RE$EARCH MONEY

The 16th Annual RE$EARCH MONEY Conference

# An Opportunity to Excel: Advancing Canada's New Innovation Agenda

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# Proceedings

Assembled and composed by Tim Lougheed and Rebecca Melville

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# Welcome

**JEFFREY CRELINSTEN**, Publisher & CEO, RE$EARCH MONEY
**MARK HENDERSON**, Managing Editor, RE$EARCH MONEY
**BRENT HERBERT-COPLEY**, Executive Vice--President, Corporate Affairs, SSHRC

Jeffrey Crelinsten opened the conference with a reference to RE$EARCH MONEY's new Web site, which now allows for breaking news between regular monthly editions of the publication, along with the inaugural edition of a new quarterly publication, Canadian Innovation News. He also referred to other events that had been held or were being planned, all of which was being accomplished by a total complement of just four workers: Craig Bamford (Subscription Manager), Mark Henderson (managing editor of RE$EARCH MONEY), Debbie Lawes (consulting editor of RE$EARCH MONEY and managing editor of Canadian Innovation News), and Chief Operating Officer Rebecca Melville.

Noting it was just under two weeks since the latest federal budget came out, Crelinsten noted that everyone had been expecting an innovation budget and that was to some extent what was delivered. More specifically, the document outlined three priorities for the government's innovation agenda: people, companies, and emerging technologies. The budget addressed each of these priorities to varying extents, as the RE$EARCH MONEY newsletter has outlined. This year's conference was therefore dedicated to exploring these issues for themselves.

"We've assembled over 40 experts and practitioners from industry, finance, academia, government, and the not-for-profit sector to share their insights and experiences with you," he said, outlining the program that would unfold over the next two days, including a novel partnership with IBM Canada that opened the conference to a group of young and student entrepreneurs. "As you know we've worked very hard over the

years to bring the private sector voice into the policy discussion. This year we've added another element to the discussion: we believe it's crucial to hear the voice of our youth."

Mark Henderson then delivered the conference's official opening address. He began by noting that this year's conference had been developed around not just the most recent federal budget, but also the innovation agenda represented within this document. This agenda, meant to redefine how Ottawa supports innovation and growth, includes themes of sustainability and inclusiveness, along with considerations of support for economic growth and fundamental science.

Henderson insisted that the government had delivered a significant number of initiatives pertaining to science, technology, and innovation. "Sector-based representatives whose spheres of activity were focuses of financial support are certainly overwhelmingly supportive of the budget," he said. "If you're in clean tech, if you're an advocate of more public participation in venture capital, a supporter of the sector-bridging initiatives of Mitacs or the fast-tracking of unskilled workers or if you're an enthusiast of the potential of artificial intelligence, this budget has something for you."

From a more holistic perspective, he added, the budget has garnered some criticism. More specifically, there is a curious lack of support for basic science. "That's not to say that science was shut out of the budget," he said. "It's seeded everywhere, from significant allocations to several government departments for the business of supporting clean energy, clean transportation and agriculture, quantum computing, stem cell research, and money to establish a secretariat for the forthcoming Chief Science Officer."

He noted that other innovation files have been targeted for further review in the coming months, including the country's intellectual property regime and the industrial R&D tax credit program. "This suggests that 2017 is not a one-off innovation budget," he said, noting that it was an indication that lawmakers appear to regard innovation as a factor that touches on all aspects of society and the economy. "After a decade of stagnant and dwindling support, we're now entering an era where Canada appears to be serious about joining the growing field of nations that use a knowledge-based economy to generate health, wealth, and a good quality of life for Canadians through innovation and value-creation for the world. Growing businesses and creating jobs is the holy grail of any government and the innovation agenda appears to be viewed as the most potent vehicle for realizing those objectives."

In addition to identifying key sectors of the economy that will play a part in this process, the budget included support for enhanced networking in the form of superclusters, simplification of programs and procurement, and digital technologies. Henderson suggested that improved speed and efficiency in the delivery of government services would be critical to helping Canada compete in a global environment, such as retaining multinational operations within the country and the talent needed for these operations to thrive. "The talent and the expertise we see in the room today and tomorrow are clear evidence that a lively discourse is an essential component in building the kind of innovation nation that we all believe Canada has the opportunity, skills, and entrepreneurial drive to achieve."


# Opening Keynote
# "Advancing the Innovation Agenda"

VALERIE FOX
Chief Innovation Consultant, The Pivotal Point

Introduction by Brent Herbert-Copley, Executive Vice-President, Corporate Affairs, Social Sciences and Humanities Research Council of Canada (SSHRC)

Herbert-Copley cautioned that even the most sophisticated technical accomplishments do not lead directly to economic success. "Our future prosperity, our future economic sustainability, won't be guaranteed by technology alone," he said. "It will be ensured by the level of creativity, of adaptability, foresight, and human understanding that are associated with our development and use of that technology. That means that cognitive and group skills, communication, reasoning, sharing of experiences, problem-solving, leadership are going to be increasingly important to business growth, the quality of life, and the success of policy." He noted that SSHRC supports researchers who are exploring these issues, including the wide range of social effects that will be crucial to economic success, such as the integration of immigrants into Canadian society.

In this context he cited Fox's credentials as a founder of Ryerson University's Digital Media Zone, a model of business incubation that is being emulated around the world. "Her 30-year-plus career exemplifies the human skills, the knowledge, the creativity that are essential to technological innovation."

Fox began by echoing this perspective. "I really care about people and I've found that it's people that are enabling us to really change Canada into being one of the most innovative countries I've ever seen."

She noted that she used to regard her own career, which has taken her into a wide range of occupations and projects, as being somewhat atypical. However, she has concluded that her experience, is now much more common. "I'm told what I have is a portfolio career, with a little bit of side hustle," she said. "So many people now have multiple jobs and are putting themselves through different types of experiences."

She added that her ongoing interest in this field has taken her to places where people share these experiences, such as TechToronto.org. This organization hosts an annual event where hundreds of people share ideas and networking opportunities in person, while hundreds of thousands more do so on-line. At this event, she was able to approach federal Minister of Innovation Navdeep Bains about three of the government's key initiatives in its innovation agenda: superclusters, the Venture Capital Catalyst Initiative, and Coding for Kids.

Fox recalled three things she has learned about innovation during the course of these activities. First of all, it looks to the future. "We have so many things that we still have to learn to thrive in the digital economy." Secondly, it takes partnership and common understanding to achieve this; in other words, "it takes a village". Above all, any action to achieve innovation has a ripple effect that affects other actions, making for a dynamic ecosystem.

She then offered observations from a variety of contemporary observers about technology and innovation, including American author Seth Godin, Paypal founder Peter Thiel, *The Economist* technology editor Ludwig Siegele, futurist Nikolas Badminton, and entrepreneur Salim Ismail. While they warn that our ability to collect, store, and communicate information has made many of the rules of business and society all but obsolete, she weighed the prospect of economic disruption against the very positive prospect that this same technology will make all of us more productive and generally improve our quality of life. Ultimately, she suggested, it might mean that the currency of the emerging new economy will rely less on technology than it does on how we affect the environment around us. All of these converging trends, she argued, are creating ideal conditions for entrepreneurship.

With regard to the new spirit of collaboration that will be required for such entrepreneurship, she offered the example of a small business in the Ontario cottage country town of Huntsville, where a single storefront serves as the conduit for several local producers of food. Similarly, she has been involved in work at Georgia State University in Atlanta, which had created an incubator hub with access to technology companies where students from all backgrounds could find their way into business. She pointed to similar trends in Canada, such as Tecla, a company that helps disabled people access everything from light switches to smart phones. The firm took advantage of a similar cluster of resources in Toronto, including the Digital Media Zone established by Fox at Ryerson.

