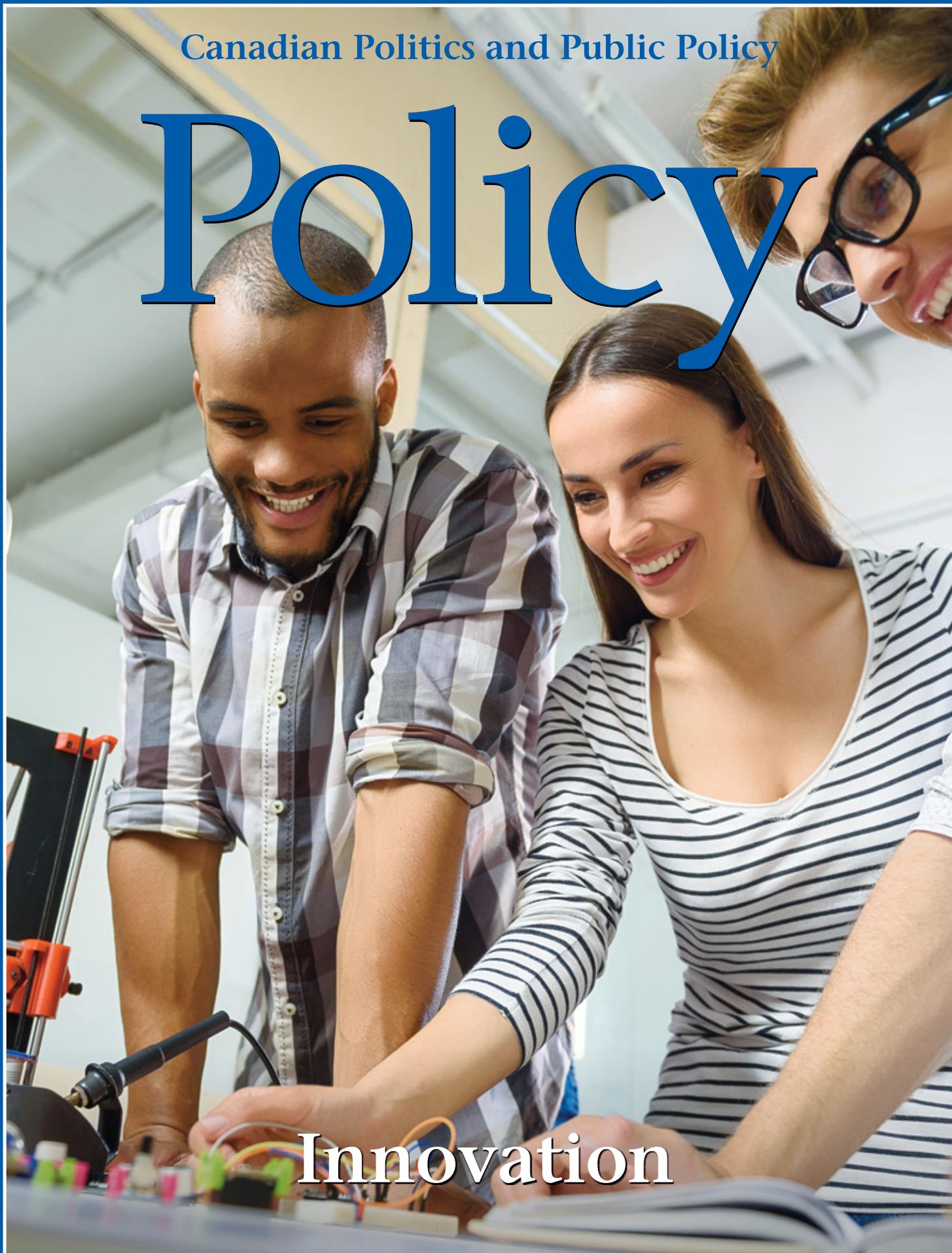


Canadian Politics and Public Policy

Policy



Innovation



Back row left to right: Patricia Boal, CTV Ottawa; David Miller, CN; Alex Munter, CHEO President and CEO; Kevin Keohane, CHEO Foundation President and CEO; Louis-Alexandre Lanthier and his son (front), CN; CN mascot; CTV's Graham Richardson; CHEO Bear. Front row left to right: McDonald's Dream Team Members: Aman Sidhu, Joshua Wilson Mallette and Anthony Farinon.

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Canadian Politics and Public Policy

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Policy

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From the Editor / Lisa Van Dusen

The Innovation Issue

Welcome to our second annual issue on innovation, again in partnership with the Rideau Hall Foundation. The RHF is an independent charitable organization established by former Governor General David Johnston to mobilize ideas, people, and resources to encourage and recognize excellence in innovation. In our two years of collaborating with the RHF, we've come to truly appreciate its value as both a catalyst for Canadian ingenuity and a collegial partner. We particularly want to thank Barbara Gibbon, the RHF's director of innovation, for her invaluable contribution to this issue. As associate editor of *Policy*, I filled in for our editor, L. Ian MacDonald, as editor of this issue.

This year marks the inaugural Canadian Innovation week from May 22-31. Our issue opens with MacDonald's Q&A with federal Innovation Minister Navdeep Bains ahead of that landmark and on the heels of his recent announcement of the five superclusters chosen to receive \$950 million in public and \$950 million in private funding to establish sectoral innovation hubs across the country.

Former clerk of the Privy Council and current BMO Financial Group vice chair Kevin Lynch launches our package of excellent contributions from the five innovation superclusters, which represent a combination of technology-enhanced modernization of Canada's legacy natural resource sectors and doubling down on 21st-century tech wizardry, with *Why Superclusters Matter*.

From the Halifax-based Ocean Supercluster, Matt Hebb writes that the initiative will provide a platform for collaborative R & D and boost innovation in the ocean economy by distributing investment risk across

the consortium. From the Montreal-based Scale AI Supercluster, Alain Dudoit writes in French that we are helping shape a new global supply chain platform and bolstering Canada's early leadership in artificial intelligence (AI). Jayson Myers of the Advanced Manufacturing Supercluster says it will enable us to address some of the most important challenges inhibiting the competitiveness and growth of Canada's manufacturing and technology sectors. Bill Tam writes that the Vancouver-based Digital Technology Supercluster will support large-scale economic growth, generate jobs and create new opportunities for Indigenous communities. And, Protein Industries Canada CEO Frank Hart explains how the new agriculture supercluster will scale up the industry's technological transformation of recent years to take Canada to a new level of global competitiveness.

Beyond the superclusters, Business Development Bank of Canada President Michael Denham describes the way in which a major boost in its Women in Tech fund in Budget 2018 will help level the start-up playing field for women-led tech companies. Kelly McGregor, manager of Communitech's Fierce Founders program for women entrepreneurs, reports from the front lines of that effort to help women close the start-up gender gap. In an invaluable look at innovation from the inside that's a must-read for policy makers, Amielle Lake, Barry Yates and Laura Lam from Entrepreneurship @UBC ask whether in Canada's start-up ecosystem, we're playing "not to lose". And, we have excellent insight into the journey of innovation and what governments can do to improve their investments from Questor Technology CEO Audrey Mascarenhas. Mas-

carenhas is a 30-year veteran of both the oil patch and clean energy, and her perspective on innovation is infused with that wealth of experience.

In one of our favourite entries in this issue, the wonder boys at Montreal visual effects and animation studio Cinesite—Dave Rosenbaum, Nick Glassman and Tyler Werrin—describe the fascinating innovation culture of filmmaking (If you're watching *Avengers: Infinity War*, you'll catch Cinesite's special effects contribution in the credits). And still in the realm of media, Thomson Reuters Vice President Shawn Malhotra lays out how perpetual innovation made one of Canada's most recognized brands the world's largest multimedia news agency. In the social innovation sphere, World Wide Hearing founder and Governor General's Innovation Award winner Audra Renyi provides an amazing window on how innovation, to her, has been a story of overcoming obstacles and applying lessons from every aspect of life. From the far North, Arctic Inspiration Award winner Trevor Bell tells the fantastic story of how SmartICE is helping Inuit communities navigate melting sea ice with the help of technology.

In our *Canada and the World* section, contributing writer Jeremy Kinsman warns that Donald Trump may bring his disruptive agenda to the Charlevoix G7. And, as officials preparing for Charlevoix prepare their arguments for sustainable energy, Canadian Nuclear Association President John Barrett briefs them on his case for making nuclear part of the mix.

Last but by no means least, the great Don Newman has a column about the Trans Mountain pipeline standoff.

Enjoy the issue. **P**



Innovation Minister Navdeep Bains in conversation with *Policy* Editor L. Ian MacDonald at his Centre Block office on April 23. *Policy* photo

Q&A

A Conversation on Innovation With Navdeep Bains

Innovation Minister Navdeep Bains sat down with Policy Editor L. Ian MacDonald on April 23 for a wide-ranging Q&A touching on the Trudeau government's five designated superclusters, advancing women in business, on-line privacy and other issues.

Policy: Minister, thank you for doing this. We want to talk off the top about the superclusters and the progress that's been made to date. Is it fair to say you're still in the starting gate but, you know, ready to go?

Navdeep Bains: Absolutely, it was a very competitive process. This is a key part of our government's Innovation and Skills Plan. Superclusters are very important. We used our power to convene, to bring industry, academia and civil society together. Essentially, the key outcome is really about jobs and growth and we're really excited about the opportunity going forward. We

had over 50 different applications or submissions to the superclusters initiative. We ultimately decided on five. We wanted to avoid giving a little bit of money to many different projects and instead, focus on the most ambitious, bold initiatives so we selected five.

Policy: One per region?

Navdeep Bains: Well, it worked out that way but as you know innovation happens everywhere across the country and if you look at the five selected superclusters as well, it really reflects two key dimensions. One is the influence of ecosystems and platforms and also playing to our strengths. The ocean or agriculture, for example. Our country is blessed with natural resources, so the question is how do we leverage these strengths and how do we make sure that these sectors of our economy are also part of our future economic growth.

Policy: What about the role of the private sector in this and the matching funds, \$950 million from the private sector, \$950 million from the government and you talked about it in your statement in February at the launch of \$50 billion of economic activity being generated over ten years. Are you comfortable with that number?

Navdeep Bains: This is business led. This is what makes this initiative different. It's not about government prescribing the sectors or the technologies or the industries. This is about businesses determining where the growth is and going out there and building partnerships and they did that in a meaningful way. We had 450 total businesses participate. Over 300 small businesses were part of this initiative as well 60 academic institutions. Clearly, one of the aspects of this initiative was to make sure that, at minimum, the private sector match dollar for dollar the investment that we are making, and they exceeded that amount and I think when it is business led and they are contributing more than they expected that demonstrates, initially the success of this initiative.

Policy: Can we talk about the five regional superclusters? First of all, the Atlantic, we have a piece from Matt Hebb, who has quite a striking statistic that only one percent of Canada's economy is linked to ocean activity. Here we have the largest Arctic space in the world, the largest ocean space in the world and only one percent of our economy is linked to the oceans.

Navdeep Bains: Enormous potential and that's why we think that if you create a platform, an ecosystem that can benefit shipbuilding, oil and gas, renewable energy, aquaculture. There's just so much potential with the ocean supercluster. What was also very interesting to see is that all four Atlantic provinces came together. Rather than making individual bids they determined that if they came together as a region to really leverage the ocean and the potential that existed there, they would have a stronger application, and they did.

What is also really exciting is that a lot of small businesses are involved. As I mentioned, a total of 450 businesses are involved in the superclusters initiative but 300 of them are small businesses. The success of a lot of these initiatives, including the ocean supercluster, is about strengthening that supply chain. It's about how can large, big firms help small firms scale and grow. How can they help them with research and development? How can they help them with technology adoption? How can they make their processes more seamless?

And, again, how can they connect to global supply chains? That is a key part because as part of our Innovation and Skills Plan we are focusing on skills, talent and people, training, retraining and life long learning. Technology adoption's another key aspect but both of those are really driven towards helping companies scale and grow. That's one of the key outcomes from the supercluster initiative.

Policy: Quebec and the AI, artificial intelligence hub in Montreal, which is already quite impressive and the alliance between the University of Montreal and McGill is quite something.

Navdeep Bains: And Waterloo as well. I was there at the University of Waterloo when they introduced their Waterloo AI Institute. It's important to note that we have over 500 companies in artificial intelligence in Canada. If you look at the potential, according to PwC, AI will actually represent over \$157 trillion of economic growth and opportunities or part of our economy by 2030. So, it's all about how can we reduce inventory, enhance the customer experience, help integrate our supply chains. Those are some of the key aspects we looked at throughout the selection process. Not only did they have ambition but they saw a real growth area and they demonstrated meaningful technology deployment through artificial intelligence as a cross platform that would impact so many different aspects of our economy. For instance, retail, manufacturing, agriculture, etc.

Policy: And Ontario and the Toronto-Waterloo corridor.

Navdeep Bains: So advanced manufacturing really stepped up in a big way. Additive manufacturing, particularly 3D printing for example, was a big play. I think it's a demonstration that these technologies are coming and they are impacting so many different industries. When confronted with this reality, we must ask ourselves how do we compete? How do we add value? How do we compete with other jurisdictions that are also betting on innovation and similar technologies? What was really interesting about the advanced manufacturing supercluster initiative is their focus on training and skills. Because as you know, in our budget, we focused on innovation and skills training. You can't have innovation if you don't have skills, if you don't have the people, the technology, the know how, the creativity. With the advanced manufacturing initiative, they really stepped up in a big way on knowledge transfer, on training and retraining because as robotics are invested, as they invest in 3D printing, they need to re-skill, they need to redeploy resources to make sure the

skills and labour force reflect the new opportunities that will emerge.

Policy: And the Prairie corridor?

Navdeep Bains: That one is really looking at how to add value to proteins through canola and pulses. Again, playing to our strengths. People recognize that China and India are growing economies, with vibrant growing middle classes.

Policy: Huge customers.

Navdeep Bains: Huge customers, especially when it comes to their daily diet. They want to consume more and more protein. So again, the question is how can we add value? How can we make sure that we are able to take advantage of these emerging economies where there is enormous economic opportunity and market access. Using genomics as well as IT to really add value to provide opportunities. Again, this demonstrates innovation isn't about the latest iPhone, it's not about the latest technology. It's about industries like agriculture, for instance, that are very innovative and they, again, demonstrate a great deal of ambition which positions Canada well in the global economy.

Policy: And finally, B.C. and the tech corridor?

Navdeep Bains: So, this is a big data play. The applicants looked at data analytics and focused on quantum technology as well through D-Wave for instance, and that's a very important company initiative as well. They looked at how they can use data and big data and data analytics to innovate, in the natural resource sectors, so of course forestry is an example of that, but also in precision health. Again, what's interesting about these superclusters is they go beyond one sector or one industry. It's about these platforms that provide opportunities for co-development. If you look at all the superclusters, there are some common themes and one of the areas that we as a government focused on was intellectual property. The latest budget further demon-

“ We’ve done really well when it comes to venture capital in Canada. We had a record number last year—\$3.2 billion in VC funding—but we need to make sure that we also create opportunities for women, so there was a special carve-out of \$50 million for women-led businesses and other businesses that, in the past, traditionally got overlooked. ”

strates our commitment to science and research.

We do well in providing additional resource to our academic institutions. Though we need to do a better job of taking that research and commercializing it. And when we do commercialize and generate the IP we have to make sure Canadians benefit from that IP. For the first time in the history of Canada, we now have a national IP strategy. As these superclusters grow, as these technologies emerge, as these ecosystems strengthen, the IP that is generated will benefit Canadians. The IP strategy we just announced will help Canadian companies address some of the key recurrent issues IP experts and industry stakeholders have been facing over the last decades. In the knowledge economy, IP is more important than ever before. If you look at the S&P 500, 84 per cent of their companies are linked to IP. Their assets. 84 per cent of their assets are linked to IP. If you look at the top 50 TSX companies only 40 per cent of their assets are linked to IP. Clearly, when you look at our U.S. peers, for instance, we need to do a better job in this new knowledge economy.

Policy: One of the things that is quite striking is the emphasis on female entrepreneurs in the budget and for example \$1.65 billion to women business leaders or start ups over three years through the BDC and EDC. Can you discuss that?

Navdeep Bains: I'm an accountant so numbers matter and we had, as you may recall, when we formed government, we had our mandate letters made public and from those mandate

letters we also came forward with metrics. Key targets that we wanted to achieve. One of the targets was that we wanted to double the number of majority woman-owned businesses to 340,000 businesses by 2025. One of the key areas that we looked at where there was a gap in our ability to achieve that target was financing for woman entrepreneurs. So, investing \$1.65 billion would deal with that gap around financing. Specifically tailored and targeted to women owned businesses to help us achieve that target. This complements another program called the Venture Capital Catalyst Initiative. We've done really well when it comes to venture capital in Canada. We had a record number last year—\$3.2 billion in VC funding—but we need to make sure that we also create opportunities for women, so there was a special carve-out of \$50 million for women-led businesses and other businesses that, in the past, traditionally got overlooked. This isn't only about businesses in traditional urban centres, but also in our rural remote communities as well. So, again, we are being very clear: innovation has to benefit the many, not just the few.

Policy: There's also \$105 million over five years to redress barriers to women start-ups.

Navdeep Bains: Correct. If you look at the start-up culture in Canada, we do really well at starting up businesses and again if you look at the data there are many opportunities not presented to women entrepreneurs and there are a range of systemic barriers that exist. We want to make sure we provide the additional resources to help the start-ups in Canada because it is not only

the start-ups that we're focused on but how do we help them scale up and become global champions That's really been the focus of our government. If you look at our Innovations and Skills plan, we consulted Canadians, we specifically consulted businesses across the country and we came to the determination that this is going to be a multi-year effort. One of the key outcomes is our ability to become a scale-up nation, rather than just a start-up nation. We will continue to support the start-ups, specifically women, but overall, we want to make sure we help companies scale up. We've presented, for instance, a procurement program, Innovation Solutions Canada. The idea is that using government as a marquee customer Canadian start-ups will be able to validate their products and services so when they go abroad they can say they have done business with the Government of Canada and that opens up more opportunities for them to scale up and grow in new markets. We've also provided opportunities for rural and remote communities. Our Connect to Innovate program is a very good example of that. In this day and age, high speed internet is no longer a luxury, it's essential. High speed internet and broadband connectivity in rural and remote communities is essential for businesses. Not only to start but scale up as well and get access to global markets. As I mentioned, innovation happens everywhere, so if we want our businesses to succeed and grow, wherever they are based in Canada, we need to ensure that all Canadians can access the basic technological tools they need in the 21st century economy. And then, of course, on skills I think it is really essential to note that we've brought forward the Can Code Initiative. This is about coding for one million kids and teachers over the next two years, again a focus on young girls and Indigenous people.

Policy: Also, that 15 per cent of small and medium-sized businesses doing business with the government would be led by women.

Navdeep Bains: We believe that num-

ber can definitely increase. We believe that government as a marquee customer can really create opportunities for these businesses to become more export oriented, become more innovative and that's what we've done with the Innovations Solutions Canada program. We would help with the proof of concept, we'd help with the prototype, we'd help them with overall procurement and it's good for government as well because it injects innovative ideas and solutions to help us address challenges and issues that we're facing within government. It makes us more nimble, better positioned to serve our constituents, at the same time it allows us to use government resources to strategically invest in Canadian start-ups and Canadian businesses, women led businesses, for them to be able to succeed not only within Canada but globally as well.

Policy: In terms of gender equity in businesses, is it helpful, and I think it obviously it is, that you've named Janice Fukakusa of Royal Bank as the Chair of the Infrastructure Bank.

Navdeep Bains: I think if you look at the governance structure for the superclusters we've actually been very clear about prescribing two areas. One is they need to have a very clear gender strategy. The Prime Minister led by example when he created the first gender balanced cabinet and we want to see leadership through the governance structure with the superclusters with a gender equality and diversity strategy. Not only at the board level but at the employment and deployed funds levels as well. These two are consistent with the legislation that just passed on Thursday, Bill C-25. This Bill C-25 is about promoting diversity on corporate boards. Corporate boards must now have a diversity policy and if they don't it is a comply or explain model, they must to explain to shareholders why they don't have a diversity policy or why they didn't reach the objectives outlined in their strategy. If you look at the UK example or if you look at the Australia example, this will actually increase the number of women on boards significantly. Right now,

in Canada, only fourteen percent of board members are women and that must change. We can do better.

Policy: There's \$4 billion over five years in the budget on R&D and Science. That's in your department.

Navdeep Bains: Innovation, Science and Economic Development. As an activist government we've been very clear: they're all linked. Science is about the long term. We need to make sure we make significant investments in science.

If you look at Canada's success in artificial intelligence. It's attributed to successive governments and here I give credit to the previous government as well, about making investments in that specific area. If we want to see Canada compete globally, and we are in a global innovation race, we're competing with China that's focused on mass innovation. We're competing with India that's focused on digital cities, for instance, then we need to be strategic about focusing on research where we can be the leader in breakthrough technology where we can develop areas of expertise. This complements the overall brand of Canada as well. The fact that we not only value diversity but we are genuinely open to people. The global skills strategy is the best example of that. This is also part of our Innovation and Skills Plan. This particular program allows Canadian academic institutions and Canadian businesses to bring someone with high in demand skills to Canada in a matter of two weeks. This is really a game changer. We introduced this program last June and thousands of companies and academic institutions have applied and we've issued many, many visas. This clearly has helped Canada, again, reap the benefits of those investments that we are making in science. It helps us translate that science and commercialize that into good IP and it allows those IP companies to succeed because, going back to IP very quickly, IP-intensive firms on average pay 16 per cent more than their counterparts when it comes to wages, they

are more export oriented and they create more jobs. At the core of that is really our investment in issues like coding but global skills as well and science is really critical to that. That's why that \$4 billion investment was important and of that \$4 billion investment in science \$1.2 billion was for the granting councils. That provides predictable funding over the next five years for us to play a leadership role on cutting-edge research.

“ *In light of what has happened in the U.S., in light of what has happened with Brexit, for instance, that's really demonstrated that Canada is in a unique position. We value people.* ”

Policy: There was a piece recently from MaRS in Toronto—a survey of tech firms. Fifty-three per cent saw an increase in international job applications since 2017 over 2016 because of the Trump administration's policies on immigration. The top choices for relocation outside the U.S. were: Canada 32 per cent; the UK six per cent; France five per cent. This seems like a huge opportunity for us.

Navdeep Bains: Enormous opportunity. We were mindful of this before the U.S. elections and we sent a clear signal when the portfolio was changed from Industry Canada to Innovation, Science and Economic Development. Our Prime Minister was very clear about his commitment to diversity and making sure that we promote better opportunities for women in entrepreneurship. If you look at our Innovation and Skills Plan, it really sets in motion the fact that Canada was genuinely open for trade, investment and people. In light of what has happened in the U.S., in light of what has happened with Brexit, for instance, that's re-

ally demonstrated that Canada is in a unique position. We value people. We understand that we don't have a monopoly on good ideas. For our companies to succeed and grow and be globally competitive we need to genuinely be open. We obviously are making significant investments in our domestic pipeline through skills and training and coding and retraining and education and lifelong learning. Making big bets on science, focussing on innovation and that's really helped strengthening Canada's value proposition and that's why you are seeing many people that want to come and study here and work here and ultimately stay here and raise their families, which is really important to us because we are a country of 35 million people and we need immigration if we want to maintain and enhance our quality of life. Not to mention that in a globalized economy, our businesses directly benefit from having a diversity of cultures, languages and perspectives around the table.

