, but it remains to be seen whether the strategy will work as intended. He said the strategy's focus on supporting basic research will potentially help development of quantum technologies that will add value to society over the long term.

"It may not be obvious right now, and not all of [basic research] will lead to those benefits, but this is how you develop things for the long run," he said. "You want Canada to come up with some of the groundbreaking things that will resonate for

Continued on page 18

research, \$45-million to develop and retain expertise in the quantum sector, and \$169-million to support commercialization through funding from agencies including the National Research Council, Global Innovation Clusters, and Innovative Solutions Canada.

Couillard said he is happy overall with the strategy, but questions remain about how quantum technology companies will benefit from the available funding.

On Jan. 23, the Liberal government announced an investment of \$40-million towards Toronto's Xanadu Quantum Technologies Inc., to build and commercialize a photonic-based quantum computer. In a June 2022 paper published in the research journal *Nature*, Xanadu described how Borealis,

the company's latest quantum computer, was capable of providing a series of numbers with a specified range of probability in just 36 millionths of a second—an operation they estimated would take the current most powerful supercomputers in the world more than 9,000 years to match.

Couillard argued that a \$40-million investment in Xanadu may make for an impressive headline in a press release, but is not necessarily as beneficial to the quantum sector as \$1-million investments spread across 40 startup companies.

Couillard argued that Xanadu "is not in great need of cash," and cited a Nov. 9, 2022, *Globe and Mail* story that said the company raised \$100-million from investors—including Canadian private capital firm Georgian and Porsche Automobil Holding SE—following the launch of Borealis.

"Hopefully, this is not going to be the trend, because there's not a lot of money in the pile. They've announced the strategy [and] I think it's a great strategy, but there's not a lot of money," said Couillard. "I'm hoping the government is not going to spend all of their money in these big splashy announcements that, in the end, is not really going to help the ecosystem."

Couillard serves as a board member of Quantum Industry Canada, a consortium of quantum technology companies that includes developers of technologies for quantum computing, quantum communications and cryptography. He is also a member of the

Canadian National Quantum Strategy committee.

Xanadu's \$178-million quantum computer project is expected to create 530 jobs in the high-tech and quantum computing fields, according to a Jan. 23 government press release.


"Quantum technologies will set the course of the future and thanks to companies like Xanadu, Canada is at the forefront ready to lead. With today's announcement, our government is strengthening Canada's position in quantum technology and helping to create more economic growth and good jobs for Canadians. We'll continue to build this sector through our National



Crypto4A's Bruno Couillard says the Liberal government should spread investments around in the quantum technologies sector, instead of 'big splashy announcements.' *Photograph courtesy of Bruno Couillard*



Prime Minister Justin Trudeau speaks with reporters after a cabinet meeting in the West Block on Jan. 31. The release of Canada's quantum strategy follows similar quantum strategies that have been announced around the world in recent years. *The Hill Times photograph by Andrew Meade*



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## Innovation Policy Briefing

# Quantum innovation depends on diversified startups investments, say experts

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decades or centuries, as well as making the new gadgets that are going to be sold on the market in the next 10 years.”

The release of Canada’s quantum strategy follows similar quantum strategies that have been announced around the world in recent years. Europe’s 10-year Quantum Technologies Flagship launched on Oct. 29, 2018, and the United States passed its National Quantum Initiative Act on Dec. 21, 2018.

Oblak said that Canada isn’t behind other nations when it comes to supporting the quantum industry. The funding for Canada’s quantum strategy was announced in the 2021 federal budget, which allowed a head start on investments into quantum technology companies prior to its official release, he said.

“In reality, this funding has already started to trickle into the research area. In that sense, I can see that there was probably a recognition that this is urgent, and we should start funding already,” he said. “Lag maybe allowed other places to catch up in the quantum area, but I wouldn’t say we’re behind. We’re still strong. And this will allow us to regain even more of the leadership that we have had for a long time.”

Investments under the national quantum strategy include an announcement by Champagne on March 15, 2022, of \$137.9-million through the Natural Sciences and Engineering Research Council of Canada’s Collaborative Research and Training Experience grants and Alliance grants to help develop the talent pipeline needed to support growth in the quantum sector.

*The Hill Times* reached out to Conservative MP Rick Perkins (South Shore–St. Margarets, N.S.) and to NDP MP Brian Masse (Windsor West, Ont.), their parties’ respective innovation critics, to discuss the National Quantum Strategy, but did not receive a response by deadline.

Nadish de Silva, a Canada Research Chair in the Mathematics of Quantum Computation and an assistant professor in the mathematics department at Simon Fraser University in British Columbia, said that Canada has historically “punched well above its weight in quantum information and technologies and we would be wise to maintain our position.”

“There will be greater competition with the rest of the world now. The race is both a sprint and a marathon in the sense that some quantum technologies are near fruition, whereas others will require sustained investment and effort over a longer timeframe,” he said in a Jan. 26 emailed statement. “I also wonder with respect to the goals of improving diversity in the talent pool, whether enough attention is being paid to the earliest stages of the pipeline. It may well be outside the scope of the [National Quantum Strategy] to address equitable STEM educational opportunities for pre-university students, but doing so is necessary for achieving the aforementioned goals.”

Stephanie Simmons, the founder and chief quantum officer of Photonic, a quan-

tum technologies company based in B.C. and a Canada Research Chair in Quantum Computing at Simon Fraser University, said that Canada is at a turning point when it comes to quantum technologies.

“It’s fantastic to move from a grassroots approach towards quantum technologies, because there’s still a lot of open questions on how best to implement these things, [and] how best to execute these things,” said Simmons, who also serves as a co-chair of Canada’s National Quantum Strategy’s Quantum Advisory Council. “It’s absolutely the right time to move towards a co-ordinated effort where we’re all rowing the boat in the same direction and maximizing the opportunity for the country and getting in front of this. A lot of other countries are making that same realization, so we are in good company.”