With regard to the ecosystem that accommodates all of these initiatives, Fox observed that it would be shaped and maintained by the next generation. "We really can't tell our kids what to do," she said. "We can only give them guidance on how to learn." She also expected this change to be reflected in an emphasis on ROL — Return on Learning — that would overshadow traditional measures of return on investment.

She described how such ROL has been attained at the Digital Media Zone, which has been linked to major corporations like IBM as well as international partners like the Bombay Stock Exchange. This also led to the founding of a DMZ equivalent in Mumbai that has since spread to three locations. Similarly, entrepreneurs from other countries have also been brought to the DMZ in Toronto, where they joined a pantheon of successful start-ups that have been spawned there.

Fox related her other experience in marketing various parts of the country for business, such as branding Prince Edward Island as a destination for the food industry or establishing an artisanal cheese operation in eastern Ontario. Such examples inspired her to conclude with an optimistic quote from Star Trek creator Gene Roddenbury: "In the 24th century there will be no hunger, there will be no greed, all the children will know how to read."


## Keynote

# "An Inconvenient Truth: Canada's Innovation Agenda"

DAVID WATTERS
President and CEO, Global Advantage Consulting Group Inc.

Watters premised the theme of his presentation around the notion of who within government might have won the debate over the best way of navigating the route toward an innovation economy. He left that as a lingering question but then described three fundamentally paths forward: one in which Canada becomes a global leader in innovation, another in which the country becomes an average innovation performer, and a third in which this performance declines. This third path — decline — represents the current trend that is actually occurring. Simply to become an average performer, he said, would cost upward of $83 billion over the next five years. Meanwhile, we still do not have appropriate timelines and metrics to go beyond even this expensive goal.

For the purposes of this presentation, then, Watters intended to outline the innovation initiatives that are in the budget, the targets that were set there, and the accompanying framework. To begin with, the budget clearly stated a goal of creating jobs and strengthening the middle class. "The way these get connected is that to access the middle class you have to have a fairly well paying job," he said. "To have those kinds of jobs you have to be producing goods and services. Part of the challenge for Canada is that the Canadian economy is relatively small, so to be able to get those well paying jobs you've got to be producing goods and services for global markets."

Watters stated that the budget gives some idea as to what kinds of goods and services those global markets are seeking, specifically the agri-food sector, artificial intelligence, clean tech. The budget also set clear innovation targets, including growing goods and services exports by 30% by 2025. Similarly, the budget also called for an increase in the clean tech sector and a more general doubling of high-growth companies from 14,000 to 28,000 firms by 2025.

Since all of these goals strongly emphasize exports, Watters said it is crucial to understand what this means. In light of political changes that could affect longstanding trade arrangements such as NAFTA, he concluded that the economic outlook is tepid and uncertain.

Another important aspect of the budget is that it represents essentially no new money, a stark contrast to last year's budget, which was fully 16 times larger than the one before. As for where the existing money will go, some $1.2 billion over the next two years is targeted to skills and innovation, which is about 0.03% of the more than $4 trillion in economic activity Canada will undertake over this same period. "You have to ask yourself, is that going to make Canada an economic leader in innovation?" It also raises questions about where the rest of that money is going. He therefore identified 12 other innovation initiatives that could also play a role.

At the top of that list is a commitment to create Innovation Canada, a new agency within Innovation, Science and Economic Development Canada. This proposal piqued Watters' curiosity, as he was unclear as to how big it would be and exactly what its mandate might be. The list also included a number of funds, which he regarded simply as vehicles for disbursing money that has already been identified. At the same time, the activities of these new initiatives will have to be sorted in relation to some 70 existing federal programs, such as the Canadian Scientific Research and Experimental Development (SR&ED) Tax Incentive Program and the National Research Council's Industrial Research Assistance Program (IRAP). He also cited the Networks of Centres of Excellence program, which currently has 44 networks, although 26 are in life sciences and health while only one deals with manufacturing and engineering.

Watters pointed to a large amount of money going into various facets of clean technology. "To me this becomes the dominant sector," he said. "The government has been very clear about a transition to a low-carbon economy, very clear about support for clean tech."

With regard to higher education, Watters noted that there are no fewer than 500,000 graduates emerging from the country's universities, which represents the emerging talent pool. He showed a graphic prepared for a meeting of university presidents, which outlined the dynamic interactions within the largest institutions, such as University of Toronto, which includes elements such as incubators and accelerators. He regards this kind of background as essential for building on the superclusters initiative that has been proposed in the budget. For example, this breakdown shows that some 80% of U of T's research activities are in health and life sciences.

He also voiced some worry about the relationship between the budget and Canada's private sector. In light of uncertainties caused by political upheaval in the United States, the role of programs like SR&ED or IRAP for industry could change. He views this in terms of the export-led strategy being embraced by the budget, which raises unanswered questions about the export- and job-creating potential in specific sector, such as forestry or mining. He does not know of any analysis that would show whether the high-growth firms to be added by 2025 lie in any of these sectors. He did, however, praise the work of Canada's Oil Sands Innovation Alliance (COSIA), which takes a collective approach to research in this specific sector that is on a par with the

successful economic development models mounted in Europe. There thousands of firms can refer to research that pertains to their line of work, while in Canada such work is conducted firm-by-firm with the support of organizations like IRAP. "This is something we should explore here a little bit further to try and maximize the benefits of research more broadly."

Returning to the question of Canada's innovation ambitions in the world, he examined where R&D investments rank within the Organization for Economic Cooperation and Development (OECD). Since 2004 these investments measured with respect to GDP (Gross Domestic Expeditures on Research and Development, or GERD) and the private sector (Business Expenditures on Research and Development, or BERD) have fallen further and further behind the OECD average. The cost of closing this gap over the next five years, as Watters stated at the beginning of his presentation, would be $83 billion. As for how that kind of massive investment might occur, he was adamant that could only come from increased revenues, which means increasing exports, as proposed in the budget.

Watters nevertheless pointed to the challenge of implementing this ambitious plan, since it is not clear that there is a single coordinating mechanism. "What's the sequence of initiatives you would expect to see over time?", he asked. In this context he showed how much of the budget consisted of "unfinished business", items that have yet to be enacted. "Establish Innovation Canada platform, develop six economic strategy tables led by the private sector, doing a review of business innovation programs, reviewing SR&ED, establishing a superclusters competition, then you've got fund after fund being created," he said. "They don't exist right now. These are promises that are not yet there in effect and we need to recognize that and it raises the issue of how can we help even more to implement what is quite an ambitious initiative that the federal government has put into place."

He noted that there have been six innovation and commercialization studies between 2002 and 2017, with the resulting insight that we are still not keeping pace with the rest of the world. With so much history, he suggested, it is important to consider why they earlier efforts failed and what mistakes must be avoided. One answer, he suggested, may be for greater levels of innovation to start within the government sector. Given a proposed 30% increase in exports, it is important just to deal with the form of that increase. "Do you want it in commodities?" he asked. "Do you want it in high-tech products? Do you want it in the service sector? We don't really have answers to those yet, but I think we should be demanding those kinds of answers fairly soon from the government." He also raised other questions that need to be answered, such as what markets in what countries are to be targeted, as well as what kinds of high growth firms are to be nurtured within Canada to achieve this growth in exports.