Policy: What's your feeling, as the innovation minister, of this Facebook story? Are you worried about it? Eighty-eight million people had their identities compromised.

Navdeep Bains: We have to be very vigilant. We have to recognize that in the new knowledge economies, especially in the new digital economy, data is a really important raw material and the protection and privacy of data, individuals' data is critical. That is why we brought forward changes to PIPEDA, the Personal Information Protection and Electronic Documents Act, in terms of making sure that if anyone's personal data that was either stolen or lost must be immediately notified by the business or the business entity. If companies fail to do so and fail to tell the privacy commissioner, they will be subjected to a \$100,000 fine per infraction. So, we're taking concrete steps to further protect Canadians' right to privacy. We're also working on a data strategy. As I mentioned, when we think of our Innovation

and Skills Plan and we look at all the different policies and programs, some of the foundational pieces are intellectual property and our upcoming data strategy and we're working on both of these initiatives. Both in terms of the economic opportunities it unlocks and to help understand the importance of data and how we can be more competitive but also understanding the privacy and ethical concerns must be taken very seriously. To answer your question, as innovation minister, I'm very mindful of the challenges and opportunities and some of the responsibilities we have around data and data protection, but at the same time we have two choices; either we defend the status quo or we recognize that, if we look at artificial intelligence for example, data is so essential, how do we get ahead of the curve and set the rules and put in place policies that allow us to compete and grow and succeed in this global innovation race and at the same time not compromise people's personal data and information. We can either resist the technological changes we are facing or we can embarrass them. As the Minister of Innovation. I'm positive that Canadians have what it takes to meet the challenges and seize the opportunities associated with what some refer to as the fourth industrial revolution.

Policy: I must say on a personal note as a journalist I worry about Facebook being an aggregator and a distributor rather than a news desk.

Navdeep Bains: Well, they said they are a platform and this is something they have to recognize. They have a responsibility and they are much more than a platform. So, they have a responsibility with regards to issues around fake news. They have responsibilities around protection of people's data and they need to step up in a big way. **P**

A conversation at the Innovation Minister's Centre Block office, April 23, 2018.

Why Superclusters Matter

Kevin Lynch

In its 2017 budget, the Trudeau government announced \$950 million in funding for regional innovation superclusters. The five submissions that were chosen and unveiled in February represent a combination of technology-enhanced modernization of Canada's legacy natural resource sectors and doubling down on 21st-century tech wizardry. Former Clerk of the Privy Council and current BMO Financial Group Vice Chair Kevin Lynch, an early supercluster advocate, writes that the sectoral innovation hubs will change Canada's industrial landscape.

What a difference a revolution makes. Ten years ago, there was no public awareness of AI (artificial intelligence), machine learning or big data; today, these and other new technologies dominate popular culture as well as business strategy. Ten years ago, info-tech companies like Facebook, Amazon, Netflix, Alibaba, Tencent and Google were fast-charging start-ups; today, they are among the most valuable companies in the world. What they all have in common are hugely scale-able technology platforms, an extraordinary capacity to gather, process and monetize data, and a willingness to flout traditional business models.

While identifying the precise characteristics required to become a tech gazelle is the dream of every business school professor, most successful tech firms share a number of common features revolving around “mind and place.” Despite existing in a digital, hyperconnected world of their own creation, tech companies, somewhat paradoxically, tend to originate from, and congregate in clusters. Why?

Such clusters are where talent gathers, where emerging technologies and ideas intermingle, where capi-

tal locates, and where interconnectiveness is a public good. Part of the uniqueness of the fourth industrial revolution—internet-enabled technological change—encourages clusters. Tech firms are not monolithic in their technologies—they are continually developing or absorbing or combining new technologies to enhance their business models. Proximity to leading edge research, technology innovations and the talent that understands how to apply and manipulate them is crucial for tech competitiveness and growth.

Clusters have always been around, whether it was medieval European guilds, Victorian cities of the first industrial revolution, postwar global financial centres in London and New York, transportation hubs around the world, manufacturing centres in many countries, back-office information services in Bangalore and, of course, Silicon Valley.

What is different about today's clusters is that they are technology-based not industry based, and that they exhibit increasing returns to scale, not diminishing ones. These properties give rise to technology superclu-

sters, of which Silicon Valley is both iconic and illustrative. Superclusters exhibit extreme density in a certain range of technologies. This density of talent, technology, ideas, entrepreneurship and capital itself creates externalities for start-ups, scale-ups and titans operating within the supercluster. Evidence from examining performance metrics across clusters demonstrates there are disproportional commercial rewards to being part of the largest of the innovation ecosystems. Density matters.

The most comprehensive global ranking of innovation ecosystems is by Start-up Genome. Their 2017 rankings (Figure 1) indicate that Canada has two innovation ecosystems among the global elite, with Vancouver at #15 and Toronto-Waterloo at #16, but none among the top 10 superclusters.

Figure 1: Unequal Distribution of Top Global Innovation Ecosystems

2017 Ranking	Ecosystem	Country
#1	Silicon Valley	U.S.
#2	New York City	U.S.
#3	London	U.K.
#4	Beijing	China
#5	Boston	U.S.
#6	Tel Aviv	Israel
#7	Berlin	Germany
#8	Shanghai	China
#9	Los Angeles	U.S.
#10	Seattle	U.S.
#11	Paris	France
#12	Singapore	Singapore
#13	Austin	U.S.
#14	Stockholm	Sweden
#15	Vancouver	Canada
#16	Toronto-Waterloo	Canada
#17	Sydney	Australia
#18	Chicago	U.S.
#19	Amsterdam	Netherlands
#20	Bangalore	India

The dynamics among the rankings are noteworthy. China has come from nowhere to have two ecosystems among the global top 10, supporting the Government of China's Strategy 2025 to be a world leader in a specific range of technologies. Tel Aviv demonstrates you don't have to be a global economic behemoth to create a top 10 innovation ecosystem, but you do have to have a clear strategy and strong leadership. After lagging, London, Berlin and New York City have surged in the recent rankings, suggesting that size alone does not beget innovation ecosystem success, but one wonders what Brexit will do to London's attractiveness. Canada has demonstrated the ability to create globally competitive innovation ecosystems, but can it "own the podium" by building a top tier supercluster with all the spin-off benefits that accrue?

The Trudeau government's "supercluster initiative" is designed to both broaden the range of technology clusters in Canada and deepen their capacity. It is expressly industry-led to emphasize applied technology innovations with early commercial applications, rather than university anchored research consortia.

The five chosen superclusters demonstrate both technological and geographic breadth: Ocean Supercluster in Halifax and St. John's; AI-Powered Supply Chains Supercluster based in Montreal; Advanced Manufacturing Supercluster in the Toronto-Waterloo corridor; Protein Innovations Supercluster in the Regina-Saskatoon corridor; and, the Digital Technology Supercluster based in Vancouver. They will receive \$950 million of federal funding over five years, to be matched at least dollar-for-dollar with funding from each supercluster consortia. To varying degrees, they will develop advanced technology applications to strengthen the competitiveness of Canada's natural resource sectors, which is certainly needed. To varying degrees as well, they will enable technology diffusion into the broader SME business community, which is desperately needed.

“What are the factors that will shape the success of the five nascent technology superclusters? First and foremost, it will be governance, not technology.”

What are the factors that will shape the success of the five nascent technology superclusters? First and foremost, it will be governance, not technology. The potential strength of the superclusters is their unique, business-led coalition of international companies, Canadian SMEs, tech start-ups, incubators and university researchers. The challenge is getting the proper governance around partner responsibilities and accountabilities, around ownership and decision rights, around allocation of funding to projects and around ambition for the supercluster—setting the key performance indicators (KPI) for success.

Second, it will be finding the right balance between the public interest and the private interest. The supercluster concept is based on externalities—that the whole is much greater than the sum of the parts—and that is the rationale for the public contribution. The partners will need to develop the public tech space, particularly for SMEs and innovation diffusion, not just their enhanced private tech space as firms. Third, and somewhat related, it will be finding the right balance between a cluster of projects and a cluster of firms. While projects will be the modalities, they are a means to the broader objective of a deeper cluster with more firms, more talent, more tech diffusion, more intellectual property, and so on.

Fourth, it will be building a collective brand for the supercluster, and this will require active marketing and brand development rather than following a passive approach. The payoff to an enhanced global tech and innovation brand is huge through attracting venture capital, global talent, global tech firms and researchers and entrepreneurs.

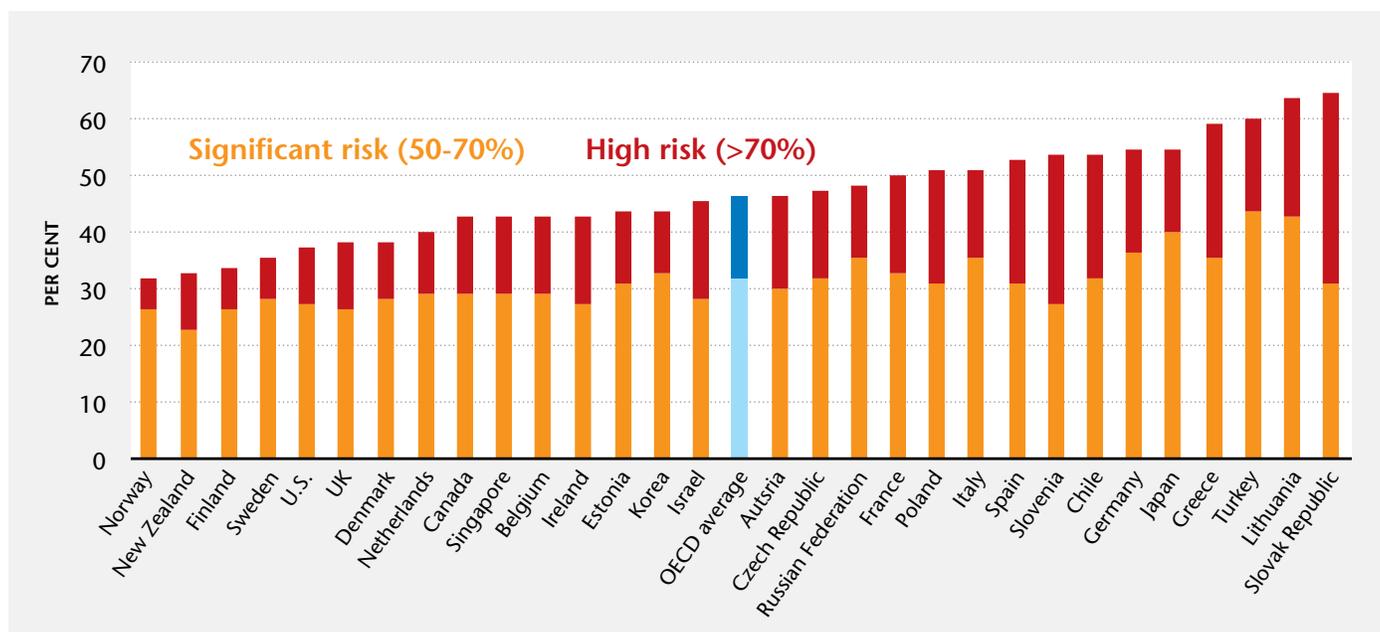
Fifth, it will be the ability to create a defining culture for the cluster. Why such an emphasis on culture in the building-out of the superclusters? I believe that a pervasive culture of innovation is essential for strong and sustained innovation success in all sectors of the economy and society—it is much more powerful than tweaking tax credits or fiddling with the terms of grant programs. It means a community where participants answer positively to cultural attributes such as: Does the cluster celebrate ideas? Does it mobilize diversity? Does it fuel innovation passion? Does it foster autonomy over hierarchy? Does it support failing forward? Does it listen hard and keep minds open? Does it think small and scale big? What entrepreneurs describe as most unique, and personally important, about top-tier innovation ecosystems besides their density and depth is their culture.

Lou Gerstner, the legendary CEO of IBM, observed in his autobiography: “I came to see, in my time at IBM, that culture isn't one aspect of the game, it is the game—whether in business, government, education, healthcare or any area of human endeavor.”

While the superclusters will unambiguously better position Canada for the world of the fourth industrial revolution, we have to understand much more clearly and strategically as business, government and educators the extent of the tech transformations underway and their implications for both the Canadian economy and society.

The mass diffusion of digital technology and the rise of AI-enhanced automation pose adjustment challenges for all economies, particularly on the jobs and equality fronts. According to a recent Brookings report:

Figure 2: Risk of Automation: Share of Jobs at Significant Risk and of High Risk of Automation



“The digitization of everything has at once increased the potential of individuals, firms, and society while also contributing to a series of troubling inequalities, such as worker pay disparities across many demographics, and the divergence of metropolitan outcomes.”

The Organisation for Economic Cooperation and Development (OECD) and McKinsey have calculated the risk of job dislocation as a result of automation (Figure 2) for a variety of countries. The results should not encourage either public or private complacency. The OECD estimates that roughly 15 per cent of Canadian jobs are at high risk of automation and a further 28 per cent are at significant risk. This points to enormous forthcoming churn in Canadian labor markets, where still-unclear new jobs with new skill sets will be created while existing jobs with existing skill sets will be dislocated.

Preparing students with the skill sets of the future and re-skilling current workers at scale for those new jobs are just as challenging and important as being at the leading edge of the technology curve to keep Canadian business competitive. Indeed, successful economies and stable societies will be those who do both.

Disruptive technological change is transforming not only the goods and services we consume and the skills needed to produce them, but also business models and the “production function” itself.

“*Disruptive technological change is transforming not only the goods and services we consume and the skills needed to produce them, but also business models and the “production function” itself.*”

Data is now a factor of production alongside labor and capital for info-tech titans, and that capital is increasingly intangible rather than the bricks and mortar of old. To an under-appreciated extent, info-tech companies are intermediaries, like banks—one intermediates money while one intermediates data, and both depend on public confidence to operate.

The info-tech business model of acquiring information about users from users and then monetizing this data through predictive analytic models depends on user trust and data rights, and that is why the Cambridge Analytica scandal is so damaging, not just to Facebook but ultimately to the unregulated info-tech business model.

And that is why trust and values will become such an important part of the technology sector going forward. My perspective is that trust can be a competitive differentiator in the global tech market, just as safety is in the food sector, and Canada should seek to differentiate its tech sector through values—“tech for good”—as well as great home-grown technology and exciting products and services. This would require real effort and likely a flexible mixture of some data safeguards regulation, explicit corporate commitments, an emphasis on values in the training of our tech workforce, and public leadership. But the payoff in terms of building the Canada tech brand and deepening the attractiveness of our tech super-clusters to global talent and capital could be transformative. **P**

Contributing Writer Kevin Lynch is Vice Chair, BMO Financial Group and Former Clerk of the Privy Council of Canada.

Canada's Ocean Supercluster: Building the Ocean Economy

Matt Hebb

Among the five winners of the Trudeau government's supercluster competition announced in February was an Oceans Supercluster. The Atlantic Canada-based consortium will use innovation to improve competitiveness in Canada's ocean-based industries, including fisheries, oil and gas, and clean energy.

Canada has more ocean resources than most countries. We have the longest coastline, the fourth largest ocean territory—including some of the world's most productive waters—and the largest Arctic Ocean territory in the world. There are “built” advantages, too: global corporations operating in all major sectors of the ocean economy, ocean tech companies who are selling to the world, some of the world's best ocean research universities, a modern navy, and substantial capabilities in federal departments and agencies.

The ocean economy comprises the combined activities in traditional sectors including conventional offshore oil and gas, shipping and port activities, capture fisheries and fish processing, inshore aquaculture, defense, shipbuilding and marine equipment, and marine tourism. It also includes activity in ocean science and technology, as well as emerging sectors like marine renewable energy, marine bio-products, offshore aquaculture, deep sea oil and gas, and ocean seafloor minerals.

Demand for ocean resources and ocean know-how is growing all

around the world. The Organisation for Economic Co-Operation and Development (OECD) projects that the world's ocean economy will more than double in size by 2030 as a result of mega-trends like population growth, increased life expectancy, rising incomes and an increase in global trade. The impact of this growth on ocean value chains will be profound. Marine renewable energy is proliferating; deep and ultra-deep water oil and gas will grow from 3 per cent to 12 per cent of the global supply of crude within 20 years; already more than 90 per cent of all goods travel by water; and aquaculture—the fastest growing animal food-producing sector in the world—will surpass the global value of wild fisheries within five years.

One might reasonably assume, given all of this, that Canada enjoys great benefit from its ocean assets. But the truth is, we derive less value from the ocean than other nations. We're not living up to our ocean-economy potential.

Norway has an economy that is about five times smaller than Canada's, but its ocean economy is nearly seven times more valuable.

Norway's current national strategy suggests that some 25 per cent of its economy is connected to ocean activity. With per-capita GDP more than 50 per cent higher than Canada's, it makes clear the ocean is capable of supporting high-value jobs and standards of living.

“*The Organisation for Economic Co-Operation and Development (OECD) projects that the world's ocean economy will more than double in size by 2030 as a result of mega-trends like population growth, increased life expectancy, rising incomes and an increase in global trade.*”

Only about 1 per cent of Canada's economy is linked to ocean activity. True, Canada's economy is more diversified than Norway's, and also true that Norway has amassed the world's largest sovereign wealth fund from its oil and gas resources. Nonetheless, it is evident that our ocean capacity is significantly under-valued. This presents an important opportunity that Canada can respond to through innovation, entrepreneurship, and collaboration.

Canada's Ocean Supercluster (OSC) addresses this opportunity by doing two important

things. First, it creates a platform for collaborative R&D based on shared industry challenges, which will result in the commercialization of innovative capabilities across different sectors of the ocean economy. This establishes market “pull” for ocean innovation. Second, it sets collaborations up for greater success by expanding the connections between ocean companies and the providers of innovative solutions. The aim is to foster innovation that responds to market demands but also pushes the limits of what is possible, or even imaginable.

There are at least two reasons why a cluster-based approach is particularly promising for Canada’s ocean industries. The first is that it is costly and complex to do anything in the ocean. Second, there is significantly less public investment in ocean infrastructure than there is in industries on land (e.g. roads, power grids, pipelines, fibre optic cable networks, cell towers, rail lines, etc.). The sharing of cost, experience and expertise, as well as the distribution of risk that comes from cluster-based partnerships, can significantly reduce barriers to innovation in ocean settings.

To give an example, all sectors in the ocean are united by the need for accurate, timely ocean ecosystem data. Marine weather, waves, current, temperature, the presence of animal life, and other key parameters are needed to predict working conditions, plan marine operations, and maintain the safety of personnel. Conversely, uncertainty about the ocean’s physical, chemical and biological parameters translates into increased operational costs and risks for ocean industries.

Improving the ability to characterize and monitor the environment in a cost-effective, real-time manner will enable ocean industries to operate more productively and to better protect and sustain ocean resources. An objective of the Ocean Supercluster technology strategy will be to lower the cost of data acquisition while improving data access, timeliness, and quality. Reliable, cost-effective and scalable technolo-



Canada’s Oceans Supercluster will deal with both traditional sectors and emerging fields such as marine renewable energy, marine bio-products, offshore aquaculture, deep sea oil and gas, and ocean seafloor minerals. *Adobestock photo*

gies for short- and long-range ocean monitoring, connected to real-time data integration and analysis, will provide a base of support for greater productivity and innovation across multiple sectors.

Commercialization of these capabilities is expected to reflect the unique operating conditions of different sectors. The tidal energy sector, for example, must gather environment data through novel methods that account for unique site characteristics, such as poor visibility, very high currents, and environmental noise. For industries undertaking bioprospecting and sampling activity, challenging undersea terrain and difficult environmental conditions can affect access, sample and data quality, and confidence in results.

Technology is necessary to develop modern, forward-thinking ocean policy and regulatory frameworks. The OSC will contribute to innovation on this front, for example, by advancing the ocean monitoring capability needed to enable ecosystem-based management approaches characterized by superior evidence-based decision making.

Ocean industry challenges will be tackled by innovation providers in areas including: environmental genomics, sensors, underwater communications, robotics and untethered maritime vehicles (UMVs), artificial intelligence, and data analytics. This will leverage the cutting-edge capabilities of Canada’s existing ocean tech SMEs, and also present opportunities for high-impact collaborations with other superclusters across the country.

In addition to a technology strategy, OSC also has a strategy to build the strength of the cluster itself—measured, broadly speaking, in terms of its capacity for innovation and for entrepreneurship. Perhaps nothing is more critical to that capacity than the ability of the OSC to develop and attract the world-leading talent needed to establish Canada’s smart ocean advantage.

Cluster-building strategy will focus on the requirements of a modern, highly-skilled ocean workforce that is diverse and inclusive. For example, a global talent fund will support the collaborative efforts of industry members to attract the world’s best engineers, scientists, and ocean executives, while a program to extend

work-integrated learning opportunities will connect ocean industries with students studying in Canadian universities and colleges.

A key OSC objective is to create the conditions for more start-ups and scale-ups in the ocean economy. The OSC will work with partners, including incubators, accelerators, and venture capitalists, to support growth opportunities emerging from the technology program. In addition, an open-call program will provide seed funding for early stage development of potentially disruptive innovations that might not otherwise emerge within existing industries.

Access to specialized design and fabrication equipment is a constraint facing smaller companies innovating in any sector. Ocean innovators of all sizes face increased cost and complexity trying to access ships, UMVs, marine heavy-lift equipment, computer lab infrastructure/computing resources, and waterfront facilities as they undertake technology demon-

“The Ocean Supercluster will enable Canada to make better use of its considerable and currently under-valued, ocean assets. It positions our country to join the ranks of global leadership in ocean innovation and sustainable ocean industry.”

stration and commercialization activity. The Ocean Supercluster will establish programs to support the costs of commercialization and technology transfer between sectors. It will also leverage significant assets like the Centre for Ocean Venture and Entrepreneurship (COVE) in Halifax, the Marine Institute in St. John's, and National Research Council (NRC) facilities across Atlantic Canada, to

provide waterfront access, specialized equipment, and the ecosystem benefits of co-locating with a critical mass of ocean innovators.

The Ocean Supercluster will enable Canada to make better use of its considerable and currently under-valued, ocean assets. It positions our country to join the ranks of global leadership in ocean innovation and sustainable ocean industry. We think of this as a strategy to move ourselves to a technology-enabled, knowledge-based ocean economy, with the advantages and benefits associated with that—greater productivity and sustainable profitability, higher value employment, expanded global markets for both valued resources and IP-based products and services, and higher overall economic output, supporting higher standards of living. **P**

Matt Hebb is CEO of Canada's Ocean Supercluster. He is currently on a secondment from his role as AVP Government Relations & Economic Development at Dalhousie University.