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*The Hill Times*

### Canada quantum industry statistics

- According to a study commissioned by the National Research Council of Canada in 2020, the total economic impact of quantum technologies in Canada by 2025, including indirect and induced effects, will be \$533-million, with 1,100 jobs and \$188.3-million in returns.
- In 2045, quantum is expected to be a \$138.9-billion industry, with 209,200 jobs and \$42.3-billion in returns.
- Earlier investments by private and public sectors, including more than \$1-billion invested by the federal government between 2009 and 2020, has helped to produce a highly skilled research and development community in quantum technologies.
- Canada’s quantum sector currently includes more than 100 ecosystem players, including companies, research labs, academic institutions, accelerators and incubators.

Source: *National Quantum Strategy Consultations: What We Heard Report, July 18, 2022, Innovation Canada*

### Global quantum computing information

- Public and private investments in quantum computing globally reached \$35.5-billion by 2022 across a range of quantum technologies.
- Private investments for quantum technologies added \$3.2-billion in 2021 alone and more than \$5.5-billion in the past decade.
- At the beginning of 2022, a total of 46 companies worldwide were actively developing quantum computing hardware.
- The quantum computing sector is experiencing a talent shortage. Globally, more than half of quantum computer companies are currently hiring.
- The fact that quantum technologies are still in their infancy means that most current jobs are highly technical, especially with academic specializations and PhDs. In the past year, however, more diverse profiles, such as marketing and sales roles requiring prior work experience, have begun to appear, showing that the market is maturing

Source: *State of Quantum Computing: Building a Quantum Economy, World Economic Forum, Sept. 13, 2022*

# Our regulatory stagnation is killing innovation

Innovation will never convert into productivity growth unless we constantly modernize our regulations, empowering businesses to implement innovative new practices that also protect consumers.

ISG Senator  
Colin Deacon

Opinion



Regulatory stagnation can cause harm because technologies, products, and business models are rapidly changing, and our regulatory frameworks are not keeping up. This creates increasing economic and public risks. The response to this stagnation is often to promote deregulation, but this, too, can increase the risk of public harm through unsafe products, underperforming services, or hazardous conditions. How do we overcome regulatory stagnation while still protecting the public and embracing the need for innovation in our economy?

There is a proven solution. I’ll get to that in a moment, but first, let’s explore the problem.

The Organisation for Economic Co-operation and Development (OECD) measures the degree to which competition and innovation policies are promoted or inhibited within member countries. Their Product Market Regulation Indicators measure and compare economy-wide regulatory and market environments. In terms of regulatory burden, Canada is one of the worst performing countries in the OECD, ranking 35<sup>th</sup> of 38 member countries.

Another bit of bad news lies within the most recent Global Innovation Index. Despite gradually improving in recent years, Canada is the only G7 country that produces less innovation output relative to its level of investment. In other words, our substantial investments in innovation are not producing commensurate results in terms of improved economic performance.

Despite increasing investments in innovation initiatives, we keep producing lackluster results, in part because of regulatory stagnation. In this ever-changing world, innovation will never convert into productivity growth unless we constantly modernize our regulations, empowering businesses to implement innovative new practices that also protect consumers.

Consider this example. Until last November, Canada’s electric metering legislation only allowed electric vehicle charging stations to charge for the amount of time used and not the actual cost of the electricity delivered. As a result, condo and rental property managers, and other po-

tential market participants, were disincentivized from investing in charging stations. Our regulatory stagnation prevented the market from helping to deliver on this top government priority.

This example illustrates the extent to which Canada desperately needs a major, whole-of-government strategy to meaningfully address our OECD-leading legacy of regulatory burden and stagnation. We must create the regulatory agility necessary to protect Canadians, spur innovation, and increase productivity growth.

Treasury Board’s current initiatives—the Annual Regulatory Modernization Bill and targeted regulatory reviews—are good steps in the right direction but barely scratch the surface. We need an approach that is far more fit-for-purpose—one that can increasingly create an efficient and modernized regulatory system that is pro-competitive, encourages innovation and investment, and accelerates the growth of business, while still protecting consumers from risks and harms.

Good news: there is a proven solution based on the use of standards. A standard is a set of criteria that is collaboratively agreed to by the stakeholders in a specific industry, including government. Standards differ from regulations in that they are developed through a rigorous and transparent process outside of government and then must be certified. Decades ago, the United Kingdom, European Union, and the United States, among others, created a strategic approach to incorporating standards into their legislative instruments.

In a recent op-ed, Keith Jansa, CEO of the Digital Governance Council, argued for the federal government to institute governor-in-council (GIC) powers to recognize standards, codes of practice, or certification programs that provide equal or greater protections to those required by law. Each departmental minister could then establish an expert advisory panel to carefully review each decision, before being approved by the minister and submitted to GIC.

In short, this approach would enable the adherence to an accredited standard to fulfil the requirements of a current regulation. Two conditions would have to be met: 1) they must be developed by an organization that adheres to best-in-class international practices; and 2) most importantly, they cannot reduce the public’s protections from unsafe products, underperforming services, or hazardous conditions.

There is an urgent need for ongoing agile regulatory reform across our entire economy. It is critical if we want to encourage businesses—large and small—to innovate, invest, and achieve productivity improvements. Prioritizing regulatory agility is an exceedingly low-cost way for Canada to become a globally competitive market for innovators, while delivering affordability and protection to consumers.

