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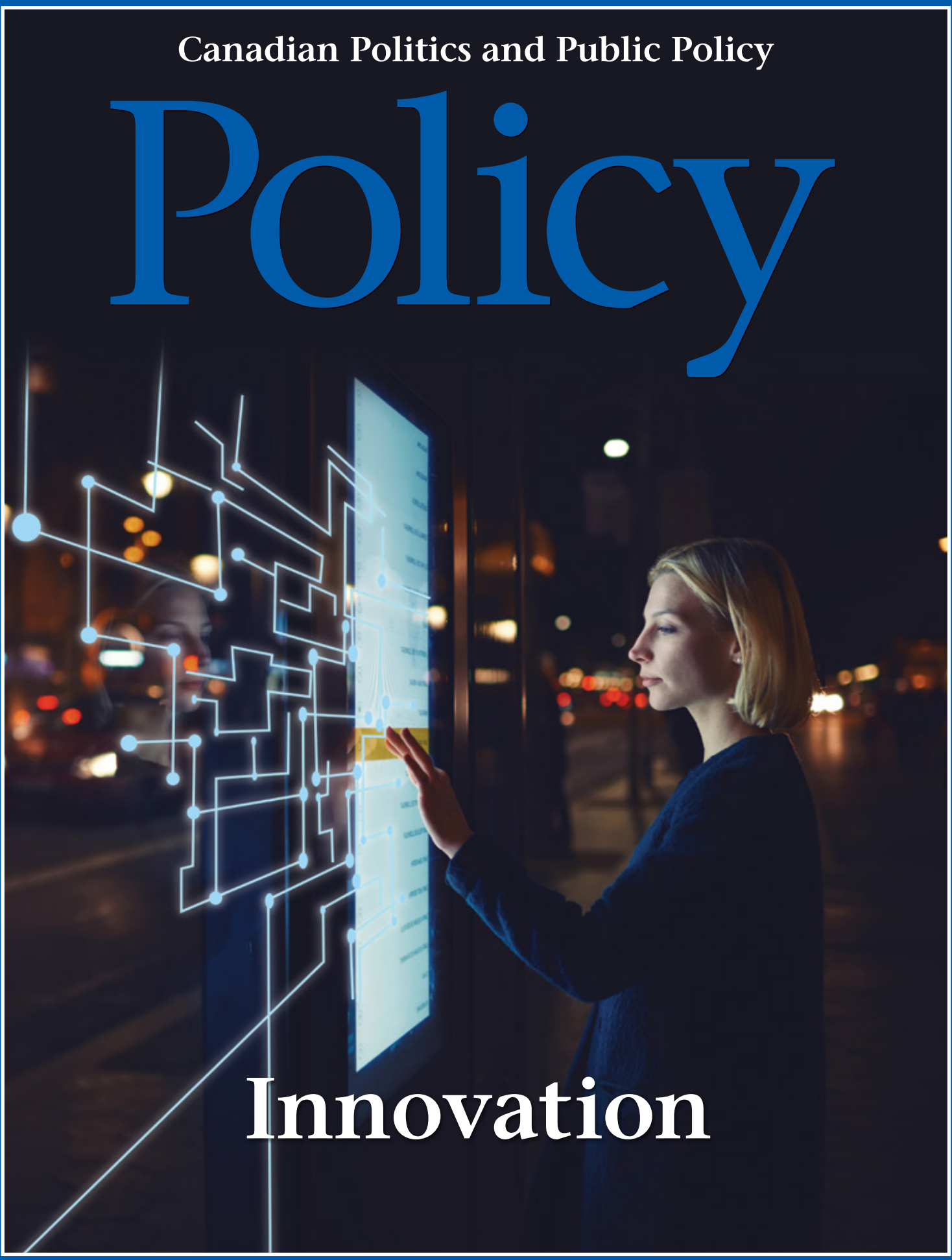
Canadian Politics and Public Policy

Policy



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A GREEN CHOICE

Policy

Canadian Politics and Public Policy

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Policy

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In This Issue

From the Editor / L. Ian MacDonald

Innovation

Welcome to our special issue on innovation in Canada, which we have produced in partnership with the Rideau Hall Foundation, a non-political charity established by Governor General David Johnston in 2012. Now nearing the end of his tenure at Rideau Hall, the Governor General shares his thoughts in a guest column on innovation. One of his legacies is the creation of the Governor General's Innovation Awards, established in 2016.

We begin with a Q&A with Innovation Minister Navdeep Bains, the Trudeau government's lead minister on the innovation file. He was both thoughtful and thought-provoking about the opportunities and imperatives for Canadian leadership on innovation.

Dominic Barton, Global Managing Partner of McKinsey & Company, is serving as Chair of the government's Advisory Council on Economic Growth, which released its first report and recommendations in February. Barton writes that Canada needs to invest heavily in skills training for workers, attract the world's top talent, and create innovation marketplaces in key sectors and technologies. He also notes: "Half of all billion-dollar start-ups in the US were founded by immigrants. Canada's reputation for openness and diversity give it a comparative advantage in the global competition for talent, and one we should capitalize on."

BMO Vice-Chair Kevin Lynch, a former clerk of the Privy Council, writes about innovation policy in an era of global disruption. Lynch says that Canada needs to raise its game in business R&D and innovation—from "reasonably good" to "globally great"—and rapidly, to build Canadian competitiveness.

Innovation isn't just about high-tech start-ups, but equally an imperative for the survival and prosperity of established companies. Linamar CEO Linda Hasenfratz provides the example of her company, Canada's second-largest auto parts manufacturer, whose products seamlessly cross the Canada-US border several times in North American auto assembly. Hasenfratz, also Chair of the Business Council of Canada, writes that: "Customers come to you if you have the products that solve their problems, problems they want and innovation is how you achieve."

Sean Finn, Executive VP of CN, writes of a culture of innovation and safety at one of the most mature industries going—railroads. CN is the largest railway in North America.

Nathalie Pilon, CEO of ABB Canada, writes about innovation and sustainable energy in the electricity space. Geoffrey Holmes and Jean-François Béland write of capturing carbon directly from the atmosphere and turning it into fuel using technology. President and CEO of Vancouver Coastal Health (VCH) Mary Ackenhusen provides an excellent window on innovation in healthcare.

Mike Katchen, CEO of Wealthsimple, asks how we build an innovative economy, and says it's not by picking winners, but by supporting them.

From business to social innovation, Paul Klein of HireUp and Tim Draimin of Social Innovation Generation propose a 10-point plan for unleashing Canada's capacity for good. Despite Canada's comparatively secure social safety net, they write that there are gaps that can be addressed by social innovators harnessing our capacity for positive change. Ian Klugman, CEO of Communitech, writes of building innovation-based ecosystems.

Sarah Prevette, founder of Future Design School, writes that innovation begins in the classroom by introducing the qualities of entrepreneurship in school. At the degree-granting end of the education system, McGill Principal Suzanne Fortier shares her thoughts on the crucial role of universities in innovation.

Breanne Everett, a winner of the Governor General's Innovation Award in 2016, writes of a personal journey from her medical residency to co-founding Orpyx, a business built on her invention of a foot sensor that provides information to diabetics. She writes of the GG's Award: "It is impossible to overstate the importance of programs that recognize innovators for their role in growing the innovation environment."

Finally, columnist Don Newman reflects on the innovation revolution in the news media over the last quarter century and more. On a personal note, I know of which he speaks.

When I began in the newspaper business in the early 1970s, I went on the road with a 35-pound portable typewriter and a 25-pound Fax machine that transmitted copy at six minutes a page, provided you could find a phone to connect the jacks. That was before laptops, cell phones, the internet, smart phones and social media that drive the news media today in a world with no deadlines.

Today, I can write this note on my laptop and push the send button from Montreal to our designer, Monica Thomas, in Calgary, thinking nothing more about it. P

Guest Column/David Johnston

Innovation: The New Imperative

One of the great privileges of serving as Governor General comes in having the opportunity to shine a spotlight on important issues facing our country. Innovation is one such issue, and this special edition of Policy Magazine, featuring insights from leading innovators working in a range of disciplines, makes a timely and useful contribution to the innovation conversation in Canada at a critical moment in time.

We're at a hinge point in our history. Not only does the 150th anniversary of Confederation offer us a rare opportunity to reflect, to celebrate, and to reimagine Canada, we find ourselves in the midst of a global moment of change. And with that change, we are presented with both challenges and opportunities. This is an age in which innovation is critical to our well-being. That means constantly strengthening our political, economic, social, technological and environmental processes. Whether in the realm of education, governance, sustainability, health care, finance, technology or civil society, the spirit of ingenuity and improvement must be part of how we operate as a society. Put simply, if change is the new constant, innovation is our new imperative.

How do we meet this imperative? One of the keys will be to make innovation more accessible—to make the concept less abstract and to ground it in reality and everyday life for all Canadians. We want to tell stories to make the importance of innovation vital and real and provide practical advice to help everyone realize they can, indeed must, be an innovator. We want to create a culture of innovation in which individuals and organizations see such creativity as part of who we are and what we do as Canadians.

One way we do that is through storytelling, which is fundamental to any culture. That's why I've recently co-authored a new book, titled *Ingenious*, with leading Canadian innovator Tom Jenkins. Subtitled *How Canadian Innovators Made the World Smarter, Smaller, Kinder, Safer, Healthier, Wealthier, and Happier*, the book highlights notable innovations throughout our history. The light bulb, the Blackberry, the canoe, the Universal Declaration of Human Rights, Blue Box recycling, insulin, restorative justice, the synthesizer, Me to We, the McIntosh Apple—this is just a sample of Canadian innovations that have improved our lives in countless small and large ways. Our aim with the book is ambitious: to establish a narrative for all Canadians, telling our inspirational stories and making them part of a rich "can do" heritage that consistently overcomes challenges. The book is one component of a suite of initiatives intended to promote the culture of innovation. That effort also includes a national innovation database, an educational curriculum developed by Nipissing University, a web site and a children's book. It's all part of building that culture, providing inspiring, real-life stories and practical advice to the next generation of Canadians—who are all potential innovators.

Celebration is another key component in our innovation strategy. The Governor General's Innovation Awards, which honour outstanding individuals, teams and organizations who are creating value, building better communities and meaningfully improving our quality of life, aim to celebrate the innovators in our midst with an eye to encouraging others to follow in their footsteps. With the second annual cohort of award-winners set to be recognized this year, we look forward to continuing to celebrate excellence and to foster an innovation ecosystem that spans the country. Some of the world's most creative people live among us, yet we haven't celebrated their stories or brought them together often enough. We aim to change that with the Governor General's Innovation Awards.

A third addition to Canada's innovation ecosystem is the Rideau Hall Foundation. Incorporated in 2012 as an independent, non-partisan charity, the Foundation is a tool we've created to amplify and broaden the reach of the office I represent. Its aim is to gather, align and catalyze forces for positive change. With priorities that include innovation, education, philanthropy and volunteerism, the Foundation is already effecting positive change in Canada. It's my hope that the Foundation can continue to help foster a world-class Canadian innovation ecosystem in the years ahead.

The good news is that Canadians have long been innovators. Indeed, what is Confederation itself if not an innovation in governance among diverse peoples? This is a remarkably vast, diverse and challenging country to live in, and our pre- and post-Confederation history is full of examples of people working creatively and collaboratively to improve our lives. As 21st century Canadians we must continue to innovate in countless ways so that our institutions and society evolve to ensure continued and enhanced relevance in a complex, rapidly-changing world. P

Q&A: A Conversation With Navdeep Bains

"We want to demonstrate that we're a willing partner," says Innovation Minister Navdeep Bains in his Q&A with *Policy* Editor L. Ian MacDonald. Policy *photo*

Innovation and Economic Development Minister Navdeep Bains met with Policy *Editor L. Ian MacDonald for a wide-ranging interview on the challenges and opportunities of innovation and Canadian comparative advantage, including the advantage of Canadian immigration policies in recruiting the best and the brightest to study and start-up new business firms in Canada.*

Policy: I wanted to begin with innovation and the opportunities in immigration. I find it quite striking. First of all, is there an opportunity for Canada, given President Trump's "extreme vetting" immigration policy, to gain comparative advantage over the US as a destination for innovators and talented foreign students?

Navdeep Bains: This is a longstanding advantage that we've had globally. We believe in having an open mindset when it comes to immigration, recognizing that our academic institutions have a unique opportunity to attract some of the best and brightest. We don't have a monopoly on good ideas. If you look at our recent global skills strategy, which is about individuals that are high in demand with specialized skills who can come to Canada within a matter of two weeks, it really speaks to that concept of being open—open to people, open to ideas.

When we say diversity is important, it's really about diversity of thought and perspectives. When I'm speaking to presidents of universities and colleges, they're noticing more interest in individuals wanting to come to Canada to study. I'm seeing that same level of interest from businesses as well. This is something that we were very alive to even before the US elections. This is an area where I wholeheartedly believe we have a value proposition that differentiates us. And it's now all about making sure that we implement our promises around immigration.

Policy: Dominic Barton in his article for this issue of *Policy* writes, "Half of all the billion-dollar start-ups in the US were founded by immigrants. Canada's reputation for openness and diversity give it a comparative advantage in the global competition for talent." I take it you agree with that.

Navdeep Bains: Absolutely. There's no doubt that diversity and talent are a source of strength for us. I think of my own father. When he came here from India, literally with a few dollars in his pocket, he sacrificed a lot. He came here with a desire to succeed. And so when people talk about immigrants succeeding in Canada, or in the US or other parts of the world, it's no surprise. They give up a lot. I think that drives them to take risks, to be entrepreneurial. You know, they want to control their own destiny a bit more. I think that's why being an entrepreneur makes sense for them.

Policy: Let me give you some examples. Steve Jobs, the founder of Apple and famously the son of a Syrian immigrant, who wouldn't be admitted to the US under Trump's immigration policy. Sergey Brin, co-founder of Google, whose CEO is from India —Sundar Pichai. A Canadian, Garrett

Camp, is the co-founder of Uber. Satya Nadella is the CEO of Microsoft. Jerry Yang, the co-founder of Yahoo. Bob Miner, an Iranian, is the co-founder of Oracle. Pierre Omidyar of eBay. In Canada, Shopify founder Toby Lutke is a German immigrant.

Navdeep Bains: That's right. I was recently talking to Toby during a dinner and we talked about his personal success. What's really interesting to note is not only their individual success, the enormous amount of wealth they created for themselves and for the jurisdiction that they operate in, the numerous employment opportunities. It`s also the fact that they genuinely want to give back. They also want to make the world a better place. Often they become very global in their perspective, and they do a lot when it comes to philanthropy and mentoring.

Toby's a great example of that. He pushed very aggressively for initiatives around computer coding for lifelong learning. And it's not simply about what it means for his business. He sees where society is going. He sees the role of technology. He's looking at issues of diversity, gender equality, focusing on encouraging girls to take science, technology, engineering and math.

These entrepreneurs` contributions go beyond their own personal success. They give back a lot to society.

Policy: Your thoughts on the three main recommendations of the Advisory Council on Economic Growth. Number one: invest heavily in skills training.

Navdeep Bains: That was a key component of our budget. We focused on innovation and skills. When we were consulting innovation leaders, businesses and academic institutions, we asked them: What is the number one issue? And it always came down to people, skills and talent. In this rapidly changing economy, there's obviously a lot of anxiety. People are worried about their jobs, their own personal opportunities and the hopes and aspirations they have for their children or grandchildren. One of the areas where we could help Canadians deal with those anxieties is to provide opportunities for everybody to upgrade their skills.

> *"When we say diversity is important, it's really about diversity of thought and perspectives. When I'm speaking to presidents of universities and colleges, they're noticing more interest in individuals wanting to come to Canada to study. I'm seeing that same level of interest from businesses as well."*

Our focus is on lifelong learning. Teaching kids computer coding. Work integrated learning. More internships. More co-ops. This is an area that would provide meaningful opportunities to upgrade skill sets and to provide employment opportunities, not only for our youth, but also for adults who have been in the workplace for 10 to 15 years and want to go back to school to upgrade their skills.

> *"People are worried about their jobs, their own personal opportunities and the hopes and aspirations they have for their children or grandchildren. One of the areas where we could help Canadians deal with those anxieties is to provide opportunities for everybody to upgrade their skills."*

Policy: And then, number two, attract the world's top talent. That's pretty obvious.

Navdeep Bains: It is. But at the same time, we need to do it in a very thoughtful way. We want to be led by the needs of the marketplace. This goes beyond attracting more engineers or technicians or individuals with certain skill sets. It could be recruiting a CEO or a Chief Technology Officer who can help a company scale up and grow. We want Canadian companies to identify what their needs are, where the gaps are, and we want to deal with it in a much more timely manner.

We made a commitment to launch the global skills strategy on June 12th—so not next year or the following year, but in a matter of weeks. And the processing time for visas will be a matter of ten working days or two weeks. If you're a company and you need to bring somebody and they need to get their visa processed—currently it can take potentially months. For companies that quickly need someone to be able to make that next investment or find the next solution or to deal with an issue, they have that nimbleness and flexibility.

This program will make Canada an even more attractive place for top talent. It demonstrates that we have a process that will be very sensitive to the needs of small businesses that want to grow and scale up in Canada.

Policy: And number three, create innovation marketplaces.

Navdeep Bains: We deal with this in the budget through the lens of the superclusters. We're looking at how we can accelerate commercialization—bring ideas to the market more rapidly. Canada is doing really well when it comes to investing in research. Relative to our G7 peers, we're really strong. Where we're challenged is when we translate those ideas into solutions that can be commercialized, that can create jobs, generate revenue for companies. That's an area that we want to focus on. We want to accelerate commercialization. The superclusters bring all the key elements together: academia, where the ideas are generated; anchor firms that have an understanding of how to grow and scale up; connecting them with smaller firms; connecting

them with civil society, different levels of government; and finding common platforms that can allow them to compete globally.

We're really excited now to go out there and engage industry, academia in a very competitive process that will let the best ideas come to us. Our objective is not to prescribe these solutions. We don't want to prescribe a path forward. We want to demonstrate that we're a willing partner. We're willing to put money in so we can leverage more money, primarily from the private sector.

"We're really excited now to go out there and engage industry, academia in a very competitive process that will let the best ideas come to us. Our objective is not to prescribe these solutions. We don't want to prescribe a path forward. We want to demonstrate that we're a willing partner."

And quite frankly, I think they understand the proposition. They understand how this would benefit them. And we think this model has a lot of potential. It's really about focusing on three to five areas. That also would increase the level of competition. We want the best ideas to come forward.

Policy: The budget says that innovation begins with smart, creative, and skilled people, and cites Canada being positioned for leadership. For example, some bullet points: number one educated workforce in the OECD; number one in the G7 for business cost competitiveness; number two in the G7 for openness to trade and investment; number three on the global entrepreneurship index; and, second-best place in the world and best country in the world to do business, and the best banking system in the world in the WEF rankings nine years in a row.

But those are all great reasons to innovate in Canada.

So the question is where do we need to raise our game. For example, while the government and universities are leaders in R&D, private sector ranks 24th in R&D and as a percentage of GDP, and 22nd overall in innovation.

Navdeep Bains: Correct.

Policy: So what do we need to do about that?

Navdeep Bains: There are a few key problems that we tried to address in the innovation and skills budget. There are certain gaps that were identified when we went out there and engaged industry, academia, civil society. Access to people and talent were key issues. And access to capital, particularly in clean tech.

We brought forward measures to deal with that: the Venture Capital Catalyst Initiative, which will be managed by the Business Development Bank of Canada. The idea behind this is: How can we continue to strengthen our venture capital ecosystem, which has done remarkably well over the past few years? Last year, $3.2 billion in VC funding was raised in Canada. That's an all-time high. So how do we continue to build momentum? How do we improve the access that Canadian companies have to working capital and growth capital and patient capital?

The other challenge we're trying to solve here is how do we create opportunities for our companies to be export oriented? One of the things that I'm very proud of is the Canadian Free Trade Agreement. The whole objective there is to allow companies to have access to more customers, deal with less red tape and position themselves well if they choose to go global. We want to have not only strong Canadian brands, but also global brands.