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Agir différemment: la supergrappe d'innovation Scale AI

Alain Dudoit

Un consensus de plus en plus large souligne l'urgence d'agir pour enrayer l'érosion de la position concurrentielle du Canada mais aussi pour établir et consolider son avantage global dans les secteurs clés de la nouvelle économie. La réalisation de cette double priorité nécessite l'émergence d'écosystèmes d'innovation performants et d'impact global. Le domaine d'action de Scale AI: les chaînes d'approvisionnement propulsées par l'intelligence artificielle est au cœur de cette nécessaire transformation.

Le Canada est un pays fortement innovant avec une solide base de recherche et des communautés florissantes d'entreprises technologiques en démarrage. De sérieux obstacles empêchent souvent de traduire l'innovation en création de richesse et nuisent à la croissance rapide des entreprises de calibre mondial. Les dépenses de R-D canadiennes s'effectuent de plus en plus dans le secteur des services, se concentrent davantage dans les grandes entreprises, et la part de R-D contrôlée par intérêts étrangers au Canada augmente. Cette situation risque de créer un cercle vicieux dans lequel les entreprises au potentiel de croissance élevé cherch-

ent de plus en plus des occasions de croissance ailleurs.

Le Canada se situe à présent bien au-dessous de la moyenne de l'OCDE et se classe au 33e rang parmi 40 pays selon un indicateur des dépenses des entreprises de R-D, qui tient compte de l'ampleur, de l'intensité et de la croissance. Le problème le plus urgent est la faiblesse des dépenses de R-D dans l'industrie, mais la croissance des dépenses de R-D du gouvernement et du secteur de l'enseignement supérieur y est à présent moindre que dans les autres grands pays.

Ce constat le plus récent posé par le comité d'experts du Conseil des académies canadiennes (CAC) est largement partagé et retient l'attention des décideurs publics et privés au Canada. Le consensus émergent souligne l'urgence d'agir pour enrayer cette érosion de la position concurrentielle du Canada mais aussi pour établir et consolider son avantage global dans les secteurs clés de la nouvelle économie. Les mesures annoncées dans les deux derniers budgets fédéraux et celles du Gouvernement du Québec s'inscrivent dans cette direction et répondent en partie à cet enjeu fondamental.

Cet enjeu interpelle non seulement les gouvernements, les entreprises et les institutions d'enseignement postsecondaires et de recherche; il s'agit aussi d'un enjeu de société: celui de changer notre culture d'innovation. Celle-ci doit s'adapter pour permettre à chacun d'entre nous de cohabiter avec une nouvelle forme d'intelligence, dite artificielle, et d'en tirer profit tout en lui donnant un sens humaniste dans toutes les zones d'activités—économiques, sociales et humaines—au sein de notre société avancée et en profonde transformation.

Les ministres de l'innovation du G7 ont fait une déclaration de politique en ce sens lors de leur rencontre à Montréal en Mars 2018. Ceux-ci « entendent faire fond sur la vision commune d'une IA centrée sur l'humain, vision qui

“ *Établi à Montréal et centré sur le Québec et l'Ontario, le projet aura un impact pan-canadien grâce au réseau national de ses membres. Ce corridor de commerce Ontario-Québec englobe un ensemble d'actifs de transport terrestre, aérien et maritime, qui offre une porte concurrentielle et attrayante au commerce international.* ”

exige d'aborder avec soin le développement et le déploiement de cette technologie prometteuse en mettant l'accent sur l'interdépendance entre la croissance économique suscitée par l'innovation en IA, l'augmentation de la confiance envers l'IA et de l'adoption de l'IA, et la promotion de l'inclusivité dans le développement et le déploiement de l'IA ».

L'initiative des supergrappes s'inscrit dans ce mouvement. Plus de 50 propositions appuyées par plus de 1 000 entreprises et 350 autres participants ont été reçues totalisant des intentions d'investissements privés de l'ordre de 17 milliards de dollars. Cette expression d'intérêt est significative de la prise de conscience au Canada de l'urgence d'agir ensemble pour réussir cette transformation nécessaire.

Dans les circonstances, les cinq supergrappes retenues par le Gouvernement du Canada partagent une responsabilité commune et une opportunité extraordinaire: celle de réussir leurs missions spécifiques et d'enclencher cette transformation de notre culture d'innovation au pays. Ces cinq consortia réunissent 450 entreprises, dont plus de 300 petites et moyennes entreprises (PME), 60 établissements d'enseignement postsecondaire et 180 autres participants issus d'industries innovatrices canadiennes.

La mesure de succès pour ces cinq supergrappes est très élevée non seulement au Canada, mais aussi à l'international. L'expérience des écosystèmes (« hubs ») d'impact mondial fait ressortir sept critères

clés de succès: 1. Accès aux talents; 2. Accès aux financements ; 3. Politiques et mesures gouvernementales favorables; 4. Capacités de R & D; 5. Chaînes d'approvisionnement intégrées; 6. Développement urbain et création d'habitats de qualité; 7. Différenciation par l'allocation du capital d'investissement, l'accès et les synergies entre les autres écosystèmes.

Le domaine d'action de Scale AI (Supply Chains and Logistics Excellence. AI): les chaînes d'approvisionnements propulsées par l'intelligence artificielle est au cœur de cette nécessaire transformation. La chaîne d'approvisionnement canadienne est un élément essentiel de notre économie, permettant des mouvements de marchandises de 1 billion de dollars, générant 66 milliards de dollars de produit intérieur brut (PIB) et employant plus de 878 000 personnes (excluant les camionneurs) partout au Canada.

Le secteur est en croissance, créant de nouveaux emplois à 1,5 pour cent par an en moyenne, et fait face à des défis de pénurie de main-d'œuvre. Selon une étude du Conseil canadien sectoriel de la chaîne d'approvisionnement (CC-SCA), les chefs de file de l'industrie et les spécialistes de la chaîne d'approvisionnement croient que la main-d'œuvre sera touchée par la technologie au cours des trois à cinq prochaines années. Ces leaders de l'industrie s'attendent à ce que l'utilisation accrue des véhicules autonomes, de la robotique et de l'automatisation, du « blockchain » et des drones ait un impact modéré à très fort sur la main-d'œuvre. Ils

croient également que l'adoption de technologies telles que l'internet des objets (IoT), l'internet mobile et l'analyse de données massives entraînera une création d'emplois plus importante que des pertes.

Le rapport de l'examen de la Loi sur les transports au Canada de 2016 indique toutefois que toutes les industries et tous les transports canadiens utilisent moins de 41 pour cent de technologies de communication avancées, la majorité en dessous de 30 pour cent. Le Canada se classe au 14^e rang des pays selon l'indice de performance logistique de la Banque mondiale.

Le taux d'adoption global de toutes ces technologies devrait se situer dans les cinq prochaines années, et il est prévu qu'elles seront largement adoptées (c'est-à-dire qu'elles deviendront notre façon de faire des affaires) d'ici 2025. Nous ne pouvons et ne devons pas rater ce rendez-vous. Il en va de notre prospérité et de notre qualité de vie.

Scale AI est la supergrappe d'intelligence artificielle (IA) dédiée au développement de la prochaine génération de chaînes d'approvisionnement et à l'accroissement de leur performance grâce aux nouvelles technologies intelligentes. Établi à Montréal et centré sur le Québec et l'Ontario, le projet aura un impact pan-canadien grâce au réseau national de ses membres. Ce corridor de commerce Ontario-Québec englobe un ensemble d'actifs de transport terrestre, aérien et maritime, qui offre une porte concurrentielle et attrayante au commerce international. Les deux provinces du centre du Canada représentent environ 60 pour cent de la population, des exportations et du produit intérieur brut du Canada. Des actifs majeurs d'infrastructure de transport dans tous les modes, des institutions d'éducation et de recherche de calibre mondial ainsi que quatre des six passages frontaliers au volume le plus élevé du Canada, alimentent ce centre économique névralgique nord-américain.

Scale AI a pour mission de promouvoir et de mettre en œuvre une vision commune constituée des objectifs suivants:

- Approfondir le leadership technologique du Canada en matière d'IA et de science des données, d'optimisation opérationnelle et de numérisation des chaînes d'approvisionnement
- Promouvoir la compatibilité technique et développer/diffuser une nouvelle plateforme de développement de nouvelles solutions d'analyse de données et de matériel d'appui
- Catalyser la coopération au sein de l'écosystème
- Accroître l'ampleur et la vitesse des transferts d'innovation
- Accélérer la croissance des PME et des entreprises en démarrage
- Accroître le nombre des talents dans le secteur et développer leurs capacités
- Aider les organisations à intégrer l'IA car elles manquent actuellement des compétences nécessaires pour évaluer, développer et déployer des solutions d'IA
- Structurer des canaux de commercialisation mondiale
- Instaurer des pratiques favorisant l'économie circulaire et le développement durable au Canada

La mission de la supergrappe comprend la mise sur pied d'un réseau numérique de développement durable, destiné à analyser, contrôler et optimiser les cycles de vie des produits que nous utilisons, et à assurer la consommation écoefficiente de nos ressources.

Le consortium de la supergrappe vise à devenir un forum de collaboration selon trois principaux axes :

- D'un bout à l'autre des chaînes de valeur, des fournisseurs aux entreprises clientes et aux consommateurs
- Entre les grandes, moyennes et petites entreprises
- À travers des secteurs verticaux et horizontaux

Le développement de cet écosystème régional de haute densité et de cette nouvelle infrastructure critique de la chaîne d'approvisionnement du futur représentent un important levier pour stimuler la croissance du PIB, renforcer nos effectifs et ancrer le Canada dans le développement durable. L'initiative est audacieuse et novatrice—et encore inédite au Canada. Elle dépasse les efforts purement technologiques. La supergrappe fera progresser l'écosystème à un stade supérieur non seulement grâce à l'innovation technologique, mais aussi à la mise à niveau des infrastructures, aux partenariats et au développement des talents.

Le domaine d'action de Scale AI est tout autant névralgique pour l'économie canadienne que pour sa position dans la compétition mondiale en profonde transformation. Ainsi McKinsey estime le potentiel de valeur annuelle totale de l'IA et des techniques avancées d'analyse des données dans 19 industries et neuf fonctions commerciales dans l'économie mondiale entre 3,5 billions de dollars et 5,8 billions de dollars pour les chaînes d'approvisionnement et le secteur manufacturier.

C'est le moment d'agir: Le Canada doit se doter de la chaîne d'approvisionnement durable du futur, propulsée par l'IA et développer une nouvelle plateforme mondiale d'approvisionnement. Les ingrédients de succès identifiés sont désormais réunis.

Le Canada saisit ainsi une opportunité unique de repenser et de réinventer sa chaîne d'approvisionnement, afin de devenir un chef de file de l'écoefficient et d'acquérir un avantage concurrentiel dans la chaîne de valeur mondiale. **P**

Alain Dudoit, ancien ambassadeur du Canada, est conseiller stratégique à l'international et Vice-président senior-partenariats a.i. Scale AI.

Les points de vue exprimés dans cet article sont uniquement ceux de l'auteur et ne sont pas nécessairement partagés par les organisations avec lesquelles il est associé.



The federal government estimates that the Advanced Manufacturing Supercluster will generate over \$13.5 billion in added economic value and create more than 13,500 jobs in Canada over the next ten years. *iStock photo*

Setting Global Benchmarks in Advanced Manufacturing

Jayson Myers

Canada's manufacturing sector represents more than 10 per cent of the country's total GDP. Manufacturers export more than \$354 billion each year, representing 68 per cent of all of Canada's merchandise exports. So, it was no surprise that one of the supercluster winners is a manufacturing group. As Next Generation Manufacturing Canada's CEO, Jayson Myers, writes, innovation in manufacturing means both adopting and adapting.

Stretching from Windsor to Quebec City, Canada's innovation corridor is home to some of the best research, technologies and manufacturing capabilities in the world. The region boasts a globally ranked start-up ecosystem in the Toronto-Waterloo Corridor, a diverse and concentrated manufacturing base, many leading technology companies, a highly skilled workforce, world-class research and educational facilities and a remarkable entrepreneurial dynamic. Imagine the economic powerhouse it would be if we could combine these assets more effectively, applying more advanced technologies to improve the competitiveness and growth potential of our

manufacturers and scaling up more technologies to apply and manufacture them in Canada.

Next Generation Manufacturing Canada, the industry-led, not-for-profit organization established to lead Canada's Advanced Manufacturing Supercluster initiative, aims to do just that. We believe the transformation to advanced manufacturing will enrich all our lives, delivering better products and good jobs while generating the economic growth that is essential to building a better world. Our goal by 2025 is to see Canadian manufacturers setting world benchmarks in competitiveness and growth through the application and production of advanced technologies.

In order to turn this vision into reality, Canada's manufacturers and technology companies must be able to offer globally competitive solutions to customers around the world. Manufacturers will need to speed up the adoption of advanced digital, materials and production technologies to manufacture new products, provide new services, optimize production processes, improve operating efficiencies and develop new revenue opportunities. Technology companies will need to scale up production capabilities more quickly as well. More of the technologies developed in Canada will need to be applied and produced in Canada. And, companies will have to attract and retain the highly-qualified people, capital investments and product mandates they need in order to sustain growth.

Federal supercluster funding will kick-start our efforts in promoting collaboration across the many companies, academic and research institutions, business networks, and government agencies and programs that make up Canada's advanced manufacturing ecosystem while building greater capacity among smaller companies to adopt and scale-up advanced technologies. It will enable us to address some of the most important challenges inhibiting the competitiveness and growth of Canada's manufacturing and technology sectors.

“ Federal supercluster funding will kick-start our efforts in promoting collaboration across the many companies, academic and research institutions, business networks, and government agencies and programs that make up Canada's advanced manufacturing ecosystem while building greater capacity among smaller companies to adopt and scale-up advanced technologies. ”

The first challenge is simply to increase visibility. We do great things here. But, who really knows what we do? Many of the capabilities and assets within our advanced manufacturing ecosystem are among the best-kept secrets in Canada. NGM Canada will build an online collaboration platform that will identify technology capabilities, map out the assets in our research and training infrastructure and allow companies to connect more easily with the resources that can help them adopt and scale-up advanced technologies. We will also support networking opportunities and collision events designed to bring people together and bridge the solitudes that exist between manufacturers that have business problems to solve and technology providers that can offer potential solutions.

The second challenge is to improve upon our record in commercializing and scaling up the technologies that are being developed here. That requires increasing awareness about the technology capabilities resident in Canada and their possible applications in manufacturing. It also requires more active facilitation of connections between small technology companies on the one hand and the manufacturers and pilot centres on the other that can provide the testing, process improvement and production support to take new technologies from prototype to full scale manufacturability and build linkages into international manufacturing supply chains. By focusing our efforts on expanding the application of new technologies in Canadian manufacturing, NGM Canada is looking to build customer demand for Canadian technologies, exponentially accelerate business growth and

enhance the ability of our technology companies to attract capital and talent from around the world.

Realizing that objective depends in turn on addressing a third challenge—how to accelerate the adoption of advanced technologies by Canadian manufacturers, most of which are small companies that often lack the resources required for effectively applying new tools and techniques in their business. Manufacturers in Canada currently lag behind their counterparts in other industrial economies when it comes to investing in research, training and new technologies. In an era of intense global competition and the rapid development and deployment of potentially disruptive technologies, the competitiveness and growth potential of Canada's manufacturing sector is at risk, and along with it the value creating potential of a large part of the Canadian economy.

That is why the supercluster will provide funding to develop and deliver a suite of tools and programs designed to help manufacturers identify the potential advantages offered by advanced technologies, the business requirements for successfully applying and managing those technologies and available options for sourcing integrated technology solutions. It will also provide funding support for technology audits, feasibility studies and access to modeling, testing, pilot, and training centres that will help manufacturers de-risk the adoption of new technologies.

While these efforts aim at enhancing customer demand and building capacity on the part of smaller compa-

nies to adopt and scale-up technologies in manufacturing, the largest share of supercluster funding—approximately \$200 million—will be invested in industry-led collaborative projects designed to develop and strengthen Canada’s leadership in technology and manufacturing. NGM Canada will invest in three types of collaborative initiatives:

1. Partnerships that aim to develop unique technologies that will significantly improve the ability of investing companies to compete and grow in global markets;
2. Partnerships that aim to transform existing manufacturing processes through the adoption of advanced technologies in order to improve the competitiveness, innovation and growth potential of companies in key sectors of Canadian manufacturing, such as steel, auto parts, food processing, high-value wood products and aerospace; and,
3. Partnerships that aim to promote the application and scale-up of brand new technologies for manufacturing in Canada.

These initiatives will involve a variety of advanced technologies including digital applications, data analytics, microelectronics and sensors, Internet-of-Things devices, artificial intelligence and machine learning, robotics, vision systems, advanced materials, and additive manufacturing. They will be led by the companies that have together committed over \$800 million to the Advanced Manufacturing Supercluster. But, they will involve many more manufacturing and technology companies, universities, colleges, and research centres in their activities. Their purpose is to strengthen Canada’s advanced manufacturing ecosystem, not only by providing matching funds for industry investments but by creating new collaborative knowledge and technology supply chains, growing Canadian customers for new technologies developed here, and building entirely new manufacturing capabilities in Canada.

Collaborative initiatives will be evaluated and selected on the basis of their technology leadership, the extent of the engagement they will generate across the ecosystem, their contribution to education and workforce training, and the benefits they promise for the Canadian economy as a whole. The federal government estimates that the Advanced Manufacturing Supercluster will generate over \$13.5 billion in added economic value and create more than 13,500 jobs in Canada over the next ten years. We do not expect to disappoint.

“What a tremendous opportunity to align Canada’s public policies and programs, our research infrastructure, and our education and training priorities to industry needs.”

But, the significance of the Advanced Manufacturing Supercluster for public policy is much greater than the ground-breaking technology initiatives it will support and the economic benefits it is expected to deliver. It represents a new approach to innovation and industrial policy. It focuses on building industry demand for new technologies rather than pushing technologies into the market place. It complements the billions of dollars invested annually in basic and applied research with a system designed to draw knowledge and expertise from the laboratory bench to deliver solutions that can be used in manufacturing. It aims to facilitate the scale-up of technologies to a level of manufacturability, not simply to license them, but to apply and produce them in Canada. It pays attention to the importance of de-risking technology adoption and scale-up. And, it makes a concerted effort to build collaboration

and strengthen the capabilities of small companies to manage the application and production of advanced technologies.

The significant commitments that businesses have made to the Advanced Manufacturing Supercluster, not to mention the potential investments identified in other related supercluster proposals, indicate the importance that industry across Canada attaches to the development and adoption of advanced technologies in manufacturing—and in many other sectors of the economy as well. What a tremendous opportunity to align Canada’s public policies and programs, our research infrastructure, and our education and training priorities to industry needs. The industry-led initiatives identified during the application process for the federal government’s supercluster program should be a beacon for governments, universities, colleges, research institutes, and business networks looking to support innovation. Next Generation Manufacturing Canada sees that policy leadership role as an important element of its mandate to position Canada as a world leader in advanced manufacturing, a mandate that will not end after the Advanced Manufacturing Supercluster’s five-year funding agreement expires.

We have already seen a significant amount of progress—even before funding has started to flow from the federal government. A number of companies and supporting organizations are now working together because they became aware of each other’s needs and capabilities during the course of the supercluster application process. That only emphasizes a lesson that stands at the heart of the way the Advanced Manufacturing Supercluster is structured and the way we intend to operate. At the end of the day, it is really not about technology at all—it’s all about people. **P**

Jayson Myers is chief executive officer of Next Generation Manufacturing Canada.



The Protein Industries Canada supercluster will capitalize on Western Canada's status as the centre of canola, pulse, cereal and specialty crop production to take Canada's progress in agriculture technology to a whole new level. *Adobestock photo*

Unleashing the Potential of Canadian Crops: Protein Industries Canada

Frank Hart

It's a measure of the evolution of agriculture in Canada that the industry's supercluster does not contain the words "agriculture" or "farming" in its title. Protein Industries Canada, as CEO Frank Hart writes, will consolidate and harness the technological innovation that is already revolutionizing agriculture to take Canada to the next level of global competitiveness.

Protein Industries Canada (PIC) is an industry-led supercluster comprised of leading Canadian agriculture technology corporations, food and food ingredient manufacturers, agriculture and food service companies, economic development agencies, and highly experienced academic and financial institutions. This supercluster is unique in its focus to capitalize on Canada's world-class strengths in agricultural and food technology to advance economic

growth through innovation in the area of plant-based proteins and co-products.

The global population is expected to reach 8.5 billion by 2030 and 9.7 billion by 2050. An increasingly affluent global middle class (approximately three billion people worldwide in 2015) is seeking higher quality foods. Global middle class consumption is growing at 4 per cent annually in real terms and creating an increased demand for plant-based protein. As an existing leader in agriculture and food processing, Canada has an opportunity to lead this new growth cycle and technology era by securing our position and reputation as a pioneer in agricultural technology development and implementation.

The vision of PIC is “to position Canada globally as a leading source of high-quality plant protein and plant-based co-products, while substantially contributing to Canada’s economic growth and international trade balance.” The mission is “to mobilize Canada’s ag/food innovation to collaborate in support of industry driven market priorities and needs.”

In order to achieve our Vision, PIC intends to:

- Build a shared competitive advantage that will attract cutting-edge research, investment and talent by addressing gaps, aligning strengths, enhancing attributes, and positioning it as a world-leading innovation hub;
- Increase business expenditures on R&D and advance a range of business-led innovation and technology leadership activities that will address protein sector challenges, and boost productivity, performance and competitiveness for Canada’s agri-food sector;
- Generate new companies and commercialize new products, processes and services that position firms to scale, integrating into global value chains,

“ *Global middle class consumption is growing at 4 per cent annually in real terms and creating an increased demand for plant-based protein. As an existing leader in agriculture and food processing, Canada has an opportunity to lead this new growth cycle.* ”

transitioning to high-value activities and becoming a global market leader in plant-based protein and co-products; and

- Foster a critical mass of growth-oriented firms and bolster collaborations between private, academic and public-sector organizations pursuing private-sector led innovation and commercial opportunities to enhance the PIC’s pool of resources, capabilities and knowledge. PIC’s proposed value chain approach of enhancing production and processing innovation, improving export and market development, and scaling the ag business sector to compete on the world stage is designed grow the Canadian economy, create jobs, and reduce our carbon footprint through increased carbon sequestration. Canadian regenerative agricultural production technology can lead the world.

The PIC proposal is built around four fundamental pillars, (1) creation of high-quality protein germplasm, (2) smart production, (3) novel process technology and product development, and (4) company support, marketing and commercialization. These four pillars will each have a separate program to focus resources together with funding for ecosystem development and technical training.