Senator Colin Deacon was appointed to the Senate of Canada as a representative of Nova Scotia in June 2018 and has since been part of the Independent Senators Group. He currently serves as deputy chair of the Standing Senate Committee on Banking, Commerce, and the Economy.

*The Hill Times*



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Benoit Boulet  
Faculty of Engineering

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## Innovation Policy Briefing



The Canadarm's success was based not just on a single technology, but numerous technologies that worked together, including the technologies that gave the robotic arm physical dexterity, visual acuity, and precise control through cutting-edge software, writes Tima Bansal. Photograph courtesy of NASA

# Corporations need to embrace a made-in-Canada approach to innovation

It is time for Canadian companies to recognize that we shouldn't be looking to Silicon Valley for inspiration, but we need our own brand of innovation that requires collaboration.

Tima  
Bansal

Opinion



When most Canadians think of the heartland of corporate innovation, they likely think of Silicon Valley. This is the home of creative destruction, failing

fast and cheap, open innovation, and chasing moonshots. But, what's good for Silicon Valley is not necessarily good for Canadian business.

Most of Canada's GDP is generated in the extractives and manufacturing industries, which rely on physical capital and heavy industry. This is a far cry from the tech sector, where innovations can be simply bolted onto a platform technology (the internet) and each innovation sits almost independently of others. An improvement in one technology simply catalyzes improvements in another. A failure in one technology rarely affects others.

In Canada's heavy and manufacturing industries, numerous technologies form a complex array that support each other to perform sometimes a single function. And failures are expensive—not just financially, but potentially to human life.

Take the example of the highly successful Canadarm that supported numerous space missions. Its success was based not just on a single technolo-

gy, but numerous technologies that worked together, including the technologies that gave the robotic arm physical dexterity, visual acuity, and precise control through cutting-edge software. Most companies excel at one of these technologies, not all. For the Canadarm to have succeeded, numerous technologies had to come together to support the overall function.

It is time for Canadian companies to recognize that we shouldn't be looking to Silicon Valley for inspiration, but we need our own brand of innovation—one that embraces the assembly of numerous technologies that require collaboration. These collaborations are not just with the usual suspects, such as suppliers and customers. They are also with competitors, local communities, NGOs, academics and governments.

Canadians are especially good at collaborating and working with others. We embrace diversity in all its forms. We are open to new ideas. And we are smart and creative.

and a projected operating capacity that far exceeded the actual capacity. But, when they came back for a second look, they spotted the magic in the machine: gasification.

Suncor saw the power of the potential partnership combining Enerkem's technology with their operational and technical expertise. In 2019, Suncor invested \$50-million and worked with Enerkem engineers on process integration. In 2020, more partners jumped on board, including the federal and provincial governments, who collectively invested more than \$230-million.

Enerkem is now well placed to scale their gasification technology—which is good for the planet and for its shareholders—on the world stage.

### The Canadian approach to innovation needs to be about systems

As the founder and leader of Innovation North at the Ivey Business School, our team is co-creating a made-in-Canada approach to innovation—one that embraces systems innovation. A topflight management research team works with approximately 20 of Canada's leading innovative companies to apply systems thinking to corporate innovation.

At Innovation North, we believe that all corporate innovation needs to fit within a system of technologies, as well as social and ecological systems. We are developing a systems design process that will not only make Canadian corporations more creative, it will also innovate more sustainable products and services that are more profitable in the long run and contribute to more prosperous societies and healthy ecosystems.

Both Suncor and Enerkem understand systems thinking. They understand the importance of integrating technologies to perform a function and support societal and ecological systems. This type of thinking has catalyzed a powerful innovation that will divert waste from landfills and create an alternative to fossil fuels.

Some of the challenges that we at Innovation North are undertaking include partnering with the Co-operators Group to make homes more resilient to climate change-induced weather events; partnering with Neo Exchange and the Royal Bank of Canada to innovate a new financial instrument to stem biodiversity loss; and partnering with the agri-food industry in southwestern Ontario to foster the circular economy.

We believe that systems-based corporate innovation is the key that will unlock Canada's research and development talents. If done successfully, supported by governments and corporate leaders alike, such uniquely homemade innovation can springboard Canada's companies on the world stage.

Dr. Tima Bansal is a professor and Canada Research Chair at the Ivey Business School. She is also the founder and leader of Innovation North—an initiative that is applying systems thinking to corporate innovation—and the founder of the Network for Business Sustainability.

The Hill Times

### How Canada's corporations will leapfrog Silicon Valley

This kind of systems-based collaborative innovation can be hard for policymakers and corporate leaders to understand. So, let me provide the example of Montreal-based Enerkem, a world leader in converting waste to biofuels and chemical products through an innovative gasification technology.

When Enerkem initially approached Suncor to fund the project, Suncor hesitated. To show the power of the gasification technology, Enerkem had presented Suncor the entire integrated waste-to-biofuels process in a commercial demonstration project. Enerkem had to pull together all the neighbouring technologies to demonstrate the power of their specific innovation. Suncor engineers, whose talents lay in process integration, focused on the flaws in the integrated process, such as potential equipment failures, weak standard operating procedures,

# Achieving Canada's EV mandates requires more money for research and future talent

Federal investment to support a pan-Canadian, academia-industry research consortium will complement the government and industry investments on the manufacturing side and set our country on the path to significant opportunities for EV innovation.

Narayan Kar  
& Madeline  
McQueen

Opinion



Last year, the Government of Canada was prompted to introduce an updated emissions reduction plan due to the ever-increasing greenhouse gas emissions. The plan outlines steps for the Canadian economy to achieve emission levels well below that of 2005, by 2030. One of the steps in the plan is implementing “cleantech,” technology that aims to improve environmental sustainability, to the largest pollutant emitting industries in the country, including the transportation sector.