How do we use government procurement to support the growth of Canadian companies? We want to identify companies that have good ideas. And we're going to have a special carve-out in the federal government's procurement budget for those companies to validate their solutions and ideas. When these companies go abroad and these companies are asked, "Do you do business with the Government of Canada?" They can say: "Yes." And that allows them to develop additional business opportunities internationally.

Even though we have a very well-educated workforce, even though we're ranked as a strong place to do business, we can still do better in developing and attracting talent. We can do better in making sure there's more capital available. And we need to do a better job of creating more market access.

Policy: Do we need to do a better job of tracking results of government investments? For example, the Institute for Fiscal Studies and Democracy at University of Ottawa put out a report in March, as you know, that the government has funded $22.6 billion for 147 skills and innovation programs with little understanding or analysis of the performance or value for money. Do you have some thoughts on that?

Navdeep Bains: Return on investment is really important for taxpayers—making sure that when we design programs, they achieve the desired outcomes. Economic growth, more jobs, more R&D—those are all very important targets. We have proposed a path forward called Innovation Canada. And the idea is two-fold. One is to coordinate and streamline our programs. And the other is to evaluate the effectiveness of these programs. And both initiatives will be housed centrally through Innovation Canada, which will allow better outcomes for Canadians and Canadian companies.

Policy: What about the role of universities in all of this? Apparently about half of our students and millennials want to have their own start up—their own start-ups and businesses. Are the universities going to be able to give them the tools and the knowledge base that they need to do that?

Navdeep Bains: If you look at academic institutions, they are promoting a lot of multi-collaborative efforts. They're bringing in law students to

collaborate with business students, with science students. These efforts equip these individuals with multiple skill sets. Academic institutions are also beginning to recognize the merits of business accelerators and incubators. The Digital Media Zone at Ryerson University, where I taught, is an example of that. It has created an environment for businesses and individuals with ideas. Like you said, young millennials want to start up their own company, make the world a better place. It's not always about making money. It's also about innovative solutions that have a positive impact on people's lives.

More and more, academic institutions provide mentoring services. They provide legal advice. They even provide opportunities for companies to get financing. So I think academic institutions are beginning to appreciate the role that they play. That's really what we're trying to accomplish through the supercluster initiative. It's to accelerate that commercial opportunity and to make sure that our industries and our academic institutions work really closely together to help facilitate that process.

Policy: And in terms of education, how does Ottawa partner with the—the provinces on what is, as we all know, under Section 92 of the Constitution, an exclusive provincial jurisdiction? The Canada Chairs were a good example of brain gains for Canada. What are your thoughts on that, working with the provinces?

Navdeep Bains: We've demonstrated that we can work with the provinces. We did so with the pan-Canadian framework on environment. We did so with the Canada Pension Plan. We demonstrated that with the Canadian Free Trade Agreement, which was signed by all the provinces and territories. Our government has a track record of demonstrating that we can work with the provinces and territories.

When it comes to education, the computing coding initiative for school-aged kids that was in Budget 2017 is a great example of how we can use not-for-profit and other organizations for this initiative. And the different provinces and territories then can use that supply base. This way, we respect educational responsibilities. And at the same time, we help support the growing demand in the area of coding.

"Our focus is on lifelong learning," says Navdeep Bains on the role of education in innovation. Policy *photo*

Policy: How do you feel about corridors of excellence, like the Toronto-Waterloo corridor? Years ago, Michael Porter, as you know, famously wrote in the *Competitive Advantage of Nations* about the diamond cluster of excellence. What do you—you know, when you travel all over the country, what are you seeing about that?

Navdeep Bains: Geography, population and a sense of history are key factors. Even for the Toronto-Waterloo corridor, a discussion is taking place. And it's really around leveraging all the technology and life science companies that exist. And it's the second-largest such cluster or corridor in North America outside of Silicon Valley.

Policy: That's quite something in itself, isn't it?

Navdeep Bains: That is a point of pride. When it comes to these corridors, there's a recognition that it's all about making sure that you create common spaces and collaboration to help generate new possibilities.

That notion of collaboration is key. For example, when I was in British Columbia, I met with UBC's President (Santa) Ono, who was tasked by Premier Clark to look at what British Columbia should propose as an idea for a supercluster. In order to do that, he brought in small businesses, large businesses, all the sectors—traditional sectors, new sectors, emerging players, established players, academic institutions. When you have all these people in the room talking about how they can work together and find common areas of interest, it makes the magic happen.

In BC , they have a neat initiative: the Cascadia corridor between themselves and Washington state. They recognize that we're in a global innovation race. It's very competitive out there. We're too small of a country to compete against each other. So how do we work together? And what relationships can we leverage going forward? There's east-west. There's also north-south. And it's also cross-sector. It's no longer just about aerospace or auto or ships. Of course, those are important areas of growth that have existed and will continue to demonstrate a lot of growth. But artificial intelligence, for example, or quantum computing have the ability to really help companies in multiple sectors. Take CAE. That's an aerospace company that's in training and simulation. They're using that technology now for healthcare solutions. I think that just speaks to the nimbleness and the flexibility that exists. And the openness that we need to have as policy makers in how we define clusters and sectors.

Policy: I want to ask you about disruptive technologies.

A study by the WEF in January, as you know, revealed that 86 per cent of US job losses between 1997 and 2007 were the result of technology-driven productivity gains, and only 14 percent because of international trade. And in this issue of our magazine, Kevin Lynch writes: "Widespread deployment of autonomous trucks in the US could put the jobs of upwards of three million truckers at risk of technological displacement." I wonder, do you see this kind of anxiety about disruptive technologies with people you meet—just in your riding of Mississauga-Malton?

Navdeep Bains: You're absolutely right. I have Pearson International, the largest airport in the country, in my riding of Mississauga-Malton. There is a strong logistical hub around it. There are warehouses and a large transportation sector. I know many people in the trucking industry. They share these anxieties and concerns. We understand the anxieties that middle-class Canadians are facing about their own prospects, about the prospects of their kids. The role of our government is to say: "How can we help deal with those anxieties in a meaningful way?"

In our first budget, we brought in tax policies to deal with that—a tax cut for middle-class Canadians. Then we focused on the Canada Child Benefit. We used tax policy to deal with some of those anxieties. Then, we focused on immediate job opportunities through significant infrastructure investments. In this budget, we're focusing on skills and innovation so that Canadians are ready and able to do the jobs of the future. The message is not about humans versus technology, humans versus machines. It's about how we can make Canada a more innovative economy, where companies come here to build innovative solutions. It's not by being the lowest-cost jurisdiction, but a jurisdiction that people come to because the best people are here, the best ideas emerge from here, the best technologies emerge from here.

I often cite the example of Germany, South Korea, Japan, where automation and technology exist in abundance, and yet they still have low levels of unemployment. What that tells me is that, if we play a leadership role in innovation and technology, if we play a leadership role in technology adoption, we'll actually create more opportunities. And if we're a laggard, it'll be to our own detriment because other jurisdictions will out-compete us in the global innovation race.

> ***"The message is not about humans versus technology, humans versus machines. It's about how we can make Canada a more innovative economy, where companies come here to build innovative solutions."***

Policy: Two more quick ones. First on clean energy, renewables, and then on the CFTA. Coal is not coming back. You probably saw the story the other day about the Kentucky coal mining museum that switched from coal to solar power? And in the US there are more jobs in solar—210,000—than there are in coal—190,000, and—or oil and gas extraction—180,000. And solar is forecast to employ 420,000 people in the US, and wind 380,000 by 2020, where—and coal costs $140 per megawatt-hour to operate, solar costs $80, and wind $60. It's pretty obvious where the future lies in energy in growth and jobs. So what are the opportunities in clean energy and renewables?

Navdeep Bains: There's a lot of potential in clean tech. This is an area that impacts all sectors of the economy. And that is why we've committed $1.4 billion in our budget to look at early-stage commercialization opportunities for clean-tech companies. We're looking at how we can continue to finance and provide that patient capital for companies that want to make additional investments and want to grow here. And then how can they become more export-oriented.

We sent a very clear signal to the market that clean technology is important to us because of the commitments we have made on the environment and reaching our climate-change goals. Putting a price on carbon is important, but one of the key ways of achieving it is through innovation—through clean technology.

There are 8,000 companies right now in Canada that are identified as cleantech companies. And their growth potential is enormous.

Policy: Finally, on the CFTA, you've said this is really about "strengthening our home field advantage."

Navdeep Bains: As a market of 35 million people, we don't have the luxury of competing against each other. We need to work together. I recognize there are regional differences. But fundamentally, we believe being open to trade and being open to investment, being open to people is how we're going to succeed in a world that's promoting protectionism, that's turning inward. With the Canadian Free Trade Agreement, we are strengthening our home field advantage. And we are saying loud and clear that Canada is open. This is how we are going to deal with those anxieties around the middle class, how we're going to see more growth in the economy. Because we've had modest growth and we need to change that equation.

How do we create good quality jobs?

The only way we do that is by saying that yes, diversity is important and yes, it is our strength, but how do we leverage that diversity for economic benefits? If you have an idea and you want to take risk and you want your company to grow, this is the place to come. We must let the world know that we have the best regulatory environment. The best talent. The best access to financing. The best opportunities for companies to succeed globally because of both our international trade and domestic trade agreements. P

Innovation and Economic Development Minister Navdeep Bains sat for this Q&A in his Ottawa office on April 13, 2017.

Innovation Nation: Supercharging Canada's Innovation Ecosystem

Dominic Barton

When the Trudeau government created its Advisory Council on Economic Growth, it turned to Dominic Barton, global managing partner of McKinsey, to chair the group. After decades spent advising major corporations and governments on how to address obstacles to success, Barton brought that experience to bear on Canada's economic strategy, particularly on innovation.

A decade ago, CBC Television aired its mini-series *The Greatest Canadian Invention*, counting down 50 inventions that were developed in Canada, including insulin, the telephone, the artificial pacemaker, and the zipper. Clearly, inventions are a core part of our heritage as a nation.

Today, creating the conditions to supercharge Canadian innovation—or taking our ideas and inventions to scale commercially—will be critical for our future prosperity. We face a demographic challenge (rapidly aging population) which, if left unchecked, could cut GDP per capita growth from the 1.9 per cent we experienced over the past 50 years to 0.8 per cent over the next 50 years. And, as the pace of technological change accelerates and competition from other countries intensifies, supporting innovation will be key to creating high-value, resilient middle class jobs.

Upping our game on innovation will not be easy, and several previous attempts to accelerate Canadian innovation have failed to deliver. Three specific issues have proved difficult to address. First, as a nation, we do not consistently translate our good ideas into revenue-generating commercial products and services. Second, we struggle to turn successful start-ups into mid-size companies, and to scale up mid-sized firms into globally competitive players. And third, many sectors lack a 'burning platform' for corporate adoption of innovation, as they are comfortably profitable and do not face the intense competition that has spurred innovation in other markets.

We believe that there are eight broad actions that could help address these challenges and transform Canada's innovation economy. The Canadian government's *Innovation and Skills Plan*, detailed in *Budget 2017*, and other recent initiatives lay a strong foundation for Canada to reach its innovation potential. That said, more opportunity still exists across the board—to increase productivity and drive inclusive growth. What is needed now is bold ambition, and a willingness to challenge our current thinking.

1. **Invest heavily in skills training for workers.** The automation of work—driven by technology—is the single most disruptive force facing labour markets today. Nearly half of Canadian jobs are at a high risk of being affected by automation over the next two decades, according to a study by the Brookfield Institute. Furthermore, the paradigm of work continues to evolve—the number of people engaged in temporary or contract work has increased substantially in recent years, and those employed full-time are switching jobs more frequently. In this changing environment, lifelong learning and re-skilling are essential to maintaining a workforce that has the skills needed to thrive in an innovation-led, increasingly knowledge-based economy. *Budget 2017* provides considerable new investment in skills development and training. Continuing to build on a strong foundation here will become more and more important in the coming decade.

2. **Attract the world's top talent.** Three-quarters of high-growth firms in Canada say that the greatest barrier to growth is a lack of managerial talent. An important first step in remedying this will be to pursue the federal government's *2016 Global Skills Strategy*, and to double down on other recent initiatives such as the fast-track visa program. In the long run, attracting international

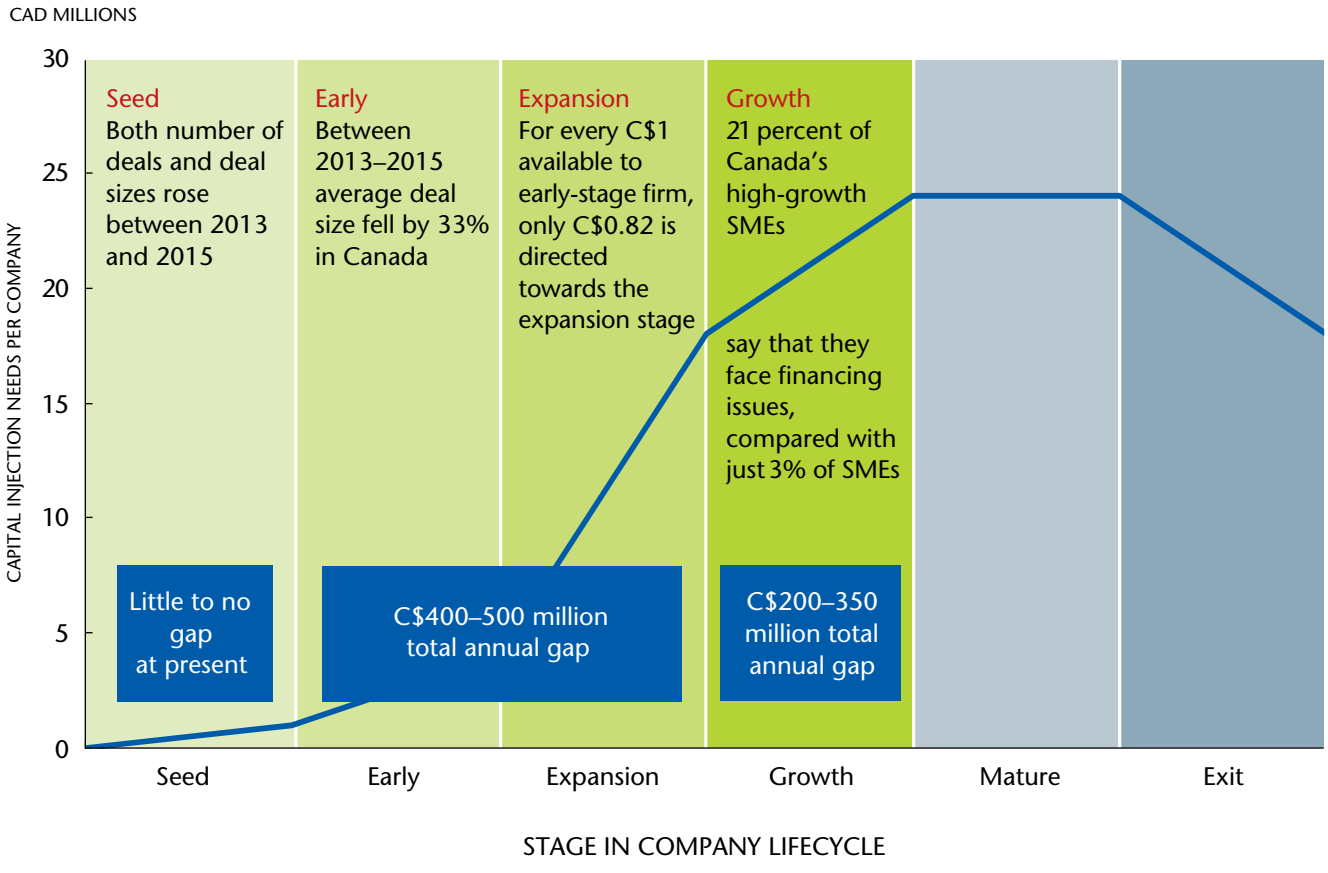
students to our globally recognized universities and increasing immigration of skilled workers will be essential. Half of all billion-dollar start-ups in the US were founded by immigrants. Canada's reputation for openness and diversity give it a comparative advantage in the global competition for talent, and one we should capitalize on.

> ***"Half of all billion-dollar start-ups in the US were founded by immigrants. Canada's reputation for openness and diversity give it a comparative advantage in the global competition for talent, and one we should capitalize on."***

3. **Create innovation marketplaces in key sectors and technologies.** Canada's innovation ecosystem is strong on many dimensions—from its remarkable base of talent, to its mix of large firms and high-growth SMEs, to its leading researchers and universities (e.g., in technologies as diverse as artificial intelligence, clean tech and quantum computing). What can be improved however, is the coordination and collaboration among these various stakeholders. To address this need, Canada should create and scale innovation 'marketplaces' or 'clusters' to match the demand for innovation from companies and governments, with the supply from researchers and entrepreneurs. These marketplaces can be flywheels of innovation and economic growth, especially when focused on sectors where Canada has already developed a competitive edge, such as ag-food, energy and renewables, mining and metals, health and life sciences, and advanced manufacturing—as well as around our leading technologies.

4. **Pivot focus to high-growth markets in Asia.** Canada's domestic market represents two per cent of global GDP and less than 0.5 per cent of the global population. To scale and become global champions, Canadian companies will increasingly need to look beyond our borders for growth opportunities, and adopt the global mindset common in Switzerland and Scandinavia. The US will continue to be our most essential international market, but as global growth dynamics shift, other countries—es-

Figure 1: Capital injection needs by stage in a company lifecycle



pecially in Asia—will become more and more important as markets for our innovations. Companies that have an explicit strategy for broadening their international footprint will not only have greater opportunities for growth, but will also tap into the vibrant innovation ecosystems that exist in these high-growth markets.

5. **Create new pools of growth capital to scale businesses.** Starting a business in Canada is relatively easy: according to the World Economic Forum, Canada ranks second worldwide in ease of establishing a new firm. The problem is that disproportionately few small companies in Canada ever become mid-market or larger firms. A survey of start-up 'exits' in Canada and the US since 2000 found that only one per cent of Canadian companies exited with a valuation of more than $500 million, compared with 10 per cent of exits in the US This is why the government's recent announcement of a private sector-led Canadian Business Growth Fund is so important. It will help close Canada's $200-350 million annual funding gap faced by firms with more than $10 million in revenue, and provide the growth capital, venture capital, and access to investor advice and support needed for those companies to expand. (see figure 1)

6. **Digitize government.** Nearly a quarter of Canada's employees work for government or quasi-government entities such as schools, hospitals, and crown corporations. At this scale, any meaningful national innovation and productivity effort must include the public sector. Opportunities abound here, particularly in digitizing government processes and services. The US Digital Service, a new federal agency, has a mandate to make government services "awesome" (i.e., better, faster, more mobile, more social) and cheaper. Another example is in the U.K., where the Government Digital Service is collaborating with individual departments; using design principles to lead a fundamental "digital transformation of government," and on a very aggressive time frame. Canada can and should make a similar large-scale, bold effort to digitize federal, provincial and municipal governments as well.

> ***"A survey of start-up 'exits' in Canada and the US since 2000 found that only one per cent of Canadian companies exited with a valuation of more than $500 million, compared with 10 per cent of exits in the US This is why the government's recent announcement of a private sector-led Canadian Business Growth Fund is so important."***

7. **Target government procurement to boost innovation.** The Canadian government should use strategic government procurement to help small, innovative Canadian companies scale-up and gain credibility in global markets. The principle here must be a shift from *requirements-focused* to *value-based* procurement, enabling the public sector to be an important first customer for Canadian innovations. The opportunity here is significant: Canadian governments at all levels spend approximately $100 billion each year to purchase equipment, supplies, and services. Innovative Solutions Canada, modeled after similar, successful programs in the US and U.K., will provide $50 million annually starting with *Budget 2017* towards earlier-stage products and services, and if successful, should be expanded even further.