A key to this supercluster proposal is the application of new technology in genomics, phenotyping, production, processing, artificial intelligence, data management, and edu-

cation to drive forward innovation and catalyze new industry growth initially related to protein and co-products and growing as the cluster expands. Our focus will be on fostering novel approaches to processing existing major acreage crops (canola, pulses and wheat) as well as creating fractions with increased commercial value and utility for both the human food and animal feed markets. A second phase of PIC projects will be directed to smaller acreage crops with significant growth potential including hemp, quinoa, flax, oats, and others. The new processing technologies will provide valuable starches, flours, carbohydrates and compounds for biopolymers, textiles, industrial oils, functional foods, animal feeds, medicines and personal care products. The PIC cluster intends to build on established local strengths in crop production, application of emerging digital/precision crop production technologies and private and public seed processing and food/feed formulation research to increase value-added co-product production with concomitant increases in exports, jobs and revenue.

Finally, new international markets are growing with demand for new plant protein supplies which must be addressed through value-added processing. Canada has an established international brand for quality ingredients which will be enhanced by providing new ingredient products for new markets. The PIC cluster aims to have all of the necessary components to participate in these new markets. ISED investment will allow PIC, its members and partners to accelerate the process of innova-

tion and create new linkages leading to collaborations. The PIC cluster is geographically centered in the three Prairie Provinces but will have nodes and partnerships throughout Canada. Western Canada is the center of canola, pulse, cereal and specialty crop production (hemp, flax, sunflower, mustard, quinoa, etc.) and has developed associated processing industries and transportation infrastructure. As an example, the scale and know-how of Canadian canola and pulse crop production cannot be duplicated in other countries. However, an agriculture-based cluster cannot be as physically concentrated as other types of clusters because of the nature of agricultural production and research. But many of the PIC members have facilities centered near Saskatoon, Regina, Edmonton, Calgary, Lethbridge and Winnipeg.

The importance of the type of linkages that PIC will facilitate has long been stressed by proponents of successful clusters. For a knowledge-based cluster, the interaction between industry and academia is vital. Industry requires access to the research results, and academia needs access to a powerful industrial customer base. As technological development is at the core of competitive advantage, an important aspect of PIC is to create an environment conducive to joint development of new technologies, creating stronger science bases and commercial deployment.

PIC also hopes to foster the development of start-up or emerging companies that may be physically located in proximity to shared facilities or services. Successful clusters are also well-funded and able to support emerging firms through accessing funds, matching investment, and in some instances, offering venture funds to assist companies. Companies that are developing new innovations, and novel plant proteins and co-products will require access to financial capital and expertise to pursue scaled-up commercial opportunities. PIC is also working with a

series of companies to create linkages between its members and a \$150 million venture capital fund operated by experienced financial operators. PIC's Western Canadian cluster is also ideally situated to export Canadian goods to market, thereby enhancing Canadian export growth and associated economic impacts. With Port Alberta, the Calgary Region Inland Port, the Global Transportation Hub, and Centre Port, four of Canada's nine Foreign Trade Zone points are located in the heart of the major canola, pulse, hemp, and oat growing areas in Canada. As such, these regions are perfectly suited for the attraction and retention of import/export trading companies and processors looking to access national, North American, and overseas global markets.

“ For a knowledge-based cluster, the interaction between industry and academia is vital. Industry requires access to the research results, and academia needs access to a powerful industrial customer base. ”

Another key aspect of the cluster will be a focus on machine learning and artificial intelligence as important enablement technologies. Intelligent technologies are changing and disrupting every sector of the economy faster than we can keep up using traditional methods. The supercluster program and this investment in innovation is exactly what is needed to apply these technologies for the success and expansion of the agriculture sector and the entire economy. As part of this focus, PIC will be partnering with colleges and universities to help shape curriculum that matches the needs of industry. These new es-

ential skills won't just help the agriculture industry today; they will be demanded by jobs that are yet to be created and are transferable to other sectors and other industries.

As we proceed in set up our entity, we are mindful that our supercluster will be the most effective, most impactful and have the greatest success if we include, learn from and make space for a diverse range of people and experiences. We are working to insure the inclusion of women, Indigenous people and underrepresented groups, at every critical juncture of the implementation process: at the board level, in project funding and in the general cluster-building activities of PIC.

For the last 150 years, Canada has been known as a leader in agriculture. We produce some of the world's safest, high quality food. For the next 150 years, we have an opportunity to continue and grow our legacy as a leader in agricultural innovation. The Prairies are the heart of Canadian agriculture and well positioned to be the geographic genesis of this innovation. **P**

Frank Hart is chair of Protein Industries Canada.

B.C.'s Potential Game-Changer: The Digital Technology Supercluster

Bill Tam

Among the five innovation superclusters designated by the Trudeau government in February, arguably the most closely-watched choice was which digital supercluster would prevail. Big data is revolutionizing how individuals and businesses communicate, do business and live their lives. The Digital Technology Supercluster will be located in British Columbia, where it seems innovation is in the air these days.

Canada's prosperity on the world stage depends on establishing a sustainable national economic advantage. For the past decade, Canada has been amassing strengths in digital technology that will underwrite benefits to the country economically and socially for generations.

The Digital Technology Supercluster is a collaborative effort of more than 350 organizations, all focused on seizing opportunities in Canada's fast-growing tech sector. This is a bold endeavour, rooted in innovation and driven by an urgent need to facilitate digital transformation and competitiveness across all industries. By bringing together the experience and expertise of various industries and institutions, leveraging data and promoting the sharing of knowledge, the Digital Technology Supercluster will propel Canada's position as a leader in forging the world's digital economic future.

The Digital Technology Supercluster will support large-scale economic growth, generate jobs and create

new opportunities for Indigenous communities. It will allow start-ups and small and medium-sized businesses the opportunity to scale globally, while expanding the productivity and competitiveness of Canada's largest companies.

“ If the prize resource of the 20th century was oil, the prize resource of the 21st is data. More data has been created in the past two years than in the entire history of the human race. ”

If the prize resource of the 20th century was oil, the prize resource of the 21st is data. More data has been created in the past two years than in the entire history of the human race. Moving forward, the global data inventory will quadruple by 2025 and worldwide revenues for big data and

analytics are expected to exceed \$200 billion in 2020.

Many of the most promising developments in digital technology—such as virtual, mixed and augmented reality (VR/MR/AR), quantum computing, cloud computing and the Internet of Things (IoT)—are expected to witness triple-digit market growth in the years ahead.

Big data is revolutionizing how individuals and businesses communicate, do business and live their lives. In today's data economy, digital transformation is vaulting some businesses to new heights. Those that do not seize the opportunity risk becoming irrelevant. The Digital Technology Supercluster sees the immense potential of digital technologies and has been designed to capitalize on these important trends.

British Columbia is well-suited as the headquarters for the Digital Technology Supercluster. Home to a vibrant, diverse and successfully technology-enabled economy, B.C. has the fastest-growing technology sector in Canada. It leads the country in technology sector GDP growth and job creation, and hosts Canada's number one start-up ecosystem, three of five Canadian billion-dollar start-ups—or “unicorns”—and two of the country's top three universities in software development.

The Digital Technology Supercluster is focused on two distinct areas: ecosystem development and technology leadership. Advances in technology must be supported by a vibrant, inclusive and collaborative ecosystem. The Digital Technology Supercluster

recognizes the need to enhance labour force skills. This includes participation by a broad range of people who reflect our diverse population. Initiatives that foster opportunities for Indigenous peoples will be integrated into supercluster activities. Other important areas of ecosystem development include supporting the growth of innovation services and increasing access to world markets for Canadian companies.

Technology leadership programs are collaborative projects that directly enhance the productivity, performance and competitiveness of member firms. Using Agile methodology, projects will take place in six-month sprints, supported by a rolling Expression of Interest (EOI) process. Above all, projects will be guided by industry needs, led by supercluster members and supported by some of the best tech expertise in the world.

With the support of several hundred private sector participants, 25 of B.C.'s post-secondary institutions, leading universities and research institutes, and funding commitments exceeding \$500 million, the Digital Technology Supercluster has the momentum to be an economic game-changer. Founding members include large corporate players, small and mid-sized companies and a consortium of six post-secondary institutions—organizations who together can lead the development, adoption and success of new products and technologies.

The Digital Technology Supercluster's open membership model enables any organization to join as an associate member. This removes any barriers preventing SMEs from joining and encourages the rapid scale-up of a community of interest around data-driven innovation. Membership provides organizations and their staff with the opportunity to explore and participate in collaborative development opportunities in a safe, inspiring place of innovation.

The Digital Technology Supercluster will be the catalyst for transformational collabora-



With the support of several hundred private sector participants, 25 of B.C.'s post-secondary institutions, leading universities and research institutes, and funding commitments exceeding \$500 million, the Digital Technology Supercluster has the momentum to be an economic game-changer. *Adobestock photo*

tion and the centre for innovation initiatives across Canada. It will build partnerships and linkages. It will pool resources and data. It will become a clearinghouse for traditional industries, academia, and non-profits to collaborate with the digital technology sector and encourage the rapid scale up of a community of interest around data-driven innovation.

The Digital Technology Supercluster's Phase 1 programs have been identified through consultation with industry. A data stack of data visualization, data analysis and data collection was applied to B.C.'s major industries: natural resources, precision health and industrial. A wide range of opportunities were explored, leading to the definition of three program areas with the most potential: Precision Health, Digital Twins and Data Commons.

The following examples demonstrate how the Digital Technology Supercluster will contribute to significant advancements across some of Canada's leading industries:

- In Healthcare, a secure, anonymous Health and Genomic Platform will build the systems required to allow medical specialists to create custom, leading-edge cancer treatments that are personalized to the unique genetic makeup of each patient, building on Canada's current leadership in this area.
- In the natural resources sector,

an Earth Data Store will facilitate and improve data collection, sharing and visualization in the resource sector—enhancing how information about resource projects is shared between project proponents, Indigenous Peoples, governments and communities.

- In the industrial manufacturing sector, a Digital Learning Factory will help facilitate the development of virtual environments that enable design, rapid experimentation and testing of cost-saving approaches to address the most significant challenges in modern manufacturing.

These initiatives are among the estimated 100 projects that will be made possible by the Digital Technology Supercluster. Over the next 10 years, the supercluster is projecting over \$1 billion in investments in collaborative projects, involving more than 1,000 organizations.

Supported by a broad base of support across industries, guided by a solid plan and focused on an area of tremendous opportunity, the Digital Technology Supercluster is ready for take-off. For more information, visit digitalsupercluster.ca. **P**

Bill Tam is co-chair of the Digital Technology Supercluster along with Greg Caws. A tech industry leader, Bill's experience spans start-up CEO, enterprise sales executive, technology developer, venture capital investor and board chair.

Canadian Innovation Week: Celebrating Women Entrepreneurs

Michael Denham

It's no secret that sexism is rampant in tech culture; there's a Wikipedia page titled "Sexism in the technology industry," among the plethora of content that has chronicled the problem in recent years. As announced in the Federal Government's Budget 2018, the Canadian Business Development Bank has increased the size of its Women in Tech fund to \$200 million. It is now the largest VC fund in the world dedicated exclusively to investing in women-led technology companies.

Canadian Innovation Week is an opportunity for us, as a country, to celebrate innovation and mobilize around the goal of strengthening a culture of innovation in Canada. With this year's inaugural edition of Canadian Innovation Week, it is important to look to innovation bright spots with the potential to make Canada the most innovative country in the world.

One of these areas of potential, which remains a relatively untapped source of innovation, is Canadian women in STEM, more specifically women tech entrepreneurs. Carol Leaman, CEO of Axonify, is an excellent example. Axonify is a rapidly-growing Waterloo, Ontario-based company that created an e-learning software platform to better train employees through gamification (the application of typical elements of game playing—point scoring, competition, rules of play—to other areas of activity).

The company had just two employees when Leaman and a partner bought it in 2011. Axonify now employs 140 people and has \$21 million in annual sales. Customers include Walmart, Toyota and Bloomingdale's. In 2016,

Leaman was named one of Canada's top 100 female entrepreneurs, and she contributes regularly to Fortune magazine. Her many awards include the Sara Kirke Award as Canada's leading female entrepreneur in 2010.

“ Only five per cent of tech companies have a solo female CEO, and women make up just 13 per cent of the average tech company's executive team, according to a 2017 report by #movethedial, a Canadian non-profit. ”

Unfortunately, successful women entrepreneurs such as Leaman are not easy to find in Canada's tech scene. Only five per cent of tech companies have a solo female CEO, and women make up just 13 per cent of the average tech company's executive team, according to a 2017 report by #movethedial, a Canadian non-

profit. This is less surprising when we look to where the pipeline for women in tech begins. Lower levels of participation already manifest themselves at the high school level. Later on, we see that—despite representing the majority of young university graduates—women are underrepresented in STEM fields. Tech companies need uninterrupted financing—access to capital at all stages of their growth. This is the game changer when it comes to growth and scaling up, as well as outsized contributions to job creation, particularly in STEM fields, and to the economy. For women tech entrepreneurs specifically, systemic gender bias compounds the challenge of access to capital. Only 10 per cent of venture dollars globally between 2010 and 2015 went to startups with at least one woman founder. Anecdotally, we have all heard stories of gender bias in venture capital (VC)—stories of the “old boys' club”. Unfortunately, the research seems to bear this out. In the case of men and women entrepreneurs using the same pitches, men entrepreneurs were more likely to get funded than women. Women entrepreneurs also see themselves awarded approximately 25 per cent of the asked amount of venture capital as compared to 50 per cent for men entrepreneurs.

In addition to the too-shallow pools of available capital, venture capital firms lack diversity in their investment teams. While the number of women partners in Canadian VC firms is increasing, women still only occupy about 12.5 per cent of investment roles. While the ecosystem is beginning to correct systemic biases through women-led accelerators and women entrepreneur-dedicated capi-

tal (e.g. Creation of StandUp Ventures Fund administered by MaRS IAF, Fierce Founders Bootcamp, Pique fund, etc.), it needs to be happening faster. We have a great opportunity to up our collective innovation and economic bench strength as a country by providing women tech entrepreneurs with the support they need. We need to first expand the size of the pipeline of women in STEM by improving STEM education for girls and providing them with more role models. Just last year, the federal government launched #ChooseScience—a campaign to encourage young girls and women to enter STEM fields and to provide them with opportunities to engage in the sciences. By celebrating women leaders in STEM, we can overwrite outdated stereotypes. The sharing of their stories provides young girls and women contemplating STEM and entrepreneurship with real role models, allowing them to see themselves in similar roles. When they enter those roles, they contribute to the shifting of the traditionally male-dominated culture found in STEM fields, including in tech companies. Building a culture of inclusion is key to creating a stronger sense of belonging for women and making STEM and entrepreneurship fields in which they can see themselves fitting and thriving.

At BDC, we are upping our game to provide women-led tech firms with the support they need at all stages of their lifecycle. As announced in the Federal Government's Budget 2018, we have increased the size of our Women in Tech fund to \$200 million. This is now the largest VC fund in the world dedicated exclusively to investing in women-led technology companies. We believe this is the kind of investment with the potential to truly make a difference. With a fund of this size, BDC has the capacity to make multiple investments in women-led tech firms along their lifecycle to ensure they have the capital they need at all stages of their growth in order to unleash their full potential. Non-financial support is also key to the growth of these companies. By also providing mentorship,



Budget 2018 increased the BDC's Women in Tech fund to \$200 million, making it the largest venture capital fund in the world dedicated exclusively to investing in women-led technology companies. *iStock photo*

peer-to-peer training, connections and other resources, we hope to equip women tech entrepreneurs with the tools and skills they need to become Canadian innovation success stories and role models.

To continue expanding the tech ecosystem, through the Women in Tech Fund, we will also be supporting and growing the base of emerging female investors and fund managers through mentorship, education and training. Additionally, women-led firms stand to benefit from an increased number of female VCs across the ecosystem. They are not only more likely to get funded but also to have a successful exit when they are financed by VCs with women partners. The hope is that with a growing number of women investors, women tech entrepreneurs will not only have better access to venture capital, but that their growing presence will chip away at the underlying systemic gender bias. We all stand to benefit from a cultural shift toward a higher standard of ethical conduct and a culture of diver-

sity and inclusion. By ensuring a safe, fair, and equitable work environment within the Canadian tech ecosystem and the VC community, more and more women and girls will be able to see themselves in this space.

To make Canada the most innovative country in the world, we must not only look to today's innovators, but also to those of tomorrow. By providing the support they need today, we hope to propel Canadian women tech entrepreneurs so that those coming up behind them can see them as role models and see themselves in STEM and in entrepreneurship. It is through powerful initiatives like Canadian Innovation Week that we can take a moment to pause and celebrate the successes of women like Carol Leaman. Canadian Innovation Week celebrations also fuel our drive to roll up our collective sleeves to improve conditions and support the next wave of women like her. **P**

Michael Denham is president and CEO, Business Development Bank of Canada (BDC).



Participants in the 2018 Fierce Founders Bootcamp receive pitch coaching from Communitech advisor Ellen Johnson. *Communitech photo*

Fierce Founders: Helping Women Close the Start-up Gap

Kelly McGregor

Since it was launched in 1997, the start-up incubator Communitech has been a force in Waterloo's transformation into "Silicon Valley North". Now, through its Fierce Founders program, it is training a new generation of innovating women.

It's not hard to make the case that female entrepreneurs face challenges men simply do not have to deal with. I can't count the number of female founders who have told me stories of potential investors who have turned them down because they can't relate to their product, can't relate to them as women, or because they were perceived as date-able over investable.

Aside from being disheartening, these reactions contradict the reality of how companies led by women actually perform. Research by American venture capital firm First Round Capital found that companies with at least one female founder outperformed all-male founding teams by 63 per cent over the last 10 years. Yet, a 2016/17 Crunch-

base report looking at global rates of investment in women-founded businesses found that only 16 per cent of venture dollars between 2010-2017 were invested in businesses with at least one female founder. Research out of Harvard University has shown that only 10 per cent of start-ups are owned by women, an experience that was matched at Communitech as late as 2015, when only nine per cent of start-ups were led by female founders.

While the reasons for this can be complicated, the lack of female role models and peers is undoubtedly part of the problem—as Marie Wilson of The White House Project puts it, “You can’t be what you can’t see.” Combined with difficulties women face in securing venture funding, this creates an incredibly de-motivating environment for potential female entrepreneurs.

In the 2018 federal budget, the Trudeau government committed to supporting female founders even further. We took our first organized steps towards meeting these challenges in 2014, when we hosted the Women Entrepreneurs Bootcamp, in partnership with Status of Women in Canada and Google’s #40forward program. Interest in the program was huge, and we quickly realized that there was not only a need for more boot camps, but that there was also an opportunity to help the most promising companies further develop their businesses. With the support of FedDev, we developed the Fierce Founders Boot Camp and accelerator programs in 2016. To date, 140 female-led companies have participated in the boot camp, and we have worked with 23 companies through three cohorts of the accelerator program.

We have learned from the needs of women applying to the boot camps, and have refined the programming to help women manage the risks of starting a company. Two key issues have come up—the boot camp needs to be focused on one particular stage of company, and the immersive learning environment is best suited to early-stage companies. As of 2018,

“*Research out of Harvard University has shown that only 10 per cent of start-ups are owned by women, an experience that was matched at Communitech as late as 2015, when only nine per cent of start-ups were led by female founders.*”

participants in the boot camp spend three days learning about problem validation, solution validation, market segmentation, and how to secure early sales. One month later, they return to Communitech to spend three days focusing on the ever-challenging pitching for investment. The boot camp culminates in a pitch competition, where the top eight participants compete for a \$100,000 grand prize. After the boot camp, women leave to build out their minimum viable products and secure their first sales.

Once female founders have a base of sales, they are invited to apply to the Fierce Founders Accelerator. After hosting three cohorts of companies in the accelerator, we have shifted the focus of the program to companies that are ready to accelerate their sales growth. Upon acceptance into the accelerator, companies move into the Communitech space and spend six months working with growth coaches to refine their sales processes, generate leads, learn how to overcome objections, and how to build a company to support that rapid growth. The accelerator also offers access to a \$30,000 matching fund from FedDev Southwestern Ontario that helps eligible companies grow even faster.

The most recent success story from the Fierce Founders Bootcamp shows the incredible impact the program has on participants. Monika Jarszonek of Ratio.City started the boot camp in January 2018 with no experience pitching, and went on to win the grand prize. Ratio.City is an online platform that provides data-driven analysis of urban real estate to help developers and real estate

professionals predict the suitability of a property for development or revitalization.

Monika’s story illustrates the importance of being embedded in a start-up ecosystem that helps companies start, grow and succeed. According to Monika, “Since winning the boot-camp Ratio.City has been moving forward at warp speed. Part of that is a result of the cash injection, which lets us make our first full-time hire, but even more important than that, the win provided us with exposure within the tech ecosystem, giving us credibility, visibility and opening doors that were much harder to for us to access as first-time founders.”

In addition to the ecosystem of start-ups, women who have participated in Fierce Founders highlight the importance of connecting with other female entrepreneurs, both as mentors and as peers. The Fierce Founders Accelerator, in particular, provides participants with an opportunity to work alongside other women growing their businesses. Martha van Berkel of Hunch Manifest participated in the Fierce Founders Accelerator in 2017, and keeps in touch with the other founders from the program through a monthly peer group, as well as day-to-day. “There is nothing quite like learning from founders who are one step ahead of where you are. The Fierce Founders Accelerator brings together founders who can share their learning, favourite hacks, and inspire one another to the next quarter’s goals,” says Martha.

Hunch Manifest’s core product, SchemaApp, enables digital marketers to optimize websites at scale using Google-recommended advanced

SEO strategy called Schema Markup. Through the accelerator, Martha and her team doubled their recurring revenue, were introduced to and onboarded a new enterprise client, and hired their first employee. Martha directly attributes that success and Hunch Manifest's continued growth, to being rooted in lessons learned through the Fierce Founders Accelerator. "Accelerators are important because they force change. For us, it took us out of the basement office, surrounded us with rock star companies, and changed the conversation to growth and scalability."

The Fierce Founders program provides start-ups with resources that would be difficult to access on their own—funding, networks, office space and expert insight. The benefits have reached beyond the scope of the program, with the participating companies providing inspiration and support to other founders in the ecosystem.

In just three years, the proportion of female-led companies Communitech works with has risen from nine per cent to 27 per cent. Despite initial successes, there remains a lot of work to do. Although the number of early-stage companies has increased, there remain very few women-founded companies that have made it past the \$1-million revenue mark and into what we call the scale-up phase of building a company. The next phase of our programming will work with founders to make that leap, through providing alumni with the resources they need to further grow their sales and attract investment.

While the focus of the Fierce Founders program has been on companies in the Toronto-Waterloo Corridor, each application round makes us aware of more women, from coast to coast, who are starting or growing technology-based businesses. To date, the boot camps have only been able to accept one of every three ap-

plicants, and the accelerator one of every four.

The announcement of a Women's Entrepreneurship Strategy in the recent federal budget creates a real opportunity to provide women across the country with this kind of support. Ideally, this strategy will combine local programs focused on early-stage support with a strong national network of female-led scaling companies, so that entrepreneurs can learn from each other and create a powerful alumni group that will serve as an example to the next generation of women considering whether to make the entrepreneurial leap themselves. **P**

Kelly McGregor is manager of the Rev and Fierce Founders accelerator programs at Communitech. She has been working with start-ups for 10 years, with a particular focus on rapid growth strategy and founder development.