As for the next steps, Watters noted that the budget's innovation proposal includes four new organizations, two hubs, four new funds, two reviews of major programs, and five policy reviews. "This is an overwhelming agenda," he said. "To me the issue is 'do we have the implementation capacity to actually advance this thing?'" In order to put that question in perspective, he contrasted the $1.2 billion for innovation with $180 billion that has been set aside for infrastructure needs, such as social housing or transit program. "There's nothing wrong with those kinds of investments but you do have to ask if much of that is old economy and we need to look at a younger generation of Canadians coming up and what about the jobs in the new economy," he said. "Are we giving enough support to creating the infrastructure of a knowledge economy to provide those great jobs?"

He wrapped up his presentation with an exhortation to one and all to look at how they could contribute to implementing this innovation agenda, which he warned might in itself require an unprecedented, innovative approach. Speaking for himself, he noted that his own organization will be doing just that.

John Stewart, of the Canadian Nuclear Association (CNA), asked Watters for more comment on the establishment of sector specific research bodies like COSIA, something the CNA has been considering for its own sector. "That collective approach in terms of doing research and development is one that we need to investigate more," replied Watters. "It requires real partnership of the private sector with government and the academic community. That collaborative model is the way to go. The Europeans have been doing this since World War II and it's a model that we need to understand and work with more."

Vicki Saunders, founder of SheEO, asked Watters about the economic challenges posed by the absence of mid-sized firms in Canada and whether this situation is changing. Watters indicated that a decline in funding to Statistics Canada has made it more difficult to take stock of such trends. What is well known is the fact that SMEs have difficulties reaching markets beyond the US, simply because it is so expensive to do so. "It's stunning that we don't look at a collective approach to helping these SMEs access international markets," he said. "You can't do it on a one-off basis." Another option, he added, might be targeting existing distribution networks as opposed to entire countries.


## Panel
## Budget 2017 and Innovation: Where do we go from here?

**Moderator: Arvind Gupta,** Former CEO and Scientific Director, Mitacs; Former President and Vice-Chancellor, UBC
**Jacques Bernier,** Managing Partner, Teralys Capital
**Martha Crago,** Vice-President (Research), Dalhousie University
**Terry Stuart,** Chief Innovation Officer, Deloitte Canada

*This panel of experts from the public and private sectors will dig deeper into the implications of Budget 2017 for the government's innovation agenda. What areas does it support, where are the gaps and how can stakeholders in different levels of government, industry, finance, academia and the non-profit sector contribute to advancing Canada's innovation agenda?*

Gupta began by asking the panel for their perspective on what the budget represented for innovation in Canada. Stuart indicated that the clear delineation of targets was a promising change, especially with respect to re-tooling education to deal with skills gaps that compromise the country's economic productivity. Similarly, the moves to shore up venture capital are also encouraging. At the same time, he was struck by the $83 billion shortfall identified by Watters as being necessary to make Canada an international innovation contender. "We think the private sector really has to start stepping up to the kind of investment that is needed," he said. "What I would have loved to have seen was more specificity around how we connect public sector investments in the budget with energizing private sector money. I didn't see quite enough of that."

Bernier acknowledged Canada's outstanding efforts in R&D, but noted the need to link those efforts to commercial outcomes and he looked to entrepreneurs to provide that link. As for government initiatives, he praised the attempt to make choices but emphasized the need for courage. "We have to make bold moves, because if we just look at linear changes we won't make it," he said, adding that this also requires a change in culture that could make Canada more attractive for venture capital.

Crago regarded the budget as a response to US election, an attempt to stave off a populist reaction like the one that swept that country. Building on Watters' observation that new knowledge would be required to create the kinds of jobs that will allow people to join the middle class, she referred specifically to the implications of artificial intelligence as a major factor in both job loss and job creation. In broader terms, she regarded an emphasis on science-based policy as being essential to future economic progress, especially in places where government funded science represents the backbone of local research activity.

Picking up on the panelists' endorsement of the budget's willingness to make choices, Gupta pointed out that this represents a departure from previously received wisdom, which insists that government has no place picking winners. He asked if this represents this innovation agenda marks the first step toward a more elaborate industrial policy that will identify specific sectors or even companies that will receive public backing.

Stuart observed that the most promising new areas, such as artificial intelligence, robotics or advanced life sciences, are evolving at an exponential pace that makes it impossible for governments to adopt a neutral stance. "They're going so fast that we absolutely have to understand how to get the skills as well as how to get our governments and companies to adopt them," he said. "We have to make those choices. We have to make them at the vertical level and we have to make them at the clusters where we're going to aggregate and focus our attention. We have a major transformation that we have to evoke."

Bernier agreed, comparing the prospect to car racing, where you have to sacrifice some degree of control in order to gain speed. Crago, for her part, acknowledged that she is not sure how Canada was able to develop the expertise to become a global force in areas such as quantum computing and AI. "It would be interesting to figure out how you select those strength areas and pump them up to move rapidly," she said. By way of example, she pointed to firms in the Halifax area that had developed around a local need for specialized equipment to support ocean research. These same firms now export to other parts of the world where similar research is done.

Stuart reinforced the argument that digital technologies represent a particular area of strength and growth for Canada, but it will require focused attention in order to achieve international success. Bernier argued that such success will benefit from a breakdown of traditional sector silos that will be prompted by the creation of clusters. Gupta reminded the panel that the country began supporting early AI and cyber-technology research in the 1980s. "We actually seeded what we now see as strengths," he said. "Nobody predicted 30 years ago that these areas would be at the forefront of our minds. Yet we made a lot of smart decisions, and I'm very curious about how we did it."

Bernier insisted that this result was not led by government decisions, but great people who moved in this direction. Crago added that some of these people came from outside Canada because they preferred living and working here, something that still applies and can be used to the country's advantage. Despite that advantage, however, Stuart argued that Canada has to get outside its comfort zone to develop talent in areas where we do not typically shine, such as marketing. He contrasts that with an environment like Israel, where marketing skill are essential to economic survival and all firms are born as global exporters because the domestic economy is simply too small. Likewise Bernier advises a shift away from expecting relatively straightforward public funding to actively seeking support wherever it can be found.

Crago brought in the issue of environmental challenge, specifically how to maintain a growing economy and a growing population in a sustainable fashion. She insisted that this challenge will not be met strictly on scientific or technological terms but also through insights offered by social science. She advocated for the

creation of a network of centres of excellence that would be in a position to address matters such as how to incorporate the full potential of immigrants as well as established population cohorts such natives.

Gupta then asked the panel about the future of start-up businesses and what should be done to help them survive and thrive. Bernier said investors used to be non-specialists, who were less demanding of companies and did not know how to assess their immediate prospects for success or failure. Now these investors are much more technically minded and knowledgable about specific markets, so they are able to identify failing prospects as quickly as possible so that everyone can move on with the least amount of financial loss. Crago referred to the earlier comment about Israel, where entrepreneurs have a very well developed sense of when to start and stop a company, which is not associated with any sense of shame or failure.

Stuart observed that many Canadian entrepreneurs display a much more modest degree of ambition than their counterparts elsewhere, such that they will only grow a firm to the point where they feel comfortable and go no further. He added that this attitude is formed early in the educational system, where initiatives like Futurpreneur Canada are attempting to build an outlook that encourages people to seek much more from their careers.

Gupta blamed this capped ambition on the country's extensive SR&ED tax credit program, which provides a major incentive to maintain an enterprise at a less-developed R&D stage. Stuart agreed and advised that the program be made a little more ruthless in cutting off such incentives. Bernier was more sympathetic to the rational for SR&ED, again bringing up Isreal, where a great deal of R&D is financed through military channels, something that is not as practical for Canada to pursue.