Transportation is responsible for 25 per cent of greenhouse emissions in Canada, while 11 per cent is from passenger vehicles alone. To reduce these figures, the government has mandated that 20 per cent of new vehicles sold in Canada must be electric vehicles (EVs) by 2026, 60 per cent by 2030, and 100 per cent by 2035. The automotive industry is responding to these mandates by producing more EVs than ever before. However, many Canadians are still unconvinced by the cost, driving range, and available charging infrastructure, despite the fact the government is providing incentives for the public to make the switch to EVs. Therefore, to overcome the limitations and alleviate the public's concerns, there is a need for further research and innovation to advance EV technology and achieve the government's desired objectives.

Although there have been significant investment in EVs and EV component manufacturing by industry, with supportive investments from governments over the past couple of years, we currently do not have enough of the specific know-how and talent pipeline in most areas of EV technology. A knowledgeable workforce is crucial to the success of new investments and manufacturing facilities. For example, the new Stellantis EV research and development (R&D) facility and LG Energy Solutions' EV battery plant currently being built in Windsor, Ont., will require nearly 3,000 engineers, technicians, and plant operators, necessitating the creation and training of more local technical talent.

Therefore, on top of the investments being made in manufacturing facilities to support the EV mandates, there must be a proportional investment in R&D at universities and colleges. Academic investments create opportunities for innovation, allow for collaboration with industry to advance technology, and most importantly, train future generations of researchers, engineers, and technicians. An example of an academic institution working closely with industry is the Centre for Hybrid Automotive Research and Green Energy (CHARGE) at the University of Windsor. This advanced EV lab collaborates with many automotive industry partners and other academic institutions to train future experts in a hands-on learning environment.

Canada has seen significant investments relating to EV batteries over the last year. In addition to having strong battery and battery component supply chains, improvement in electric motor, power electronics, and control supply chains are also required. Localized supply chains provide great potential for commercialization and economic benefits and will support EV manufacturing. Canada has unique competitive advantages in future EV supply chain development with our 100-plus-year experience in automotive innovation and manufacturing. As well, all minerals and metals required to produce EV components can be found in Canada. However, our future workforce will need to be trained in design and manufacturing of EVs, and in sustainable ways to extract the precious resources needed to produce them.

Industry, government labs, and academic institutions are very keen to produce research breakthroughs in the areas of an electric vehicle's battery, powertrain, and software. These are the most expensive components in an EV and are also the ones in need of the most development, as without them, you don't have an EV. Some specific examples of future innovation in battery and powertrain areas include power or energy density improvement, enhanced thermal management for improved performance and durability, and cost and weight reduction. On the software side, better control and energy efficiency improvement through artificial intelligence and machine learning algorithms are required.

A federal investment to support a pan-Canadian, academia-industry research consortium will complement the government and industry investments on the manufacturing side and set our country on the path to significant opportunities for EV innovation in the future. The consortium can help improve battery longevity, electric motor performance, thermal management, automotive cybersecurity, and develop solutions for EV lightweighting and battery crash safety. This will help Canada become a leader in EV design and manufacturing, while working towards achieving public EV trust and the government's emission reduction goals.

*Dr. Narayan Kar is a professor within the electrical and computer engineering department at the University of Windsor, where he also holds Tier 1 Canada Research Chair position in Electrified Vehicles. He is the director of the Centre for Hybrid Automotive Research and Green Energy (CHARGE) Lab at the University of Windsor. Madeline McQueen is the research and development engineer at CHARGE.*

The Hill Times

# Canada can become the international low-carbon innovator of choice

Canada brings more to the table than natural resources and a peaceable temperament, because its research strengths include the full panoply of needed disciplines.

Martha Crago  
& Benoit  
Boulet

Opinion



The war in Ukraine has made energy security top of mind for countries such as Germany. As leaders look for alternatives to Russian oil and gas, many also see an opportunity to accelerate the transition to clean energy and meet commitments to reduce emissions.

This heightened urgency to decarbonize economies is great news for Canada. Our country boasts abundant mineral reserves, needed for a world in which electricity will be king, as well as the environmental and labour standards to extract them ethically. We have a peaceful, trustworthy reputation on the global stage—an asset becoming more and more valuable as countries feel vulnerable.

Realizing the opportunities, the prime minister and the minister of innovation, science, and industry have been making the most of Canada's newfound allure, seeking out strategic new economic partners. The federal and provincial governments have been strengthening economic clusters centred on the energy transition. For example, the Vallée de la transition énergétique in Bécancour, Que., focused on the battery sector, has attracted both multinational giants such as BASF and General Motors, as well as made-in-Quebec enterprises.

As Canada courts investment, we must also think about building our attractiveness as a research and innovation partner—and that is where our universities add substantial value to the innovation ecosystem. In short, we must do more than become a *supplier* of choice; we must also become a global *innovator* of choice across the supply chain needed to build the low-carbon economy.

Canada brings more to the table than natural resources and a peaceable temperament. Its research strengths include the full panoply of needed disciplines: smart grids, microgrids, next-generation batteries and cells, electric vehicle development, new sustainable materials, renewable energy technology, vehicle automation, sustainable mining, battery recycling, and more. For example, McGill engineering professor Jeffrey Bergthorson has been working with Siemens Energy at advancing metal-water

reactors, which burn metals to create hydrogen as well as to create heat that could be used to generate cheap, carbon-free electricity.

Canada must build on our strong research foundation and strengthen its capacity to create new international partnerships across the research, development, and innovation (R, D & I) cycle. To do so will require timely, targeted investment.