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UBC entrepreneur Valerie Song introduces her technology at the e@UBC venture showcase. *UBC photo*

Canada's Start-up Ecosystem: Are We Playing 'Not to Lose'?

Amielle Lake, Barry Yates and Laura Lam

Canada's tech start-up environment has produced world-changing innovations, from BlackBerry to Shopify. But there remains a hollow middle in the start-up ecosystem, and it isn't going to be filled if women continue to be consigned to the sidelines.

Since the 1970s, Canada has established a start-up Hall of Fame of sorts. It includes Nortel, Research in Motion, Slack and Shopify. These are the big ones, the ones that managed the ultimate breakthrough; to achieve valuations north of a billion dollars. We are incredibly proud of these achievements. At the same time, we fail to acknowledge the reality we are facing. The list of very large companies (>\$1 billion) is relatively small. Worse, the list of large (>\$100 million) and medium-sized companies (>\$20 million) is almost blank. Drop down to

the bottom tier of companies, valued at less than \$10 million, and we have a large pool that is only growing—not in size but in quantity. This is a problem. In the Ocean of start-ups, Canada has managed to produce plankton, minnows and 1 or 2 whales. Not exactly a thriving ecosystem.

To make things worse, the gap is a self-fulfilling prophecy of sorts. An entrepreneur will start a company and if they are lucky, they will be one of the very few that survive. From there, if they manage to gain momentum, they get purchased. The acquirers are often large, well-capitalized entities south of the border that then take their purchase and convert it to an exit for ITS shareholders at 10 times what Canadian shareholders received for their start-up. A simple case study is my own experience. I founded Tagga. We toiled for years and as soon as we gained traction we made the call to sell. For most, the exit would appear to be a success. Six months after we proudly closed our sale, our acquirers announced that they had leveraged our tiny company to re-define their entire offering. Our buyer was doing over \$100M in revenues and now armed with a differentiated technology, they can race down their growth path, providing ten times the returns to their shareholders.

Barry had a similar experience. He became the CEO of software company Monexa, which was then sold to NetSuite. It was an excellent liquidity event for Monexa shareholders. Then, 18 months later, Netsuite, founded in California, was purchased by Oracle for \$9.3 billion. California-based Monexa competitor Zuora raised close to US\$250 million in venture financing and recently went public. Zuora now has a US\$2 billion market cap though Monexa was first to market.

So what happens next? Our returns cycle back into the Canadian economy, going just a tenth of the distance of that of our US counterparts. Access to Capital has long been a problem for Canadian entrepreneurs. Still, the prob-

“ So again, the cycle repeats itself. An ecosystem with less capital and a talent pool of inventors rinses and repeats the same formula: start a company, prove the technology solves a problem and then sell it to a US buyer for small returns and little leverage. The more we do this, the smaller we get. ”

lem doesn't end there. The fallout of producing smaller businesses means we produce a considerably different pool of start-up talent. To put it simply, we have excellent technologists but we are weak on management teams that can scale or commercialize. So again, the cycle repeats itself. An ecosystem with less capital and a talent pool of inventors rinses and repeats the same formula: start a company, prove the technology solves a problem and then sell it to a US buyer for small returns and little leverage. The more we do this, the smaller we get.

Since the nineties, the Government has made some concerted efforts at both provincial and federal levels to support the technology start-up community. Two amazing programs have emerged to support entrepreneurs and early-stage investors: Scientific Research and Experimental Development (SR&ED) tax credits and Eligible Business Corporation (EBC) tax credits. These programs have enabled start-ups to invest millions upon millions back into their companies whilst encouraging investors to support them because of the personal benefits that are reaped. In fact, SR&ED has become so popular, it's now a stimulus for encouraging large technology companies to establish their R&D offices in Canada. Microsoft, Facebook and Google are prime examples. Without these government programs, the Canadian start-up economy would dry up quickly. At the same time, we need more. We need support in commercializing our efforts. We need government programs that facilitate the recruitment of experienced foreign leadership, sales and marketing talent. We need programs that provide grants or tax

credits for market research and customer validation programs.

Finally, much like our competitive counterparts, Canada fails to support its female entrepreneurs and investors. Our venture capitalists financed about 4 per cent of our female entrepreneurs last year. While many efforts have been made to increase the support for women in investing and entrepreneurship, Canada's entire start-up ecosystem is currently only betting on half of the population.

So, how do we get out of this spin cycle? The path forward is easier said than done, but the solution still feels simple enough. We need to expand our thinking around what constitutes success in entrepreneurship. Canadian start-ups need to go beyond building interesting technologies, they need to distribute them. There is no reason why we can't become stewards of our own innovations.

Our message to the investors, government and other ecosystem participants is to invest in collaboration and diversifying our thinking to support scaling companies. This means simplifying the sourcing of talent that can scale an organization, strengthening go-to-market programs, diversifying product lines to build new revenue streams, and building broad distribution partnerships. For government, this means investing in commercialization programs for companies that are both early and late in their journey to market. Both market research and showcasing Canadian companies should be a priority.

Over the last few years, the Canadian Accelerator and Incubator Program (CAIP) has dis-

tributed millions of dollars to incubator and accelerator programs across the country. In British Columbia alone, there are some 60 incubator and accelerator programs. Within each of these programs, we are attempting to build better companies. The challenge is, it's the same programming, an over-emphasis on the things that keep us from being successful: building product and exiting. We have observed very few incubators and accelerators that focus on recruitment of executive leadership, sales training, go-to-market plans and the like. A way forward would be to concentrate this funding effort to reflect major centres across Canada. In this model, we could dive deep into both technology domain expertise as well as broaden programming and training to focus on marketing, executive leadership and sales. We can pool our resources and diversify our investment

Even if we manage to raise the bar and strengthen our national sales and

“ *Improving the quantity of mid-to-large and very large companies that Canada is able to produce will generate benefits across all aspects of Canadian life. More successful companies means more jobs, more tax dollars, increased wealth and a greater ability to innovate.* ”

marketing muscle, we would still be selling ourselves short if we look for our winners to come from just half of the population. While many programs have entered the market over the last several years to support women in entrepreneurship, they are not radical enough to drive massive transformation. From 1999 to 2009, female

entrepreneurship grew by just 13 per cent. We need to provide greater incentives for women contemplating a career in entrepreneurship. These incentives should come in the form of both capital and mentorship.

Improving the quantity of mid-to-large and very large companies that Canada is able to produce will generate benefits across all aspects of Canadian life. More successful companies means more jobs, more tax dollars, increased wealth and a greater ability to innovate. All the same, if we continue to hollow out our entrepreneurship middle, then all our efforts and investments across public and private spheres will only result in diminishing returns down to zero. **P**

Amielle Lake is entrepreneur in residence at Entrepreneurship at UBC and Co-Founder of the Women's Equity Lab. Barry Yates is Managing Director of Entrepreneurship at UBC. Laura Lam is Marketing Manager of Entrepreneurship at UBC.



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The Innovation Journey: Lessons from Clean Tech

Audrey Mascarenhas

The term “innovation” has become such a rhetorical commodity in politics and business that it risks becoming an abstraction. Audrey Mascarenhas has been president and CEO of Questor Technologies since 2005. In more than three decades in the energy sector, first in the oil patch, then in clean energy, Mascarenhas has learned an enormous amount about innovation. She shares that insight, from how to navigate the innovation path to how the government can improve its investing strategy.

The online Business Dictionary definition of innovation is: “The process of translating an idea or invention into a good or service that creates value for which customers will pay. To be called an innovation, an idea must be replicable at an economical cost and must satisfy a specific need.”

In other words, the innovation creates a change by improving on the way things were. Many think of innovation as a bright idea, but much of innovation is really about incremental change—seeing a better way. When you see a better way, that is just the start of this innovation journey. There is a long, tough road ahead to figure out how to prove and convince others that this is the better way. Once you do, the next step is determining how to grow and scale up the idea so it is adopted globally, creating worldwide change. It is at this stage that Canada fails because it does a poor job supporting its innovators.

Innovation is a very tough road if

you think of it beyond just the bright idea. It is a journey fraught with many challenges and pitfalls—often referred to as “valleys of death”—of which there are many on the path to success. Governments fund the early stage because it’s exciting and sexy and the easiest part of the journey. In Canada, the majority of our government funding goes to start-ups and demonstrations. The next part of this journey is where the going gets tough and needs an innovator/leader with tenacity.

The team that travels this next part of the journey has to be strong and entrepreneurial because nothing goes according to plan and everything takes twice as long as you expect it to. In this segment of the journey, the team is trying to convince venture capitalists, banks, government funders, clients and employees that the innovation idea is a better way. There are moments of joy and despair and the team that survives this is now ready to scale up. It is at this important and vital

juncture, where value gets created, that Canada drops the ball.

In the product world, scaling up means having clients that repeatedly buy your product because it adds value to them, which gives you the traction and team to grow the company. This sounds pretty simple but determining the team that is going to be successful is not that easy. The private market lives and dies on being able to do pick the winners and losers. If they don’t pick well, then they lose their investment. Prior to making an investment, they meet the team and evaluate many things; the CEO, the management team, track record, ability to execute, size of the market, what clients are saying, the “pull” for the product or idea, etc. Many investment houses are starting to use quants to design complex mathematical models and algorithms to identify the stars. The list of things to look for in picking winners is long and most investors have made mistakes and lost money but have learned from experience.

To the current government’s credit, there is a recognition that we have a significant problem in Canada, as we are not scaling up the companies we invested in at the early stages. These companies were supposed to create future jobs and generate the GDP Canada needs for a sustainable economy. They are leaving Canada and growing their companies elsewhere. These entrepreneurs are leaving because of a lack of growth capital, minimal appetite for change in Canada, bureaucracy, poor/cumbersome regulation, lack of appreciation and red tape. In other words, Canada is funding the rest of the world’s GDP

growth and de-risking other countries' innovation cycles because we do not understand the full and difficult innovation journey.

Recognizing the gap and lack of scale-up capital, the government set aside \$1.4 billion dollars in the last budget specifically for scale-up, allocated to a variety of government organizations. Each of these organizations has been growing their internal investment teams to manage the funds so there will be an administrative (G&A) cost, which has typically run at 29 percent, leaving approximately \$1 billion to invest. To generate a return on this investment it would require a team of individuals with a strong investment skill set and experienced track record to determine the winners that are worthy of investment. It is quite unlikely that people of this skill set would be sitting around waiting for a job in government. So how do we leverage the bright minds making smart investment decisions in the real world?

The bureaucratic process currently in place is application-form based and does not leave room for the decision makers to meet with and understand the companies they would be investing in. In other words, the \$1 billion will be invested in companies good at application form writing and not necessarily in entrepreneurs running great companies ready to scale. The lack of understanding of the innovation journey means that there will not be a return on the tax dollars invested. If we truly want to be successful at scaling up and creating great companies, we have to take a tailored, focused approach to the winners and invest strategically to generate a great return on the investment for the future of Canada.

Canada has chosen to strategically invest in clean technology. Budget 2017 invested over \$2.3 billion in this segment and demand is projected to grow from \$1 to \$3 trillion globally and be the 3rd largest industrial sector by 2020. This large market opportunity has the potential to create significant GDP growth for



Questor Technology's Plugging and Abandonment (P&A) Trailer, an innovation created in response to the thousands of wells requiring abandonment in Colorado. *Questor Technology photo*

the country. Clean tech is not a sector on its own but a mega-trend that will affect most sectors as the world transitions to a low carbon economy. This is what makes this sector unique but also very impactful. It is imperative here that we are thoughtful and strategic on our investment decisions in this space.

The technology solutions that we champion and invest in must make business and technical sense. It is imperative that a balanced approach is taken. If we only invest in moonshots and start-ups, we will lock ourselves out of a fast-growing global opportunity. History has shown that it takes eight to 20 years for a company to develop traction, therefore, if we do not take a balanced approach and invest in the entire innovation value chain we will waste that money and generate a negative return on the investment. This sector also needs clear regulation that encourages adoption and leadership that embraces change.

Here are my recommendations:

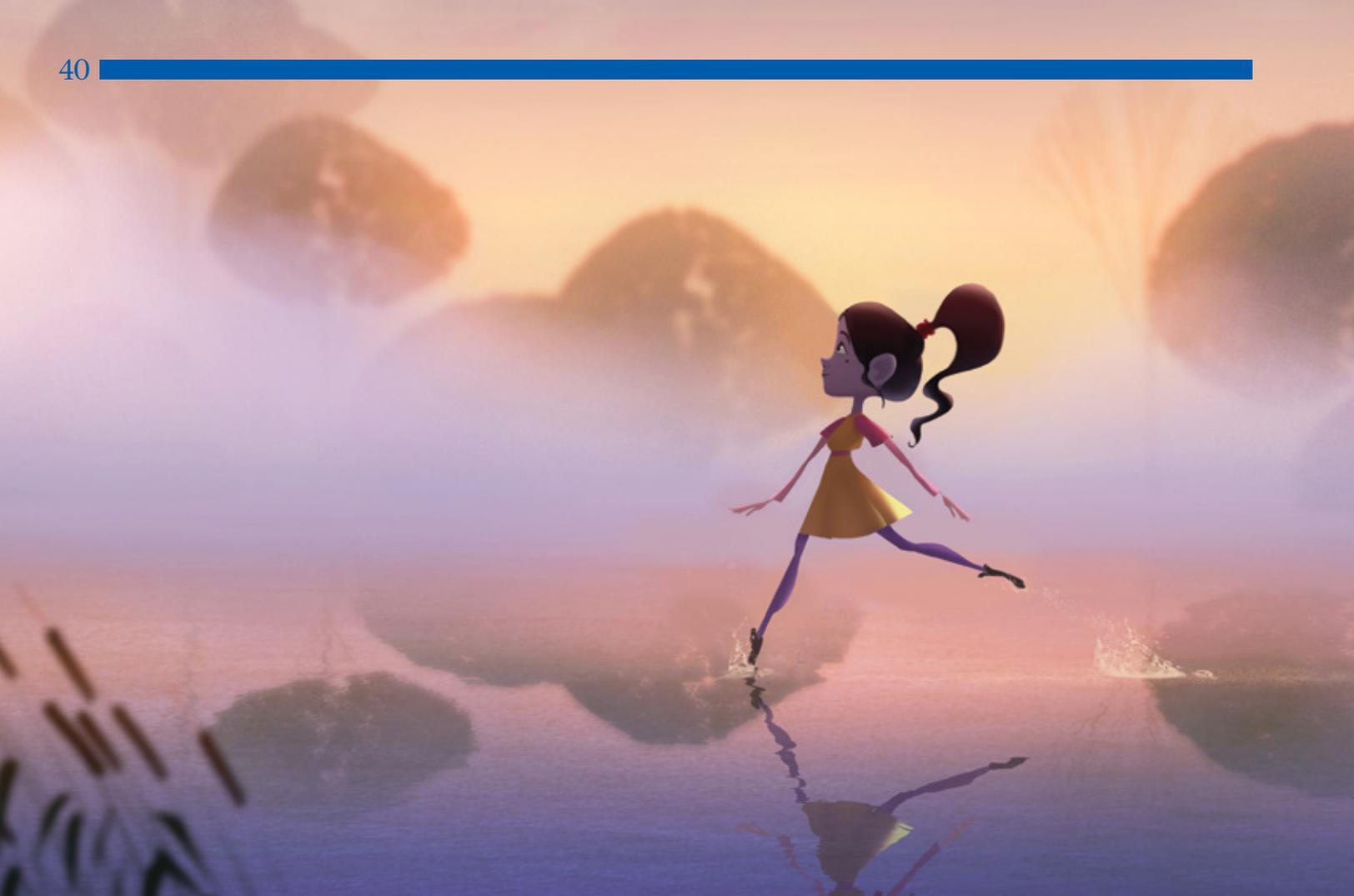
1. **Pick winners:** Engage the private sector. Public/private partnerships. A "Scale-up Bank" perhaps. Change the current process that only supports the ones that

are struggling. Meet with the companies. Create an advisory board with retired successful CEOs and entrepreneurs. "Own the podium"

2. **Balanced approach:** Invest in the entire innovation ecosystem.
3. **Fail fast:** Stop propping up struggling companies. Let them fail when they should.
4. **Regulation:** See what other countries are doing—pick the best rather than reinvent the wheel—use it to catalyze change rather than kill it.
5. **Acting faster:** Entrepreneurs not hearing back for 8-12 months is too late. The pace of change is exponential.
6. **Be strategic:** Figure out where you have a strategic advantage and go for it.

If we are to succeed in creating a great future for Canada and our young people, we have to rethink how we are supporting the full innovation cycle and take a balanced approach across the whole continuum. It is a tough journey that is much more than the idea alone. Canada needs to find its "gazelles" and nurture them to ensure we have a strong vibrant country for our children. **P**

Audrey Mascarenhas is the President and CEO of Questor Technology Inc.



Concept art by Jeremy Baudry for Riverdance, a Cinesite Studios production made possible with generous tax credits from Montreal and Canada. In theatres spring 2020. Cinesite photo

Innovation: The One Constant in Entertainment

Dave Rosenbaum, Nick Glassman and Tyler Werrin

While Canada has established itself as a nexus of film technology talent, especially in animation, most people don't realize just how much Canadian-created content they're looking at when they're watching a film. Not only are Canadian companies like Cinesite creating our culture, but by constantly adapting creatively in one of technology's most rapidly-evolving environments, they're setting a standard for innovation.

At the intersection of creativity and technology, innovation and entertainment collide. Starting with the Frenchman Louis Lumiere's motion picture camera in 1895 and the American Thomas Edison's Vitascope projector in 1896, the goal to entertain drove some of the largest technological innovations of the 20th century. The 1920s brought lighting and film exposure techniques in pursuit of motion pictures, the 1930s and 40s introduced

broadcasting, the 1950s and 60s delivered televisions into every modern home, the 1970s and 1980s brought cassettes, CDs and DVDs to make media mobile, and the 1990s ended this century of rapid evolution with the digitizing, storing and distribution of high definition quality media. The one constant in entertainment was—and is—innovation.

For 25 years, Cinesite Studios, a powerhouse in visual effects and animation in Montreal, Vancouver and London, has thrived on bridging creativity and technology. From work on blockbusters like *Avengers: Infinity War*, *Jurassic World* and every *Harry Potter* film, to animated projects like *The Addams Family*, *Riverdance* and *Harold Lloyd*, Cinesite operates as a catalyst for studios, investors and artists to reach global audiences.

Cinesite uniquely combines three filmmaking businesses: 1) Visual effects for major movie blockbusters, 2) Production service partnerships with other studios, and 3) Original animated feature films. This structure of three businesses within one company is an enterprising approach that hedges investments, maximizes talent and necessitates constant ingenuity.

This decade has changed the film industry, with subscription video on-demand services like NETFLIX, Amazon Prime Video and Hulu expanding the options of how and what content reaches audiences. Cinesite, in partnership with the Canadian government, is creating, marketing and distributing films that take advantage of this dramatic and fundamental shift. But for growth in Montreal and Vancouver to succeed, there must also be a diverse talent pool that constantly improves and is challenged. Canada's enticing tax credits have made it a global leader in the gaming industry, welcoming Electronic Arts, Ubisoft, Gameloft, BioWare and others. This was an excellent start.

“ Part of innovation is research, which is borne through the exchange of ideas. Each client has certain expectations for how their films should be produced, created and inevitably delivered, from budget to picture quality to distribution methods. ”

More investments in other growing technical industries have also resulted in a rising talent pool of engineers, designers, artists, product managers and producers. This, combined with many imaginative start-up companies, has produced a sophisticated culture and cutting-edge infrastructure that are proving indispensable to Canada's economic growth in the billion-dollar entertainment industry.

Cinesite in particular is growing in scope and scale, aiming to create one thousand jobs by year's end. The sheer variety of opportunities offer Cinesite unparalleled and unique flexibility within the industry—and the company has created 500 jobs in both Montreal and Vancouver. The intricacies and idiosyncratic parameters each global client demands from Cinesite have fueled its knowledge base. The collaborative and egalitarian atmosphere of a wide variety of product enables Cinesite to build a vast and extensive library of experiences and innovations.

Part of innovation is research, which is borne through the exchange of ideas. Each client has certain expectations for how their films should be produced, created and inevitably delivered, from budget to picture quality to distribution methods. This robust intake of information is invaluable research that Cinesite tests equally; the most successful methods circle back, benefiting all.

Cinesite further fills in the gaps between budgets, schedules, and talent with an original content slate designed and developed to target different and distinct audiences.

Essentially, one studio is able to effectively appeal to a wide range of financial opportunities, a breadth of studios' brands, a variety of distribution needs and the gamut of audiences' tastes.

This production strategy also allows for the filmmakers themselves to explore new techniques, create more niche films and work on projects that may be deemed too risky for traditional studios. When a studio can create projects that take more risks, it attracts riskier filmmakers. And riskier filmmakers tend to be more innovative. In creating movies that appeal to uniquely targeted audiences, the consumer wins. No longer does one film have to be all things to all people; each film can be something to someone.

“ When a studio can create projects that take more risks, it attracts riskier filmmakers. And riskier filmmakers tend to be more innovative. ”

Thanks to the generous tax subsidies provided by Canada, we're able to further impact the quality of our original slate by reinvesting the tax credits back into the films, not increasing the budgets, simply budgeting less from the start. What was a \$100 million movie ten years ago can now be accomplished at a fraction of the cost thanks to innovation's advancements in technology, Can-

ada's progressive tax strategies and Cinesite's dynamic business model. Bonus: because each movie is produced at a much lower cost, recouping initial investment is quicker, the economy is stimulated faster and the desire to reinvest is heightened.

“ *There are two kinds of innovation: The first is when you see an opportunity, define a plan, then execute it in a controlled manner. The second is when you fail to react to the market and are forced to change with less planning, all the while fighting the temptation to do nothing and hope the innovation isn't required.* ”

But, it's one thing to make movies in Canada; it's quite another to sell them to the world. As Cinesite continues to partner with other movie studios to find theatrical success, there is additional opportunity to leverage the way viewers now engage with films. Over the past decade, filmmakers have shifted from traditional Hollywood techniques to sell their films. Today's fans are less engaged by traditional film marketing, which is limited to repurposed images and brief outtakes of the film into billboards and television commercials. Fans now have near-infinite content choices in the palm of their hand and are therefore harder to focus and entertain. The trend now is to capitalize on social content, games and advanced technologies like augmented reality to draw in customers immune to stale marketing. To successfully brand a new film, fans now expect custom content crafted by the same filmmakers behind the film. Cinesite is actively and aggressively pursuing these complementary avenues of en-



Cinesite photo

agements as a vital part of our overall strategy.

Marketing used to start once a film was nearly completed, but the core creative teams who worked on the films had moved onto new projects. A disconnected creative team, often an external agency, devised and executed their own marketing strategy. While this was manageable in traditional print advertising and trailers, it is a significant challenge on platforms requiring much more elaborate custom content for burgeoning new media ecosystems.