Gupta changed the topic to consider the economic implications of populist movements around the world. "There's increasing talk in developed nations that they should look inward and not outward," he said. "And yet our strategy is going to be to try to export more."

Stuart conceded that it is an awkward time to become export focused, but added that the only way for such a strategy to succeed is to aspire to the very high global standards. This is one of the lessons shown in the experience of export-led companies, which have longer life-spans than their non-exporting counterpart, simply because they have had to learn how to achieve those standards. He also added a caveat: "It's not across the board. It's exporting explicit things that we are the best in the world at."

Bernier indicated that this approach also called for a much stronger defence of intellectual property. Crago also revisited her earlier point that companies sought out members of the scientific community for information about products that could have significant export potential. Similarly, she reiterated the notion that the underlying principles of these relationships is a matter for social science research, as opposed to purely scientific investigation.

Gupta noted that budget did not address issues affecting "shovel-ready" industries, such as forestry, mining, and energy. He suggests it is a serious oversight to ignore innovation in these sectors, where Canada has some demonstrable advantages and proven export strength. Stuart responded with a reference to Dave Watters' praise for COSIA and collaborative work in the energy sector. "That model should be understood by a lot more people," he said. "That's a good example of how we support industry sectors collaborating with one another." He added that international transportation initiatives, examining leading-edge ideas such as the Hyperloop, could lead to the same sort of collaborative strength.

Gupta concluded that even an apparent threat, such as the prospect that the US might ask to renegotiate the North American Free Trade Agreement, could provide a timely opening to introduce innovation in established fields. "Maybe the Americans wanting to reset NAFTA is a chance for us to think about how we want to use our natural resources in a more clever way," he said, suggesting that tariffs on softwood lumber could serve as the impetus for establishing domestic industries that export more valuable finished wood products rather than raw materials.

During questioning, Ron Freedman of Research Infosource asked if a firm had revenues upward of $30 million, would that money be better invested in R&D or sales and marketing. Stuart regarded an optimal mix as being 70% spent on sales and 30% on R&D. "We have a desperate gap in marketing and sales, both marketing Canada as a country and marketing our companies," he said. Crago noted that sales and marketing are not prominent within post-secondary curricula, despite calls from the business community for this kind of teaching.

Bert Van Den Burg of NSERC asked the panel for its perspectives on what Innovation Canada should be. Stuart understood this new body to be akin to a one-stop shopping for entrepreneurs to obtain help from the government. Gupta added that the National Research Council's concierge program, created just two years ago, was supposed to fill this same role, which raises questions about why Innovation Canada is now being proposed.

Diana Royce of the Network of Centres of Excellence AllerGen asked the panel to draw distinctions between the budget's current emphasis on clusters and the established role of networks such as hers. Crago described clusters as being business-led, with few of the research qualities associated with an NCE. Bernier cited the importance of bringing businesses on board, but it will be equally important for these businesses to back up with role with tangible investments. Royce wondered if the cluster concept could be integrated with existing NCEs that might be reaching the end of a natural lifespan, such that this could be a natural next step for participants in these networks.

An on-line participant asked why declines in the growth of the country's clean technology sector were not met with new money in the budget. Dave Watters confirmed that this sector is in the midst of a downward trend, but the direction of the field has not been captured in any public policy. Stuart suggested that clean technology's rhetoric got ahead of its ability to deliver, so that early investors were disappointed by short-term results and not willing to wait for longer-term progress.

Conor Meade of The Evidence Network asked what skills and capacities need to be nurtured to improve the country's sales and marketing performance. "Even in the past five or 10 years the tools people use for sales and marketing have been transformed by technology," he said. "What do we need to do on the university, college, K-12, incubator/accelerator level to build Canada's scale-up capacity?"

Bernier recalled his earlier point about the need for a cultural shift that would make it more social acceptable to run a profitable business. Nor do we have examples of large, successful, profitable businesses that can help people learn how to acquire these skills. Stuart compared the need for courage to that mounted by the Own-the-Podium initiative associated with Olympic success.

# Strand A: Improving Canada's homegrown talent

## Panel 1

## Promoting an entrepreneurial and creative society

**Moderator: Hélène Joncas**, Intel Canada & Board Director, Startup Canada
**Narinder Dhami**, Managing Director, LEAP: The Centre for Social Impact
**Vanessa Williamson**, Dean, Applied Research and Innovation, Seneca College

*Building on the priorities identified in Budget 2017, this panel explores how embracing entrepreneurship, developing skills for innovation in our youth and reskilling working Canadians will improve our prosperity and quality of life. Will our education system adapt? How can we leverage Canada's diversity and attract top global talent? How can industry needs be met effectively in a rapidly changing global environment? And what policies do we have or need to foster a culture of innovation and entrepreneurship?*

Joncas began by asking what a creative and entrepreneurial society looks like. Dhami considered that fact that the collection of largest players in both the private and non-profit sectors has remained largely unchanged for decades. She envisioned an unleashing of innovation in social entrepreneurship, so that in the future there would be a much greater diversity of organizations amongst the largest in the field. This approach will also address some of the biggest challenges facing Canada, such as increasing rates of youth unemployment and the changing needs of fast-growing indigenous communities. "All of these challenges can be solved by social entrepreneurship," she said. "To solve them at scale, you need infrastructure around it."

Williamson cited three principles that would shape a creative entrepreneurial society: creative thinking, problem solving, and leadership. "It's a question of how we take those underlying skills and bring them to the workforce and the economy in general," she said, adding that the success of such a society would depend on having more people utilize post-secondary education to acquire new skills. "Success from my point of view would mean that these programs that feed off the foundation of Budget 2017 actually include the colleges so that they contribute to leveraging all the resources that are here in Canada."

Williamson referred specifically to language in the budget that points in this direction, such as a broadening of the description of the Mitacs program to include all post-secondary institutions rather than just universities.

Dhami suggested that success in this context would mean tackling some of the largest and most persistent social issues, especially those calling for public-private collaboration. While ultimately the goal would be to solve these issues, in the short run she would welcome changes to funding in the social sector. "If decision-makers on funding were to re-think how they distribute more than a $1 billion into the charitable sector every year, we can really make big strides," she argued.

Joncas posed the question of how the creativity of Canadian entrepreneurs should be unlocked, which prompted Williamson to cite the need for government programs that are as inclusive as possible. She offered an example from Seneca College, which has an entrepreneurship centre that targets immigrants and people at the margins of society who might not typically be thought of as participating in this kind of activity. "We've got two ventures that have been brought forward by recent immigrants who have come to the college to study and now are moving on through their exposure to our system to create these ventures," she explained.

Dhami agreed. "We often underestimate those who would be considered marginalized, whether they're new immigrants, refugees, or people with disabilities," she said. "We should choose to unlock that potential there." She cautioned that this process is sometimes stymied by desire to support all charitable ventures, rather than steering support toward those that are having the greatest impact and doing better work.

Williamson said that while some companies make repeated use of government support systems, that is not necessarily a bad thing. "Providing people with more support probably gives them a better chance of being able to scale," she said. "Giving some of these companies the opportunity to come again, to learn new things, to get better and actually improve by leveraging talent as well as other resources, is a good thing. We're trying to move from being a start-up nation to a scale-up nation."

Joncas considered the distinction between providing support and providing life-support, and asked if Canada had achieved a proper balance in this regard. Williamson agreed with that distinction but reiterated her support for the value of repeated use of programs by some client firms.

Dhami built on the idea that the implications of innovative technologies such as artificial intelligence, which are already being embraced by the business community, could be channeled into the non-profit sector. She offered the specific example of software that is tailored to work with dementia patients to improve their quality of life. "It would be nice at a policy level when we're making these decisions on businesses that are for-profit that we mirror some of that same structural funding into the social side," she said.