First, we need to dramatically increase our pool of highly skilled personnel so Canadian companies have the workforce needed for expansion. The government should create internationally competitive stipends to attract and retain more than 500 graduate students in fields related to clean technology, critical minerals, and automotive and battery supply chains. In a red-hot global market for talent, the dollar value of fellowships for students will need to exceed \$50,000 net, after tuition is paid. These students would be trained in partnership with industry, preparing them to tackle critical industrial challenges.

Secondly, Canada needs funding to quickly connect researchers from university, industry, and government across the nation in the areas related to the energy transition. The mechanism needs to be selective, to build on existing industry relationships, and to provide adequate funding to enable real advances. Bringing Canada's R, D & I talent together will allow us to respond rapidly to emerging opportunities for international partnerships and strengthen our attractiveness.

Finally, we need the ability to create bilateral large-scale projects involving collaborations between post-secondary institutions and industry in Canada and in like-minded countries, collaborations that address urgent energy transition needs. Funding mechanisms could include a significant expansion of existing programs, new funding programs, or a network of centres of excellence between Canada and its chosen partner. Here, the Nov. 30, 2022, announcement that the government is entering into formal negotiations for close collaborations under Horizon Europe is welcome.

Driven by the war in Ukraine and very public commitments to rapidly lower emissions, countries are developing their low-carbon economies at a breakneck pace. Canada has the assets needed to thrive. But to lead, we must quickly put in place the necessary measures to attract and retain talent and build international R, D & I partnerships.

*Martha Crago is the vice-principal, research and innovation, at McGill University and an internationally respected adviser on university research and partnerships. Benoit Boulet is the associate vice-principal, innovation and partnerships, at McGill University and an expert in the design and control of electric vehicles and green energy systems.*

The Hill Times

## Innovation Policy Briefing

# The effect of climate crisis on Canadian coastal communities is an all-hands-on deck situation, but the Liberals aren't acting

If the Liberals keep delaying on disaster mitigation and prevention, our coastal environment will become more hostile.

NDP MP  
Lisa Marie  
Barron

Opinion



Members of the Canadian Armed Forces respond to Nova Scotia's request for assistance with relief efforts in the aftermath of Hurricane Fiona in September 2022. DND photograph by Corporal Connor Bennett

We are in a climate emergency and Canadians are already experiencing unprecedented and destructive weather events. In my riding alone, many coastal communities are seeing these devastating effects.

Hurricane Fiona's destruction on the East Coast was a shocking example of the consequences of more frequent and extreme weather events. Homes were dragged out to sea, small craft harbours decimated, and communities left without power.

On the West Coast, people are seeing similar tragedies, with harsh flooding and rising water temperatures.

As a parent, I'm beyond worried about the future we are leaving for our children.

Canada has an opportunity now to rebuild more sustainable weather resistant infrastructure and plan for the future. But advances in the blue economy will depend on good climate resilient infrastructure that meets the needs of coastal communities. The Liberal government needs to be investing in this critical infrastructure instead of dragging its feet on climate protections.

Right now, the Liberals' lack of a plan for disaster mitigation means that people's livelihoods are in jeopardy. The scale of damage caused by Hurricane Fiona is significant, and people are worried harbour repairs won't be completed in time for this year's fishing season. On the West Coast, flooding has caused devastating

personal and economic losses because of highway and railway closures.

Coastal and Indigenous communities, workers, and all Canadians are anxious about the future of our marine environments, their jobs, and their safety. This is a situation that will only get worse without disaster funding.

The key is readiness—maintenance, and prevention, which is less expensive than repairing damage. Researchers are already indicating that droughts, floods, and storms could cost Canada more than \$100-billion by 2050.

With the current situation, there is a need but also an opportunity for fishers, all levels of government, and industry to innovate together to create real solutions

for our changing environment. The Blue Economy Strategy has two critical goals: protecting the natural environment and fostering a stronger business environment. This is an opportunity to do both at once, and it should not be wasted.

Firstly, small craft harbour overhauls and modernization is needed—wharves need to be built higher, breakwaters need to be thicker, and more investments in resilient gear must be made. But beyond this, there is tremendous room for innovation.

Adaptation, research, and development are the way of the future and it's time Canada starts heading in this direction.

As change and innovation happens, we must make sure the

government and other stakeholders consult with those who live and work in coastal regions. Communities need clear and timely transition plans, developed with public input. But right now, it seems that the Liberals' involvement or distribution of information to those affected by coastal planning and policy is only an afterthought.

It's time to change this approach and instead listen to fishers and act quickly.

When independent fishers speak, they are doing so with generations of accumulated knowledge on their communities' infrastructure needs. It would be wise to listen.

As with many climate-related avenues, the window open to us now will not last forever. The Liberal government is in a position where it clearly sees what is coming—and an ounce of prevention is worth a pound of cure. If the Liberals keep delaying on disaster mitigation and prevention, our coastal environment will become more hostile.

We can innovate now, in preparation for harder times ahead, or we can attempt to innovate under increased pressure, at a disadvantage, in the middle of those hard times.

The Blue Economy Regulatory Review provides a real opportunity to look at ways that we can encourage growth and innovation in climate preparedness. And now more than ever, the past year has taught us the importance of being prepared. Our coastal communities know that the climate crisis is an all-hands-on-deck situation; it's time to treat it like one.

MP Lisa Marie Barron represents the riding of Nanaimo-Ladysmith, B.C., and is the NDP critic for fisheries, oceans, and the Canadian Coast Guard. Being born on the East Coast, and raising her children on the West Coast, she has a deep appreciation for marine habitats. She values the importance of Canada's blue economy, as well as the need for conservation efforts.

The Hill Times

# The Government of Canada is advancing Canada's position as a global leader in innovation

It has become clear that we can't keep doing things the same old way; we need to make sure Canadians benefit from their own ingenuity.