To solve this, Cinesite is innovating the way digital and marketing are funded and created by making it a part of the production. At Cinesite, digital and marketing efforts begin when a film goes into production, rather than once the film is near completion. This parallel approach allows us to pair the film creators with digital experts at an early stage, allowing the two groups to build story-driven interactive content. Fans want to be immersed in the world of the film to meet the characters in depth and to do this successfully, the filmmakers must fundamentally be involved. The good news is that the most creative and innovative filmmakers always want to be intrin-

sically involved and the studio need only adapt. Be it through visual effects for major movie blockbusters, production service partnerships with other studios or original animated feature films, audiences never tire of being entertained. Cinesite has a foothold in all three, so the studio is well-positioned to capitalize on opportunities that come its way.

There are two kinds of innovation: The first is when you see an opportunity, define a plan, then execute it in a controlled manner. The second is when you fail to react to the market and are forced to change with less planning, all the while fighting the temptation to do nothing and hope the innovation isn't required. The thing is, innovation is ineluctable and inevitable. If you don't do the first, controlled innovation, you'll end up doing the second, forced innovation anyway, and at greater cost. Cinesite, thanks to Canada's support to grow creative and technical industries, is positioning Montreal and Vancouver to be innovative leaders in this next paradigm shift within the entertainment industry. **P**

Dave Rosenbaum is Cinesite's Chief Creative Officer, Nick Glassman is Cinesite's Chief Digital Officer and Tyler Werrin is Cinesite's Head Writer.



Thomson Reuters employees are working to embed emerging technologies into customer solutions as part of a \$100 million investment in a new Toronto Technology Centre that will create up to 1,500 jobs. *Thomson Reuters photo*

Innovation, or How Thomson Reuters Won the Other Information War

Shawn Malhotra

The brand that is now frequently cited as Canada's most globally recognized was born in the mining towns of Northern Ontario in the early 1930s. Roy Thomson, the son of a Toronto barber, launched North Bay's first radio station, then the Timmins Daily Press. Today, Thomson Reuters is the world's largest multimedia news agency, providing business and international news, financial market data and regulatory information to the financial, legal, tax and accounting industries as well as a range of other content to consumers around the world.

Thomson Reuters has been serving professional knowledge workers in more than 100 countries for more than 100 years. As all good Canadians do, we bring a grounded, common-sense approach to the way we run our global business. But, perhaps the most inherently Canadian trait we share with all enduring businesses is a healthy focus on innovation.

We did 'Big Data' long before the term became corporate jargon. We began applying machine learning 15 years before Watson played Jeopardy. Today, our AI tools use social media

to verify fact from fiction and enable our journalists to filter out social media noise and identify breaking news events.

Ours is a great story, and a very Canadian one. Thomson began as a newspaper company in Northern Ontario in the 1930s. Over the decades, the business expanded across industries and borders, including a highly successful ownership stake in a North Sea oil and gas consortium. But the company's leaders had the foresight to know that oil was a non-renewable resource. They needed to find the oil wells of the 21st century: information.

Fast-forward to roughly 30 years ago—Thomson was a holding company that published about 200 newspapers, along with textbooks and professional journals, as well as the largest leisure travel business in the UK. Thomson had the foresight to understand the sweeping change the internet and digitization of content would bring and started to divest its print assets for higher-margin digital, professional information and services assets.

While at its core, Thomson remains an information publishing company, early investment in electronic delivery became a corporate priority. At the time, the Thomson Corporation provided much of the specialized information content the world's financial, legal and research organizations relied on to make business-critical decisions. In 2008, the company bought Reuters Group, a global financial information and news business.

Throughout our journey, we have been innovating and building a company designed to compete in the Information Age. Customers used to pay for printed volumes of need-to-know data. They moved on to networks of information stored in databases and delivered in electronic form. Today, they pay for the right answer, delivered at the right time when they need it in their working lives.

“ Thomson had the foresight to understand the sweeping change the internet and digitization of content would bring and started to divest its print assets for higher-margin digital, professional information and services assets. ”

With the explosion of data and proliferation of “free” information, it has become harder than ever to extract true value from this wealth of opportunity. The foundation of our innovation efforts has been the work we do under the hood. Need-to-know proprietary data is important. But, the key has always been the information architecture around the data that enables us to extract value-added meaning from the information.

To make better use of the data we had, it needed to be “freed” from the silos it was created for and managed in. So, in the early 1990s, Thomson Reuters began phasing in artificial intelligence, natural language processing and machine-learning technologies to with increasing sophistication.

“ The foundation of our innovation efforts has been the work we do under the hood. Need-to-know proprietary data is important. But, the key has always been the information architecture around the data that enables us to extract value-added meaning from the information. ”

Back in 1975, the CN Tower had just been completed and journalists were still writing stories on typewriters and filing them by phone. There was no internet and no personal

computers. West Publishing (a future division of Thomson) launched Westlaw, one of the first online legal research services. Attorneys used ‘dumb’ terminals to dial-up to a mainframe. The content was limited (disk space was expensive), the search language simplistic. Soon the search was enhanced to allow the use of Boolean terms. Full text search only came much later. Over the next decade, the content expanded significantly, but search engine technology remained much the same.

In 1992, we launched the first commercial natural language search engine. It was the first search engine in-market to introduce probabilistic ranked searches for natural language queries—a form of machine learning. This program used statistics to provide an estimate of what answer is the one the lawyer is probably looking for. Before this, results were simplistically ordered and users had to wade through long lists of irrelevant responses to find their answer.

We were also one of the earliest in the information industry to introduce full machine-assisted automation at scale for text-mining and content-enhancement technologies. This enabled the search of mass amounts of unstructured data and dramatically reduced the time it takes to sift through hundreds of legal documents.

By 2000, the internet and the web were seeing exponential growth. Machine learning approaches for many information tasks started to get more and more traction. We created machine learning technology that enabled us to manage the massive scale of data we had. And, in contrast to

the general public, our customers (lawyers, accountants and bankers) had very specific information needs.

In short, while a Google search allows users to ask a simple question and receive a factual compilation of information, a WestLaw search goes a step further—the software comes back to the inquirer with a complete set of jurisprudence. The sweat and hours that lawyers would have devoted to unearthing the individual pieces of information needed for understanding a precedent are now handled by our software. The platform includes natural language search, which further simplifies the way legal research is conducted, helping researchers find answers in one tenth of the time.

In the last twenty years, the amount of information has exploded—for all business professionals. The quantity is overwhelming, and it is accelerating rapidly. For context, more data has been created in the past two years than in the entire previous history of the human race. At Thomson Reuters, we now process and collect more data in a single day than we did in a month five years ago. Even as we move to the cloud, we still store 60,000 terabytes of data in our data centers. To put that in context, the U.S. Library of Congress contains 200 terabytes of data and the total size of Wikipedia is 3 terabytes. Thomson Reuters data is used to price \$3 trillion in assets daily—nearly 2.5 million price updates per second.

We believe that the key to extracting value is to do more with data. In order to effectively use data, it's important to understand how it connects to the real world. By using shared platforms and working across our businesses we are making our data more accessible and valuable for our customers, no matter how they access it. Our customers rely on us for the answers they need.

Today, across Thomson Reuters, we use our subject matter experts, artificial intelligence and

machine learning to continually improve how we find, extract, tag and structure data. We fuse world-class content with emerging technology and deep domain expertise ensuring our answers stay ahead of the curve. We have transformed ourselves from a publishing company into an information and technology company.

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Our customers are dependent on knowing about events and risks that can affect their companies, their clients, markets or supply chains. Staying up-to-date is critical, but the amount of data that is produced daily is overwhelming. We use AI technologies to automatically consume and analyze the fire hose of data from news, markets and social media.

Behind the scenes, AI technologies have been deployed across Thomson Reuters. The vast data sources that we have create an almost unlimited number of opportunities for specialized information extraction. The various solutions further expanded our knowledge base and connected the content, making research easier and enabling new forms of analytics.

That is why we are investing in technology. Globally, we invest more than \$3 billion per year on tech-

nology. We have more than 12,000 software engineers, systems architects and data scientists around the world who design and develop products that address the complex needs of conducting business in today's world and advance our customers' experiences.

In 2016, we opened our Thomson Reuters Technology Centre in downtown Toronto, which is also home to our global Centre for AI and Cognitive Computing. The Toronto Technology Centre is expected to create 400 new technology jobs by the end of 2018 and up to 1,500 jobs in total. In the fall of 2017, we announced we are investing \$100 million in a permanent location for our technology centre.

Ten years after the first iPhone®, a new digital world powered by big data, cognitive computing and the cloud promises to change the way we live, work and interact. We have been a pioneer of digital product development for decades. From using Blockchain to bring developing countries the confidence of secure land records to using machine learning to help journalists and readers alike separate fact from fiction. We are applying cutting-edge technologies to emerging challenges. **P**

Shawn Malhotra is Vice President, Thomson Reuters Technology Centre.



World Wide Hearing Executive Director Audra Renyi conducts a hearing test on a little girl in Guatemala. WWH has screened more than 45,000 people and provided over 3,000 hearing aids worldwide. *World wide Hearing photo*

Innovation: Connecting the Dots

Audra Renyi

In May, 2017, Audra Renyi was awarded one of six Governor General's Innovation Awards, a prize that recognizes and celebrates "outstanding Canadian individuals, teams and organizations whose exceptional and transformative work help shape our future and positively impact our quality of life." Renyi has worked in investment banking on Wall Street and volunteered in Chad, Rwanda and Kenya. That range of experience has informed her approach to innovation.

When I heard that the Governor General would be granting me an innovation award, it made me think, "What makes a prize-winning innovator?" I certainly never thought of myself as one. And yet, I won the 2017 Governor General's Innovation Award.

Innovation is not necessarily a patented engineering solution—a *chose ponctuelle* in French—but a potentially endless sequence of small steps, each solving a small problem on the way

to changing the way big things are done. Each step allows you to bypass a wall you have run into, forcing you to zig or zag as needed, but always in the general direction of your ultimate quest for the big change.

Innovation is not just game-changing technology or major scientific invention. In my personal journey, innovation has mostly been about connecting the dots. That is, taking what seem to be disparate things or experiences and putting them together, re-organizing them to create a solution that is exponentially better than the status quo. Connecting the dots might simply mean linking demand with supply. In our case, it was realising that there was a huge unmet need for hearing aids in developing countries; my goal was to find a way to supply those countries with the hearing aids they needed: quality product at an affordable price. That's why I helped launch and grow World Wide Hearing, a non-profit focused on providing hearing aids to children from the poorest areas in the world; and why I founded earAccess, a for-profit social enterprise that sells a Canadian brand of hearing aids called ACCESS to lower-middle income populations around the world.

The media rarely speak of business-model innovation. In my case, if the poor were to have hearing aids, a new business model was needed since all the old ones were failing at this task. My innovation process started with a big, global problem: more than 466 million people suffer from disabling hearing loss; 80 per cent of these people live in lower- or middle-income countries, and fewer than 1 per cent currently have access to hearing aids. At an average price of \$2,500, hearing aids remain unaffordable for most people, yet they cost as little as \$50 to manufacture. On the long road to consumers, hearing aids incur regulatory and legal costs, service charges, warranty costs, distribution fees and high profit margins. Our innovation lies in creating alternative distribution

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paths free of these costs and obstacles, and in passing on the savings to the end user.

To really innovate and make a difference, you have to be deeply aligned with your mission and your passion. Innovation actually translates into a lot of hard work, so if you are going to work hard, you might as well be working on something you really care about. My best ideas did not happen while I was meditating on a mountain. They came in moments of intense pressure when we had to solve an urgent problem and we needed a good solution, fast. Nor can I claim that the best ideas came only from me: it was often a team effort of bouncing ideas off each other until we arrived at a viable solution. Personal mentors, like the visionary founder of the World Wide Hearing Foundations, Claudio Bus sandri, and my father, Pierre Renyi, were instrumental in the co-creation process and have provided a sounding board for my ideas (not incidentally, both have had to wear hearing aids since childhood). Finding mentors is key to helping you through what is often a lonely journey as an innovator-entrepreneur. Connecting with other entrepreneurs and exchanging advice and war stories is helpful in reminding yourself that you are not alone in your fight to make the world a better place. And, entrepreneurs don't exist without financing and I am extremely grateful to Grand Challenges Canada for their early and ongoing support. They were crucial in allowing us to make things happen.

Innovation is also about failing, a lot. And then failing again. There

were times when I became discouraged after repeated failures—at earAccess we struggled to find a path to market—but then I pulled myself up each time and ploughed on, and eventually found a solution. Innovation is 10 per cent creative ideas and 90 per cent hard work, execution and perseverance. I once heard a female entrepreneur say that being an innovator is about “being at peace with feeling constantly uncomfortable.” That is exactly how I feel every day: just when I think I have figured it all out, something else comes up, an unexpected problem needing a solution. Once I accepted the fact that that is the way most entrepreneurs feel, I felt liberated.

In 2012, I was kidnapped in Argentina—this was the period of the country's economic crisis. It was what they called an “express kidnapping”—we were driven around Buenos Aires and then abandoned in a slum at 4am in the morning. I had only just arrived in Argentina for a 6-month student exchange program. After that traumatizing experience, the obvious choice was to go home and forget all about Argentina. However, I decided to stay on for a full year in the country. It turned out to be one of the best decisions I ever made. The result of staying on was that I felt more resilient in the face of whatever life threw at me. Resiliency and the ability to overcome adversity are useful qualities in innovators.

It is a widely-held belief that to start an innovative business, you need a brilliant, earth-shattering idea. That is not the case—in fact, most entrepreneurs start businesses

in areas where they have simply seen gaps in the market; they seek to fill those gaps without a very clear idea about exactly how they are going to do that. I started a company with a back of the envelope business plan that completely changed in a matter of months (even weeks) and we pivoted many, many times.

People have asked me over the years, “How do you find your passion?” The only way to discover your passion is to ask yourself what really drives you; if you are not sure, then try working in an area or start a project that gets you excited. It can be a small side project, but the most important thing is to just get started and start “doing”. You will learn along the way what you enjoy—and don’t enjoy—and that experience will guide you onto the path that is right for you. The enemy of innovation is inaction. Personally, I would rather be criticized for something I did than for something I failed to do. And, despite all the challenges, noth-

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ing is more rewarding to me than knowing I’ve created something that has made the world a better place.

There is no question that the future of a middle power like Canada lies in

innovation. It might not be widely known but Canadians have been very innovative for a long time. Former Governor General David Johnston’s book “Ingenious” lists a huge number of Canadian innovations. And the GG’s Innovation Award is now there to recognize innovators and foster new growth. So, come join us in working hard at making the world a better place. **P**

Audra Renyi is the executive director of the non-profit World Wide Hearing and the founder & CEO of earAccess Inc. She is a recipient of the 2017 Governor General’s Innovation Award.

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Moses Amagoalik, a SmartICE operator in Pond Inlet, measures sea-ice thickness in Eclipse Sound using the SmartQAMUTIK (March 2018). SmartICE puts into the hands of communities the tools they need to travel safely on changing sea ice. *Michael Schmidt photo*

SmartICE: Innovating Climate-Change Adaptation in Canada's North

Trevor Bell

For Canada's Inuit communities, melting Arctic ice affects everything. Memorial University geography professor Trevor Bell co-founded SmartICE, a system of ice mapping and measurement that incorporates Inuit knowledge and relies on community input to provide near real-time information on ice conditions. It shared the Arctic Inspiration Award in 2016, a \$1 million prize endowed by Arnold Witzig and Simi Sharifi to thank the country that became their home.

Innovation responds to many types of opportunities and drivers. For SmartICE, recent unprecedented changes in sea-ice conditions, and the associated impacts on Inuit safety and livelihoods motivated our technological innovation. Severe social inequity between Inuit and most other Canadians, together with first-hand experience working with Inuit communities, drove our social innovation. And to grow our northern enterprise will require further innovation—this time in social financing.

SmartICE integrates on-ice technology, remote sensing and Inuit knowledge to generate near real-time information on ice conditions. To understand the enterprise's origins and relevance, it's important to appreciate that for more than six months of the year, sea ice hugs the Arctic coastline, where Inuit have lived and travelled for millennia. Sea ice is therefore not only a hunting platform and travel highway, it defines Inuit culture and identity.

Unfortunately, Arctic climate change is causing sea ice to be thinner, form later and break up earlier than before, resulting, for instance, in a decrease of 20 per cent per decade in September sea-ice extent along the Baffin Island coast. More troubling for ice users, warmer ocean currents are thinning the ice from beneath, leaving treacherous conditions undetectable at the surface.

Although often expressed as a gradual change, the greatest impacts of climate warming are typically experienced through the increasing frequency and magnitude of extreme events. Sea ice is no exception. The extremely warm winter of 2009-10 in the eastern Canadian Arctic provides insight into the impacts felt by communities when sea-ice conditions are severely compromised.

A survey of Nain residents (Nunatsiavut Inuit) revealed that about half of the respondents couldn't use their typical on-ice travel routes and took more sea-ice travel risks, while about three-quarters reported they were unable to predict ice conditions and were afraid to use the ice. Conditions prevented more than a third from going hunting and accessing country food (the traditional Inuit diet; Arctic char, seal, caribou) in a community where 80 per cent of households are food insecure. Close to one-in-twelve sea-ice users surveyed had fallen through the ice.

These statistics tell the real story of the widespread impacts of climate change happening now in Inuit communities and demonstrate the

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critical need for both mitigation and adaptation actions. SmartICE was initiated as an urgent response to these impacts. Building on a close research partnership with the Nunatsiavut Government, the project team set about exploring how monitoring and information technology could be adapted for both the harsh sea-ice environment and the specific needs of Inuit travelers.

“ In response to community feedback, our maps have a straightforward legend that recommends Go, Slow Go, and No Go travel areas, based on ice stability, roughness, occurrence of leads and open water, and other travel hazards. ”

From the outset, SmartICE had some key principles and goals that helped direct its development. Foremost, it is designed to augment—not replace—Inuit knowledge of sea ice through involvement of Inuit in all aspects of its operation and decision-making. For it to be an effective climate-change adaptation for Inuit, SmartICE had to generate relevant sea-ice information at the community scale, in a timely manner, and in a format that is both comprehensible and accessible.

In practice, SmartICE operators travel along community trails towing our mobile ice-thickness sensor (SmartQAMUTIK, from the Inuktitut (Baffin) word for an ice sled). The sensor generates real-time ice thickness data to help guide the operator, while the operator's track is colour-coded according to ice thickness for the benefit of the community. Sea-ice users then modify their traditional travel routes based on this up-to-date information.

Likewise, our stationary ice-thickness sensor—the SmartBUOY—is designed to be affordable and efficient in measuring sea-ice thickness and snow depth at strategic locations identified by the community. These locations are usually representative of larger ice areas or early indicators of dangerous ice conditions. Its advantage over the SmartQAMUTIK is that the SmartBUOY operates autonomously at any distance from the community and transmits data by satellite.

SmartICE is preparing sea-ice travel hazard maps at the community scale every couple of weeks and more often during shoulder seasons when ice conditions are particularly dynamic. The maps are validated through the observations, measurements and traditional knowledge of our SmartICE operators. In response to community feedback, our maps have a straightforward legend that recommends Go, Slow Go, and No Go travel areas, based on ice stability, roughness, occurrence of leads and open water, and other travel hazards.

But SmartICE is not just a technological fix. It strives to be a social innovator, empowering communities to adapt to unpredictable ice conditions while maximizing societal impact. Following its successful demonstration in two pilot communities (Nain and Pond Inlet), and in response to increasing demand for its services, SmartICE established a northern social enterprise. The Arctic Inspiration Prize (2016) made this transformation possible—it was the game-changer that allowed SmartICE to shift its outlook from community research partnership to northern service provider.

Why a social enterprise business model? That was an easy choice. First, it is consistent with Inuit societal values, such as caring for the environment (Avatittinnik Kamatsiarniq) and community (Pijitsirniq) and being innovative and resourceful (Qanuqtuurniq). Second, it commits to creating positive community change—not profit for “southern” shareholders—while applying an entrepreneurial approach to the delivery of its services. To illustrate this social innovation, we are re-designing our SmartBUOY technology so it can be assembled by trained Inuit youth in Nunatsiavut for distribution across Inuit Nunangat. This technology production centre—the first of its kind up North—will not only harness the vast potential of Inuit youth, which can make up 60 per cent of local populations, but also inspire a new generation to embrace knowledge, technology and research as a vehicle for economic development and community well-being.

In the spirit of reconciliation and self-determination, and for SmartICE to be effective, Inuit are involved in all aspects of its operation and decision-making. Community sea-ice user groups created by SmartICE are made up of elders, youth, experienced and young hunters, and representatives from key local organizations (e.g., hunters and trappers). The groups, self-named ‘Siku-miut’ (“people of the ice”), advise

SmartICE Inuit operators when and where to survey and how the information should be shared with their communities.

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As SmartICE expands across the Arctic—currently nine communities, with about another dozen pursuing start-up opportunities—the enterprise needs to think ahead to its long-term sustainability and expanded market needs. This includes both scalable services and ongoing technology development to respond to more intensive climate impacts. For example, warmer temperatures and increased snow accumulation will turn sea-ice surfaces into slush, resulting in increasingly more dangerous ice travel. SmartICE is developing and integrating a new sensor that measures the occurrence and thickness of slush, for deployment on the SmartQAMUTIK.

Although less featured in the popular media than sea ice, freshwater ice on lakes and rivers is also experiencing shorter and less predictable seasons. It is estimated that almost 10,000 km of winter trails provide surface access to re-supply remote, mostly Indigenous communities across the

northern provinces and territories of Canada. With few exceptions, these trails are not monitored for ice travel safety, despite the evidence of increasingly warmer winters and documented break-throughs of resupply vehicles. SmartICE is adapting its monitoring systems and services to generate near real-time information on freshwater ice conditions for the benefit of both communities and businesses across the Arctic interior.

Mining, shipping, fisheries, tourism, emergency response, national defense and environmental monitoring are all carried out to some degree on or through ice in the Arctic and therefore information on ice conditions, especially during the dynamic freeze-up and break-up periods, reduces their risk and improves operational performance.

SmartICE is actively engaging industries and government services to explore how it can meet their ice information needs on a commercial basis, while subsidizing services for communities. It is also exploring opportunities for social financing, which mobilizes private capital to deliver both a social dividend and an economic return to achieve societal and environmental goals. Being an Arctic Inspiration Prize laureate opens doors to prospective investors and we are extremely grateful for the generosity of Sima Sharifi and Arnold Witzig in creating the prize and recognizing the importance of Arctic innovation. **P**

Trevor Bell is University Research Professor in Geography at Memorial University of Newfoundland. Since its inception Trevor has led the development of the SmartICE initiative, a recipient of the 2017 United Nations Climate Solutions Award.



Prime Minister Trudeau attends a working luncheon during the G7 in Taormina. May 26, 2017. Adam Scotti photo

The G7: Hard Talk or a Sleep-Walk?