8. **Prioritize existing business innovation programs.** Canada spends more than $5 billion annually on a multitude of programs to accelerate innovation, enable commercialization, and strengthen exports. We can still do a much better job of scaling up programs with proven impact, and cutting those without. To do this successfully will require regular assessment and systematic data collection on effectiveness, as well as a major mindset shift towards resource re-allocation and optimization. Also needed is a regular review of regulatory barriers—removing or re-tooling those that create unnecessary barriers to innovation.

Canada has the potential—and the need—to be an innovation powerhouse in the coming decade. From our world-class education system, to our diversity and reputation for openness, to our strong existing sectors, we have all the right ingredients to attract and equip the next generation of great Canadian inventors and business builders. Capturing this opportunity will be one of the most important drivers of Canada's future prosperity for all. P

Dominic Barton is Global Managing Partner of McKinsey and Company and Chair of the Trudeau government's Advisory Council on Economic Growth.

Innovation Policy in an Era of Disruption

Kevin Lynch

As so many authoritative economic sources, surveys and corporate titans have told us recently, the nature of work is about to change drastically. Automation will replace many existing jobs and governments are scrambling to adjust their innovation policies accordingly. Kevin Lynch, one of our regular contributors who is uniquely positioned to assess the evolution of thinking on adaptation to the Fourth Industrial Revolution, outlines the opportunities and pitfalls of policy making in an age of disruption.

We are in the midst of an era of disruption, driven by the extraordinary scale, scope and speed of technological change, and spawning transformative innovations throughout economies and societies. These new technologies, from big data to machine learning to artificial intelligence to quantum computing to the internet of things, to much more, are intersecting and intertwining in unimaginable ways—a virtual revolution (Figure 1).

But few revolutions transpire without upheaval, uncertainty, and swaths of winners and losers, and technological revolutions are no different. This one not only has the potential to fundamentally transform what we produce and how we produce it, but its impacts are being felt well beyond the production economy—how we communicate, interact, date, learn, get news, and govern.

People are totally transfixed by technologies that have created self-driving cars and trucks but blissfully ignorant of the job-displacement potential of such automated vehicles.

Uber sent a shipment of beer 200 miles along an interstate in a self-driving truck. Elon Musk likes to be photographed arriving at meetings in San Francisco in a self-driving Tesla. Amazon is experimenting with drone delivery of packages in selected neighbourhoods. Cool technology, disruptive innovations and new business models. A productivity and growth gain from technological change, to be sure, but also a looming social pressure and policy quandary.

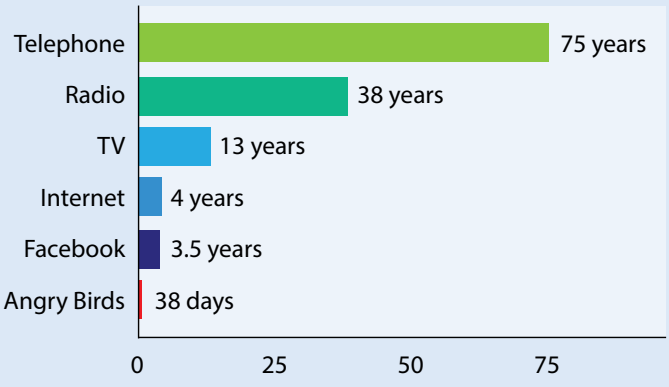
Widespread deployment of autonomous trucks in the United States would put the jobs of upwards of 3 million truckers at risk of technologi-

Figure 1(a): Technology is disrupting things, again

- Artificial intelligence (AI) and advanced robots
- New computing technologies (quantum, neural, …)
- Blockchain, distributed ledgers
- Internet of things (linked sensors)
- Big data, cloud computing
- Virtual and augmented realities
- 3D printing
- Neurotechnologies, geo-engineering
- Nano materials
- Energy storage

Source: McKinsey

Figure 1(b): The "PACE" of disruption (time to reach 50 million users)



Source: Citi GPS: Global Perspectives & Solutions

cal displacement. In Tom Friedman's words, this is the hollowing out of middle-income paying jobs requiring middling education. More generally, McKinsey & Company estimates that, through a combination of machine learning, big data, massive computing power and artificial intelligence, some 40 per cent or more of current jobs in North America could be automated in the foreseeable future.

This highlights the duality of the policy challenge facing governments, business and society. On the one hand, we have a significant long-term growth problem, caused by slowing productivity performance and shrinking labour forces due to aging. The main driver for rebuilding potential growth is innovation, which increases productivity, improves competitiveness, expands product choice for customers and moves firms up the value-added curve. And Canada has a considerable way to go in rebuilding growth through improvements in our innovation performance as even a cursory examination of global rankings makes strikingly clear (Figure 2).

There is no silver bullet for Canada's innovation underperformance: no elusive tax incentive, no reclusive venture capitalist, no exclusive intellectual property policy that can suddenly turn on the innovation spigot. But there is much we can and must do, starting with a national innovation strategy.

> ***"There is no silver bullet for Canada's innovation underperformance: no elusive tax incentive, no reclusive venture capitalist, no exclusive intellectual property policy that can suddenly turn on the innovation spigot. But there is much we can and must do, starting with a national innovation strategy."***

Here, the 2017 federal budget provided encouraging signals. First, we have to set ambitious targets and assign accountabilities. Building world-class innovation superclusters has driven innovation and growth in other countries, ranging from the United States to Israel, Singapore and the Netherlands, and the government has signalled its intention to work with business, universities, technology centres, risk capital and the entrepreneurial start-up community to do so here on a competitive basis. We should aim to have at least one innovation ecosystem in the global top 10 by 2020; half-measures will not succeed.

Second, we have to become a global talent hub, and align policies to achieve this. Extraordinary talent drives brilliant research, solves intractable problems and creates new ways of looking at old things. What sets successful innovation ecosystems apart is that they are magnets for such talent. Recognizing that talent pools are global, not national or local, the government's new Global Talent Visa and other measures to attract researchers and innovators should build on one of our greatest strengths—our diversity.

Third, we have to modernize our policy toolkit to support innova-

Figure 2: A global scorecard on innovation

Despite pockets of excellence, strength in start-ups and some best-in-class university research strengths, Canada is pretty mediocre in business R&D and innovation, particularly in established firms. We have to go from "reasonably good" to "globally great", and rapidly, to rebuild Canadian competitiveness.

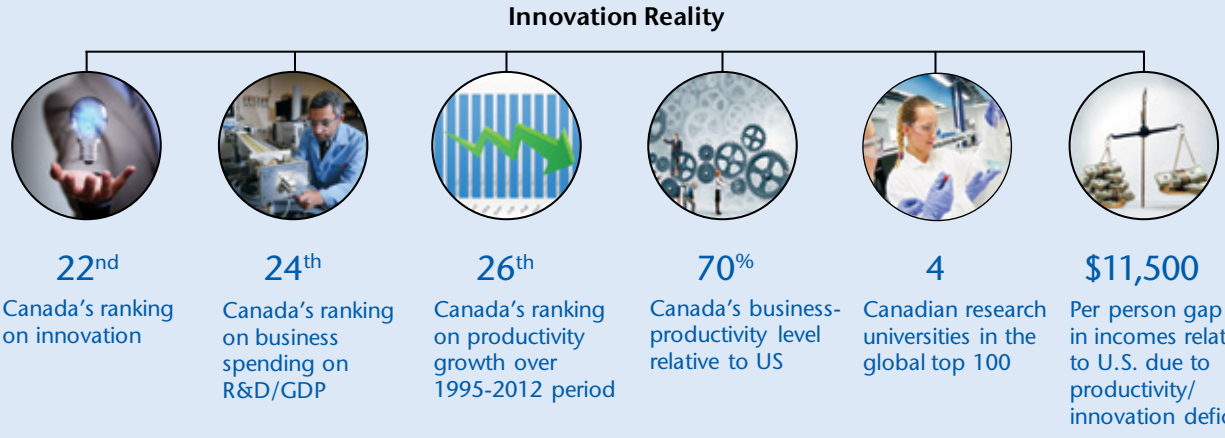
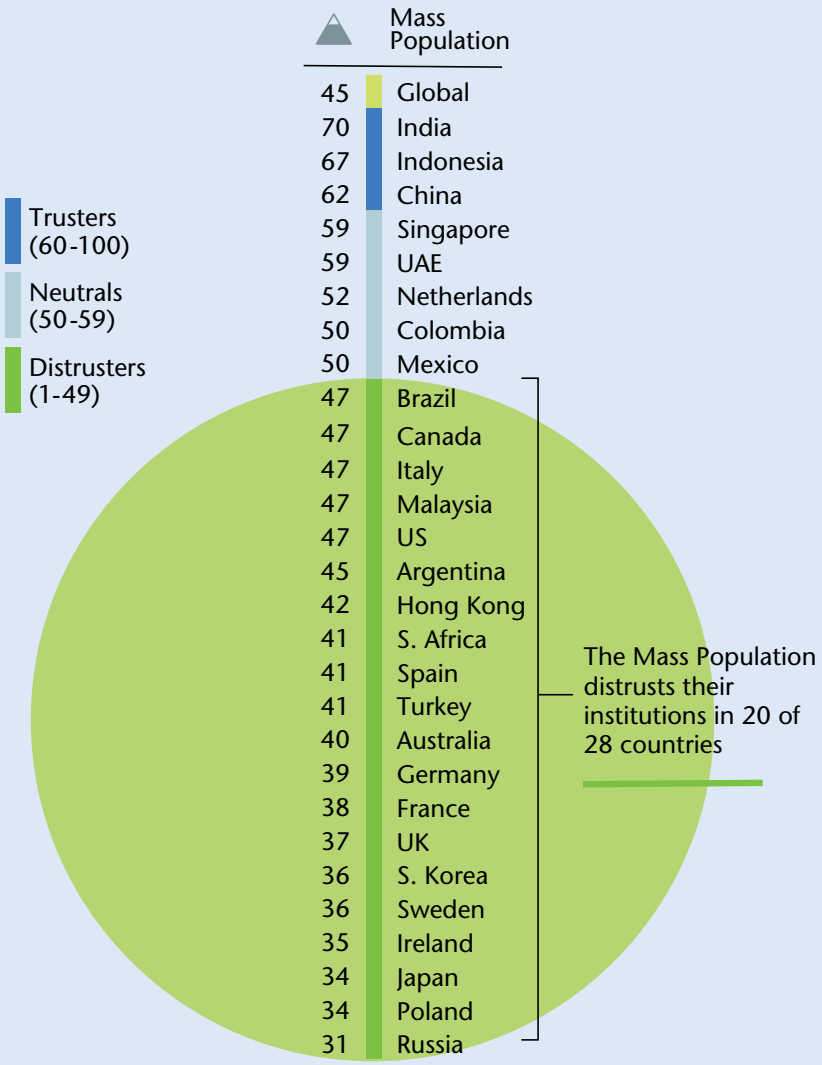


Figure 3: A world of distrust (2017)

Trust affects governing, managing and innovating, and, distrust is growing: in 20 of the 28 countries the Edelman Trust Barometer surveys, less than 50% of the general population expresses trust in the core institutions of government, business, media and NGOs. Trade displacing jobs, technology displacing jobs, short-termism displacing long term investing, lower long term growth, inequality displacing opportunity—are all elements of the loss in trust.



(Dis)trust factoids

59% of the general population in Western countries trusts a search engine more than traditional media

Trust in government globally has fallen to 41%

Only 37% of the general population globally trusts corporate CEOs

"Trust inequality" between informed public and general population is over 20 percentage points in the US, UK and France

Source: 2017 Edelman Trust Barometer, Global Report

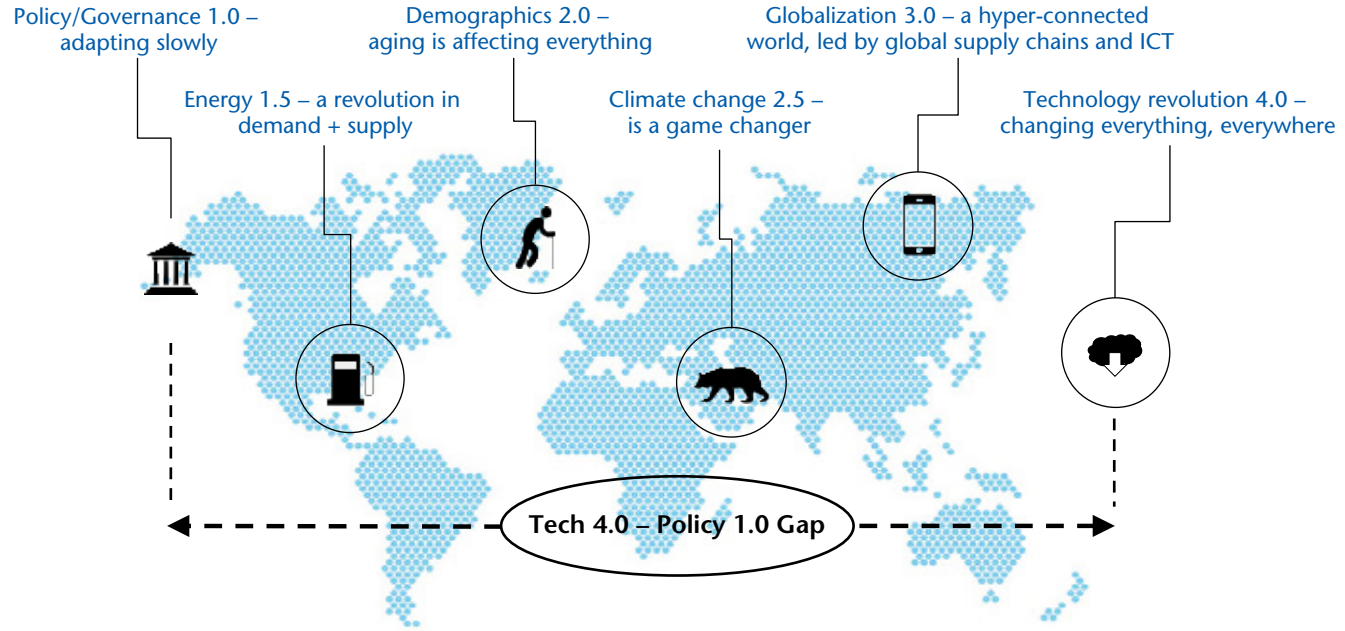
tion. Recognizing the importance of early customers to start-ups, the budget opened up federal procurement to innovative SMEs, and hopefully the provinces will quickly follow suit. Expanding access to risk capital through BDC's "VCAP 2.0" and the financial institutions-led "business growth fund" will help respond to the substantial scaling up challenge that Canadian start-ups face, as does promised assistance to access global markets and supply chains. But we still rely too much on tax-based assistance to innovation, something future budgets should tackle, and the absence of a "Canadian DARPA" (Defence Advanced Research Agency), which has been so successful in the US and elsewhere in developing dual-use advanced technologies that the private sector can commercialize.

And fourth, the importance of a culture of innovation to economic success cannot be underestimated. We need to encourage curiosity in our education systems; conformity seldom stimulates innovation. We need to emphasize cross-discipline interactions; the sharing and diffusing of diverse ideas cultivate innovation. We need to incent collaboration; innovation is a team sport not a solitary endeavour. We need to celebrate successful innovators; recognition by peers and community is both a powerful reward and an effective incentive to others to follow suit—something the Governor General, the Right Honourable David Johnston, has long been a leader in advocating and doing.

But the other side of the innovation coin is the inevitable technological job replacement and displacement. New jobs emerge, old jobs disappear. The nature of work and jobs change. This is not new; it is the history and future of disruptive innovations—from the steam engine, electricity, automobile, and computers to digitization, telecommunications and the internet more recently and to future innovations not yet clear. The policy, economic and social problem is to

Figure 4: Disruptive trends are creating policy gaps

Disruptive global trends are reshaping our world. One consequence: the status quo is not a strategy for future success, anywhere. A second consequence: a large capacity gap has emerged between a world of "Technology 4.0" and "Policy 1.0".



match educational training with future job requirements and to meet the reskilling and retraining needs of workers and firms as technological shifts occur. This challenge, while always present, is greatly magnified in eras of disruption.

The duality of the political challenge is very real. The slowdown in growth has broadly and deeply impacted most Western economies and societies in the last fifteen years, exacerbated by the global financial crisis, limiting real wage gains and constraining the capacity of government finances to provide public goods.

At the same time, workers made redundant by robots and global supply chains are embracing populist tenets ranging from nationalism to protectionism to distrust of "others" and anti-establishment resentment. As history teaches us, bouts of fervent populism seldom end well, so we have to get ahead of the disruption curve in our policy thinking about both restoring growth and responding to technological job displacement.

Importantly, the capacity to act depends on trust, the soft infrastructure that supports both governing and managing. Here, the reality is not good. According to the Edelman Global Trust Barometer (Figure 3), in 20 of the 28 countries they monitor, a minority of the general population now expresses trust in the core institutions of government, business and the media. Overall, trust in government has fallen to 41 per cent and trust in mainstream media is about the same—about 60 per cent of the general population in western countries have more confidence in a search engine than traditional media for news. Disconcertingly, we appear to have entered a "post-truth world" and this can only hamper efforts to deal simultaneously with growth and displacement.

In all this, any real precision on the scope of the possible impacts and the feasibility set of policy responses is still largely unknown (Figure 4). But selective opting in and out of these technological changes and disruptive innovations is not a choice; they are global trends.

Going forward, a smart growth strategy should deal with both rebuilding growth and reducing exclusion. What will be the nature of the new jobs that technological change will create and the skills required for them? How do economies and societies handle disruption on this massive scale? What are the possible models to reskill and retrain this magnitude of the workforce—will countries need a repeat of the GI Bill—an AI (Artificial Intelligence) Bill for the 21st century to facilitate such a reskilling? How are the costs of adjustment and the benefits of this technological change going to be shared? These questions are indicative of the risks and unknowns inherent today, and form the basis for developing an inclusive growth strategy. P

Contributing writer Kevin Lynch is Vice Chair of the Bank of Montreal and former Clerk of the Privy Council and Secretary to the Cabinet.

Linamar CEO Linda Hasenfratz sits to the right Prime Minister Justin Trudeau, with Ivanka Trump to his left as President Trump hosts the first meeting of the Canada-United States Council for Advancement of Women Entrepreneurs and Business Leaders at the Cabinet Room of the White House on February 13. *Adam Scotti photo*

Being Ready for Anything,
OR HOW TO INNOVATE AMID PERPETUAL CHANGE

Linda Hasenfratz

In 2002, Linda Hasenfratz took over as CEO of Linamar, the auto parts company her father, Frank, founded in 1966. Since then, she has built the business into the second-largest auto parts manufacturer in Canada and the largest employer in Guelph, Ontario, with 9,000 workers. In 2014, she was the first woman named EY Entrepreneur of the Year for Canada and, she is a member of the Canada-United States Council for Advancement of Women Entrepreneurs and Business Leaders. And, she knows a little something about innovation.

At Linamar, we have long believed our prosperity as a company is based on our competitiveness—our ability to capture opportunity and the culture we have created and nurtured. Competitiveness is 100 per cent driven by our ability to innovate and our ability to run efficient operations.

Innovation is absolutely critical to success. Customers come to you if you have the products that solve their problems, products they want, and innovation is how you achieve that.

Innovation shows up in a lot of places in companies; in the products we design, in the processes we develop to make those products, and in the development of new materials to enhance those product designs or processes. And, of course, in the continuous improvement of all of that, every single day.

Our governments can and should help companies make these investments, through strong Scientific Research and Experimental Development (SRED) tax credits and grants to support innovation investments. Our governments also play a key role in efficient operations by keeping regulations and taxes to a minimum as well.

Innovation is clearly linked to any company's strategy.

The relationship between innovation and strategy begins with identifying your customers' needs. What are their biggest problems? What are their most significant costs? What do they or their customers like least about their products?

"The relationship between innovation and strategy begins with identifying your customers' needs. What are their biggest problems? What are their most significant costs? What do they or their customers like least about their products?"

The automotive industry is a great example to look at.