Williamson added that policy decisions should also reflect what the college system can bring into this process. "I don't see this a competition with universities, I think this as being entirely complementary," she maintained. "The types of things that we train for within the college system and the types of graduates that we create are very different from the graduates that we see from the university system. And they all need to be out there to create this type of entrepreneurial system and move it forward."

Given that the successful implementation of AI that is occurring now is the result of research investments that were made decades ago, Joncas asked what areas should be invested in now to yield similar promise in the future. Dhami suggested that the emphasis now should be on scaling up activities that have been demonstrably successful. In this context Joncas asked Dhami to unpack the meaning of the LEAP Centre's use of the term "venture philanthropy".

"We apply the principles of private equity and venture capital to traditional philanthropy to scale the impact of non-profits," Dhami explained. "If you were to speak about the spectrum of social finance, on one end is traditional donations and the other is social investing. We sit in that middle ground. Our model is based on institutional capacity in the non-profit sector that is often lacking."

Joncas noted that just as many Canadian businesses are committing themselves to becoming the best in the world, so too should social enterprises set similarly high standards. Williamson pointed to a college track record that features thousands of graduates who have gone on to become entrepreneurs. "We've embraced a lot of international partnerships so people get direct exposure to the way that the entrepreneurial system is working in other parts of the world," she said, noting that this overcomes a Canadian tendency to look no further than the United States for external markets.

Larry Lam of the BDC asked the panel about whether it is possible to train an entrepreneur. "You can teach an entrepreneur about process, about business, about different aspects of running and growing a successful business," he said. "But I don't know that you can teach an entrepreneur to thrive in an environment that is very dynamic and risky. Should be looking at recognizing and identifying those that are better suited to be entrepreneurs and nurturing that in those people?"

Joncas agreed, but suggested that some educational intervention is warranted because otherwise it will take too long for an individual's capability to come to full flower. Dhami added that her own perspective was shaped by working in microfinance in Africa, where she encountered the risk and unpredictability of an emerging market. She suggested that the current generation of students will be more open to this kind of non-traditional work experience and the new types of work that will emerge. Williamson stated that the goal of this kind of education is not so much to learn the mechanics of a business as to inspire student to seek out these alternative paths for their lives and careers. Nor should such inspiration be aimed at making all students entrepreneurs, but simply cultivating the critical-thinking and problem-solving skills that are valuable assets in any walk of life.

Diana Royce of AllerGen observed that an educational context that is integrated with entrepreneurial activities, such as the University of Waterloo's intense relationship with the high tech community, enables students to learn directly from individuals in these organizations. This ensures that an entrepreneurial perspective is not only accessible, but regarded as permissible for young people contemplating their future. Williamson responded that this is just the kind of atmosphere Seneca has been working to create.

Rory Francis, of BioAlliance PEI, added that even if individual students do not go on to become entrepreneurs themselves, a positive educational experience that showcases the value of these activities could go a long way to changing negative perceptions of those activities in Canadian culture and respecting them accordingly. Dhami and Williamson each concurred, with Joncas adding that a recognition of entrepreneurship can be invaluable in creating teams that take seek a broadly based skill set.

Ashlin Van Roon, a University of Ottawa student, asked about how existing educational structures must be adapted to build better working relationship with entrepreneurial sectors such as citizen scientists. Dhami suggested that integrating such individuals into bodies such as incubators could go a long way toward this goal, Similarly, Williamson suggested that a growing interdisciplinarity of college curricula can contribute to this objective.

# Strand A: Improving Canada's homegrown talent

## Panel 2

## Preparing for a digital world

**Moderator: Dan Sinai,** Senior Executive, Innovation Ecosystems, IBM Canada
**Lisa Cashmore,** Director, Network Operations, Canadian Digital Media Network
**Matthew Johnson,** Director of Education, MediaSmarts

*The digital revolution is opening tremendous opportunities for individuals, institutions and entrepreneurs. At the same time, it is disrupting entire industries and threatening to marginalize those who lack the digital literacy and skills required to thrive in the digital economy. This panel looks more closely at the opportunities and challenges facing Canadians in the digital economy and how each of us and the institutions we operate in need to adapt in order to succeed and prosper.*

Asked to define digital literacy, Cashmore identified two components: the skills behind digital technology and access to that technology. Johnson concurred, describing digital literacy as "a life skill that everybody needs. It encompasses everything from privacy and security to consumer awareness of the commercial nature of the devices and platforms that we use. And also things like ethics and empathy, understand the effect that digital communication has on the way we communicate with one another and understanding the ethical implications of what we do and what we create using digital technology."

Johnson acknowledged that coding skills are widely regarded as a fundamental aspect of digital literacy, but even with those skills people are often digitally creative. He suggested that social media like Twitter opens this potential to all users. Nevertheless, Cashmore suggested that the subject is not well defined, either in general public discussion or in government policy. By way of example she pointed to school programs that introduce student to coding but not necessarily in ways that would nurture the kind of talent that the high tech industry is seeking. Such a disconnect may simply be natural, she conceded, given that the educational

system of 20 years ago did not necessarily know about the kinds of technology that would become the foundation of the current economy.

Johnson also pointed out that digital literacy represents and important component of the government's innovation agenda. A great deal of innovation is not rooted in technical solutions, he argued, but instead a creative desire, often with a significant human or social dimension. In this context, it is therefore important that people engaged in innovation have a fully rounded digital literacy education, rather than simply being embedded exclusively in the technical aspects of their work. This need is often apparent in many working environments, where technical solutions are hailed as the only worthwhile goal, often to the exclusion of other social or cultural values. "You do wind up with hostile environments because things like ethics and empathy haven't been stressed," he said. "You wind up with large companies losing customers because they didn't consider ways to make their platform safe from harassment or paying millions of dollars in fines because privacy wasn't an issue. These digital literacy skills we define are not just life skills that everybody needs – they are that – but they're just as important or indeed even more important for the people who are innovating."

A member of the audience reinforced the call for this broader appreciation of digital literacy, especially as it applies to bringing women working in these industries. Johnson indicated that these and other implications are profound enough to warrant a national strategy on digital literacy. Diana Royce of AllerGen countered that the training that is actually taking place in universities and workplaces is far ahead of where any formal policy might be. By way of examples she described her encounter with a student who had developed practical inventions during the course of her studies, simply producing them up on a 3D printer.

Another question from audience raised the intriguing challenge that a digitally literate generation has shown itself to be less willing to be less willing to employ some older, analogue technologies that are still essential, such as making contact by telephone or setting up face-to-face meetings. Johnson acknowledged that it is essential to find a balance of old and new in order to succeed, especially in the case of opening up export markets, which is only possible when you physically visit these destinations. Cashmore suggested that these are two distinct skills sets that will ultimately cross over, such as using extensive digital exchanges to make the most of a personal meeting. This is already happening to some extent in the latest marketing curricula, which try to ensure that the traditional skills of selling are not lost even as digital technologies are embraced.

On a similar note, a questioner raised the further concern that the latest generation of digital technology users have a profoundly different perception of privacy. Johnson responded that this is a topic his organization has examined closely. "What we found, and what other privacy researchers have found, is that young people do care a lot about privacy," he said. "But they tend to conceptualize it differently than people from previous generations. For them privacy is not about keeping some things locked away and other things public, but rather selecting the publics that they want to see different things." In this context, they select particular audiences with whom they share otherwise private information. At the same time, while these individuals are conscious of how information they post may affect their reputation, they are much less aware of how they are being constantly tracked on-line.