Jeremy Kinsman

As the Charlevoix G7 approaches, there is some question as to how the June 8-9 summit could play out as a Trumpian disaster. As veteran diplomat Jeremy Kinsman writes, if the disruptive president plays skunk at the La Malbaie garden party, Justin Trudeau should think about publicly calling him out on it and issuing a heavily qualified final communiqué.

Remember Pan Am Airlines? Eaton's? Kodak? The Warsaw Pact? Brands that died because they didn't keep up with competitors or with demand or with the pace of change. Will the G7 be the next to go? The outcome of the G7 Summit June 8-9 in Charlevoix may well decide.

The world's press is coming to cover what they anticipate will be an epic dust-up with President Trump over

trade, climate, migration, populist nationalism, and the merits of the liberal international rules-based order. They are asking how the G7 can pretend to global leadership if its leading member is retreating from the world in pursuit of America first, “always America first?”

Though he was relatively quiescent at his first Summit in 2017 in Italy, Donald Trump has been feeling his unilateralist and nationalist oats since. In fact, the 2017 G7 meeting didn’t really get much done. If it happens again, the question arises: are they necessary—particularly as the US President seems to hold authoritarian strongmen in higher favour than G7 democratic allies?

The Canadian chair, Prime Minister Justin Trudeau, hopes to skirt conflict with an agenda of big-canvas hope. Its leitmotif, meant to be the “lens” through which to view everything else, is the Trudeau government’s timely mantra of gender equality and women’s empowerment. Its proclamation is rhetorically uncontested even though the U.S. is slashing funding to abortion-tolerant international health care agencies in ways that will cause real damage to women and girls. Its uncontested reasonableness can’t evade the fact that the agenda’s other four other items are highly divisive:

1. Investing in inclusive growth “that works for everyone,” including “open trade,” which will have to counter evidence that in the G7, inclusivity trends are in the other direction;
2. “Preparing for jobs of the future,” anticipating technological change, which evokes globalization’s export of manufacturing jobs.
3. Climate change and clean growth, bound to challenge the Trump administration’s science-denying isolation.
4. “Building a more peaceful and secure world.” Canada is safely mobilizing the G7 against the exclusion of Rohingyas and the subtraction of democracy

“ *The world’s press is coming to cover what they anticipate will be an epic dust-up with President Trump over trade, climate, migration, populist nationalism, and the merits of the liberal international rules-based order.* ”

in Venezuela, and seeking robust solidarity against Russian misbehaviour. But will the G7 together re-dedicate support for democratic institutions, the rule of law, and social trust at home?

Frank, open, and public disagreement could doom the G7 by exposing its disunity on the most important issues of the day. But the G7 could be equally doomed to irrelevance by an attempt to paper over fundamental differences in favour of loose agreements on hopeful generalities and abhorrence of problems elsewhere, like Myanmar. The G7 is doing what its founders wanted to avoid: institutionalizing itself in ministerial committees and pronouncing on other peoples’ problems rather than knuckling down in candour to confront our own. Once, the annual G7 was the planet’s biggest political draw. It was first convened in 1975 at Rambouillet and included the leaders of the United States, France, West Germany, Britain, Japan and Italy. Canada, under Pierre Trudeau and with backing from President Gerald Ford over objections by French President Valéry Giscard d’Estaing, joined in 1976. The group originally sought to build on an informal forum of finance ministers of the world’s biggest economies set up in 1973 by U.S. Treasury Secretary George Schultz. Mired in their most serious recession since the 1930s, the leaders were grappling with the electoral costs of hard economic choices, and the G7 provided group political cover for unpopular decisions to tighten belts and to resist protectionism.

As summits went from being only “economic” to also being geopolitical, the G-7 had

big moments. There were game-changing confrontations, notably between Brian Mulroney with Margaret Thatcher over her support for South Africa’s apartheid regime. The Europeans pressed Ronald Reagan to come off his hard line on the Cold War. He did, the Cold War ended and to suit more optimistic times, Russia joined what became a G8.

Anti-terrorism and anti-proliferation moved to the top of the political agenda. After 9/11, the meetings re-committed to a common front against jihadism, searingly underlined when the 2005 Gleneagles Summit was interrupted by the London Underground bombings by radicalized British men that killed 52. (Will the infamous van murders on Toronto’s Yonge Street April 23 by a disturbed citizen similarly galvanize G7 members to face up to the home-grown damage wrought by our monetized social networks?)

On its main economic credo, the G7 was unwavering in its internationalist faith in the rules-based system for dispute settlement and in open global markets and economic growth which indeed brought hundreds of millions out of poverty. But as China, India, and Brazil benefited and rose, they insisted on representation and their say on the rules. Hopes for the more broadly-based and representative G20—championed by Canadian Prime Minister Paul Martin—accelerated at the G8’s expense when the financial crisis of 2008-09 called into question the credibility of western economic management.

The G20 did help steer the world through the financial crisis. But it failed to find the political will and

agility to realize hopes it would enable trade-offs between developed and rising economies across sectors, so as to advance climate change mitigation and concessions on world trade in respective negotiations that were stalled. It didn't happen: the Paris Accord on climate change did emerge, though without binding national commitments, but the World Trade Organization Doha Round collapsed.

Authoritarian regimes prospered from globalization with top-down economic command and controls. In the G20, they opposed discussion of human rights, inclusiveness, refugees, and, God knows, democracy. So did Russia, kicked out of the G7 over the annexation of Crimea in 2014, now embarked on a Putinesque fantasy adventure into a mythic Russian past of authoritarian glory.

In trying to re-gain its credibility, the G7 comes across as defensive. Individual leaders are buffeted at home by political cross-winds from divided electorates. Japan's Prime Minister Shinzo Abe may soon be forced from office. It's unclear who will represent Italy. Britain's Theresa May is on the ropes over Brexit, and Germany's Angela Merkel is a reduced political force. France's Emmanuel Macron has the most international wind in his sails, but has to confront union rebellion at home.

When Pierre Trudeau hosted Canada's first G7 Summit at Montebello in 1981, he wanted a North-South theme (Margaret Thatcher sneered, "Oh, come on, Pierre".) The crowd of foreign journalists thirsted instead for the colour story on how just-elected conservative Reagan would get along with social-democratic European partners. Trudeau did emerge as something of a global champion of developing countries. Reagan charmed everybody and went back to Washington evidently unchanged by anything he'd heard.

Justin Trudeau will be both skilled and lucky if his turn, again in an ex-French seigniorial locale, comes off as

well. Reaching a meaningful accord with climate skeptic and economic nationalist Donald Trump is going to be a stretch. On the other hand, with President Macron in Washington, President Trump seemed flexible on Iran and on trade. If the Trump who comes to Charlevoix is that guy, there's some hope for conciliation. However, international media are lusting for the "Great Disrupter show" knowing that Trump has systematically disdained the norms of international cooperation that the G7 defends. Still, G7 leaders have tried to keep their own relationships with the U.S. president as constructive as possible.

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All share one point of agreement: relief that someone else is in the chair. They'll give Trudeau a break. No one expects him alone to browbeat Trump into submission on issues like trade, climate, and migration. Widening income disparities? No way Trump's team would agree to that preoccupation even being on the agenda. Trump's hold-out and isolation will make an agreed communique of any substantive significance hard to produce.

If Canada pushes hard, it could blow up. Trump could walk out. Or not show up. However, if Canada goes instead just for a bland chair's statement, in order to keep him in, it will

show the G7 has no added value left. Exhortations to cut back on plastics, save the oceans, and empower women and girls won't save its global brand for decisive relevance on G7 issues right now if they defer to Donald Trump's fixations. Hopefully, someone at this meeting—Macron, Merkel—will step up and remind partners that the global economic recession that was the group's founding *raison d'être* has now been succeeded by a global democratic recession, whose reversal should be a challenge these democracies welcome. If they can't because the biggest member is practising a divisive and unhealthy populist nationalism, the G7 will go the way of Enron and Nortel, and other once-great but mismanaged ventures that sleep-walked into obscurity.

If Trump remains a malign unilateralist presence, to save the G7, Justin Trudeau may have to recognize openly that the world's major industrialized democracies reject Donald Trump's harmful view of international cooperation, and his manhandling of basic, inclusive tenets of democracy. A chairman's closing statement that says "most of us here" continue to place our belief systems in international rules-based cooperation, fact-based and transparent decision-making and inclusivity may be the G7's first such acknowledged internal separation. But it may be its survival moment, a stand on values that looks forward confidently to future, better, more harmonious, times. "Let's see what happens." **P**

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Climate Action, Clean Energy and the Case for Nuclear

John Barrett

With more and more countries struggling to meet the emissions goals set out in the 2015 Paris Agreement, it makes sense to consider all the low-carbon options at our disposal. Canadian Nuclear Association CEO John Barrett makes the case, ahead of the G7 in Charlevoix, for an approach that includes a renewed focus on nuclear energy.

As world leaders gather in Charlevoix, Quebec, this June for the 2018 G7 Summit, the agenda will focus on concrete solutions to global challenges that extend far beyond the borders of these seven countries. Climate change and clean energy will be front and centre. What does Canada have to offer in leadership and real solutions?

Canada and France are leading the way in clean energy generation in the G7 and this is due in part to major investments in low-carbon, affordable nuclear power. In fact, according to a recent report by Natural Resources Canada, Canada's electrical system is 80 per cent free of greenhouse gas emissions, second only to France out of all G7 nations. Furthermore, thanks to investments in clean energy, Canada's overall GHG emissions profile went down by a few percentage points in recent years even as the economy grew.

This is important because time to meet international climate change targets is running out.

The International Energy Agency's first Global Energy and CO2 Status Report found global carbon emissions hit a record high in 2017, after three years of being flat. In Canada, a joint audit, conducted by federal Environ-

ment Commissioner Julie Gelfand and auditors general in nine provinces, found Canada was not on track to meet its 2020 or 2030 greenhouse gas emission targets.

Investments in clean and affordable energy aren't just about reducing

emissions, they are the foundation to ensuring access to jobs, health-care and education. Clean and cheap energy is necessary to lift communities out of poverty while ensuring environmental protection. Without proper electricity, countries suffer. As the World Bank reported, "one-quarter of the world population have no access to electricity. In the absence of vigorous new policies, 1.4 billion people will still lack electricity in 2030."

And, according to the World Health Organization (WHO), seven million people die every year from air pollution. The challenge is to produce policies and investments to transition to a lower-carbon economy. And



Bruce Power nuclear generating station is the largest operating nuclear power facility in the world. It is located on the shore of Lake Huron, 190 km from downtown Toronto and can generate almost 55 billion kWh per year—enough electricity to power 4.9 million Canadian households. CNA photo

to help other countries, where appropriate, to acquire the technology and materials for generating electricity from low-carbon sources.

Some propose single solutions based on a preferred technology. Single answers to complex problems invite false hope for technologies that are today neither available nor proven effective when quantity, reliability and affordability are considered. This adds a considerable risk for huge costs as well as detrimental environmental impacts.

For example, Germany's Energiewende is a cautionary tale on why going green isn't as easy as it sounds. Germany has shut down nuclear plants while making huge investments in wind and solar energy. However, its emissions have not declined. The new renewable energy has only offset the loss of nuclear—meaning that Germany has given up on meeting its 2020 emissions targets. Coal still represents 40 per cent of Germany's electricity mix. At the same time, the cost of power over the last decade has escalated, rising by close to 50 per cent.

This begs the question that, if we are really concerned about the impacts of climate change and if we really do need to ramp up energy production as a method of lifting people out of poverty and driving economic growth, why would we not include a low-carbon option such as nuclear power?

Instead of looking to Germany, look to Canada, especially the province

“Outside Ontario, New Brunswick has also demonstrated the benefits of nuclear to a clean and affordable electrical grid; displacing tens of millions of tons of carbon dioxide from the atmosphere.”

of Ontario. Ontario is the real clean energy leader.

Nuclear power is the main driver of Ontario's almost zero-emission energy grid. The province is home to one of the largest nuclear on the planet. Nuclear provides the bulk of the electrical generation to the province; close to two-thirds of the energy supplied every day comes from the nuclear generating stations.

Outside Ontario, New Brunswick has also demonstrated the benefits of nuclear to a clean and affordable electrical grid; displacing tens of millions of tons of carbon dioxide from the atmosphere. And thanks to the power of uranium from Saskatchewan, a pop-can sized amount of this rock is all the amount a person would need to power their lifetime; using a small amount of the Earth to create massive amounts of power.

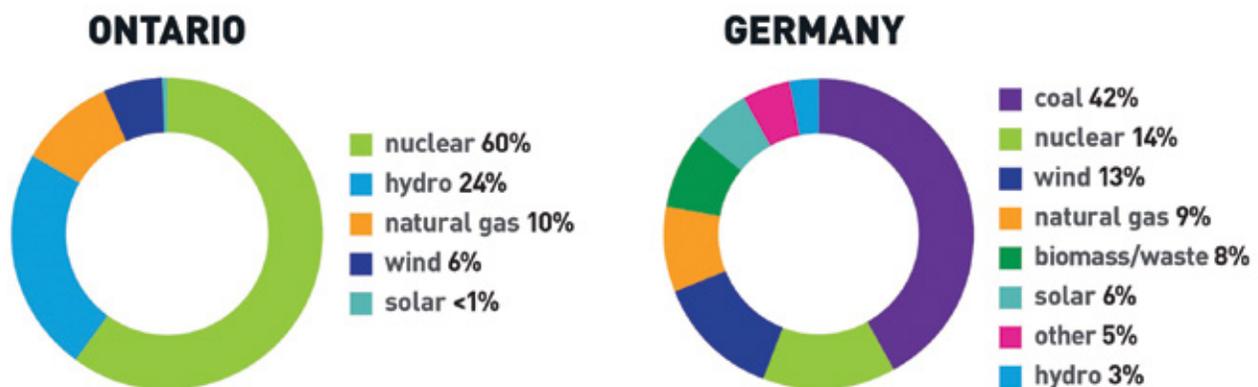
The next generation in nuclear energy technology is already here. Natural Resources Canada is leading a mapping process under the Energy Innovation Program to explore the potential for on- and off-grid applications for small modular reactor (SMR) technology in Can-

ada. Driven by interested provincial and territorial governments and energy utilities, the exercise will assess the characteristics of different SMR technologies and how they align with user requirements and Canadian priorities. The roadmap will be an important step for Canada to advance innovative, next-generation nuclear technologies and become a global leader in the emerging SMR market.

Meanwhile, the CANDU-reactor refurbishment program, supported by Ontario's Long-Term Energy Plan, is underway and moving through the first phase at the Darlington Nuclear Generating Station on time and on budget. This program will replace major components and refurbish 10 reactors in total over the next 12 years at Darlington NGS and at Bruce Power's site in Kincardine.

This \$26 billion program is the single largest clean-energy investment by any jurisdiction in the western hemisphere and possibly beyond. Moreover, it has unleashed creative juices, as both Ontario Power Generation and Bruce Power are encouraging innovation and advanced technology use at every step. Already there are important advances in robotics and

Figure 1: Electrical Supply Mix in 2015—Ontario vs. Germany



control systems that will have application in other, non-power sectors of the Canadian economy.

Canada's nuclear contributions to the G7 aren't limited to energy. Nuclear science and technology has many proven benefits, meeting nine of the United Nations 17 Sustainable Development Goals. Nuclear reactors provide opportunities for water desalination to communities that experience water shortages. Desalinating water requires a tremendous amount of energy and nuclear can do it while releasing hardly any greenhouse gas emissions into the atmosphere.

Research and innovation in health care has helped to make Canada a world leader in the production of Cobalt-60, which is used in many areas of our health industry. Cobalt-60 is used in sterilization, diagnostics and treatments. This includes isotopes to help detect and treat diseases, new research into gamma therapy, and blasting tumor cells from the inside out and protect-

ing healthy, surrounding tissues.

Canada's nuclear reactor technology and uranium exports have, over the last 30 years, contributed globally to the avoidance of at least a billion tonnes of CO₂ (in displacing fossil fuel sources)—a unique and ongoing contribution to global climate change mitigation which no other Canadian energy source can claim.

The next generation of nuclear technology will build on Canada's track record of excellence, looking to recycle current spent fuel, developing reactors that can provide power and heat to communities and even hold the promise of carbon-free gasoline.

Climate change and clean energy are two of the most pressing issues of our time. Canada has a real opportunity to continue to take centre stage on these issues. The facts still matter. If we are to achieve our climate targets, sustainably manage resources for future generations and provide the world with access to clean and cheap energy, then we need nuclear to be

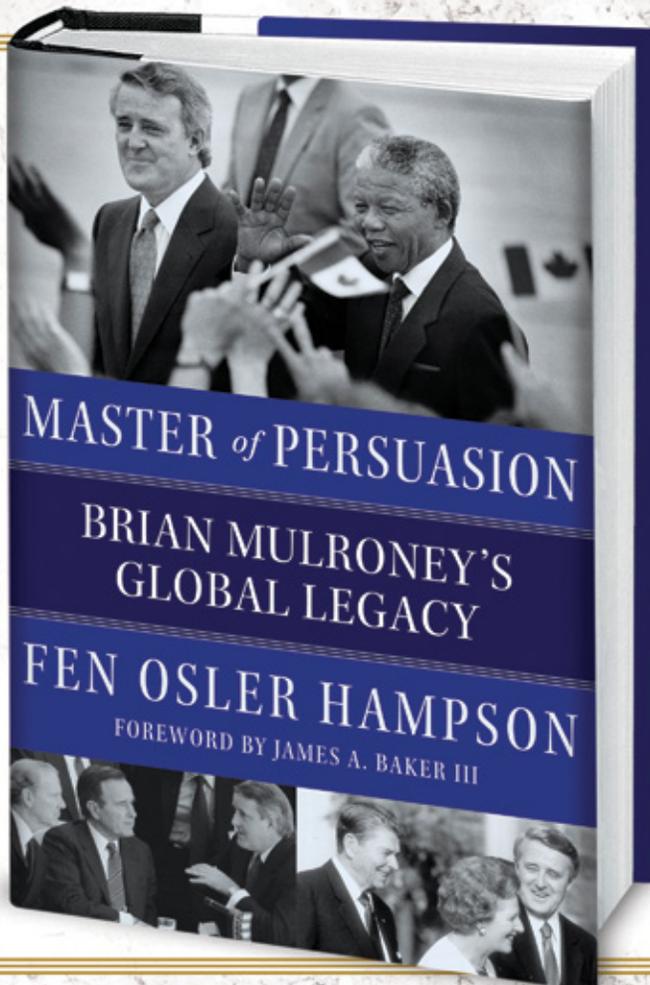
part of the mix. Recognizing this is an important step to bringing real solutions today, without waiting for technologies that are not here now.

With time running out to meet greenhouse gas emission targets and to prevent climate change from increasing temperatures by two degrees Celsius—now is not the time to expect a silver bullet to appear or to rely on one technology over another.

A more effective and realistic approach is to foster collaboration that makes the best use of all available solutions to create a low-carbon future, allowing the world to meet emission targets while avoiding the potentially catastrophic impacts of climate change.

Thanks to nuclear's role in our electricity mix, Canada and Ontario can show how it can be done. **P**

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Column / Don Newman

Pipeline Politics

Supporters of the twinning of the Trans Mountain pipeline carrying oil sands bitumen from Alberta across British Columbia to the Pacific Ocean always knew the project would be a tough sell.

But no one realized just how tough a sell it would be, even after the political landscape changed last summer when the New Democrats—propped up by three Green Party members in the B.C. Legislature—replaced the Liberals as the provincial government.

And not many people realized that there would be a lot more at stake than getting the product of the Alberta oil sands to tidewater and onto ships bound for the markets of Asia.

But there is. Over the past year, what seemed like the easiest pipeline project to get approved and built has become weighted down with most, if not all, of the issues that are central to politics and public policy in Canada, particularly in 2018: Energy versus the environment, federal versus provincial rights and reconciliation with Indigenous peoples.

The NDP government of John Horgan ran against the Trans Mountain twinning in the B.C. Election in 2017. It finished a close second, two seats behind the pro-pipeline Liberals. But three Green Party MLAs hold the balance of power, and when they threw their support to the NDP, it meant that any possibility the NDP position could be moderated was no longer in the cards.

Instead of negotiating conditions to make the pipeline more palatable,

the Horgan government has gone for the nuclear option. It has drafted legislation which gives it the authority to regulate bitumen in pipelines that cross provincial territory. Supported by some Indigenous groups and environmentalist organizations, it has submitted the proposed legislation to the B.C. Court of Appeal.

The fact it has asked for a court ruling means the government in B.C. knows it doesn't have the jurisdiction it is trying to enforce. Since the 1920s, courts—including the Supreme Court of Canada—have ruled that inter-provincial pipelines are a federal responsibility. That is the argument that the Trudeau government and the government of Alberta will make when they oppose the B.C.

initiative. And, since the Trudeau government has approved the twinning of the pipeline, the B.C. Government will lose, even if the issue ends up at the Supreme Court of Canada.

But will it really lose? Court cases take time, Kinder Morgan has imposed a tight deadline of May 31 for B.C. dropping its obstruction or it says it will abandon the project. It is quite possible the case could still be before the courts when the deadline is reached. Federal and Alberta government efforts to underwrite some or all of the costs to prevent Kinder Morgan from walking away may prevent that. But even if they do, Premier Horgan can show his Green Party partners that he did all that he could to block Trans Mountain and remain in office with their support.

And if the plan is salvaged and work begins. What then?

Environmentalists and those Indigenous groups still opposed to construction say they will block the pipeline right of way with thousands of protesters. Who will remove them? Normally a provincial government would ask Ottawa to send in the army to handle such a disturbance. But would a B.C. government opposed to the pipeline do that—particularly when the protesters are its supporters?

In my view, there are compelling economic reasons for proceeding with the twinning of the Trans Mountain pipeline. But even more important, allowing demonstrators to forcefully block a legally approved pipeline would make a mockery of the rule of law.

The law must be upheld in a democracy. Already the Constitution is being strained by the fight between Alberta and British Columbia, and the dispute between Ottawa and B.C. Excessive Indigenous protest or blockades could strain the reconciliation process. The viability of major economic development projects could be put into question for years to come.

Clearly, there is a lot more at stake in the future of the Trans Mountain project, than just getting more Oil Sands production to tide water on the west coast. **P**

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the Bell

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Kinder Morgan and the Trans-Mountain crisis

Elizabeth May questions Canada's ability to meet Paris Accord agreement goals

Nurturing our growing cleantech business

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FROM THE EDITOR

This edition of *The Review* explores important topics that have been dominating the headlines: the business of cleantech in Canada, energy, the environment, and Bill C-69.

More than a year after Budget 2017 announced significant funding to support the growth of the cleantech sector, Before the Bell and Dale Smith take a look at where we are and whether or not we are on track to achieve the objectives in “Nurturing Canada’s cleantech future.”

Shannon Watt, director of energy and health policy with the Chemistry Industry Association of Canada, writes that growing the cleantech sector in Canada must also include the chemistry industry in “Canada’s Clean Tech Future needs chemistry industry solutions.”