The face of the automotive market is changing, which makes this an exciting time to be bringing innovation to the table to gain market share in a shifting landscape.

The clear imperative for our industry is around reducing emissions and improving fuel economy.

That means finding ways to reduce weight, diminish noise and enhance product design in existing internal combustion engine (ICE) vehicles and developing new exciting products for hybrid and electric vehicle platforms.

So, how will that play out?

Well, we think in multiple stages.

In the short term, it's all about improving the ICE. There is huge potential for doing so, as detailed above. The emissions of an ICE are 30 times lower today than they were 25 years ago—enormous progress has been and will continue to be made. At Linamar we have come up with innumerable innovations to drive light-weighting; one example is a hydroformed camshaft—manufactured through using highly pressurized liquid to displace tubular material around a lobe to dramatically cut the weight of the cam by up to 60 per cent while maintaining strength compared to traditional cast cams.

Hybrid vehicles will be critical in the medium term. They are an important bridging technology to the battery electric (BEV) vehicle as technology challenges such as range, infrastructure and charge time are solved. We have many initiatives underway for hybrid vehicles in both the ICE systems and the electric systems as well as in the driveline area and body. For example, we have developed an electronically actuated axle that creates better drivability in the vehicle while turning any architecture into a hybrid. It can also be used in BEV vehicles. Our unique disconnect systems disengage the AWD system when road conditions are good through a Self-Energizing Electro-Magnetic Disconnect Actuator which will also re-engage the system when slip conditions are detected. This eliminates the parasitic losses of all that spinning apparatus using fuel when it is not needed.

For BEV, our opportunities lie in the noted driveline systems as well as in elements of the electric motor system, again bringing new lightweight materials and optimized casting processes to bear to create better products in the electric system. Multi-speed gearboxes are also a key opportunity we are developing. Another is replacing heavy stamped steel assemblies in the body with aluminum castings through new technologies we have developed for casting high strength aluminum yielding 45-50 per cent weight savings.

As we move to an autonomous world where vehicles can communicate with each other, there are exciting innovations we can bring to the table specific to the AWD system to deliver important information from one vehicle to those traveling behind it regarding road conditions to improve safety of operations. Our pilot tests show we can engage disconnect systems for the AWD system much faster using vehicle-to-vehicle (V2V) communication than could ever be done by a human—our response times just aren't as quick as sophisticated sensors at sending those messages.

"As we move to an autonomous world where vehicles can communicate with each other, there are exciting innovations we can bring to the table specific to the AWD system to deliver important information from one vehicle to those traveling behind it regarding road conditions to improve safety of operations."

When will all of this happen? We don't know for sure, some predict many years away, others think these evolutions will happen sooner. We can't predict the future. We can make an informed guess at what might happen based on

our knowledge of our industries and technology.

What we should *not* do is try to pick a future and bet on that happening.

What we *do* need to do is develop a strategy that will see us successful in as many of those different futures as possible. That is exactly what we are doing for our automotive business—developing products for each type of vehicle propulsion so we have great opportunity in each. Then it doesn't matter to us *when* a shift happens or even *if* it does. We have the product strategy for any future of propulsion. That's business savvy innovation.

I would like to come back to the idea of focusing on your customers' needs as you develop your innovation strategy. You can't innovate for innovation's sake alone. There must be a customer who wants that product and values it.

A good example are the concepts of car sharing and ride hailing. Some people think that in the future no one will own a vehicle. That may very well be true for a typical urban dweller who just needs to get to work and back each day but may not be for many others.

As we contemplate these topics we need to remain grounded in understanding all consumer needs. Most of the people making predictions about future vehicle ownership do not represent the full demographic of the market. To speculate that every suburban household or smaller city/town resident will no longer own a car is likely unrealistic.

Suburban drivers have different needs for their vehicles. Drivers with kids go from school to dance to soccer, then home, with all required bits for that stored in the car. They go grocery shopping and get large orders, sometimes at multiple stores. They run errands with children in car seats, making multiple stops. To call a ride hailing service to do all that, carrying all those packages and car seats and other bits along every step of the way isn't very practical.

In cities, today's millennials expect instantaneous response and service. Will these people who want to rapidly get from A to B be happy to stop and pick 2 or 3 other people up along their route to B? Will the high-energy urban business person be happy to share a vehicle with someone on their commute to work when they need to make a phone call or work on a confidential project?

We can all speculate about a future that technology will enable but if the customer doesn't want it, it won't happen, or not to the extent that you might envision. Innovation, like every other aspect of a successful business strategy, always begins with the customer and what they want, not what technology can do. It is where the two intersect that we find true transformative change. P

Linda Hasenfratz is CEO of Linamar Corporation, Chair of the Business Council of Canada and a member of the Canada-United States Council for Advancement of Women Entrepreneurs and Business Leaders.

Une culture d'innovation industrielle

Sean Finn

Bien que l'innovation soit devenue une obsession pour les écoles de commerce et les gourous de la gestion de partout dans le monde, ce concept est souvent associé aux jeunes entreprises du milieu des technologies et aux génies méconnus qui travaillent dans les garages et les cafés de Cupertino ou de Kitchener. Pourtant, les entreprises traditionnelles font face à leurs propres défis en matière d'innovation, et certaines d'entre elles connaissent beaucoup de succès. Sean Finn, vice-président exécutif au CN, explique comment l'une de ces entreprises traditionnelles se distingue.

L'nnovation, dans les secteurs public et privé, repose avant tout sur la capacité de proposer des idées neuves et de les transformer en nouveaux produits et services.

Pour créer des grappes et des partenariats de calibre international—les supergrappes qui sont des aimants pour les idées, le talent et les capitaux—le Canada doit disposer de solides relations avec les chaînes d'approvisionnement nord-américaines et mondiales.

Lorsque l'on parle d'entreprises novatrices, les Canadiens pensent souvent immédiatement à des entreprises spécialisées dans la technologie. Cependant, à titre d'ancien président de la Fédération des chambres de commerce du Québec, puis du conseil de la Chambre de commerce du Canada je sais qu'il existe d'innombrables exemples d'entreprises innovatrices dans des secteurs traditionnels. Vous trouverez difficilement plus traditionnel que le secteur ferroviaire. Le premier véritable chemin de fer au Canada remonte à 1836 lorsque John Molson et d'autres gens d'affaires de Montréal ont financé La Compagnie du chemin de fer de Montréal et de Champlain. Depuis ces humbles débuts, plusieurs générations de cheminots ont eu à cœur l'innovation.

À la fin des années 1980, le Canadien National était une institution canadienne emblématique fière de son histoire, dont le logo était l'un des plus réputés dans le monde. La société d'État était cependant un chemin de fer nord américain qui accusait du retard en ce qui a trait à la productivité et à la rentabilité. Le gouvernement du premier ministre Brian Mulroney savait qu'il devait agir, le CN s'est donc départi d'actifs non essentiels, dont sa chaîne hôtelière. Le premier ministre Mulroney a aussi insufflé un nouveau dynamisme à la haute direction de l'entreprise en y nommant une personne de l'extérieur, l'ancien greffier du Conseil privé Paul Tellier. C'est en 1995 que le gouvernement du premier ministre Jean Chrétien a privatisé le CN. La privatisation, dirigée par le ministre des Transports Doug Young, était une mesure audacieuse pour le gouvernement et a constitué un tournant décisif : le début d'une culture de l'innovation au CN.

Depuis 1995, le CN s'est transformé en profondeur. Dans le cadre d'une déréglementation graduelle, le CN a fait d'importants investissements qui ont permis de passer d'un réseau majoritairement canadien à un réseau véritablement nord-américain. Aujourd'hui, le CN couvre le Canada, de Vancouver et Prince Rupert, sur la côte ouest, à Halifax, sur la côte est. Le réseau du CN couvre également le centre des États-Unis, s'étendant de Chicago vers le sud où il longe le Mississippi jusqu'à La Nouvelle-Orléans, en Louisiane, et Mobile, en Alabama, sur la côte du golfe du Mexique. Le CN est le seul chemin de fer transcontinental de l'Amérique du Nord qui relie ces trois côtes. Il a maintenant accès à près de 75 % des consommateurs américains et dessert tous les grands marchés canadiens.

Le CN a amélioré son ratio d'exploitation—une mesure clé de l'efficacité—le faisant passer de la tranche supérieure des 80 % en 1994 à la tranche médiane des 50 % en 2016. Et la capitalisation boursière du CN, qui était de 2,5 G$ en 1995, a augmenté pour atteindre plus de 70 G$ à l'heure actuelle.

La concurrence pour les idées, le talent et les capitaux est d'envergure mondiale, alors le Canada a tout intérêt à se concentrer sur les domaines dans lesquels il joue déjà, ou pourrait jouer, un rôle d'incubateur de l'innovation. Il existe déjà au Canada des chefs de file novateurs de classe mondiale dans le secteur du transport ferroviaire de marchandises. Ces entreprises jouent un rôle essentiel pour faciliter le commerce et les exportations canadiennes.

À l'heure actuelle, le CN est en pleine transformation culturelle. Nous demandons à tous les membres du personnel de passer d'une logique articulée autour du secteur ferroviaire à une logique axée sur la chaîne d'approvisionnement. Nous les incitons à se concentrer simultanément sur deux lignes de pensée. La première concerne nos activités quotidiennes, soit acheminer les marchandises de nos clients de façon sûre et efficace du point A au point B. La deuxième est orientée vers l'avenir :il s'agit de trouver des des façons de faire encore mieux. En un mot : innover.

L'engagement du CN à l'égard de l'innovation est perceptible partout au sein de l'entreprise : dans notre attention constante à la sécurité, dans notre détermination de collaborer avec nos clients et d'assurer la durabilité ainsi que dans notre approche d'engagement auprès des intervenants.

« Aujourd'hui le CN couvre le Canada, de Vancouver et Prince Rupert, sur la côte ouest, à Halifax, sur la côte est. Le réseau du CN couvre également le centre des États-Unis, s'étendant de Chicago vers le sud où il longe le Mississipi jusqu'à la Nouvelle-Orléans, en Louisiane, et Mobile, en Alabama, sur la côte du golfe du Mexique. Le CN est le seul chemin de fer transcontinental qui relie ces trois côtes. »

Le CN, le plus important chemin de fer en Amérique du Nord, est une entreprise traditionnelle qui relève le défi de l'innovation. *Source : CN*

Il s'agit d'offrir un service supérieur et sûr moyennant un faible coût marginal. Nous y parvenons en comprenant l'ensemble des besoins de nos clients, en partageant des données avec les partenaires de la chaîne d'approvisionnement et en adaptant nos activités d'exploitation pour satisfaire leurs besoins efficacement.

L'innovation suscite des améliorations en matière de sécurité au CN. Nous misons sur des idées novatrices pour faire progresser l'analyse prévisionnelle et améliorer la sécurité en tirant parti de l'un de nos principaux atouts : le système avant-gardiste de détection en voie du CN et les autres outils de détection et d'inspection. Le CN recueille des données en temps réel à partir de ses nombreux détecteurs de défauts pour permettre à son personnel de réparer les voies avant qu'un incident ne se produise. En tenant compte des nombreuses données historiques, le CN élabore aussi des indicateurs de l'état des rails, des traverses et des autres composantes de la voie et permet le remplacement des actifs appropriés au moment opportun. L'analyse des données marque le début d'une ère nouvelle pour la sécurité ferroviaire et permettra de mieux comprendre l'état général et le cycle de vie de l'infrastructure de la voie et des wagons.

Le progrès que nous avons réalisé sur le plan du service offert à nos clients du secteur céréalier peut servir d'exemple de travail de collaboration avec les clients. Cette année, malgré des conditions hivernales difficiles, nous avons obtenu d'excellents résultats, et nombre de nos indicateurs clés de l'exploitation surpassent des records.

Une chaîne d'approvisionnement céréalière hautement performante exige une solide collaboration de bout en bout. Le CN favorise une communication ouverte avec tous ses intervenants : agriculteurs, exploitants de silos, ports, fournisseurs de wagons et gouvernements. Par des interactions quotidiennes et hebdomadaires, les parties tentent de comprendre et d'optimiser la performance de la

chaîne d'approvisionnement en partageant de l'information, notamment sur l'approvisionnement en wagons-trémies et en conteneurs, la planification du chargement des navires et la gestion des pipelines, pour assurer une exploitation portuaire sans heurt.

Le CN innove sans cesse pour améliorer l'ensemble de la chaîne d'approvisionnement. Nous avons fait l'acquisition de nouvelles locomotives capables d'acheminer plus de wagons céréaliers avec moins de carburant. Ces locomotives fonctionnent aussi en traction répartie, ce qui nous permet de faire circuler des trains plus longs par temps froid, alors que l'on devrait normalement les raccourcir en raison d'une baisse de la pression d'air dans les freins.

Les clients du secteur céréalier continuent d'investir dans le réseau du CN. Les exploitants de silos modernisent leurs installations pour accroître les débits. Les silos des terminaux portuaires ont accru leur capacité, et de nouvelles installations permettent le déchargement plus rapide des trains-blocs et le chargement plus efficace des navires.

À titre de chef de file du secteur ferroviaire nord-américain, le CN, joue un rôle important et doit assumer une part de responsabilité quant au soutien les pratiques écologiques et la prospérité économique. Le transport par train est de quatre à six fois plus écoénergétique que le transport par camion et génère 75 % moins de gaz à effet de serre pour un volume équivalent de marchandises. Un train à lui seul peut diminuer de 280 camions le nombre de véhicules sur nos routes. Afin de réduire son bilan carbone, le CN a tiré parti de son modèle d'affaires unique en exigeant moins d'actifs, en acquérant des locomotives économes en carburant et en investissant dans des technologies de pointe.

Au cours des dix dernières années, l'efficacité énergétique du CN a augmenté d'environ 20 %, et notre consommation de carburant actuelle est inférieure d'environ 15 % à celle de la moyenne du secteur.

Les responsables des politiques peuvent contribuer au virage écologique du secteur canadien du transport des marchandises en examinant le programme PREGTI du Québec, qui vise à réduire les émissions en faisant la promotion des modes de transport ferroviaire et maritime. Au CN, nous, avons déjà réussi à tirer parti de ce programme afin d'inciter des clients au Québec à passer du transport routier au transport ferroviaire. Le chemin de fer peut jouer un rôle encore plus important dans l'l'atteinte des objectifs du Canada en matière de changements climatiques. Par l'entremise de nos efforts d'engagement auprès des intervenants, nous encourageons activement les autres provinces à adopter cette politique écologique avant gardiste.

> ***« L'innovation suscite des améliorations en matière de sécurité au CN. Nous misons sur des idées novatrices pour faire progresser l'analyse prévisionnelle et améliorer notre sécurité. »***

Après la tragédie à Lac-Mégantic, en 2013, la conscience sociale des chemins de fer, y compris ceux qui n'étaient pas directement impliqués dans l'incident, a été mise en doute. Le secteur ne pouvait donc plus maintenir le statu quo dans son approche d'engagement auprès des collectivités. C,est ainsi qu'au CN, nous avons lancé le programme Engagement structuré auprès des collectivités. Aujourd'hui, nous entretenons des contacts réguliers avec un réseau unique d'élus municipaux, provinciaux et fédéraux, les Premières Nations, les premiers intervenants et les chambres de commerce dans huit provinces. Nos contacts directs avec les intervenants permettent à ceux-ci de mieux comprendre le rôle que joue le CN dans les économies nationale et locale ainsi que son objectif : celui d'être le chemin de fer le plus sécuritaire en Amérique du Nord. Au CN, , nous profitons d'un avantage tout aussi important : celui de mieux connaître les enjeux locaux ainsi que les possibilités d'expansion commerciale. Bien que nous ne soyons pas toujours d'accord les uns avec les autres, nous maintenons les voies de communication ouvertes et nous efforçons d'être de bons voisins qui veillent à la sécurité de ceux qui les entourent.

Au CN, l'innovation fait désormais partie de notre ADN en ce qui concerne la sécurité, le service à la clientèle, la durabilité environnementale et l'engagement auprès des intervenants. Notre mentalité d'innovation nous incite à nous transformer pour dépasser notre titre actuel de meilleur chemin de fer de l'Amérique du Nord afin de devenir le chef de file nord américain en matière de transport et de logistique.

Nous croyons fermement que le Canada peut devenir un centre mondial d'innovation et continuerons à faire notre part. Les membres de notre personnel ont à cœur l'innovation et continueront à proposer des idées visant à améliorer la productivité et la compétitivité du CN, de nos clients et, ultimement, du Canada.

Faire du Canada un centre mondial d'innovation est à notre portée. Pour citer Perrin Beatty, président et chef de la direction de la Chambre de commerce du Canada, le Canada jouit « d'avantages importants, y compris notre riche héritage de ressources, les compétences de nos citoyens et notre proximité avec le marché le plus important au monde. Avec de l'imagination et du travail ardu, nous pouvons transformer ces avantages en succès d'affaires qui bénéficieront à toutes les familles canadiennes. » P

Sean Finn est vice-président exécutif Services corporatifs et chef de la direction des Affaires juridiques au CN et ancien président du conseil de la Chambre du commerce du Canada ainsi que de la Fédération des chambres de commerce du Québec. sean.finn@cn.ca

ABB's new Canadian headquarters in Montreal is a hub of intelligence and electric R&D. *ABB photo*

Industry: Our Hidden Digital Champion

Nathalie Pilon

As Canadian industries adapt to the Fourth Industrial Revolution, digitization is transforming every aspect of our lives, from interpersonal communication to culture to politics. ABB, a Swiss-based multinational that works with utility, industry, transportation and infrastructure clients transitioning to renewable energy, is on the leading edge of this revolution. ABB Canada President Nathalie Pilon provides her perspective on innovation from the front lines.

In the digital sphere, community is instant. We are living through an information technology revolution set against a context of sustainability, energy concerns and the Fourth Industrial Revolution—the meshing of the digital world of people and machines as internet meets production. This is our ever-evolving workspace, where technology accelerates growth and innovation like never before and more than ever we aim to create a Canada whose people,

technology and innovation ecosystem can compete on the global scale. Never has there been a better time for leaders to adopt sustainable business practices by taking ownership of the digital space and becoming connectors, and for the federal government to support our digital economy and its players.

As a Canadian with 20 years of experience in the world of manufacturing, I have a particular interest in our industrial sectors. Our workforce sees the products of digital innovation everywhere. 3-d printing has revolutionized how we produce plastic components. Additive manufacturing will take the printing of steel or any metal products to unprecedented levels. Already we've seen the electrification of transport, adoption of cloud technologies, the whir of Industry 4.0. Innovation continues to grow as we unlock the digital realm.

In fact, McKinsey Global Institute tells us that the Fourth Industrial Revolution's internet of things, services, and people represents an $11.1 trillion business opportunity within the next eight years—more than 10 percent of global GDP. On top of that, we are learning that digital allows full transparency and encourages efficiency, productivity and knowledge.

This is good news for industries that have already incorporated software and automation into their operations and processes, but despite digitization's deep penetration in the media, retail, and high-tech sectors, less than 40 per cent of global industry in general is currently digitized, according to McKinsey. Manufacturing needs to join the digital world, and this transition deserves attention from our government as it progresses. Supporting development, modernization, and digitalization in industry will help to secure Canada's future as a valuable player on the digital field.

After all, Canada has what it takes to become a digital champion, and our industrial sectors are overflowing with untapped potential. Companies like my own can be hidden champions. At ABB, our 70 million connected devices, embedded with software, have a presence in more than 100 countries. In Canada, we employ 4,000 Canadian experts in power and automation in more than 50 locations coast to coast, leading in our technology supply to utilities, to industries and for infrastructure. From high voltage direct current systems for Hydro Quebec or the Maritime Link, which allow the transmission of electricity over thousands of kilometres with little energy loss, to energy efficient mining hoists in Saskatchewan for Potash, or electrification systems that power intelligence and control for Oil and Gas pipelines such as for our customers TransCanada and Suncor among others, or robots and automation for manufacturing that today are instrumental to maintaining and re-shoring jobs for our industries in Canada. We are embracing the digital shift and have built a solutions and services platform—called ABB ability™—with Microsoft's azure cloud and IBM's Watson analytics as key components. Digital innovation is helping us to move more securely into a future that includes the electrification of public transport, remote performance diagnostics for ships and oil rigs, and a complete transformation of industry as we know it.