Liberal MP  
Andy Fillmore

Opinion



Canadians are innovative, taking on challenges and coming up with inventive ways to solve them. Consider insulin, road lines,

the paint roller, or the Java programming language: Canadians have great ideas.

It has become clear that we can't keep doing things the same old way; we need to make sure Canadians benefit from their own ingenuity. We know that we have to make a different kind of investment and work with industry in a new, collaborative way. In short, we need to innovate.

That is why our government fundamentally shifted Canada's innovation landscape with the launch of the Global Innovation Clusters and Innovative Solutions Canada. These two programs are reshaping how our nation supports—and benefits from—our own good ideas.

The Global Innovation Clusters are driving innovation across the country in five areas

where Canada has a significant competitive advantage: digital technologies, plant-based protein industries, next-generation manufacturing, artificial intelligence and supply chain logistics, and the ocean economy. These clusters are the Government of Canada's co-investment with industry to continue building ecosystems that accelerate innovation and take innovators further, faster through collaboration.

Canada's Ocean Supercluster is a prime example of how this approach generates success, tapping into the combined strengths of the small, medium, and large enterprises operating in Canada's oceans and forming partnerships to develop innovative projects and solutions that enrich the lives of all Canadians. The Ocean Cluster has approved more than 70 projects worth more

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In November 2022, Innovation Minister François-Philippe Champagne announced more than \$1 billion in funding to support scientists, researchers, and students, but only about 20 per cent (generously) will get tenure track positions, writes Sarah Lubik. *The Hill Times* photograph by Andrew Meade

# The Valley of Never- Having-Lived: Canada's innovation talent problem

In Canada, we celebrate how we support companies, but in reality, our innovation system is structurally and culturally stacked against entrepreneurial scientists from the start.

Sarah  
Lubik

Opinion



As Canadian policy and investment encourages more innovative startups, we constantly hear about the “valley of death”: the point where a startup has some momentum but struggles for market traction. We hang lofty hopes on research-based startups getting past this to solve global challenges and grow into scalable companies. However, focusing on the valley of death will keep us ignoring a valley in even greater need of bridges: The Valley of Never-Having-Lived. This is where potentially world-changing startups and entrepreneurs never get the chance to realize their potential.

In Canada, we boast about the science-based companies that have grown to make substantial impact, including: AbCellera, behind solutions used to treat COVID patients, and STEMCELL Technologies, Canada's largest biotech firm. Such companies usually stay in Canada, create jobs to keep and attract talent, and provide Canadian solutions to pressing global challenges. We celebrate how we supported these companies, but in reality, our inno-

vation system is structurally and culturally stacked against entrepreneurial scientists from the start. This begs the question: *how many transformative ideas never got the chance to live?*

The federal government recently announced investments of more than \$1-billion into world-class research, graduate students, and post-doctoral researchers. But of these highly educated people working on transformational research, only about 20 per cent (generously) will get tenure track positions, and yet we train them as though they all will. Consequently, the remaining 80 per cent will pursue other careers, often with limited preparation in how to effectively apply their talents in industry, government, and other organizations, and end up changing careers without support. The failure to fully realize this potential represents a substantial loss of the full impact of that massive investment in talent, and ensures that the ideally placed people to take our research forward don't have the opportunity or skills to do it. Just as tragic, when we lose those highly skilled people from their own fields instead of helping them move into relevant positions in entrepreneurship or industry, we also undermine our national capacity to absorb innovation into industry, further weakening our return on Canada's substantial investment in research.

We need to realize this is a people problem before it's a venture problem. Many of these highly educated graduates have the tenacity, drive, and passion needed to be an entrepreneur or intrapreneur, but are not taught to communicate the potential of their science to broader audiences, or how to create a compelling plan for impact. They are rarely socialized to regard entrepreneurship or industry as an attractive path and, even if they are, they are often juggling their studies and several jobs to make ends meet, so lack the opportunity to focus or even try.

Addressing these challenges requires a bridge over that valley and accessible on-ramps. In the national Mitacs Inven-

tion to Innovation (i2I) program, research graduate students, post-docs, and faculty members from any university in Canada learn to develop an entrepreneurial mindset, learn to translate between science and business, and link into national networks of mentors. During the program, Dr. Ben Britton, co-founder of rapidly growing clean-tech venture Ionomr, learned to explain how their membranes would change the fuel cell industry for partners and investors. NanoSentinel's founder, Dr. Viridiana Perez, like many female scientist-entrepreneurs, didn't realize she was an entrepreneur until i2I. She pursued training first but began to identify as an entrepreneur later. Many others do not get an opportunity to participate or focus where stipends, internships, and post-docs could yield incredible returns. In Simon Fraser University's entrepreneurship Co-op (eCo-op) program, cleantech startup Moment Energy's student founders were given non-dilutive \$10,000 awards to spend a few semesters on their venture. With minimal investment, they pivoted into a cleantech company now working with Nissan and Mercedes-Benz.

These experiences show the incredible potential in front of us to catalyze an exponential return on Canada's investment in research and highly educated people by investing in targeted, insightful pathways, programming, and removing barriers for entrepreneurial scientists. With an early focus on people, Canada's innovation ecosystem could ensure that the next transformative science-based venture not only gets the chance to live, it gets set up to thrive.

*Dr. Sarah Lubik is an award-winning researcher, ecosystem-builder, and educator focusing on developing the entrepreneurial mindset and supporting science-based innovation. She is the executive and academic director of the Charles Chang Institute for Entrepreneurship at SFU and the academic director of the national Mitacs invention to Innovation (i2I) Skills Training and i2I programming at SFU.*

*The Hill Times*

## Canadian innovation lacks forward thinking

If Canada focused more on the merits of the individuals who they are putting in charge and less on giving themselves diversity and climate change scorecards, perhaps we could get back to using the greatest public service I have ever known.