A psychiatry professor at the University of Ottawa commented on the value that digital technology has brought to work with patients. She suggested that the key to this process was in educating these individuals to become knowledgeable and comfortable with this approach. Before teaching people the technical details of digital technology, they should be taught what they are bringing to the table in the first place, by involving them on committees that determine how particular activities will take place. Cashmore cautioned that the promise of such as strategy could well be tempered by the physical limitations people encounter just in gaining sufficient access to the often expensive hardware to work with digital technology.

A final comment from the floor returned to the notion that a lack of sensitivity to non-technical values can create toxic working environments. She related the story of a well intentioned firm that sponsored a robotics program at her daughter's school, but only if they fielded an all-girls team. This turned out to be frustrating because the two genders did not learn to work together and there was even a significant amount of resentment on either side. The lesson was that teamwork and diversity are worthwhile goals, but so too is the opportunity for a majority group to learn how to work with a minority group.


# Strand B: Emerging Technologies

## Panel 1

## Supporting global science excellence

**Moderator: Bert Van Den Berg,** Director, Colleges, Commercialization and Portfolio Policy, NSERC
**Allison Barr,** Director, Ontario Office of the Chief Scientist, Ministry of Research, Innovation and Science
**Rémi Quirion,** Chief Scientist of Quebec

*Canada's unparalleled excellence in scientific research has been a source of pride for Canadians for a long time. This sterling record lies in stark contrast to Canada's reputation as a laggard in innovation. How do we cultivate excellence along the entire continuum from discovery to innovation? How do we increase our capacity to train talented people who can apply their knowledge to find innovative solutions in the commercial realm or the policy sphere? Can our educational institutions train younger generations differently so they are equipped to succeed in business as entrepreneurs or in government as evidence-based decision makers? As we connect globally to maintain links with the evolving knowledge frontier, how do we support and grow niche areas where Canadians can be global leaders?*

By way of introduction, Barr began with an announcement that her office had just completed an online public consultation to help determine the mandate of this new department and begin the process of hiring a chief scientist. "The public is very passionate about science and very supportive of this initiative," she said. "What we heard is that the CSO [Chief Science Officer] should be an interlocutor between the external science community and internally within government." They have also consulted with jurisdictions that have chief science officers, including Quebec within Canada as well as other countries, such as Israel and the UK. Beyond the role of interlocutor, she suggested that a CSO's task was that of overcoming what she called the "paradox of information", namely that we have access to so much material about science and technology that the real challenge is knowing what to trust. The result has been a distrust or serious skepticism of elite groups

such as scientists, a problem at the CSO's office could address. With specific regard to science excellence, she pointed out that the Ontario government funds or co-funds a number of institutes in strategic areas such as quantum computing or biotechnology that are dedicated not only to supporting pure research ventures, but also the commercial development of such work in collaboration with industry partners.

Quirion noted that his position has been re-shaped several times during his tenure there, leading him to conclude that a key quality for a chief science officer is resilience, which establishes the foundation of trust with officials within government. He added that Ontario and Quebec receive the lion's share of federal funding in science and technology, which makes a strong case for cooperation that would yield even greater gains from this sizeable, growing investment. Part of his job is also providing visibility for Quebec science abroad, which means he accompanies government officials when they travel, an opportunity to work closely with them that he also uses to build further trust. He also emphasized that infrastructure and equipment rank second to the need to nurture and hire the right talent to employ these resources. "For me the future of Quebec, the future of Canada, is in the students, the trainees, the grey matter," he said, adding that is hard to round up this talent, especially when it comes to convincing young people to take up a career in science. Even in high profile fields such as artificial intelligence, he observed, most of the new cadre of researchers comes from outside of the country. This implies that the nature of science education in Canada should be changed to draw in more students, a goal that Quirion cited as a major challenge. Likewise, Quebec has a relatively small population when considered in a global context, which means the province much link with the rest of the world to ensure that it can reach the forefront of various fields and lead in chosen sectors.

Barry Kirk, of the Canadian Automated Vehicle Centre of Excellence, suggested that in his field — self-driving cars and drones — he sees federal agencies like NSERC trying to accelerate research in this field even as federal departments like Transport Canada try to rein in the results. He suggested these conflicting mandates are counterproductive. "How can we do a better job of synchronizing policies between the innovation side of the coin and the safety side of the coin?" he asked.

Quirion responded that this query applied to other areas, such as new medical devices. He proposed that an office of chief innovator could relieve some of the tension between research and regulation, but the success of these efforts — like those of the chief science officer — will depend profoundly on trust. Barr stated that Ontario has a Chief Health Innovation Strategist whose job is just that, located within the Ministry of Health. She added that Ontario is also attempting to build the same sort of bridge between departments in other areas where innovation might be held back. Bert Van Den Berg, VP Partnerships at NSERC, cast Kirk's question as a problem rooted in the fundamental design of the research, something NSERC attempts to overcome with funding efforts that bring as many different stakeholders into a research project as possible, so that potential conflicts can be addressed directly and resolved quickly.

David Crane asked two specific questions about the office of the chief science officer. The first dealt with where it is located within the government hierarchy, so as to avoid its being held hostage to any one department's agenda. Secondly, he asked who the primary audience for this office is supposed to be. If the job is simply ensuring the public has access to scientific research within government, he regards that as insufficient grounds for creating such an elaborate agency. By way of contrast, he pointed out that the Canadian federal government's priorities of innovation in artificial intelligence and quantum computing have not been accompanied by formal documents to provide outreach, while in the United States these topics have been dealt with by high profile publications from the National Science Foundation.

Quirion replied that his most obvious audience is the minister to whom he answers, as well as allied departments with an interest in that ministry's activities. In addition, he regarded the scientific community as

being part of his audience, as well as the wider public. Drawing on Barr's term, he summarized this post as being that of an interlocutor. With reference to where he is situated in government, his office is within the ministry responsible for research and innovation. In this respect, he is more like a member of cabinet than a government employee. As for whether he might be better off as part of the premier's office, there are advantages and disadvantages to this prospect. While it might be nice to be located close to this central seat of power, that office is so busy that it can be difficult to have an effective meeting on any given subject. "Often it goes faster when I tell my minister and she goes to the prime minister, which is how it works now," he said.

Barr says this issue is still undetermined in Ontario, with an agreement that the Chief Science Officer should have access to the premier's office but still be heavily involved with the Ministry of Science and Innovation. "Certainly there's a public-facing role for the chief science advisor," she said. "They build the science culture, science diplomacy. But what we heard back from the consultations is that this will be an important role for government." She added that it will be a way of connecting the scientific community with the policy making community, which often do not interact with one another. Quirion agreed and insisted that the role of "advisor" is at once more direct and less formal than it might initially appear to be. "It's not writing long reports," he argued. "It's a 15-minute phone call." In this respect the task is far different from a scientist offering a formal opinion, which might demand much more time to formulate and would be expected to be a definitive answer to some question. Advice in this context may not be taken, and Quirion said this result should be accepted in the sense that science will only be part of the input into any government decision. Barr noted that in her exchanges with the science advisor to the Irish government, that position is framed as a matter of curating science information for use in any kind of deliberation.

Jean-Pierre Martel of FPInnovations returned to the point about attracting talent, something his own organization has an interest in pursuing. Quirion recommended introducing more flexibility in the way science students are educated and employed, so that their career paths can be as open as possible rather than being confined to traditional, narrow degree programs. This includes raising the amount of money available to students, so that they do not abandon their academic aspirations because of economic pressures. Likewise, governments need to streamline immigration procedures so that foreign students and faculty members do not encounter bureaucratic barriers that may keep them out of this country.