> *"McKinsey Global Institute tells us that the Fourth Industrial Revolution's internet of things, services, and people represents an $11.1 trillion business opportunity within the next eight years—more than 10 percent of global GDP."*

With so much connection potential in industrial installed bases, Canada's next adventure is to consider how our industries can be supported in complete digital transformations —reinventing fundamental value propositions, business models, business processes, technologies, and the human element inside a context or network of intelligently planned infrastructure that supports energy efficiency, zero waste, and reduced emissions. With our geography of nearly 10 million square kilometers filled with valuable natural resources, 36 million people and the world's longest coastline, it is essential to have a national strategy that supports our industrial players to compete with digital and an export infrastructure that is energy efficient and intelligent.

> *"With so much connection potential in industrial installed bases, Canada's next adventure is to consider how our industries can be supported in complete digital transformations."*

Furthermore, billions of dollars of investment are required to update and modernize our energy infrastructure simply to maintain current levels of reliability and safety performance, without even taking into consideration the increased investments required to integrate a future energy world that incorporates LEED buildings, new infrastructure for vehicle to grid demand supply, EV charging networks for cars or larger flash charging systems for electrical buses and trains. This goes to the heart of creating a sustainable and competitive economy for Canada.

The transformation is a strategy for building our industries as important pillars in a planned infrastructure

Clean tech such as solar electricity panels is part of "the whir of Industry 4.0", now moving into the digital revolution, writes ABB Canada President Nathalie Pilon. *ABB photo*

that focuses on delivery, transport and export, with information from rapidly accelerating progress in open-source software, sensing technologies, big data, artificial intelligence, automation, machine learning, expert systems, and communications.

The technological innovations that have been changing our lives as consumers since the beginning of this century are now being applied to the industrial space. As entire industries are transformed, it is important for the federal government to support our economy and its players on policy and to support innovation in industrial work spaces. Leaving the road open for innovation in the industrial sectors and supporting this ongoing advancement will help us to step confidently into the future.

The changes we're facing are, quite simply, unlike anything we have come across before: in the types of products we create, the services we offer, the value we deliver, the nature of the new competitive advantage we will seek, the engagement models with customers, and—perhaps most importantly of all—the metrics and perspectives by which our customers view this challenge as a pass/fail test.

If we embrace this digital future intensely and strategically and view it through the lens of what customers want and need to succeed in their own rapidly evolving businesses, we stand an excellent chance of leading our country into an exciting new era of innovation, growth, opportunity, and success. P

Nathalie Pilon is President of ABB Canada.

An artists's depiction of a Carbon Engineering 'air contactor slab' that would capture 100,000 tonnes of CO_2 per year and turn it back into fuels like gasoline or diesel in a process called air to fuels (A2F). *Carbon Engineering photo*

It Takes a Country: Innovating Canada's Clean Tech Future

Geoffrey Holmes and Jean-François Béland

With the exception of recent regressive measures in the United States, countries around the world are transitioning toward clean energy, creating enormous economic opportunity for innovators. One of those companies is Squamish, B.C. -based Carbon Engineering, which is capturing carbon directly from the atmosphere and turning it into fuel using technology so promising that Bill Gates is CE's largest private investor.

The Rideau Hall Foundation "gathers, aligns and catalyzes ideas, people and resources to move the Canadian spirit and our shared aspirations forward." One value that our Canadian spirit has always embodied is innovation, the importance and pace of which have never been greater. Countries around the world are increasingly moving towards clean economies that will produce and use renewable energy,

minimize waste and environmental impact, and continue to deliver better health and lifestyles for their citizens.

Meeting this challenge and making this transition will require innovation. New technologies, ideas, and methods are needed to realize this vision, and this in turn presents a great opportunity to those countries, start-ups, and even individuals that can deliver the best solutions. Canada is enhancing its strength in many of the sectors that will play a critical role in this transition—from healthcare to education to energy and resources—but there is much more to be done. Cultivating and harnessing innovation requires participation from government, the private sector and higher education. Our experience at Carbon Engineering is one example of how these sectors can work together to make progress in developing the technologies and industries of the future.

In December 2015, over 190 nations signed the COP21 agreement in Paris and committed to reducing greenhouse gas emissions and stabilize global warming below 2°C. The COP21 agreement commits nations to reducing emissions to far lower levels to avoid the worst effects and dangers of climate change. In coming decades, nations and economies must eliminate over 80 per cent of the 40 billion tonnes of CO_2 emissions currently produced from the use of fossil fuels, and we must eventually get to net zero. These deep cuts will require far more than displacing fossil power generation with renewable electricity; they will require new industrial technologies, new agricultural practices, and carbon-neutral means of powering transportation.

While the Paris Agreement was an important milestone, the largest challenges remain ahead, as countries decide how to cultivate the changes needed to meet these targets. Here in Canada, the federal and provincial governments are creating policies that incentivize clean energy and support innovation, are leveraging existing agencies that support and fund innovative start-up companies, and are enhancing funding for universities and academic institutions to lead the way on research that will produce the clean technologies of tomorrow.

> *"Since we were founded in 2009, our mission has been to develop and market technologies to capture CO_2 from atmospheric air, and use it to produce liquid transportation fuels. We do this with a method we call "Air to Fuels", or A2F for short."*

At Carbon Engineering, we're an example of a private start-up company performing technology development and commercialization. Since we were founded in 2009, our mission has been to develop and market technologies to capture CO_2 from atmospheric air, and use it to produce liquid transportation fuels. We do this with a method we call "Air to Fuels", or A2F for short. A2F involves capturing CO_2 from the air, using clean electricity to split water and make hydrogen, and then combining the two to directly synthesize liquid hydrocarbon fuels like gasoline, diesel, or jet-A.

Fuels produced this way have several advantages: they're drop-in compatible with existing engines, produce fewer particulates and less pollution than fossil fuels when they burn, and since they're made from atmospheric CO_2, when they're used they simply return their carbon to the atmosphere. Such "closed carbon cycle" fuels can help us displace the need for fossil fuels made from crude oil, and in turn cut our net carbon emissions while still powering our transportation infrastructure.

Technologies like A2F present great opportunities, but also many challenges in order to get them to work and get them into our commercial markets. A2F is a technology that will eventually have to be deployed at large scale, and in competitive energy markets, in order to help make a difference in reducing emissions. As a result, we must engineer and demonstrate this technology over many years with successive prototypes and pilot plants, all of which takes investment, talent, and innovation.

> *"Some estimates say the market for low-carbon energy and the technologies that deliver it will be worth several trillion dollars per year in coming decades. Twenty-first century, jobs, innovation, growth, and competitiveness will favour those countries and companies that lead the way on clean tech."*

These challenges apply to many clean energy technologies, and can make securing private investment in clean tech challenging. Clean energy technologies, especially those that are disruptive, can take longer or require more investment than software-based businesses before they get to market. Further, clean energy technologies that seek to reduce GHG emissions face an evolving and uncertain market landscape in terms of how emissions will be restricted, or what types of cap and trade or carbon taxation schemes will be used to push energy markets towards renewables. As a result of this uncertainty,

often called "market risk", private investors and large corporations are often hesitant to pursue disruptive clean tech concepts.

But the reward is large for companies and countries that can get it right. Some estimates say the market for low-carbon energy and the technologies that deliver it will be worth several trillion dollars per year in coming decades. Twenty-first century, jobs, innovation, growth, and competitiveness will favour those countries and companies that lead the way on clean tech.

CE's pilot scale air contactor in Squamish, B.C. This device can scrub roughly 1 tonne of CO2 per day from the air. *Carbon Engineering photo*

> ***"So far, we have been supported by BC Innovative Clean Energy Fund, Sustainable Development Technologies Canada, Climate Change and Emissions Management Corporation, the NRCan Industrial Research Assistance Program, and several others. In each case, agency support has given us the boost we needed to unlock private investment, and to achieve the next milestone on our development path."***

With challenges to investment in clean tech, but high stakes for success, Canada is fortunate to have a "support system" for companies like Carbon Engineering. At each step of the way on our trajectory—from early lab work to engineering to R&D, and now to demonstration scale—we have found agencies and programs whose support has been critical. First, Carbon Engineering was spun out of Dr. David Keith's research group at the University of Calgary. The research and work done in that group was critical in launching Carbon Engineering in the right direction. Second, over our years as a private company, we have utilized support and funding from Canada's innovation agency in order to attract and leverage private investment. This has given us more runway and the ability to hire top talent in order to reach our goals.

So far, we have been supported by BC Innovative Clean Energy Fund, Sustainable Development Technologies Canada, Climate Change and Emissions Management Corporation, the NRCan Industrial Research Assistance Program, and several others.

In each case, agency support has given us the boost we needed to unlock private investment, and to achieve the next milestone on our development path. This system, our private investors, and the hard work of our team and partners has now put us in the position where we're aiming to build a commercial-scale facility based on our A2F technology to synthesize liquid gasoline and diesel from air, water, and renewable electricity.

Our A2F facility will be the first of its kind anywhere in the world, and will give Canada a lead in an advanced fuels technology. Our vision is to harness Canada's existing depth of expertise in energy and resources and direct this towards innovative technologies like air to fuels, so that Canada becomes a leader and exporter of clean technology and know-how as other countries tackle the challenge of powering their transportation systems with clean fuels.

Now is the time for Canada to double down on clean energy technology, to take a lead in what will be the largest growth industries of the coming decades, and to continue to enhance and evolve the right set of policies, funding mechanisms, and research institutions to retain our lead in clean energy. P

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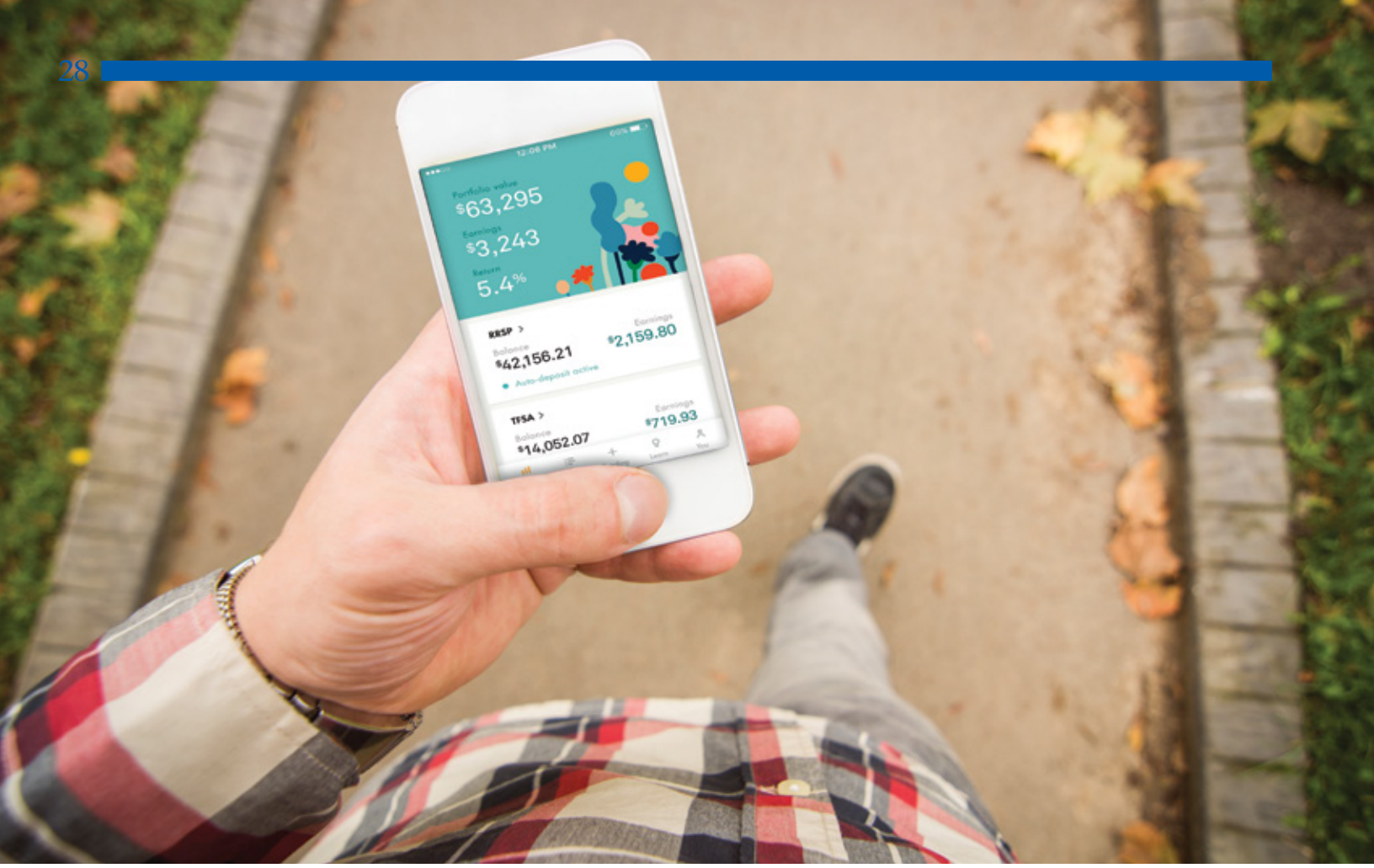

Wealthsimple Financial Inc., founded by Michael Katchen in 2014, is focused on making "investing easier for millennials. *iStock photo*

How do We Build an Innovation Economy? Support the Winners

Michael Katchen

Canada has had a tradition of supporting innovation by spreading the incentives in an effort to float all the innovation boats. Former Silicon Valley entrepreneur and Wealthsimple founder Michael Katchen, who has been called an Industry Mover by the Financial Post, *a Change Agent by* Canadian Business Magazine, *and one of Toronto's 50 most influential people by* Toronto Life, *as always, has other ideas.*

Canada has many of the right ingredients to develop innovation, we just haven't quite perfected the recipe. And one key ingredient we consistently lack is "naive ambition"—the belief in one's success, despite any evidence to the contrary. We have a culture of favouring fairness over unbridled competition—and that's not a culture that's conducive to building globally competitive companies and sectors. This attitude extends to government and institutions as well.

Canada already has some of the crucial components to build globally competitive sectors, including excellent schools producing world-class talent. But there is a lot more that can and should be done if Canada is serious about transitioning to an innovation economy. Here are some examples of how government can effectively support the type of innovation that will ensure our future as an ambitious, globally competitive economy.

As Canadians, our instinct toward fair play means we don't want anyone to miss out—the right attitude when it comes to many programs, but not the key to developing innovation. From a policy perspective, this approach results in resources being spread too thinly across sectors, geographies and organizations to ensure everyone gets a little piece of the pie. But the reality is that the best way to construct a prosperous innovation economy is on the backs of a few winners.

Building up a sector to the point where it's mature enough to compete and win globally is a resource-intensive undertaking, and it will require that we choose and invest—heavily. It's inevitable that there will be losers: sectors in which it does not make strategic sense to invest because there aren't the same odds of producing leaders. This can be a tough thing for Canadian policy makers to accept.

Canada has the opportunity to be a true global leader in a few areas right now. These include artificial intelligence and machine learning, quantum technologies and life sciences. Investing heavily in these high-potential sectors should be a priority and the government has in fact made commitments to investing in these areas. While this is the commendable, my concern is that we'll see what we often do when it comes to the allocation of resources: in an effort to be fair, resources will be divided into smaller and smaller pieces. And what starts out as a meaningful amount of funding will be spread among multiple sectors, and then across every province, and then several innovation centres within those provinces, until it's no longer a significant enough investment to really move the needle. It feels safe to not put all our eggs in one basket. But if we really want to win on a global scale, we have to place big bets.

"Canada has the opportunity to be a true global leader in a few areas right now. These include artificial intelligence and machine learning, quantum technologies and life sciences."

"The 2017 federal budget includes $950 million over five years to support the innovation "superclusters" that have the most potential to accelerate economic growth. This is the right approach, and if implemented well, could have a significant positive impact."

Canada reportedly has over 100 innovation incubators across the country, backed by various government, not-for-profit, academic and private-sector organizations. And that is simply spreading ourselves too thin. The federal government appears to recognize this: the 2017 federal budget includes $950 million over five years to support the innovation "superclusters" that have the most potential to accelerate economic growth. This is the right approach, and if implemented well, could have a significant positive impact.

According to an estimate by McKinsey & Co. based on data from leading technology clusters worldwide, building a Canadian supercluster could have enormous economic benefits: a $50-billion increase in equity value, a $17.5-billion annual increase in GDP and more than 170,000 high-quality jobs. The long-term value of an investment like this would significant to the nation.

Talent is the most important resource needed to build an innovation economy. And Canada needs to be ruthless in ensuring we can attract and retain the best talent in the world.

There are three key components to ensuring we have the best-in-class talent required for a thriving innovation economy. The first is developing the talent we have here through our educational system and initiatives such as STEM programs. The government has made it clear that this is a priority, and will be investing significantly in skills development over the next four years.

The second component is retaining the skilled talent we have. We have institutions such as the University of Waterloo and the University of Toronto producing some of the best graduates in the world, but we lose too many of them—traditionally to the United States, though the Trump administration's immigration policies may mitigate that trend. We need to be far more competitive in keeping these graduates here. International students should be able to easily transition from student visa to permanent resident, so we don't lose graduates due to immigration uncertainty.

We should also look critically at why graduates leave and how we can counter it. Often the motivation is financial—there's typically more money to be made south of the border. Tax breaks for recent grads and other financial incentives could go a long way to retaining talent in the years immediately after graduation, which

are key—if we don't keep them then, we will likely lose them forever. It may not be "fair" to implement an incentive like that, but it is competitive.

The third component to building a world-class talent pool is attracting global talent to come here. With the current political climate in the United States, Canada seems to have a unique opportunity to attract the top minds to come here and work on the most interesting problems of our time. It's imperative we don't squander this opportunity. Canada already has a brand that is well-known around the world. The livability of our cities, quality of our education systems and inclusiveness of our society are lauded around the world. We need to leverage this brand to market Canada internationally.

Supporting the innovation that is already successful is key to building an innovation economy. This can feel counterintuitive, because it is exactly the opposite of what support typically means from a policy perspective, where extra assistance is given to those who are doing less well to bring them up to the level of those doing better. Typically support is given to the "losers," not the "winners."

"Canada already has a brand that is well-known around the world. The livability of our cities, quality of our education systems and inclusiveness of our society are lauded around the world. We need to leverage this brand to market Canada internationally."

However, a better strategy when it comes to driving innovation is to support the organizations, companies, and entrepreneurs who are already succeeding, and help them scale to the point where they can compete globally. It takes a lot of resources to become a global company, but these global powerhouses are what we will need to win in an innovation economy.

I moved back from Silicon Valley to found Wealthsimple in Toronto because I saw the potential that existed here—a potential already demonstrated by the success of homegrown technology companies such as Shopify and Hootsuite. There are more companies, more capital and more talent here than ever before. We are at a moment in history when the opportunity exists for Canadian innovation to thrive. There is no reason Canada shouldn't be a global leader in innovation—we just need the ambition that will allow us to win. P

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SolarShare Co-op members, investors and staff gather to celebrate the launch of the Goodmark roof-mount solar system in Toronto, Ontario. *SolarShare photo*

The Other Innovation

UNLEASHING CANADA'S CAPACITY FOR GOOD

Paul Klein and Tim Draimin

While the Trudeau government has made innovation a pillar of its economic policy, there has been no targeted focus on social innovation. Despite Canada's comparatively secure government-funded social safety net, there are gaps in our social and sustainability fabric that can best be addressed by social innovators harnessing our capacity for positive, constructive change. The authors propose a 10-point plan for social innovation.