Aman  
Chahal

Opinion



The challenge with Canada's innovation agenda is that it is all execution and no planning.

Billions of dollars have been deployed through agencies promoting cleantech development and innovation support with nothing meaningful to show for it. While one may want to blame some malicious scheme at the heart of the matter, the truth remains quite simple: the challenges of bias in the workplace compounded by the motivation to gain voters makes the Canadian government incredibly incompetent.

We love hearing the loud, obnoxious, cocky, and incredibly underqualified person in the room set the direction, right?

I have personally sat in rooms where marginalized founders gave the most eloquent of presentations to ask for government funding. They were decorated with degrees and experience, but were told they “just didn't have it.”

Meanwhile, people who manage places like Sustainable Development Technology Canada (SDTC) created a “seed” fund that doesn't give out money at the seed stage.

To be honest, I don't really care that those organizations are basically pushing all the money out the door to people who do not deserve it. I also would not care that they could, just as easily, send that money to the marginalized founder and make more of an impact. It does not even matter to me that their bonuses are tied to how much money they spend, not fund performance.

My problem is this: it is just so embarrassing. I could deal with being discriminated against. But if Business Development Canada is going to create the affirmative action “fund” for female entrepreneurs, can they also publish the list of male founders they are funding through all their other funds? The marginalized founders could try to become co-founders at those companies.

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## Innovation Policy Briefing



A combination of advances is making 5G a major element in countries' digitalization strategies, upon which their prosperity increasingly depends, writes Martin Cave. *Unsplash photograph by Paul Hanaoka*

# The U.K. spectrum policy is keeping wireless prices low—can Canada do the same?

Canada risks an inadequate supply of spectrum that may limit competition for 5G services, drive up both spectrum and 5G service prices, and delay access to a very significant new technology.

Martin Cave

Opinion



A group of economic consultants recently calculated that between 2010 and 2020, average smartphone speeds in advanced countries increased by 100 times, and data consumption per mobile subscriber went up 90 times. Quality-adjusted prices fell by similar amounts. It is thus not

surprising that the importance of the mobile sector to economic prosperity is recognized by governments, companies, and households.

In mobile technology, the last decade belonged to 4G. We are now in the era of 5G. In one sense, 5G is just a better version of 4G, based on a new technology which provides faster and cheaper internet access to all mobile users. In a more important sense, it is transformational. Its data capacity is huge; and it is versatile, in that a single network—its operation now largely transferred to the cloud—can be “sliced” to provide a range of different services in terms of speed, latency, and other characteristics. This combination of advances is making 5G a major element in countries' digitalization strategies, upon which their prosperity increasingly depends.

Clearly, the availability of spectrum is a precondition for the development of 5G, and the focus internationally has been on the 3.4-4.2 MHz range. Spectrum is the radio waves on which data travels, and getting this out and used in an efficient way is essential to the development of new services.

The norm for allocating spectrum is to auction it. Best practice is to get it out quickly: the sooner the spectrum is available, the sooner 5G can start. Most advanced countries have done so, starting as far back as 2018.

Another key choice is the amount of spectrum made available. Essentially, where more spectrum is available, the lower the auction clearing price will be. Some governments have restricted the offer in certain auctions to enhance auction revenues. But the alternative spectrum policy of “pile it high and sell it cheap” is likely to confer more benefit on customers and even on the government itself (through higher growth and tax revenues).

I have looked at the release of spectrum for 5G in Canada and the United Kingdom. The U.K. was quick out of the blocks in 2018, auctioning a mid-band (3.4-3.6 GHz) spectrum formerly used by the U.K. Ministry of Defence. After bidding for the 150 MHz of spectrum, all four existing mobile network operators gained between 20 and 50 MHz. With previous holdings, that left each of them with at least 40 MHz: the sole new entrant left empty-handed.

In the second 2021 mid-band (3.6-3.8 MHz) 5G auction, three operators came away with 40 MHz each. This left each operator between 80 and 100 mid-band MHz. Each nearly has the 5G holding recommended by the International Telecommunication Union. The prices per MHz per population have been calculated to be US\$0.16 in 2018 and US\$0.09 in 2021. Thus, each of the four operators got their hands on a good holding at a low spectrum price, which was consistent with expectations of competitive 5G service prices.

Things have gone differently in Canada, where the only mid-band auction to have taken place so far was not held until July 2021, when 200 MHz of mid-band spectrum were assigned. But 89 MHz of this already sat with three large mobile operators. Of the remaining 111 MHz, 47 MHz were reserved for regional carriers' mobile providers. This left the three national operators competing for 64 MHz. Hardly enough to meet Canada's needs.

This scarcity led to keen competition among them and high prices—US\$1.12 per MHz per pop (respectively seven and 12 times higher than the prices which were

observed in the U.K.). Such high prices may foreshadow higher service prices when the networks are in place. It is true that more spectrum is on the way, but it won't be available in cities until 2025 or rurally until 2027.

The two countries also differ in their enthusiasm for set-asides, or reserving spectrum at auction for new or smaller operators. Canada has a history going back many years of using set-asides, as described in my co-written 2010 paper for the CD Howe Institute, “Solving Spectrum Gridlock.” In my view, international experience shows it is quite difficult to promote entry or growth of small operators via set-asides. The cost in terms of lost opportunities of assigning valuable spectrum to this purpose should be subject to a rigorous risk analysis which takes full account of valuable spectrum being “sterilized” for years in the control of failing smaller operators.