Barr added that opportunities for experiential learning can be crucial to attracting and keeping people in scientific professions. As careers in academia become fewer and further between, programs to promote entrepreneurship are a way of engaging individuals in science-based careers.

Van Den Berg observed that cutting edge science draws on international collaborations, which led him to ask the panelists what they are examining to connect Canadian researchers to this global research community. Barr pointed to Ontario's suite of provincially funded research institutes in strategic areas, which are characterized by work that operates at a globally significant level. Similarly, a competitive research funding program supports the most outstanding individuals and their projects. Quirion outlined Quebec's own efforts to ensure that the province's researchers are at the cutting edge of their fields, not necessarily in every discipline, but in those that have been identified where global leadership is possible.

Jutta Treviranus from the Inclusive Design Research Centre argued that innovation should spring from fresh, original thinking, rather than trying to emulate the best thinking from elsewhere. "Innovation isn't a race to the same pinnacle," she said. "Let's start looking at, when individuals arrive here, not trying to indoctrinate them to an exact Canadian perspective but to also look at what we can add to and collaboratively create innovative teams." Quirion said that Quebec has already embraced this notion, supporting even high school students who bring forward interesting ideas that might lead to the development of a small business of some sort. Barr

added that in the Ontario government's consultations around science advice, the need for diversity was prominent, with many respondents insisting on initiatives such as those that would create roles for women or aboriginal knowledge.

An on-line participant in the conference asked the panel how they would measure the success of a chief science officer. Barr offered qualities such as becoming a credible and trusted advisor to government as being evidence of success.


# Strand B: Emerging Technologies

## Panel 2

## Agriculture: Canada's Secret Growth Engine

**Moderator: Marc LePage,** President and CEO, Genome Canada
**David McInnes,** Consultant & Special Advisor to the Canadian Agri-Food Policy Institute
**Carla Ventin,** Vice President, Federal Government Affairs, Food & Consumer Products of Canada (FCPC)

LePage began with a rationale for agriculture's pre-eminent place in the Canadian economy, and its potential role as a lucrative gateway into the bioeconomy. "It's huge," he said. "If you look at our export stack, 20% are in what you would call the bioeconomy: agriculture, food, forestry, aquaculture. That is by far the single biggest conglomeration of exports. It's bigger than oil and gas and electricity. It's bigger than automobile manufacturing and parts. So if you can't grow that sector, it's hard to imagine you're going to have growth in the economy."

He added that the firms responsible for this sector are large and well established, having scaled up and providing significant employment for Canadians. And while this sector engages in a great deal of innovation, LePage noted that it is widely perceived as being part of the "old" economy, and therefore in decline. "This is a very technologically sophisticated area," he insisted, offering the contrast between Sustainable Development Technology Canada's current estimate of clean technology sales — $19 billion — and the Canola Council of Canada's estimate of sales associated with this one crop — $26 billion. In 2005, he pointed

out, canola sales were just $5 billion, which indicates how substantial growth has been in this area. Other crops, such as soybeans and pulses have seen similarly dramatic increases over the past two decades.

Ventin built on this theme, describing the role of her organization in food processing, which is a key part of the extensive value chain that moves food from farm fields into people's homes. "A lot of things you don't know about the food processing industry: it's the largest employer and manufacturer in Canada," she said. "It employs more than auto and aerospace combined." In addition, member companies that belong to Food & Consumer Products of Canada are found right across the country, which makes this a truly national industry in a way that auto and aerospace are not. With regard to the federal budget, she observed that it put agri-food in the spotlight, especially insofar as there was an unprecedented willingness to pick "winners" in the economy, including this sector. This contrasts sharply with previous budgets that never mentioned agriculture to any significant extent.

McInnes referred to a then-unpublished roundtable report, *Canada as an Agri-Food Powerhouse*, that the Canadian Agri-Food Policy Institute was preparing in collaboration with the Public Policy Forum. The document would be formally presented to government at the end of April as a way of highlighting the potential of this sector. Meanwhile, he pointed out that while every industrial sector likes to think it is Canada's most important, this one does deserve some special status. "What is it about the agri-food sector that is deeply touching so many people?" he asked. "The choices you and your family make about what you put in your mouths — you are deeply concerned, your kids are deeply concerned about what is in that food, where does it come from, is it good for me, and is it causing harm to animals, people, labourers, or the environment. This is a profound shift that is taking place here and around the world." Given the profound physical and economic resources Canada can bring to bear on these matters, this is why discussion of these topics has come to the forefront of the government's current agenda. "This is an investment and innovation opportunity for the country," he said, echoing Ventin's assertion that it was remarkable to see a budget that ranked the significance of food with that of clean technology and digital technology.

Unfortunately, because the agri-food sector is so very diverse, there is no single group that speaks on its behalf, which put it at a disadvantage with respect to the very focused industrial representation in the automobile or aerospace sectors. McInnes reiterated that the closest thing to this kind of representation is the mounting consumer interest in the field, which is unique. Another challenging aspect is the need to assign an economic value to the land and water that are vital to agricultural output without burdening agri-food with demands that make it globally uncompetitive. He regarded such considerations as part of a major shift in our mind-set when it comes to this part of our economy, a vision that was signaled in the recently released report from the Advisory Council on Economic Growth, *Unleashing the Growth Potential of Key Sectors*. "Canada can and will become the trusted global leader in safe, nutritious, and sustainable food for the 21st century," McInnes quoted from that report. "That's quite a call."

LePage responded to these remarks by pointing out that the public perception of this sector has to evolve to meet this potential, which includes a re-branding of it that highlights innovative areas such as artificial intelligence, big data, and genomics, all of which play a role in modern agriculture even though for many young people it is seen as a marginal, even primitive pursuit. By way of example, Ventin referred to a 2014 report by KPMG that was mandated by Industry Canada, *Technology Readiness Assessment of Automation and Robotics in the Food and Beverage Processing Sector in Canada*. "There is huge room to grow," she argued. Ventin added that the diversity of the field posed the problem that support for this kind of innovation could emerge from many different parts of government, which could prove to be frustrating to individuals and companies looking for help. She suggested that just as the government was displaying a newly found propensity to pick winners, so too should it adopt a one-stop shopping approach for this kind of support.

Ron Freedman of Research Infosource asked the panel for comments on the non-food aspects of agricultural production and how this field was evolving. Jean-Pierre Martel of FPInnovations in turn offered his own comment from the perspective of forestry, a huge sector that is already well steeped in this aspect of the emerging bioeconomy. "There's an ongoing conversation around creating a supercluster around bioeconomy that would be feedstock agnostic, looking at both agricultural feedstocks and forestry feedstocks, and how we could bring added value to the sector," he said, referring to end products such as biofuels or bio-materials.

Christine Trauttmansdorff of Colleges and Institutes Canada asked about coming training challenges that may be appearing in agriculture and agri-food. McInnes commented that a top priority is just getting students to take this sector seriously as a career prospect. "When you look at how agriculture is represented — the little red tractor with the nice hillock and the barn in the background — that's not agriculture today," he said. "Actually agriculture is precision technologies, satellite imagery, GPS, where you're putting a precise amount of water and fertilizer on a plant. You're managing landscapes by square metres so you can maximize your yield." Genomic insights into the microbiome or retail data to tailor production according to consumer tastes are also integral parts of this business. "This is a high-tech play," he insisted. Ventin agreed and offered specific examples of the complex research that goes into the preparation of foods that we take for granted, such as how to reduce their salt content while retaining or improving the taste, or keeping these products fresh for longer periods. Returning to the issue of automation, she pointed out that European firms had leapt to the forefront in this area, which requires sophisticated engineering to take raw food from the field and make it ready for wider distribution in ways that are safe and efficient. "There's a lot of technology around," she said. "There's just not a lot of understanding of what's needed."