Policy makers continue to view innovation through the lens of technology and business, but there's an important third dimension: social innovation, or how social behaviours and actions are influenced in ways that result in positive social and environmental outcomes.

Social innovation isn't new to this country—far from it. There is a legacy of made-in-Canada social innovations, including Housing First, the Registered Disability Savings Plan, the Women's Institute, Roots of Empathy and the Great Bear Rainforest Agreements. However, despite the fact that many charities, non-profits and busi-

nesses across Canada continue to put a priority on social innovation, solutions to the country's most pressing social challenges remain elusive and the costs to the country and to Canadians are simply not acceptable.

Globally, the Organisation for Economic Cooperation and Development (OECD) reports that Canada is falling in comparative mainstream innovation rankings, spending less on innovation in 2012 than in 2004. "Only 2.2 per cent of our firms even engage in innovation," said leading innovation researcher and Munk Chair of Innovation Studies Dan Breznitz. And, despite the fact that in 2016 the Economist Intelligence Unit identified Canada as the third best country in the world for social innovation, our social sector has been locked out of the innovation agenda and remains one of the least supported sectors in terms of innovation incentives and access to R&D infrastructure, capacity and capital.

With the OECD reporting that Canada's social spending exceeded $300 billion in 2015, there is a direct economic case for social innovations that tackle root causes of social problems and deliver economic savings aligned to social or environmental well-being. The current and projected costs to the public purse are enormous and maintaining the status quo isn't an option. Too many Canadians don't have access to the medications they need or to dental care, real progress on climate change is far from where it needs to be and housing has become unaffordable. Indigenous people face even more challenges, including lack of clean drinking water, low levels of education and employment and lack of access to healthy food.

In the year of Canada's 150th anniversary, we need to ensure that Canadian businesses, charities and non-profits have what they need to deliver a better quality of life for everyone in the country. Meaningful social change has become a public priority—especially among millennials. According to the 2016 Cone Communications Millennial Employee Engagement Study, millennials consider a company's social and environmental commitments when deciding where to work (76 per cent), won't take a job from a company that doesn't have strong corporate social responsibility (CSR) practices (64 per cent) and want their employer to provide support and resources for them to make positive social and environmental changes at home (83 per cent).

"With the OECD reporting that Canada's social spending exceeded $300 billion in 2015, there is a direct economic case for social innovations that tackle root causes of social problems and deliver economic savings aligned to social or environmental well-being."

The business sector has recognized the value of CSR. Great examples of Canadian leadership in this area include the Bell Canada Let's Talk program to break the silence around mental illness and the Home Depot Canada Foundation's Orange Door Project, which has made ending youth homelessness a priority.

Charitable organizations are the bedrock of vital social services needed by Canadians and many are considering new ways to achieve their mission in innovative ways. For example, Rise Asset Development provides low-interest business loans to individuals who have experienced mental health and/or addiction challenges, are interested in self-employment but are unable to secure traditional bank financing.

Some of today's most remarkable social innovation is taking place beyond CSR and charity. We're seeing promising social innovation in hybrid organizations that are tackling socio-economic problems in new ways.

Here are three examples:

1. The Rate Drop Rebate, a partnership between the government of Ontario, banks and credit unions, helps businesses grow by hiring people facing barriers to employment, including people with disabilities, newcomers to Canada and unemployed indigenous persons.
2. SolarShare, an Ontario-based co-operative that has 1,350 members, gives residents and investors the opportunity to invest in community-based solar electricity projects that offer financial, social and environmental returns.
3. HireUp helps prevent and end youth homelessness by connecting employers to youth facing severe barriers to employment. It operates as a hybrid social enterprise, with a for-profit entity that links youth to work and a nonprofit that provides upskilling. HireUp has shared more than 300 jobs at companies such as Home Depot Canada, Walmart Canada and Scotiabank with youth at more than 50 service providers nationwide.

Unleashing the potential of social innovation will be impossible without significant change from Canada's public sector. Here are 10 recommendations that we believe are necessary to improve the lives of more Canadians in a way that will be sustainable for the country.

1. Innovate innovation: Technology, business and social innovation

A comprehensive strategy that integrates technology, business and social innovation and supports incubation, market access, procurement, talent development, social financing and partnership building. This will require new policy and funding to link economic and social goals and accelerate the integration of mainstream and social innovation.

2. Make Canada's brand inclusive innovation

Establish inclusive innovation as Canada's global brand, identified as all sectors combining strengths to develop new value capable of deploying solutions to Canada's

biggest challenges in lockstep with economic objectives.

3. Update policy to unlock Canada's powerhouse of social assets

Overhaul the regulatory environment in which social good operates. Enact a set of reforms to unlock critical social assets among charities and non-profits across Canada.

i. Create an arm's-length agency to replace Canada Revenue Agency's outdated charities division as a regulator for charities and non-profits that also seeks to strengthen the sector's capabilities to deliver solutions in partnership with government and the private sector.

ii. Modernize treatment of charity/non-profit earned income to unleash the growth of non-profit social enterprises.

iii. Replace the "direction and control of funds" test for charitable grants with a "destination of funds" test to remove obstacles facing charitable activities with multi-sector, innovation partner-based arrangements.

iv. Legislate a new federal incorporation form for blended or shared-value companies, such as British Columbia's Community Contribution Companies.

v. Add social procurement to Canada's new innovation procurement policy to assist scaling existing and future evidence-based social innovations that positively transform outcomes for Canadians.

4. Accelerate "Social R&D"

Dramatically improving Canada's social performance will require the acceleration of research and development capabilities across the social sector.

i. Broaden eligibility for R&D funding and other federal support programs to include nonprofit social impact organizations.

ii. Support the development of social R&D open data infrastructure, metrics and assessment to accelerate impact as a learning sector.

iii. Expand and continuously update national well-being indices building on the Canadian Index of Wellbeing and the Social Progress Index.

iv. Support a dedicated Indigenous Innovation Demonstration Fund (IIDF).

v. Building on past programs like CURA at SSHRC and the two-year renewal of the Social Innovation Fund for colleges, provide long-term funding for the applied research capabilities of universities and colleges to strengthen knowledge building and facilitate experiential learning partnerships with community organizations and businesses.

vi. Support development of a Pro Bono Marketplace for skills-based volunteering that gives social purpose organizations access to specialized skills, tools and resources to increase their management capacity and impact.

vii. Expand resources available for Social R&D by establishing an arm's-length multi-sector and multi-department fund that aggregates, reviews, and disburses philanthropic, private and public capital for high-impact experimentation.

5. Shift government from silos to cross-sector co-creation

Break down silos and improve cross-sector collaboration by shifting from focusing innovation exclusively on building assets in-house (i.e.: each department hosts an innovation lab) to brokering partnerships with outside nonprofits and businesses for new collaborative hybrid platform supports.

6. Set 10 audacious goals for 2030

Use the just-announced Impact Canada Fund to establish 10 grand challenges for Canadian institutions and citizens to collectively solve by 2030. Align federal departments to champion and collaborate cross-departmentally and across sectors around their particular challenge.

7. Establish a multi-sector solutions finance agency

Provide financing vehicles for each stage of the social innovation lifecycle from ideation to scale including: catalytic first-loss capital, demonstration funding, social R&D, matching dollars for intermediary platforms financing performance and outcomes vehicles, and scale capital, especially aligned with the 10 grand challenges. Capital sources would include philanthropy, private equity, and public partners. Business Development Bank of Canada could be the host.

8. Create a National Inclusive Innovation Agency

Build on the experience of other national platforms like Nesta, the U.K. government's endowed foundation for innovation, establishing an endowment for an arm's-length agency to mainstream social innovation.

9. Create a National Social Innovation Council

A government-appointed advisory council tapping social innovation expertise and networks from the community and business sectors, to guide the deployment and evolution of integrating social innovation into the federal government's innovation agenda.

10. Support a national social innovation network

To successfully support the integration of social innovation into a next-generation innovation agenda, co-create a multi-city Social Impact Network to fast-track development of new collaborative hubs and partnerships for tackling complex challenges.

Canada has a unique opportunity to take up the mantle of leadership and advance social innovation as a cornerstone of Canada's Innovation Agenda. The time to act is now. We can't afford to wait. P

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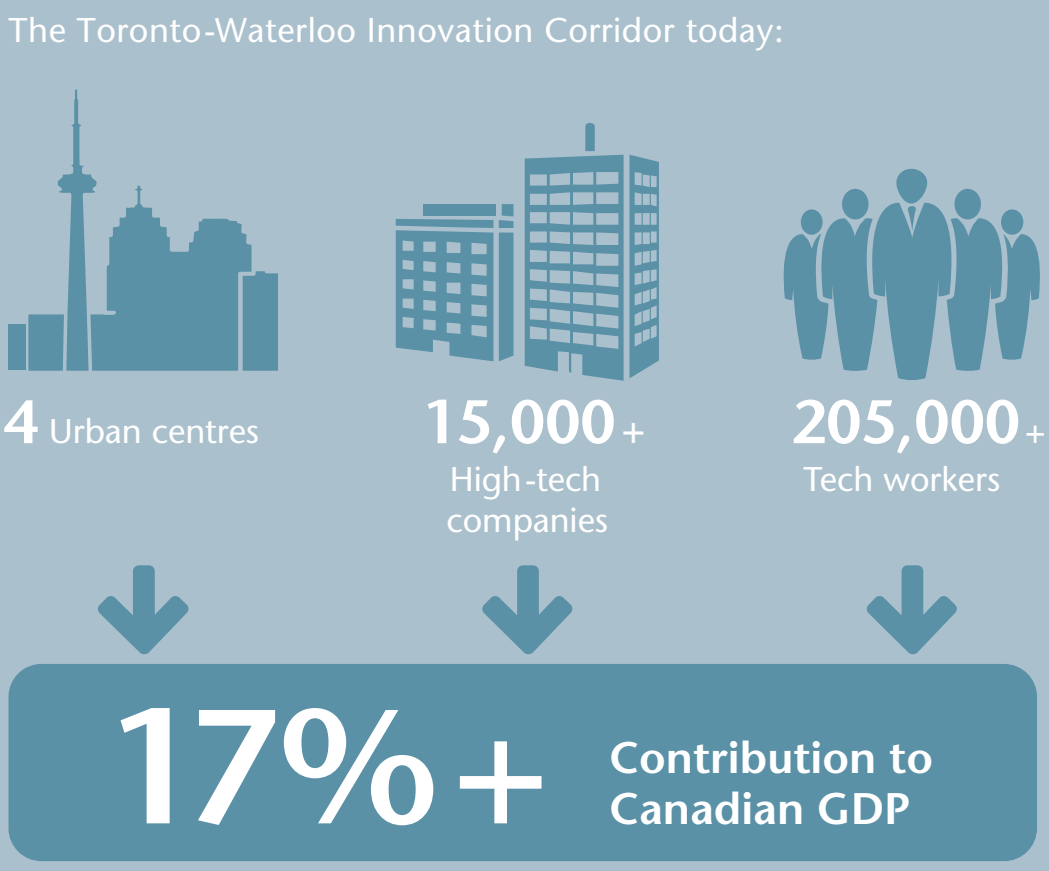

Toronto-Waterloo Corridor is now home to more tech start-ups than any other location outside Silicon Valley. Communitech is an industry-led innovation centre that supports, fosters and celebrates a community of nearly 1,000 tech companies.*"Tech North" Toronto-Waterloo Innovation Corridor initiative image*

There's no App for That: Creating a Supercluster is a Recipe

Iain Klugman

First, there was Silicon Valley. Then came London-Cambridge, Berlin, Singapore and Tel Aviv-Haifa. In Canada, Waterloo Region now has the highest density of tech start-ups outside Silicon Valley. As CEO of Communitech, a non-profit start-up incubator that offers services to more than 1,000 firms each year, Iain Klugman knows there's no such thing as a pop-up supercluster. And, it takes more than money.

As home to one of Canada's most dynamic tech communities, Waterloo Region attracts thousands of curious visitors each year, each looking to find out what's behind the incredible growth we've seen in recent years.

As they tour key locations such as the University of Waterloo, with its ever-expanding engineering facilities and the Institute for Quantum Computing; the Perimeter Institute for Theoretical Physics; and the Com-

munitech Hub, first-time visitors are invariably struck by the energy coursing through the community and the sheer volume of innovation-related activity. And repeat visitors typically note the changes they see, from the growth of our university campuses, to the cranes in the sky and new businesses downtown, to the construction of a new light rail transit system.

These changes have coincided with a surge in local entrepreneurial activity that has given Waterloo Region—with a population of just over 500,000—the highest density of tech startups outside of Silicon Valley, with an average of 440 new tech companies appearing each year for the last five years. Not surprisingly, we're often asked to share the blueprint for our vibrant and diverse innovation ecosystem, which implies that any community can simply pluck the right materials off a shelf and build their own.

Instead, we encourage people to think of it as a recipe, because if the past 20 years since Communitech was founded have taught us anything, it's this: Building a vibrant tech community is messy, unpredictable and highly dependent on the quality and availability of ingredients, and these vary from place to place.

Building a national innovation economy for Canada, then, will depend on how successful its regional innovation economies—places like the Toronto-Waterloo Corridor, Vancouver, Ottawa, Montreal and Halifax—can be at executing on their own unique recipes. That means assembling their own ingredients, experimenting continually to get the right mix and, hopefully, creating a feast of opportunity for entrepreneurs—especially for those who have moved beyond the startup stage and have the potential to achieve global scale, as companies like BlackBerry and Nortel once did.

So, what's in the recipe? Here are what we consider to be foundational ingredients for a well-functioning regional innovation economy:

"The healthiest tech ecosystems have a balanced mix of companies, from homegrown enterprises young, old, small, medium and large; hardware and software companies; and foreign multinationals. Doubling down on established tech regions that already have diversity and momentum offers the fastest route to national success."

Small, medium and large tech companies:
It might sound obvious, but if there are no technology entrepreneurs already present and building companies in a community, it's going to be incredibly difficult and take an inordinate amount of time to build an innovation economy there. The healthiest tech ecosystems have a balanced mix of companies, from homegrown enterprises young, old, small, medium and large; hardware and software companies; and foreign multinationals. Doubling down on established tech regions that already have diversity and momentum offers the fastest route to national success.

Sources of capital:
Whether it comes from local angel investors, previously successful entrepreneurs, large corporations, government funds or venture capital firms from Canada and beyond, risk capital is essential to fuel the rapid growth necessary for tech companies with demonstrably marketable and scalable products.

Strong academic institutions:
It's no secret that innovation runs on brain power. Post-secondary institutions that deliver of-the-moment instruction combined with relevant and rewarding work opportunities, such as those offered through the University of Waterloo's celebrated co-op program, are crucial suppliers of talent to regional innovation clusters.

Supportive and engaged public sector partners:
Municipal, provincial and federal governments all have critical roles to play in fostering the conditions in which innovative entrepreneurs can thrive. Useful public sector contributions include everything from financial support for fledgling tech companies to investments in innovation hubs, to streamlined immigration policies, to infrastructure projects that make communities more livable for and attractive to world-class talent. In Waterloo Region's case, the City of Kitchener's $110-million economic development investment fund has helped spark the ongoing transformation of the city's post-industrial downtown into a hive of knowledge-economy activity that includes academic institutions, the Communitech Hub, dozens of tech companies and new residential development.

Supportive and engaged private sector partners:
It really does take a village to raise a thriving tech community. Banks, law firms, accountants, intellectual property experts and insurance companies all have valuable contributions to make to the growth of local innovation economies, and all should be able to recognize they have a vested interest in doing so.

Physical spaces to bring people together:
As much as the internet has enabled people to work and build companies from wherever they happen to be, humans are social animals who are at their best when they can gather in a place where they feel they belong. Not every community has an old tannery waiting to be turned into a tech hub, but when we opened ours in 2010, we had no idea how quickly it would grow

and evolve into the centre of gravity that it has since become. Whether it's an old factory, a church basement or a hotel banquet hall, physical spaces and lively events matter when trying to build a strong sense of community in an innovation economy.

Great amenities:
The smartest people in the world can work wherever they want. If we want to attract them to Canada, we need to make sure our communities not only offer challenging work with great employers, but efficient, modern public transit, easy connectivity to international airports, abundant arts, cultural, culinary and recreational offerings, affordable housing and diverse employment opportunities beyond tech.

> *"Like a pinch of saffron in a fragrant biryani, this ingredient is hard to find and worth more than its weight in gold, but, as we've learned in Waterloo, there is no substitute for a strong, homegrown culture of collaboration across all sectors of the local economy."*

Collaborative culture:
Like a pinch of saffron in a fragrant biryani, this ingredient is hard to find and worth more than its weight in gold, but, as we've learned in Waterloo, there is no substitute for a strong, homegrown culture of collaboration across all sectors of the local economy. The only reason Communitech exists is that, 20 years ago, a group of tech entrepreneurs set aside competing local agendas and recognized they could all achieve more for themselves, their companies and the region by pulling together. It wasn't long before the rest of the community rallied around the cause, and today, few would dispute the results that effort has produced, not just for Waterloo Region, but for Canada.

Of course, executing on a great recipe also depends on clear understanding of who the chef is—and in this case, it can only be one person: the entrepreneur. As important as the rest of us might be in supporting the process, it is essential that we all recognize that without entrepreneurs—risk-takers with the big ideas, ambition and ability to build things people want—there can be no innovation economy. The emergence of a new generation of entrepreneurs through the boom in startup activity has been encouraging, but if Canada aims to become a globally significant innovation nation, we need far more of our startups to grow into world-leading businesses with annual revenues north of $100 million.

Fortunately, over the past decade, we've seen several such high-growth companies emerge from our startup communities, including Shopify, Hootsuite and Kik, with several more poised to follow in their path. At the same time, though, we've learned that scaling companies face specific challenges that early-stage startups don't necessarily face, specifically in securing the top talent and growth capital they need. To that end, we've been making strides that will be bolstered by measures announced in the recent federal budget. These include the Global Skills Strategy to streamline immigration to Canada for highly skilled workers; the $400-million Venture Capital Catalyst Initiative; increased funding for superclusters; and the new Innovative Solutions Canada fund to spur government procurement of technology from Canadian entrepreneurs.

Still, there is much work to do. If Canada is to succeed, we need to become the location of choice for the world's smartest and most ambitious people, whether they were born and raised here or are seeking new opportunity from abroad. To keep up the pace of startup creation, for example, we need to do more to encourage entrepreneurship and STEM-related careers in our young people, regardless of their gender, ethnic and economic backgrounds. To help our companies scale, we need to recruit and develop business professionals who know how to take companies from $10 to $100 million in revenue, and then keep growing. And to develop the next generation of technologies, we need to keep investing in technologies like quantum computing and artificial intelligence, where we have a chance to lead the world.

> *"The emergence of a new generation of entrepreneurs through the boom in startup activity has been encouraging, but if Canada aims to become a globally significant innovation nation, we need far more of our startups to grow into world-leading businesses with annual revenues north of $100 million."*

Thankfully, Canada—with its stable and open democracy, strong global brand and diverse, well-educated population—has never been in a better position to grow a world-leading innovation economy.

We have the ingredients. What we need to do now—all of us, together—is execute on the recipe. P

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Future Design School young innovators engaging in a leadership challenge at Young Innovators Camp in the MaRS Discovery District.
Future Design School photo

Creating Future Designers: It Starts in the Classroom

Sarah Prevette

In an exceptional example of Canadian innovation, Sarah Prevette has deconstructed the qualities that make entrepreneurs and transformed them into teachable components that are being transferred to the next generation of Canadian innovators. Here's her prescription, based on that experience, for fostering innovation the way we teach other valuable knowledge and skills: in the classroom.

When we think about education, we need to be asking ourselves; how do we prepare kids for a rapidly changing world?

The current global landscape reveals an increasingly uncertain future, characterized by political instability and cultural intolerance. The colliding global factors of climate change, rising populism and scarcity of finite resources are dramatically reshaping the reality that today's youth will face.