In Canada, there is a risk that an inadequate supply of spectrum may limit competition for 5G services, drive up both spectrum and 5G service prices, and delay Canada's access to a very significant new technology.

*Sir Martin Cave is a visiting professor at the Imperial College London. He was an academic co-director at the Centre on Regulation in Europe and is now a member of the board of directors. He is a regulatory economist specializing in competition law and in the network industries, including airports, broadcasting, energy, posts, railways, telecommunications, and water.*

*The Hill Times*

# The Government of Canada is advancing Canada's position as a global leader in innovation



The Liberal government fundamentally shifted Canada's innovation landscape with the launch of the Global Innovation Clusters and Innovative Solutions Canada, two programs that are reshaping how our nation supports—and benefits from—our own good ideas, writes Andy Fillmore. *Photograph courtesy of Unsplash*

through two streams: the Challenge Stream, where companies respond to departmental challenges for their early-stage research and development (R&D) needs, and the Testing Stream, where they can test their last-stage R&D with a department. The program's Pathway to Commercialization gives selected companies the opportunity to sell their innovation directly to the government without further competition.

As of January 2023, Innovative Solutions Canada's Challenge Stream has issued more than 330 awards for funding. And since 2010, its Testing Stream has awarded almost 705 contracts valued at more than \$372-million, enabling hundreds of Canadian SMEs to commercialize their innovations and create high-value jobs.

Together, these programs are supporting the advancement of economic outcomes for Canadians. The Global Innovation Clusters are building partnerships and developing technologies that will have applications around the world, opening up big markets for homegrown innovations, while Innovative Solutions Canada is helping Canadian SMEs advance and commercialize their R&D.

Both programs create well-paying jobs for Canadians, help companies scale up, and position Canada as a global innovation leader.

They are also positioning Canada to succeed in the economy of the future and in global markets. All Canadians will benefit from their continued success.

*Andy Fillmore is the Member of Parliament for Halifax and parliamentary secretary to the minister of innovation, science, and industry. First elected in 2015, he has held numerous roles in government including parliamentary secretary for Canadian heritage, for democratic institutions, and for infrastructure and communities.*

*The Hill Times*

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than \$360-million. These projects are delivering more than 120 new made-in-Canada ocean products, processes, and services to sell to the world. Together, these projects are positioning Canada as a leader in the blue economy and are expected to generate thousands of jobs for Canadians.

Across all five clusters, the numbers tell us that this approach

is working. The Global Innovation Clusters have exceeded expectations, approving more than 500 projects worth more than \$2.24-billion—\$1.4-billion from industry and other partners, which involved almost 2,400 partners, more than half of which are small and medium-sized enterprises (SME). More than 8,000 members can connect with like-minded peers, drawing on expertise and resources, to shape projects that

will have an undeniable impact on the everyday lives of Canadians. More than this, the clusters are on track to meet or exceed the overall job creation target of 15,000 direct, indirect, and induced jobs by 2023, and 50,000 by 2028.

To keep building momentum, the government is doubling down with another \$750-million over six years for the Global Innovation Clusters, as announced in Budget 2022.

Complementing this, Innovative Solutions Canada is delivering strong results that benefit Canadians. The program is designed to take advantage of the government's capacity as the largest purchaser of goods and services in Canada (roughly \$22-billion annually) to support the growth and scale-up of SMEs.

Innovative Solutions Canada supports commercialization

# Canadian innovation lacks forward thinking

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We all have biases about something. But certain biases leave us all paying the price. I would love to see an analysis for how many people left SDTC following its many "restructurings" that shows how many degrees and years of experience walked out that door. If I could venture a guess, you would find people from all walks of life on that list.

Bias operates at every level of the Canadian decision-making agenda.

In 2017, the House Standing Committee on Industry, Science,

and Technology chaired by then-Liberal MP Dan Ruimy submitted to the government one of the best-articulated policy papers on intellectual policy. It was a policy masterpiece. That entire report was overruled because in reality, politicians rely more on a handful of biased "industry experts." This shortsightedness has led to a focus on patenting only IP policies in Canada giving rise to organizations such as the Innovation Asset Collective. Granting agencies like SDTC then push companies to pay for ineffective advice from these or-

ganizations. No real checks and balances.

If Canada focused more on the merits of the individuals who they are putting in charge and less on giving themselves diversity and climate change scorecards, perhaps we could get back to using the greatest public service I have ever known.

Those of us consulting with the real experts, actual Canadians and the general "non elite," are a bit tired of the political messaging. This mess was made by reactionary execution, not researched public policy. No one cares about

the scorecards. You can't actually reduce emissions by projecting greenhouse gases saved. Those technologies must be commercial if we are to save this planet.

How is it even possible that Ottawa is a half-hour flight from Bay Street, but there are zero master of business administration (MBA) programs from the three most finance-focused MBA schools in Canada working to advise on funds? Just because we are giving out a grant does not mean most of your companies are successful, because most of the companies in normal funds fail. Am I the only one who studied at school?

Three things that can be done now to increase efficiency of all government "innovation" funding programs:

1. Create an independent ombudsman that can review complaints about decisions made by granting agencies;

2. Create an independent whistleblower line for all government agencies; and
3. Do a review of which individuals have been "acting" in high-level roles for more than six months.

Make all complaints anonymous and justify why.

Welcome to innovation.

*Aman Chahal is the industrial professor for innovation and entrepreneurship at the faculty of mechanical engineering in the University of Alberta. Currently working on building an incubator to promote commercialization of research on campus, her specialization is in identifying commercialization barriers in the cleantech field and finding innovative business models to increase adoption. She worked in Ottawa in the innovation and cleantech field from 2016-2018.*

*The Hill Times*