Susan Rohac, vice president, BDC Cleantech Practice, helps explain their

role in supporting the growth of the sector in “Upping the ante for Canadian cleantech companies.”

Expanding on the theme of growing cleantech we shift to look at energy and the environment.

Green Party Leader Elizabeth May raises concerns over Canada’s ability to meet its commitments to the Paris Accord in “Mind the gap – How far off is Canada from Paris agreement goals?”

Dale Smith for the Sixth Estate takes a closer look at the issues of energy and the environment and questions if Bill C-69 will achieve its goals in “Energy and the Environment: Will Bill C-69 make a difference?”

In a closing feature, Dale Smith circles back to examine the impact Bill C-69 would have on the Trans Mountain pipeline project in “Energy and the Environment: Kinder Morgan in the Crosshairs.”

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Nurturing Canada's growing cleantech future

BY DALE SMITH
Sixth Estate

The federal government made cleantech a priority in its 2017 budget and outlined \$2.4 billion in investments to help Canadian companies. Before the Bell discussed the pressures that are influencing the growth of the cleantech sector in Canada and spoke with the stakeholders who are betting on it being the industry of the future.

Cleantech includes any technology, process, product, or service that reduces negative environmental impacts through significant energy efficiency improvements, the sustainable use of resources or environmental protection activities. It includes a broad range of technology related to recycling, renewable energy (wind power, solar power, biomass, hydropower, biofuels, etc.), information technology, green transportation, electric motors, green chemistry, lighting and more.

The Paris Climate Accord was seen as one of the biggest drivers of cleantech in Canada because it establishes a global framework that enacts increasingly stringent targets.

“That sends great signals to the marketplace, and it sends great signals to technology developers,” said Velma McColl, managing principal of Earncliffe Strategy Group. “It’s the most important thing for the long-term growth of cleantech in the world.”

Denis Leclerc, president and CEO of Éco-tech Québec, noted that the Accord is a work in progress.

“It’s going to take time, it’s going to take effort,” said Leclerc. “We will need collaboration between the financial sector, business and government.”

Scott Thurlow, lawyer and past president of the Renewable Fuels Association, said that there needs to be a mix of regulation and incentives from government in order to spur investment in the cleantech sector.

“I would warn against regulation unless it is exceptionally well-designed,” said Thurlow, citing the example where the previous government’s rules around renewable diesel actually drove emissions up because product was being shipped from Singapore to fill the mandated targets.

McColl said that the cleantech sector is far more mature and sophisticated than it was 10 or 15 years ago.

“We wasted a lot of political time saying you need to make a choice between incentives and regulations,” said McColl, noting that the issues are not about meeting minimum standards or compliance mandates. “If Canada is going to win at cleantech in the world, we need to be far more sophisticated. The core objective is getting to market and scaling up.”

Thurlow added that companies like Walmart have the ability to make decisions at a high level that can influence consumer choice, which is what will help adoption of the sector.

“You can create all of the best cleantech in the world, but if nobody wants to take it upon themselves to adopt it, you’re just going to go out of business,” said Thurlow.

Some of that drive toward adoption is being seen in the chemistry sector, said Shannon Watt, director of environment and health policy with the Chemistry Industry Association.

“We have a company in Sarnia that makes succinic acid – succinic acid is used in pharmaceuticals, cosmetics, plastics, paint coatings, everything. What’s so unique about this company is they’re using plant-based feed stocks, so it’s a bio-succinic acid that’s identical to the original succinic acid,” said Watt. “We have another member who recently opened a plant – if you think of polystyrene foam, we use it once, we can’t recycle that. A new plant opened up with the goal of recycling polystyrene foam. There are real opportunities for innovation in the chemistry industry.”

To help cleantech companies grow, the Business Development Bank of Canada

(BDC) hired a dedicated team to disburse the money allocated to cleantech in Budget 2017.

“It takes a different skill set than what the bank already had, and we needed dedicated people who had cleantech experience — experience in doing financial modelling for more complex companies, and we’ve got a really good team in place now,” said Susan Rohac, vice president of growth and transition capital at BDC.

Rohac said that the bank has the infrastructure and systems in place to help cleantech companies ramp up quickly, as well as the partnerships with like-minded organizations that also want to support cleantech companies.

“It takes a lot of different players to raise a cleantech company,” said Rohac. “Government plays a role, and we’ve got to see the private sector, chartered banks and venture capitalists step up as well. We’ve got to see corporations step in and support these companies and we’re starting to see that in the deals we’re doing.”

Once companies are up and running and have sufficient capital to get them past the “valley of death” phase most start-ups hit, Export Development Canada says that they are committed to deploying \$2 billion in export credits for cleantech by 2020.

“It’s a sector that’s very internationally focused,” said Carl Burlock, senior vice-president and global head of financing and investments with Export Development Canada. “Since 2012, EDC has supported over \$3.5 billion in clean technology exports to over 100 countries. That level of activity reflects what’s happening in the global cleantech sector.”

Burlock noted that by some estimates, cleantech was a \$1 trillion sector globally last year, with the potential to grow to \$2.5 trillion by 2020. To that end, the federal government is looking to deploy what tools it can to support cleantech through its entire life cycle.

“We’re very cognizant of that scale-up challenge in the innovation sector generally,” said David Lametti, MP for LaSalle-Émard-Verdun, QC, and Parliamentary Secretary to the Minister of Innovation, Science and Economic Development.

“With a variety of different tools, with a variety of different partners, we are trying to see that life cycle through and make sure that Canadian companies can have the initial research, do the initial start-up, get to scale-up, and hopefully be getting to export and being leaders on the world stage,” said Lametti.



Shannon Watt

DIRECTOR OF ENVIRONMENT AND HEALTH POLICY AT THE CHEMISTRY INDUSTRY ASSOCIATION OF CANADA

Canada's Clean Tech Future needs chemistry industry solutions

Canadians and policy makers are seeking to transition to the low-carbon economy and address the challenges of climate change. Canada's chemistry sector and its highly skilled workers are uniquely positioned to deliver the solutions.

Canada's chemistry industry is the fourth-largest manufacturing sector in Canada, directly responsible for 87,000 jobs while supporting another 525,000. From building insulation to solar panels, the products that will help move society to a more sustainable future need chemistry. But the industry is also looking internally to reduce its ecological footprint. By implementing best-available technologies, the sector has been able to reduce its greenhouse gas (GHG) emissions by 67 per cent since 1992.

Chemistry enables green technology

In Canada, the building sector is responsible for 40 per cent of GHG. Chemistry products such as insulation, window coatings, reflective roofing and other innovative

chemistry-based materials dramatically lower these emissions by reducing heat loss and the demand for cooling.

Reducing GHG in transportation also provides opportunity for innovation. Lighter vehicles, alternative fuels and moving to electric vehicles will depend on advances in materials, fuel and energy storage developed through chemistry.

Chemistry is also a critical part of nearly every renewable power generation source. From the composite materials in wind turbine blades, to solar panels and batteries, chemistry is essential.

Canada's chemistry sector is moving us to a low carbon future

Canada's abundant, low-carbon resources, such as natural gas and natural gas liquids, hydroelectricity and biomass, enable chemistry products that are 80 per cent less GHG-intensive than those from some

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European or Asian markets, which rely on higher-carbon feedstocks such as crude oil or coal.

The Canadian chemistry sector is doing even more to reduce its ecological footprint by implementing green technology at its facilities. Canada's modern and highly innovative

chemistry facilities include continuously up-graded equipment, re-engineered processes and products, and one of the lowest GHG-intensive national electricity grids.

We can do more

With the right policies and support from government, the chemistry sector could attract \$25 billion in new investments by 2025. The positive impact of this new investment will not only spur economic growth and drive innovation — it will leverage the already considerable contribution that the Canadian chemistry sector makes in meeting rapidly growing global market demand for chemicals with the lowest carbon production available.

Read more in our report Chemistry: Essential to Canada's Transition to a Low-Carbon Energy Future at canadianchemistry.ca

Shannon Watt is the Director of Environment and Health Policy at the Chemistry Industry Association of Canada (CIAC).

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Susan Delacourt, Dennis Leclerc, President & CEO at Écotech Québec, Velma McColl, Managing Principal at Earncliffe Strategy Group and Scott Thurlow, Lawyer & Past President at Renewable Fuels Association.

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Susan Rohac
VICE PRESIDENT,
CLEANTECH PRACTICE, BDC

Upping the ante for Canadian cleantech companies

Innovative Canadian clean technology firms have the potential to not only advance Canada's sustainable economy, but also to drive clean growth across the globe. Despite Canadian cleantech entrepreneurs being best in class, they continue to face difficulties scaling their business. With its mandate to support these companies announced in Budget 2017, BDC is poised to help Canadian cleantech companies overcome this hurdle.

BDC has a long history of investing in cleantech both directly and indirectly, particularly in venture capital. Through our Industrial, Clean and Energy Technology Venture Capital Fund with \$287M capital under management, we have been investing in cleantech start-ups with global potential for 16 years. We also invest indirectly through leading cleantech VC funds and provide term debt and other financing to cleantech firms.

Building on this experience, Budget 2017 announced BDC's \$700-million, five-year commitment to the cleantech industry to help Canadian cleantech firms grow. This new capital allows BDC to take on more risk and provide debt and equity financing to help cleantech companies overcome barriers to scale and better compete globally.

Selection criteria include commercially demonstrated or market-ready technology gen-

erating positive environmental impact, substantial revenue growth potential, and management ambition and capacity to scale up.

While access to capital is key, we also know that it is not the only piece of the Canadian cleantech puzzle. These firms require more than just money to succeed. Getting the proper advice can be a game changer. Given this, our cleantech practice is also leveraging our network of highly seasoned executive advisors to provide tailored advisory services.

We also know that navigating the vast number of programs and initiatives available can be overwhelming for companies. This is why partnerships and collaboration across the



Our intent is to back the best in Canadian cleantech and our endgame is a commercially self-sustaining cleantech industry that catalyzes ever-greater institutional investment."

— Susan Rohac
BDC

ecosystem are of vital importance for providing coordinated support. We are working closely with Export Development Canada, Sustainable Development Technology Canada, the Clean Growth Hub and others in order to take a team approach to growing Canadian cleantech champions.

Spearheading this entire initiative, we have created a new national multidisciplinary team fully dedicated to cleantech. We were proud to recently announce the team's first four investments, totalling \$40 million. These are

investments are in leading scale-ups covering a diverse range of technologies, including biofu-

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els, plastics recycling, heavy oil upgrading and remote GHG sensing.

These four investments are just the beginning. Our intent is to back the best in Canadian cleantech and our endgame is a commercially self-sustaining cleantech industry that catalyzes ever-greater institutional investment. BDC is proud of the role it can play to help our most promising companies scale into global cleantech champions.

BDC is the only bank devoted exclusively to entrepreneurs. It promotes Canadian entrepreneurship with a focus on small and medium-sized businesses. With its 118 business centres from coast to coast, BDC provides businesses in all industries with financing and advisory services. Its investment arm, BDC Capital, offers equity, venture capital and flexible growth and transition capital solutions. BDC is also the first financial institution in Canada to receive B Corp certification. To find out more, visit bdc.ca.



Catherine Clark, David Lammetti, MP La Salle-Émard Verdun, QC, Parliamentary Secretary to The Minister of Innovation, Science & Economic Development, Carl Burlock, Senior-Vice President & Global Head, Financing & Investments, EDC, Susan Rohac, Vice President, Cleantech, BDC and Shannon Watt, Director of Environment & Health Policy at Chemistry Industry Association.



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Elizabeth May
LEADER OF THE GREEN PARTY
OF CANADA

MIND THE GAP – HOW FAR OFF IS CANADA FROM PARIS AGREEMENT GOALS?

On March 27th, Commissioner for Environment and Sustainable Development, Julie Gelfand, issued an historic report. It was the process more than the subject matter that made it historic. For the first time ever, the federal Auditor General working with provincial and territorial auditor generals, turned their attention to a single issue and prepared a coordinated audit.

The issue was climate and the audit was not encouraging. Canada’s governments are not on track to achieve our climate targets. Measured against Canada’s current target – 30% below 2005 levels by 2030 – we are 66 mega tonnes short.

Since the report’s release, our Minister for Environment and Climate Change has been dismissive. She claims the report does not reflect our current reality; that it is backward looking. But the federal auditor is only reporting Environment Canada data when it comes to the gap. We are not on track to hit the 30% below 2005 levels by 2030 target. The audit looks at what is being done in measurable ways. Only five federal departments out of 19 federal departments and agencies have even conducted a review

of the risks to government assets posed by the climate crisis.

What makes this even more distressing is that the target (30% below 2005 by 2030) is not consistent with the Paris Agreement. It is far too weak for Canada to do its fair share of reducing Greenhouse Gases (GHG) consistent with the Paris target — much less to claim global leadership.

The huge gap is that the Paris Agreement is more a framework for future action than a blueprint to avoid climate disaster. The Paris Agreement overarching target is to try to hold global average temperature increase to 1.5 degrees C above what it was before the Industrial Revolution, and, if that goal is missed, to as far below 2 degree C as possible. Every nation within Paris (all nations on earth, including the USA) have filed their targets (described as “NDCs” – “nationally determined contributions”) with the UN secretariat on the UN Framework Convention on Climate Change (UNFCCC). The UNFCCC was negotiated and signed back in 1992 at the Rio Earth Summit. Every climate negotiation since then has been conducted within the umbrella of the UNFCCC. Paris differs from Kyoto in that the targets

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in Paris are not part of the text of the agreement. Every nation can change the target any time, but only to “ratchet up.”

On the eve of Paris, all the NDCs were reviewed by the international scientific body (the IPCC) and the numbers were crunched to see how far the current targets would get us to our goals. The news was not good. The 2015 goals took us to a range well over 2 degrees and to above 3 degrees. Clearly, current targets are inadequate.

Minister McKenna confirmed that in Paris, describing the 30% below 2005 by 2030 left in place by the Harper administration was weak. She described it as “the floor” and said we would do better. But within a year, the floor was the ceiling, and the entire Pan-Canadian Framework is built around the Harper target.

And now it is confirmed we are not on track to meet that target.

Good intentions are not enough. We need bold climate leadership.

Elizabeth May is the Member of Parliament for Saanich—Gulf Islands, British Columbia, and Leader of the Green Party of Canada.



April 12, 2018 Before the Bell host Catherine Clark in conversation with Julie Gelfand about her recent report.

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Energy and the Environment: Will Bill C-69 make a difference?

BY DALE SMITH
Sixth Estate

The Trudeau government's centrepiece environmental legislation — Bill C-69, the Impact Assessment Act—is currently undergoing debate. But as the government proceeds with its pitch that being strong on the economy and strong on the environment go together, are business and environmental groups actually sold on the policy?

Anna Johnston, lawyer with West Coast Environmental Law, said that C-69 has many promising elements, notably the fact that it brings the public and other constituencies — including Indigenous communities — into the dialogue at earlier stages and includes a sustainability test. But there remains a problem for her.

“Everything is permissive in the Act, so at the end of the day we don't know if decisions actually make sure that projects are going to help Canada meet its Paris Agreement obligations, whether they'll contribute to sustainability, or whether the public will be meaningfully engaged as the early stage intents,” said Johnston. “We're going to have to wait and see.”

Rachel Curran, who was an advisor in Stephen Harper's PMO and is now a principal with Harper and Associates, noted that the timelines in the bill are potentially indefinite.

“Part of the thinking behind the Harper Government's changes to the environmental assessment rules was to at least give investors a firm timeline by which they could expect a decision — not necessarily a positive decision, but a decision,” said Curran. “The new legislation extends that timeline potentially indefinitely.”

Jacob Irving, president of the Energy Council of Canada, said that for the pipeline industry in particular, they feel like they are on a “razor's edge,” and are worried about the future of pipelines in Canada. Other members of the industry are concerned about the timelines and are exploring how to make them more stringent and predictable in order to encourage investment.

“Even in the best construction of a regulatory process, there are all kinds of potential off-ramps and unintended consequences that could arise once you start living it,” said Irving. “That's the same no matter who you have in government and how they may change a regulatory process.”

Irving added that ministerial discretion can also throw uncertainty into the process, but it can similarly offer salvation to some proponents who feel that they are losing the process otherwise.

That question of discretion is why environmental groups are unhappy with the bill, says Stephen Hazell, director of conservation and general counsel at Nature Canada.

“Having certainty at the political level is super important and we don't have that with the bill,” says Hazell, adding that it makes it hard to judge intentions, and that while every government likes to have more discretion, the business and environmental communities like rules.

“Impact assessment is about providing information for decision makers so that we can make sound decisions,” said Hazell. “The

Impact Assessment Act that has been proposed is a good step.”

Bill C-69 also implements the federal climate price backstop that will be imposed on provinces that don't have their own carbon pricing mechanisms. For Craig Stewart, vice-president of federal affairs with the Insurance Bureau of Canada, this is essential because his industry believes that in order to affect change, there needs to be a price on carbon.

“We're experiencing the effects of climate change now,” said Stewart. “Right now, Canadian taxpayers are paying billions in losses from disaster assistance, through upgrading infrastruc-

ture because essentially, we're seeing the effects, and our industry is losing a billion [dollars] a year from events we're seeing like the floods here in Gatineau, to the fire in Fort McMurray in 2016, and the Calgary and Toronto floods in 2013.”

While groups like the Canadian Taxpayers Federation estimate that Canadian households could pay an additional \$400 to \$900 per year under the proposed carbon taxes, depending on their electricity provider, Stewart says that it's less than they would be paying in terms of other tax dollars to deal with climate change, whether it's municipal taxes to upgrade storm water infrastructure to deal with increased flooding or relocating critical infrastructure.

“As insurers, because we are suffering billions in losses right now, we have to look at how that's going to affect insurance policies,” says Stewart. “The costs are here. The cost of inaction is far more than the cost of action.”

Julie Gelfand, Commissioner of the Environment and Sustainable Development, noted that in her recent report on how governments around the country are working to reduce their greenhouse gas emissions, only Nova Scotia and New



Catherine Clark, Julie Gelfand, Commissioner of the Environment & Sustainable Development, Craig Stewart, Vice President of Federal Affairs at IBC, Stephen Hazell, Director of Conservation and General Counsel at Nature Canada and Jacob Irving, President Energy Counsel of Canada.

Brunswick were on track to meet their 2020 targets, and that most governments are nowhere near ready to adapt to increased flooding and forest fires and rising sea levels.

“Canadians, therefore, are not ready,” said Gelfand.

Gelfand added that governments across the country need to do more risk assessments, noting that the federal government has \$66 billion in assets that are not assessed for climate change risks.

“They should be assessing the risk and then developing adaptation plans so that they are ready when these changes are going to occur. They are occurring right now,” said Gelfand.

Energy and the Environment: Kinder Morgan in the crosshairs

BY DALE SMITH
Sixth Estate

With the drama ramping up between British Columbia and First Nations on one side and Alberta and Ottawa on the other over Kinder Morgan’s proposed Trans Mountain pipeline expansion, a Before the Bell panel looked into what’s at stake, both in the immediate impasse and in the longer term.

Rick Anderson, principal with Earncliffe Strategy Group, surmised that the current pipeline debate is chiefly a disaster for business and investment in Canada.

“We talk about investor confidence but we also talk about political risk,” said Anderson. “Major corporations from around the world look at countries as places to invest, and Canada has traditionally been a pretty stable place on that score. We’re now getting into a zone where decisions we make in the legal process, or the political process, or the regulatory process, can no longer be relied upon by investors.”

Anderson said that — especially when it comes to energy projects — Canada now demonstrates a high level of political risk.

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— Rick Anderson
Earncliffe Strategy Group





Susan Delacourt, Anna Johnson, Lawyer at West Coast Environmental Law, Rachel Curran, Principal at Harper & Associates and Rick Anderson, Principal at Earncliffe Strategy Group.

Energy and the Environment: Kinder Morgan in the crosshairs

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“I don’t think there’s much risk for political actors,” said Rachel Curran, principal with Harper and Associates, noting that she doubts either of the two premiers or even the prime minister will necessarily pay a heavy political price for the brouhaha. The Canadian economy, however, will pay the price as we are still dependent on resource development for export, Curran asserted.

“We are one of the best countries in the world for developing resources safely and responsibly and getting them to global markets in a safe way,” said Curran.

Curran said that Canada removing itself from the resource development game is a shame, as it represents more than 50 percent of our export market. She believes that this is leading to a flight in foreign capital, with investors unwilling to take on the risk of resource development projects.

“One of the major reasons is we can’t get these projects done,” said Curran. “That’s bad for business, it’s very bad for our economy, and ultimately it will be bad for future generations.”

That prediction of capital flight was disputed by Craig Stewart, vice-president of federal affairs with the Insurance Bureau of Canada. Stewart said that foreign capital may be balking at energy projects not because of what is happening in Canada around pipelines like Trans Mountain, but rather because they are diversifying and moving away from riskier, environmentally unsound investments.

“There is a shift in capital moving away from these twentieth-century projects to new twenty-first century projects,” said Stewart. “It’s happening globally, and our members are diversifying around the world.”

Anna Johnston, a lawyer with West Coast Environmental Law, conveyed her sense is that if built, the Trans Mountain expansion would be a disaster for future generations.

“It was a preventable issue,” said Johnston. “With greater engagement with Indigenous peoples and the public in advance of the project in the very early stages, before any major design decisions were made, before any environmental approval decisions were made and even before leaders and government started to champion the project, had there really been a genuine dia-

logue, then we might have been able to prevent this issue from the very beginning.”

Johnston said that alternatives could have been found if they were at the table earlier, but even if the pipeline ultimately doesn’t get built, it won’t affect the country’s GDP in a significant way.

Johnston says that any investor uncertainty happening right now is because of the country’s broken environmental assessment system, which is why the proposed new system under Bill C-69 shows promise.

But would the Trans Mountain expansion be approved if it had been assessed under Bill C-69? Johnston is unsure.

“That’s one of the fundamental problems with the Act,” she said. “We don’t have that policy direction from the outset. We don’t know whether projects that are clearly contradictory to our climate obligations and are opposed by Indigenous peoples and the public, whether they would go through.”

Curran is also unsure, and doubts that a proposal would have even been made.

“I don’t think a company would frankly enter in the process at all,” Curran said.

Curran noted that the pipeline is supported by 50-plus First Nations who have signed benefit agreements with the company, and that it has the support of the majority of British Columbians.

“With this legislation, it will make it even harder to get these projects done,” said Curran.

Anderson pointed out that the pipeline industry association has also stated that there wouldn’t have been an application under the new system.

“There might be a permit if it went through the application process, but would they find themselves in the same situation with a permit that they feel they can’t proceed with?” Anderson asked.

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Ottawa → Montréal	Jusqu'à 12	198 km	1 h 55 min	2 h 27 min	227 \$	33 \$	194 \$
Ottawa → Québec	Jusqu'à 8	482 km	5 h 23 min	4 h 39 min	488 \$	44 \$	444 \$
Toronto → Montréal	Jusqu'à 13	541 km	5 h 25 min	5 h 30 min	562 \$	44 \$	518 \$

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