The time is now for Canada to revamp our education system and ensure that we are equipping students with the skillsets they need to adapt, adjust and problem-solve as required. We need to infuse our youth with the creative confidence and personal impetus to innovate the many solutions that will be required to address the problems of the future. This is Canada's moment to showcase our unique capability for leveraging diversity of thought, skill and talent to foster a culture of innovation that focuses on solving the world's most pressing issues.

According to the World Economic Forum: "Sixty-five per cent of children currently entering primary school will have jobs that do not yet exist and for which their education will fail to prepare them, exacerbating skills gaps and unemployment in the future."

We cannot predict the jobs that today's kindergarteners will be graduating into, or how their world might be altered by the widespread adoption of technologies such as artificial intelligence, quantum computing or new technologies that have not yet been invented. However, we do know, without any shred of doubt, that automation will continue to change employment opportunities and will render many traditional roles obsolete.

We need not wait until our primary students make it into the job market to see the impact of the changes on our workforce. The WEF estimates that one-third of the skillsets required to perform today's jobs will be "wholly new" by 2020. Our economy faces an immediate upheaval, and many participating in today's workforce will quickly find themselves in need of major up-skilling over the next several years. The transformation is well underway and we have a responsibility as a country to proactively set up the infrastructure to support those affected by the transition.

"According to the World Economic Forum: "Sixty-five per cent of children currently entering primary school will have jobs that do not yet exist and for which their education will fail to prepare them, exacerbating skills gaps and unemployment in the future."

Through ongoing consultations over the past year, the federal government has gained considerable insights into the unfolding technology revolution and in the latest budget announced new measures, including $225 million towards the creation of a new skills agency and an additional $150 million for investing in emerging technology clusters. Under the thoughtful stewardship of Hon. Navdeep Bains, minister of innovation, science and economic development, Canada's innovation agenda has taken shape and is helping coalesce an action plan for the future. While these measures are indeed encouraging, there is still much work to be done.

"While there is a groundswell of support to teach kids to code, including $50 million in new funding from the federal government, it is but one small piece of a much larger puzzle. Many are beginning to recognize the benefit of teaching kids computational thinking but there is an ever-increasing need to also engage kids in real-world problem solving."

Education is under provincial jurisdiction, and our school systems are in need of reform. While there is a groundswell of support to teach kids to code, including $50 million in new funding from the federal government, it is but one small piece of a much larger puzzle. Many are beginning to recognize the benefit of teaching kids computational thinking but there is an ever-increasing need to also engage kids in real-world problem solving.

At Future Design School, we believe that it is time to raise the bar in every classroom across the country. We need to increase our expectations and realize that kids are capable of far more than the work that they are currently producing. We need to re-focus education on empowering student innovation and building entrepreneurial mindsets. With an uncertain future, cultivating resourcefulness and creative prowess should be placed at the very forefront of learning. There is a pressing impetus to look at the ubiquitous traits that make our entrepreneurs successful and determine how best to cultivate these attributes within every student from coast to coast.

Great entrepreneurs have fantastic imaginations, are wildly optimistic and see the potential that exists within every challenge. They tend to have insatiable curiosity and possess remarkable abilities to connect seemingly disconnected ideas. Successful entrepreneurship relies on gaining profound insight into the nuances of issues; developing deep empathy for the needs of others and building solutions that are iterative by nature. Innovative leaders are dedicated to ongoing experimentation, commit themselves to continuous improvement and understand that failure is

a necessary part of the innovation process.

We believe that schools can cultivate these entrepreneurial traits in all students through enabling real world experiences that allow children to fail forward. Schools need to see themselves as sandboxes where kids can experiment, find inspiration, try out new ideas and fail without penalty. Engaging students through their own interests and encouraging them to pursue projects with sustained inquiry means re-thinking existing frameworks. Traditional timetables with prescribed allotments for subjects are far too limiting and impede world-class learning. In fact, the very idea of having specific subjects needs to be re-examined. Allowing exploratory learning means giving students personalized choice and giving them the latitude to learn at their own pace.

> ***"We have seen amazing examples of teachers who, after engaging in our professional development, have overhauled entire grades and courses to implement new types of learning that foster future-ready skills."***

The curricula in provinces across Canada are continuously being assessed and augmented, and in some cases, such as in British Columbia, the curriculum has recently been overhauled in order to better support this type of investigative learning. Even without full-scale infrastructure change, teachers in every community can take advantage of the latitude they have in choosing how best to cover ministry expectations, even if they are unable to change the subject matter they cover. We have seen amazing examples of teachers who, after engaging in our professional development, have overhauled entire grades and courses to implement new types of learning that foster future-ready skills. With the right tools and teachers; innovative learning is within our reach.

To create schools that develop future designers and change agents, we need to actively empower the most important cultivators of this type of learning—our educators. We need to grant teachers greater flexibility in determining the best ways to construct learning experiences for their students. Teachers need to see themselves as facilitators who are focused on helping students to ask the right questions, rather than keepers of knowledge or oracles with answers. Teachers need to feel empowered to deliver project-based learning that is personalized to each student's interest, differentiated to their learning style and capability, and covers multiple disciplines and expectations throughout the process. If we want to truly cultivate entrepreneurial students, then we need to start by building entrepreneurial teachers.

We need to empower our teachers to take risks and give them the agency to facilitate learning that has uncertain outcomes. That means greater autonomy in determining assessments and tearing down the barriers that are keeping teachers from experimenting and being innovative themselves. We need a system that actively advocates and supports our educators to be entrepreneurial. We need to take a careful look at what we are prioritizing, and the culture it creates in schools. Innovation in schools will not be possible without cultivating innovative culture—and culture starts at the very top.

We need leaders in all of our provinces to place an emphasis on innovation in school. In order for Canada to seize our moment on the innovation stage, we must ensure that all schools across the country are fueling curiosity, enabling the exploration of ideas and giving students impactful, real-world learning experiences.

> ***"Education needs to be re-focused on fostering innovation. It needs to place a greater emphasis on the journey of learning, and less on the final outcome, more on the questions and less on the answers."***

Education needs to be re-focused on fostering innovation. It needs to place a greater emphasis on the journey of learning, and less on the final outcome, more on the questions and less on the answers. Students should be actively engaged in solving real problems facing their communities; acquiring new skills and knowledge from experience and their own passion-driven inquiry. School should be where each student develops an entrepreneurial mindset, which includes grit, resilience, mindfulness, empathy, creativity and resourcefulness. We need to start prizing creativity as high as numeracy and literacy—and fast. P

Sarah Prevette teaches creativity, innovation, and design thinking to some of the country's biggest business leaders. She is the founder of Future Design School, which transforms education by fostering entrepreneurship in a classroom setting.
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Bringing Healthcare Into the 21st Century

Mary Ackenhusen

Innovation in healthcare is one of the great challenges of our time. Canada, like all developed countries, must reconcile changing demographics and fiscal demands with the need to provide patient care in a changing technological environment. As President and CEO of Vancouver Coastal Health (VCH), Mary Ackenhusen leads the largest academic and tertiary health authority in British Columbia, serving a population of 1 million with a budget of $3.4 billion. Ackenhusen provides a window on how one regional health system is innovating toward more sustainable healthcare.

Our healthcare system is under tremendous pressure to balance patient care with financial pressures. British Columbia's $18.8 billion dollar health budget for 2017/18 makes up almost half of the provincial government's overall expenditure, and BC invests more than $600 million in health research on an annual basis. In order to ensure that research is being translated into better patient outcomes and to meet the demographic, disease and therapeutic challenges of the 21st century, we have to become more efficient at adopting new innovations.

Innovation may not be the only answer but it is a conduit for change. VCH is focused on leveraging innovative treatments, devices and processes to not only improve healthcare delivery, but also create a more efficient healthcare system. Here are a few innovative solutions VCH has recently trialed, demonstrating the shift from the typical acute care model:

TEC4Home

Telehealth Emergency Community Continuity of Care Connectivity via Home (TEC4Home) is a tele-monitoring program that supports the safe transition of heart failure patients from hospital to home, bridging the gap between acute and community care. Patients go home sooner and daily electronic check-ins enable community nurses to help patients avoid subsequent emergency hospitalization. This benefits patients and reduces pressure on emergency room and hospital resources. VCH is also expanding tele-monitoring to patients with chronic obstructive pulmonary disease (COPD), establishing a new standard of care. TEC4Home is very important not only to VCH, but also to the province. Rural and remote communities face unique challenges with healthcare delivery, including limited human resources. Technology is an obvious way to augment staffing and other health resources in all communities, but it is time we start using technology to its full extent. TECH4Home is an important opportunity to target patient populations outside the hospital setting.

R-D and Canines

As part of VCH's commitment to find better ways to protect patients from 'superbugs', Vancouver General Hospital (VGH) assessed Ultraviolet C (UVC) disinfection as part of a five-month pilot innovation project. The Rapid Disinfector Ultraviolet DC (R-D) is a mobile, germ-killing UVC robot used to disinfect patient rooms, operating rooms and bronchoscopy/endoscopy suites. The process is automated and augments traditional cleaning methods. A lower-tech innovation that complements R-D comes in the form of a four-legged hospital employee. Angus, the English spaniel, is trained to sniff environmental reservoirs of the Clostridium difficile superbug with 95 per cent accuracy. Once Angus finds the hidden reservoirs of bacteria on hospital surfaces and equipment, the R-D is brought in to eradicate the germs.

Kelty's Key

Kelty's Key (www.keltyskey.com) is an online therapy service for adults managing mental health conditions such as anxiety and depression. The program provides Therapist-Assisted Internet-Cognitive Behavioural Therapy (TAI-CBT) to patients as well as self-help, education and training resources for common mental health issues. Plans are underway to develop a formal training institute to ensure this high-impact, made-in-BC program realizes its full potential.

These projects are examples that have been funded by research grants, industry and/or philanthropic dollars. However, due to relentless demand and cost pressures, once this initial funding runs out, it is often difficult to keep new

practices/projects going. This not only minimizes the benefits gained from innovation but continues to add to the financial burden on our health system.

Using PHIX to fix the system

The Pacific Health Innovation eXchange, or PHIX, is a new initiative in BC that is designed to facilitate the adoption of innovation in the healthcare system, beyond pilot projects. It is a partnership founded by Vancouver Coastal Health, VCH Research Institute, VGH & UBC Hospital Foundation and the University of British Columbia. PHIX is a research and innovation hub with a mandate to evaluate innovations to improve patient care, to facilitate the commercialization of innovations created through BC and Canada's investments in health research, and support the growth of health innovation companies in British Columbia. PHIX will use a commercial model to manage its finances, which will enable PHIX to adopt commercial accounting practices, enter into risk-sharing partnerships with industry, and to hold equity investments in new health enterprises.

Here are some of the challenges that PHIX is addressing:

- There is no formal pathway for innovators to interact with the healthcare system. PHIX is a single point of contact for innovators, entrepreneurs and businesses to engage with the healthcare system in relation to new products, services and practices.
- PHIX is creating a new process to evaluate the impact of innovations on healthcare delivery. The evaluation process will seek to quantify both improvements in patient outcomes and delivery of a clear return on investment.
- Current procurement practices are very cautious, which can be a barrier to purchasing the most efficient and effective innovations. PHIX is working with policy makers and purchasing teams to address the legal requirements of transparency and fairness at the start of the conversation with innovators. The intent is to enable the healthcare system to be an effective customer, able to purchase new solutions that provide demonstrable value.

British Columbia's $18.8 billion dollar health budget for 2017/18 makes up almost half of the provincial government's overall expenditure, and BC invests more than $600 million in health research on an annual basis. iStock photo

> *"PHIX is working with policy makers and purchasing teams to address the legal requirements of transparency and fairness at the start of the conversation with innovators."*

- PHIX will focus on innovations and solutions that address major challenges in healthcare delivery, such as moving care from within expensive acute care hospital wards to the home or community, and supporting improved management of chronic health conditions.
- PHIX will work with the healthcare system to implement successful pilot innovations and facilitate the development of treatment options with the potential to be scaled commercially.
- Gene sequencing and genomics offer great potential for health prediction and prevention and for personalized treatments. PHIX is exploring new business models that can maintain accountability and affordability while bringing the benefits of gene technologies to healthcare delivery.

VCH and its partners involved with PHIX are taking a strategic approach to the opportunities and challenges of delivering healthcare in the 21st Century, building on BC's leading health research and excellent clinical care. Creating a sustainable healthcare system requires change and a certain amount of risk. PHIX is an intentional approach to assess and validate new approaches to ensure measurable gains and value. It will create a new pathway to evaluate health innovations, create a new integrated model to prioritize innovative research and fuel the next generation of innovations to benefit British Columbia and beyond. P

Mary Ackenhusen is president and CEO of Vancouver Coastal Health (VCH).

Des étudiants de McGill devant le Musée Redpath, sur le campus historique de l'université à Montréal. *Source : Université McGill*

Résumé : L'université innovante

Suzanne Fortier

On ne saurait évoquer les origines de la Silicon Valley sans parler du rôle que l'Université de Stanford y a tenu, d'une part en façonnant des rebelles entrepreneurs dans l'âme, d'autre part en mettant à leur disposition l'infrastructure universitaire indispensable à ces mordus de l'innovation. Ce modèle d'université, véritable pivot d'une supergrappe, existe aujourd'hui de Cambridge à Waterloo. Suzanne Fortier, principale de l'Université McGill, analyse avec minutie cette dynamique du point de vue universitaire.

Au cours des trente dernières années, nos universités ont bien changé. Les tours d'ivoire d'autrefois sont aujourd'hui des établissements ouverts, branchés et déterminés qui jouent un rôle de premier plan dans l'écosystème d'innovation du Canada. Les technologies de l'information gagnent peu à peu les sciences biologiques et physiques, et cette fameuse quatrième révolution industrielle laisse entrevoir des transformations encore plus profondes. Dans cet article, nous présentons certaines des initiatives qu'ont

prises les universités afin d'améliorer leur prestation en enseignement ainsi qu'en recherche et de mieux collaborer avec les autres acteurs de l'écosystème évoqué précédemment, puis y allons de quelques suggestions porteuses d'avenir.

L'étudiant d'aujourd'hui carbure à l'innovation : il veut que ses idées changent le monde, concrètement. Comme l'explique Karl Moore, professeur à la Faculté de gestion Desautels de l'Université McGill, les jeunes de la génération Y « ont besoin de sentir que leur gagne-pain est véritablement utile, mais aussi qu'il leur permettra d'atteindre les plus hauts sommets. Ils se projettent constamment dans l'avenir et s'interrogent sur leurs motivations ».

Au Canada, près de la moitié des étudiants de niveau postsecondaire disent vouloir fonder leur entreprise après l'obtention de leur diplôme. Les universités ont donc bonifié leur offre en conséquence, par l'ajout de programmes d'entrepreneuriat et de possibilités d'apprentissage en milieu de travail. À ce chapitre, l'Université de Waterloo a fait œuvre de pionnière et est aujourd'hui un chef de file mondial. De nos jours, la quasi-totalité des universités canadiennes ont un centre d'entrepreneuriat proposant des cours et des services tels du mentorat, du financement de démarrage et des formations intensives. À titre d'exemple, *le Pôle d'entrepreneuriat* de l'Université de Sherbrooke permet de mailler chercheurs et étudiants avec d'éventuels partenaires d'affaires. À l'Université de la Colombie-Britannique, l'accélérateur d'entreprise *entrepreneurship@UBC* offre des ateliers, du mentorat, des locaux de démarrage ainsi que des programmes de validation de marché et d'élaboration de modèle d'affaires. À compter de 2018, l'Université Dalhousie aidera ses étudiants à commercialiser leurs innovations technologiques par l'entremise d'*ideaHUB*. Et ce ne sont là que quelques-unes des stratégies déployées sur l'échiquier universitaire canadien.

> ***« La Table ronde sur l'enseignement supérieur et les entreprises, groupe de dirigeants d'entreprises et d'établissements d'enseignement postsecondaire de premier plan, entend faire en sorte que tous les étudiants de niveau postsecondaire du Canada puissent vivre une expérience enrichissante d'apprentissage en milieu de travail avant l'obtention de leur diplôme. »***

Outre la formation générale, les étudiants, les professeurs et les jeunes diplômés ont souvent accès à des formations spécialisées en entrepreneuriat social et en démarrage d'entreprises technologiques dans des domaines divers allant des TI aux arts, en passant par la santé et les technologies vertes. Ainsi, l'Université de Toronto propose neuf incubateurs et accélérateurs, chacun étant spécialisé dans un créneau. L'Université Ryerson possède quant à elle dix « zones » à vocation entrepreneuriale, notamment l'incubateur DMZ, qui œuvre dans le secteur numérique. À McGill, enfin, le Centre Dobson pour l'entrepreneuriat de la Faculté de gestion Desautels offre désormais, en partenariat avec cinq autres facultés, des mineures en entrepreneuriat dans des domaines variés allant des affaires sociales aux affaires agricoles.

La Table ronde sur l'enseignement supérieur et les entreprises, groupe de dirigeants d'entreprises et d'établissements d'enseignement postsecondaire de premier plan, entend faire en sorte que tous les étudiants de niveau postsecondaire du Canada puissent vivre une expérience enrichissante d'apprentissage en milieu de travail avant l'obtention de leur diplôme. Les étudiants le souhaitent ardemment : l'offre de stages et d'emplois d'été de grande qualité ne suffit pas à la demande. Certaines entreprises proposent des programmes d'apprentissage par l'expérience non seulement afin de repérer de futurs employés, mais également pour accueillir dans leurs rangs de jeunes talents qui, par leurs idées audacieuses, seront un véritable moteur d'innovation. C'est le cas des programmes *Bleu Extrême* d'IBM et *Garage Internship* de Microsoft.

Universités et entreprises se donnent la main pour multiplier et bonifier les possibilités. Ainsi, le Consortium de recherche et d'innovation en aérospatiale au Québec (CRIAQ) entend rehausser la compétitivité du secteur aérospatial en favorisant le maillage entreprises-universités, notamment dans le cadre de programmes visant à soutenir les étudiants désireux de faire de la recherche.

Bien entendu, l'apprentissage dans un milieu de travail innovant et dynamique n'est pas à la portée de toutes les entreprises. Néanmoins, le vent tourne, et les dirigeants considèrent désormais les stagiaires et les jeunes recrues non plus comme de simples employés en formation, mais bien comme de véritables atouts porteurs d'innovation.

Pour innover en 2017, on doit réunir des gens aux parcours et aux expériences multiples, qui pourront mettre en commun leurs connaissances et leur expertise. La collaboration universités-entreprises s'est d'abord incarnée dans le parc scientifique : en ces lieux s'affairaient chercheurs du milieu universitaire, de l'État et du secteur privé dans un esprit de collaboration. Le Stanford Research Park est l'étalon-or des parcs scientifiques. Fondé en 1951, il allait donner naissance à la Silicon Valley, l'une des

plus grandes réussites du monde en matière de grappes industrielles.

À l'époque, les parcs scientifiques et technologiques étaient habituellement situés dans des coins reculés, loin des campus. Aujourd'hui, ils se trouvent souvent au cœur même des campus et des villes. En effet, des quartiers de l'innovation poussent dans les campus et les villes du monde entier, les universités intégrant davantage leurs activités innovantes au tissu urbain dans une démarche holistique. L'Institut Brookings décrit ces quartiers comme « un savant mélange d'entrepreneurs et d'établissements d'enseignement, de jeunes pousses et d'écoles, d'aménagements polyvalents et d'innovations médicales, de vélopartage et d'investissements rentables, le tout desservi par le transport en commun, alimenté par des sources d'énergie propre, branché sur la technologie numérique et propulsé par la caféine ».

Occupant généralement une zone géographique restreinte, ces quartiers se distinguent par leur densité et la diversité des personnes physiques et morales qu'ils abritent. Ainsi, le *MaRs Discovery District*, situé au centre-ville de Toronto tout près de l'Université de Toronto, propose des activités de mentorat à près de 1 000 jeunes entreprises et aide ces dernières à trouver du financement et à prendre du galon. À ce jour, ces entreprises ont recueilli 2,6 milliards de dollars en capital. Par ailleurs, en 2013, l'École de technologie supérieure et l'Université McGill ont lancé le Quartier de l'innovation dans Griffintown, à Montréal; ce quartier compte aujourd'hui 20 partenaires du secteur privé et a accueilli dans son giron l'Université Concordia et l'Université du Québec à Montréal. Il héberge 12 incubateurs et accélérateurs dans des domaines tels que l'innovation sociale et la technologie, et s'engage dans des partenariats avec des écoles. Certains quartiers, par exemple le projet phare *22@Barcelona*, ont pour mandat de revitaliser des secteurs marginalisés et de favoriser l'acquisition de compétences au sein de la population. *L'un des derniers-nés de la famille, Cornell Tech*, déménagera à l'été 2017 sur Roosevelt Island, au large de New York.

L'établissement de liens à l'échelle mondiale est tout aussi important que ces réseaux locaux. Les entreprises exportatrices innovent généralement davantage : le commerce international étant le théâtre d'une concurrence plus féroce, les entreprises doivent se dépasser pour tirer leur épingle du jeu. Les réseaux mondiaux de diplômés d'universités canadiennes—celui de McGill compte 250 000 personnes —peuvent favoriser les échanges commerciaux et la conclusion de partenariats d'affaires novateurs. Ainsi, l'Université de Waterloo s'est tournée vers ses diplômés de la Silicon Valley afin de trouver des mentors et des capitaux pour le Corridor d'innovation Toronto-Waterloo, stratégie qui commence à faire d'autres adeptes dans le milieu universitaire.

> ***« À l'Institut et hôpital neurologiques de Montréal (INM), l'Université McGill se livre à ce que la revue Nature qualifie d'« expérience extrême en science ouverte ». Pendant cinq ans, l'Institut mettra non seulement l'intégralité de ses données, des échantillons de sa biobanque et de ses résultats à la disposition des scientifiques du monde entier. »***

D'ores et déjà à l'avant-garde en matière de recrutement d'étudiants internationaux, l'Australie met actuellement à l'essai une stratégie de mobilisation de son réseau mondial de diplômés, lancée en 2016. L'État souhaite jeter des ponts entre les entreprises ainsi que les missions diplomatiques australiennes, d'une part, et son réseau international de diplômés, d'autre part, et favoriser l'adoption de pratiques exemplaires en matière de mobilisation des diplômés de divers établissements d'enseignement. Ce projet n'en est qu'à ses balbutiements, mais il semble prometteur. Chez nous, le fédéral a récemment annoncé la mise en place de « supergrappes » qui, moyennant un effort de concertation entre universités et entreprises, pourraient constituer le point de départ de puissants réseaux de diplômés. Si le travail est loin d'être terminé, nous avons néanmoins fait des pas dans la bonne direction.

Les observateurs l'ont souligné à maintes reprises : au Canada, le savoir universitaire n'est pas suffisamment mis à profit dans les entreprises. Il existe certes des signes d'un solide maillage universités-entreprises—par exemple, les entreprises financent un pourcentage plus élevé de la recherche menée dans les établissements d'enseignement supérieur au Canada qu'aux États-Unis et, en moyenne, dans les pays de l'OCDE—, mais on pourrait faire mieux.

Chaque secteur doit miser sur ses atouts. Des chercheurs universitaires ont lancé quelques entreprises dérivées florissantes, et certaines licences se sont révélées plutôt lucratives, mais le fait est qu'en matière d'innovation, le plus grand atout des universités demeure leur capacité de produire des données de recherche fondamentale et préconcurrentielle… et de les diffuser.

Aussi, de nombreuses universités canadiennes s'appuient-elles maintenant davantage sur des partenariats stratégiques à long terme. Toutefois, la confiance nécessaire pour bien communiquer, évoquer des problèmes d'affaires, dévoiler des découvertes pleines de promesses et échanger de l'information cruciale ne s'installe pas du jour au lendemain.

Le nouveau CHUM (Centre Hospitalier de l'Université McGill), au site Glen a Montreal. *Source : Wikipedia*

La diffusion élargie du savoir—en particulier lorsqu'il est issu de fonds publics—constitue une autre démarche de plus en plus en vogue. À l'Institut et hôpital neurologiques de Montréal (INM), l'Université McGill se livre à ce que la revue Nature qualifie d'« expérience extrême en science ouverte ». Pendant cinq ans, l'Institut mettra non seulement l'intégralité de ses données, des échantillons de sa biobanque et de ses résultats à la disposition des scientifiques du monde entier, mais il encouragera aussi fortement ses partenaires à lui emboîter le pas. De plus, l'INM ne fera breveter aucune de ses découvertes pendant cette période.

En raison de la complexité du cerveau, la mise au point de traitements efficaces contre les maladies neurologiques avance à pas de tortue. Guy Rouleau, directeur de l'INM, est d'avis que « la diffusion rapide des données aura pour effet d'accélérer la découverte des mécanismes en jeu et peut-être aussi de nouveaux médicaments ».

Cette initiative audacieuse n'est pas passée inaperçue. La Fondation familiale Lawrence et Judith Tanenbaum a signifié son soutien par un don de 20 millions de dollars, établissant dès lors l'Institut de science ouverte Tanenbaum. En mars, l'INM a annoncé qu'il collaborera avec le Centre de recherche et de mise au point de médicaments de même qu'avec Merck à la création d'une plateforme de modélisation des maladies neurologiques. D'autres partenariats avec le secteur privé se dessinent, et des fondations internationales de premier ordre comptent participer à la définition des paramètres d'évaluation et à l'analyse des données.

Les véritables retombées de l'expérience menée à l'INM ne seront connues que dans cinq ans, après l'évaluation des paramètres définis. Quoi qu'il en soit, cette initiative, à l'instar de toutes celles que nous venons d'évoquer, témoigne d'une volonté d'explorer de nouveaux modes de collaboration visant à favoriser l'innovation au Canada.

Ouverte, branchée, déterminée : au cours des dernières années, j'ai vu non seulement des universités canadiennes, mais également des entreprises, des administrations publiques et des organismes à vocation sociale s'engager résolument dans cette voie. Ottawa et les provinces sauront les accompagner grâce à des mesures prises récemment, notamment les supergrappes, les investissements diligents en intelligence artificielle, le soutien à l'entrepreneuriat et à l'apprentissage en milieu de travail ainsi que la mise sur pied d'un organisme voué à l'acquisition de compétences. P

La professeure Suzanne Fortier est la principale et vice-chancelière de l'Université McGill. En 2016, elle a été nommée membre du Conseil *consultatif en matière de croissance économique auprès du ministre des Finances du Canada ainsi que du* Global University Leaders Forum *du* Forum *économique mondial.*

Breanne Everett accepts her Governor General's Innovation Award from Governor General David Johnston, at Rideau Hall, May 19, 2016.
Sgt Ronald Duchesne, Rideau Hall, OSGG Photo

The Mental Weight of Innovation: Overcoming Doubt

Breanne Everett

Dr. Breanne Everett took a huge personal risk when she chose to take a leave from her medical residency to pursue an MBA and focus on Orpyx, the business she co-founded based on her invention of foot sensor devices that provide feedback to diabetic users. As one of the first group recognized by Governor General David Johnston with his awards for innovation in 2016, we asked her to write about the importance of recognition to innovators.

On May 19, 2016, I was awarded the Governor General's Innovation Award (GGIA).

Even now, almost one year later, I question how I could be deserving of this recognition. I have come to acknowledge that the feeling of unworthiness will always go part and parcel with discussion of the Governor General's Innovation Award (GGIA). And I've found peace with this because I think this was exactly what His Excellency David Johnston knew

would happen (and intended to have happen) when he spoke to me as his equal, shook my hand, and placed the otherworldly, weighty copper trophy into my hands that day.

It was impossible not to be hyper-aware of the honourees accepting the inaugural GGIAs on the stage with me that day: Dr. Jeff Dahn had pioneered methods and breakthroughs in lithium-ion battery technology; Dr. Robert Burrell had developed the world's first therapeutic application of nanotechnology for wound healing; Christi Belcourt is an established and prominent Métis visual artist whose work has generated due attention to issues of identity, culture and community division; Kinova (led by Charles Deguire) has revolutionized robotic assistive technology to push people beyond their physical limitations; and Mark Torchia and Richard Tyc have created the NeuroBlate System to make once-inoperable brain tumours accessible and treatable.

It was also highly predictable that including me in that crowd would stir those 'Impostor Syndrome' feelings. And yet, I think it was imperative that I receive the Governor General's Innovation Award.

Because when I say "I," I don't mean it in the sense of the singular pronoun. "I" am representative of a larger group. "I" am the emblematic budding entrepreneur, past the idea stage, but short of broad-reaching, tangible success (short of even being cash flow positive, for that matter). "I" am every person who has taken a big risk, knowing that the potential for failure exists, but for whom those doubts are vastly outweighed by positivity and determination toward achieving an end goal. In John Saddington's infographic, *The Emotional Journey of Creating Anything Great*, "I" find myself alternating between states of submersion in the 'Dark swamp of despair', and exhilarative suspension by the bridge of belief, persistence, family and humour that spans above it. "I" am every entrepreneur who has had to worry about making payroll, somewhere between one and 74+ times. "I" am every person who has been told "no", that it won't work, and that it would have been done already if it was worth doing. "I" am every female entrepreneur who has been made to feel I am trespassing on traditionally male territory; that you can only ever have a maximum of one female on a project team, or else it gets too catty; that your male colleagues need to teach you how to dress. "I" am every person who doubts her self-worth because of being knocked down so many times, but who ultimately knows it's in there because there hasn't been a time when she hasn't stood up.

"I" am every person who has been told "no", that it won't work, and that it would have been done already if it was worth doing. "I" am every female entrepreneur who has been made to feel I am trespassing on traditionally male territory; that you can only ever have a maximum of one female on a project team, or else it gets too catty; that your male colleagues need to teach you how to dress."

That is whom the Governor General gave this Award to—not to me, but to a larger group of entrepreneurs who question themselves everyday about the decisions they've made. Innovation is a process. It starts somewhere. It does not start with overnight success. Recognizing innovative thinking, fostering an appreciation of it, and an expectation for it, is also innovative, in and of itself. Too often, that moment of recognition happens at the point of achieving an obvious success.

An important but often overlooked part of the task of setting a successful national innovation agenda will involve cultivating a healthy recognition of innovation—across the spectrum from ideation, actuation, and then finally realization. And the Governor General's Innovation Award does just that.

Recognition is just as important for the R&D team as it is for the innovation ecosystem of which they are a part. Certainly, being recognized at the highest level while just a budding entrepreneur comes with the challenges of feeling unworthy of this remarkable fellowship of leaders. More importantly, however, recognition can change the course of a person's life. It is a bet that she/he will succeed. It is an occasionally heavy expectation that she will succeed, or at least, that she'll die trying. It can lift up the entrepreneur, her company, their innovation, and the many people whose lives will change as a result of it, if successful. This has certainly been my experience. It's knowing that a bet has been placed on you, and that, if you succeed, then many other people will have succeeded, too.

Recognition by the GGIA changed my life. Full stop. But I also believe its impact goes beyond one medical device startup.

Canadians, I believe, have innovation pumping through their blood vessels. Sometimes it takes the smallest spark to turn an innovative thinker into an innovator—moving them from thought to action. Recognition was my spark. As a medical school student and then as a resident in plastic and reconstructive surgery, I had never dreamed of starting a business (beyond a medical practice). It was relatively uncharted, as I was unaware of any other residents who had done this, let alone set aside their medical career to do so.

But the inventor in me never stopped looking skeptically upon my environment, and I've always questioned how things

are done—if perhaps there is a better way. It was the spark of recognition between a clinical need I saw (better management of the diabetic foot), and a solution I could imagine (a sensor-based smart insole system) that started the engine turning. It was the recognition of my colleagues, collaborators, residency program, the University of Calgary, family, friends and mentors that that turned my invention into an innovative business. A succession of sparks.

> ***"Taking the leap from being innovative to being an innovator sometimes only requires the nudge of recognizing yourself in others who are doing the same thing."***

I am not unique in having professional training and finding myself frustrated with the status quo. I am contacted on a near-daily basis by people who see themselves in my story and are seeking perspective before they jump in. I see a groundswell of interest from medical students, residents and practising physicians in starting their own ventures, which I believe is rooted in the precedence of a growing group of Canadian "doctorpreneurs." Taking the leap from being innovative to being an innovator sometimes only requires the nudge of recognizing yourself in others who are doing the same thing.

That awareness of the innovation environment—the existence of other innovators and their accomplishments (and failures), and of the larger and interconnected mesh of support for innovation—is critical for incoming innovators. It is not without supportive professional networks, risk-taking early stage investors, considered innovation-incenting grant programs, agenda-setting foundations, pioneering procurers and intrepid first users that this ecosystem can truly thrive.

Canada is doing much of this well, but requires some considerable pencil sharpening when it comes to building a healthy, comprehensive and truly "venturesome" venture capital contingent. I am confident with more focused attention on the criticality of innovation, and with giving a voice to our entrepreneurs, areas of ecosystem deficiency will be highlighted, dissected and addressed. With recognition, we will get there.

It is hard to describe the impact of the Governor General's Award at the level of the entrepreneur: the tremendous awareness it has brought to our company, special consideration I receive when people know that my work has been honoured by the GG. But it is impossible to overstate the importance of programs that recognize innovators for their role in growing the innovation environment, knowing that when we do so, other inventors will recognize their own potential for action. The award established by His Excellency sets that tone on a national level. P

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Column / Don Newman

The Innovation Catechism

Innovate, adapt and change. That is today's mantra, as companies struggle to keep up with the latest technological changes in their field and countries look to adopt the policies and programs that will help them do it.

Re-tool for the 21st century. If you don't reinvent the way you do business, you soon will have no business to do. In fact, it is more than a mantra. It is a catechism for the innovation faith.

If that sounds cynical, like I'm against innovation, technology and change in general, we'll I am not. I am for it. But I have seen technology dramatically change the field in which I made my career. For many years, it changed it for the better. Now, I'm not so sure.

When I entered my first editorial office to begin my career as a newspaper reporter, I couldn't believe the noise. Typewriters, probably 35 of them, all clattering away as reporters filed their stories as the deadline approached.

And it wasn't just the reporters' typewriters that were making a noise. So were the typewriters of the people editing the stories, writing headlines, changing the wording of an article.

And when the editors had finished their handiwork, they shouted for a copy boy to pick up the finished product. The edited copy was placed in a plastic cylinder, the cylinder closed and put in a pneumatic tube that whisked it one floor up to the composing room.

There, a compositor retyped the story on a type-setting machine, setting it in type in a way that was ready to be put in a page frame. The noise in the composing room at deadline was as loud as the sound in the newsroom. Putting out a paper was a very noisy business. And that is without taking into account the roar the presses made when they were printing the finished product.

But innovation was happening well before the current drive to innovate. And newspapers were some of the early adapters.

Thirty years ago, computers were becoming small enough that people could carry them around. Slightly bigger ones could be installed on desk tops. Suddenly, reporters could write their stories on computers, and editors could receive them on their computers. Gone from the newsroom was the clacking of typewriters that had been a staple for some 100 years. The semi-audible click of computer keys replaced it.

And not only was it people working in the same room. Now reporters in distant locations with access to a telephone line could have their computers connected to the ones in the home office. Gone were the days of finding a telegraph office to send your copy as a message into the paper's wire room. Just write the story and push send.

Not only did technology change the newsroom, it made the composing room redundant. As innovation has taken hold, the production of newspapers has changed dramatically.

On the face of it, you would think that a good thing. But sadly, it is not. The same technology that streamlined the production of newspapers also created a whole new world of communication on the internet.

Blogs, Facebook, YouTube and so many other carriers of information have sprung up across the web. But the totality of their impact has been to destroy both the readership and the advertising base of most newspapers.

Even world-famous papers like the New York Times and the Guardian in London are being economically hammered. To survive, each is trying to expand its brand beyond its national borders, seeking online subscribers anywhere in the world.

In many ways, both journalism and communications have never been better. But the people working at it are not compensated as they once were. And the future is so uncertain, I find it hard to recommend to any young person with a passion for policy, politics and truth to go into the career that provided me with so much satisfaction and fulfillment.

And I share the concern that without a vibrant media and press, democracy is under threat from the clowns who claim there are "fake news" and "alternative facts" available to take the place of any uncomfortable truths.

Should the innovation that has left one of the pillars of democracy wobbling not have happened? No, we cannot be Luddites, break up the machines and throw them into the sea.

But in the rush to innovate, we must be aware of all the consequences, the many positive but also the negative. In the end, a better society has to be the result. Not one that is diminished. P

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VIA Rail Canada

CANADA 150

POURQUOI TU N'EMPRUNTES PAS UNE NOUVELLE VOIE?

En choisissant VIA Rail pour vos voyages d'affaires, vous profitez de nombreux avantages :

Vous maximisez votre productivité

Grâce au Wi-Fi, aux prises électriques, aux sièges confortables et l'utilisation de votre cellulaire, vous verrez qu'il est aussi agréable (sinon plus) de travailler en train qu'au bureau.

Vous réduisez votre empreinte écologique

En faisant un choix sensé, vous contribuez à un avenir plus vert.

Vous aidez les contribuables

Vous réduisez vos dépenses et entraînez des économies pour tous les Canadiens.

POURQUOI TU NE PRENDS PAS LE TRAIN?

Liaison	Nombre de départs par jour	Distance	Temps productif en train	Temps non productif en voiture*	Coût du voyage en voiture**	Coût du voyage en train (à partir de seulement)	Économies pour le contribuable (voyage en train)***
Ottawa ⟷ Toronto	Jusqu'à 18	450 km	**4 h 23 min**	4 h 34 min	467 $	**44 $**	423 $
Ottawa ⟷ Montréal	Jusqu'à 12	198 km	**1 h 55 min**	2 h 27 min	227 $	**33 $**	194 $
Ottawa ⟷ Québec	Jusqu'à 7	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 $

Les employés du gouvernement du Canada sont admissibles à un rabais de 10 % sur leurs voyages personnels réservés auprès de VIA Rail.
Les employés du gouvernement du Canada peuvent profiter de tarifs spéciaux pour leurs voyages d'affaires réservés par l'entremise des Services HRG de voyage partagés.
Le rabais ne s'applique pas sur les tarifs Évasion et sur la classe Prestige.

* 30 minutes ont été ajoutées à la durée totale du voyage en voiture afin d'inclure les retards dus au trafic et au mauvais temps.

** Le coût du voyage en voiture est calculé selon la formule suivante : coût en $ du voyage en voiture (taux de 0,55 $/km établi par le Conseil du trésor pour l'Ontario pour une voiture conduite par un employé du gouvernement X distance parcourue) + frais en $ d'employé gouvernemental (taux horaire moyen d'un employé gouvernemental de 48 $/h selon un salaire de 100 000 $ par année, y compris les avantages sociaux X durée du voyage) = coût total en $ pour le contribuable.

*** L'économie pour le contribuable associée aux voyages en train est calculée selon la formule suivante : coût en $ du voyage en voiture – coût en $ du voyage en train = économies en $ pour le contribuable.

Les tarifs et les conditions peuvent changer sans préavis. MC Marque de commerce propriété de VIA Rail Canada inc.

UN CHOIX VERT

Digital innovation at ABB is about people

We are living through an information technology revolution set against a context of sustainability, energy concerns, and the fourth industrial revolution – the meshing of the digital world of people and machines as internet meets production. This is our ever-evolving workspace, where technology accelerates growth and innovation like never before and more than ever we aim to create a Canada whose people, technology and innovation ecosystem can compete on the global scale. **abb.com/future**

ABB

A Partner For A Better Tomorrow

More than 600 students in the Dominican Republic are learning to use new laptops provided by Barrick in partnership with One Laptop Per Child. The program is introducing modern technology, internet connectivity and new educational tools to communities around Barrick's Pueblo Viejo mine, opening up a world of possibilities for students and their teachers.

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