David Crane indicated that building on the strengths of agri-food and agriculture will take large firms to provide leadership and venture capital. He also observed that climate change is altering water flows across the country and could create serious problems in prime growing areas like the Okanagan Valley and the prairies. He then challenged the underlying premise that this budget is a game-changer, suggesting that $60 million over five years is hardly a sign of real commitment. "We have been down-grading our investment in federal agricultural science for a decade," he said. "You might argue that this is only a partial catch-up to what we used to do." Nor is this funding tied to a particular strategy, he added, pointing to huge questions about the best way to proceed. LePage responded in general terms, acknowledging Crane's point but offering an optimistic perspective that this modest move in the budget represents an ongoing shift in the right direction. Ventin pointed out that food processing currently receives only five per cent of the R&D funding available for all of agriculture, which means there is nowhere to go but up. She suggested that the budget signaled just this kind of progress by now placing food processing on a par with areas such as clean technologies, artificial intelligence, and quantum computing. With regard to the need for large firms in the sector Ventin said the large players already there are often foreign owned, which has led to them being ignored by the Canadian government, which may be inappropriate. Rory Francis of PEI BioAlliance added one further observation, which is that the $60 million mentioned by Crane is not the entire federal research budget for this area but only the incremental amount.

Another question revolved around the challenges associated with public acceptance of Genetically Modified Organisms (GMOs), which has the potential to disrupt agricultural research funding in this area. LePage maintained that Genome Canada has no bias in this regard although policy still remains vague around new and potentially disruptive gene-editing technologies such as CRISPR, which could be used in human beings.

# Strand A: Growing Companies

## Panel 3

## Scaling up

**Moderator: Marc Duhamel**, Professor, Microeconomics, Université du Québec à Trois-Rivières
**Margo Crawford,** Founder and CEO, The Business Sherpa Group
**Doug Michaelides,** Founding Executive & Head of Sales and Marketing, Stratford Managers
**Haroon Mirza,** Managing Director & Entrepreneur in Residence, OneEleven

Each of the panelists offered an introduction that placed their own background in the context of this discussion. Crawford began by describing how she and two colleagues formed a high tech company and later sold it, subsequently forming her current firm, which helps small and mid-sized businesses scale up their operations. Mirza outlined his experience running small venture firms before joining the accelerator that he currently runs. Michaelides also runs a firm that helps companies scale-up, an activity that he came to understand in detail while working at Nortel Networks.

Duhamel asked the panel what hurdles companies face after start-up that prevent them from growing. Michaelides immediately distinguished between the success of a company's innovation work in technical terms and its ability to create a sustainable business model. "We build great products," he said. "What we don't do as well is build businesses. And those businesses that we do build we're often tempted to sell, so we become a farm team for Silicon Valley." In this respect, the challenge of scaling is not improving one's performance but becoming self-funding and resilient. Here the obstacle can be people's experience, their ability to help an organization shift from working harder to working smarter, and cultivating a process of continuous improvement.

Mirza then identified three pillars that are essential to scaling up: access to customers, access to growth capital, and access to talent. The first of these items revolves around selling and more importantly, the mechanics of building what he called a "sales machine". Growth capital most prominently comes from venture

firms, but he suggested that aggressive start-ups would be looking globally to find this resource wherever they can. Finally, the kind of talent with the experience and ability to grow the firm can be hard to find, which often makes it necessary to seek out these people beyond Canada's borders.

Crawford suggested that the move from start-up to scale-up involves some important changes in perspective. In start-up mode, for example, the focus is short-term, getting the next round of financing and other immediate decisions. In scale-up mode, however, longer-term considerations come to bear. This means the type of talent you will seek out needs to be very different, and it can be harder to find. "It is talent that has a long-term view, like chief marketing officers, sales and business development, and people who can integrate processes within the organization," she said. "Sometimes that talent will be coached and groomed. Sometimes it will be achieved through an M&A strategy, or you may have to look at alternate models of bringing in that talent to support the company's scale-up." Similarly, she added, the notion of innovation evolves from a straightforward focus on technology to innovation in processes or business models, which are essential to scaling up.

As for what governments might be able to do by way of supporting these moves to scale-up a company, Crawford pointed to a frustration with metrics, specifically an emphasis on jobs and exports as measures of success. She suggested that job creation might be indirect, rather than taking place within the company, and expansion of exporting activity might not take place entirely within Canada but instead through acquisitions taking place abroad.

Mirza advised that governments should engage in measures that increase equity value creation. He suggested steps such as making it easier to bring in talent from abroad or improving the ability to sell to the government itself. Government could also promote and showcase outstanding performers, which can have the ability of attracting both money and talent to these enterprises. Michaelides recommended that governments should not focus as closely on supporting innovation efforts but helping growing firms become self-sustaining. "That's a big shift in thinking from seeding technology and intellectual property to creating business models," he said, adding that he was pleased to see the federal budget's emphasis on skills creation in addition to the discussion of innovation. However, much of this emphasis was on early-career investments, and he would like to ensure that experienced people have an opportunity to further broaden their skill base. Nor should these efforts be restricted to government, he argued. "If we want to create a scale-up culture in the country, it's got to be business people who aren't just about creating a start-up to sell it but one that can create a dominant position in a world market," he said.

Duhamel observed that these responses were stepping away from a strong dependence on the priorities of science and technology to values that are more closely associated with commerce training. This raises the question of how these two sets of factors are to be balanced.

Crawford suggested that business intelligence had to take on the same weight as technical innovation. "The innovation is no longer just happening in the technology being developed, the innovation has to be in smart business models," she said.

Mirza recalled that when he was at Carleton University's School of Commerce there was nothing in the curriculum that dealt with sales, but he outlined an even more revealing experience he had there when representatives of a number of start-up firms were invited to meet a high profile venture capital investor and ask him anything they wanted. Mirza was disappointed when no questions were posed. "They were afraid to ask him questions," he concluded, adding perhaps a sense of curiosity should also be nurtured in business schools.

Diana Royce of AllerGen referred back to the conflict between short-term and long-term planning. "We have a system in our investment programs to start things up but there's no plan for continuity," she said. "We aren't good at judging performance, so we don't support performance." Crawford agreed that the limitations around metrics pose a major challenge in this regard, one that can sometimes only be overcome when management changes to reflect a new set of priorities.

Mirza emphasized that entrepreneurship is a long game, one that often calls for a serial approach of selling an earlier enterprise rather than scaling it up. He indicated that such individuals are regularly seen at his organization, repeat entrepreneurs who return with greater experience and greater resources that will allow them to go much further the next time. In this light, he maintained that when entrepreneurs sell a start-up, this should not necessarily be regarded as a negative outcome but an important step toward enabling this individual to scale up some future venture.

Michaelides disagreed to some extent, acknowledging that this makes a compelling case, but it may not necessarily be true. "From an economic perspective of the country I do think we need something to encourage the creation of the engines, the anchors — we need another Nortel, we need another RIM."

Mirza countered that the sale of an enterprise releases capital that was tied up in that enterprise and frees it to go into other ventures. He reiterated that the process represented a long-game that sustains a wider ecosystem where larger enterprises will ultimately appear.

Jeff Crelinsten concluded with a key question to the panel about the size of the companies that they deal with. Michaelides said that his clientele has a minimum of $10 million, that being the point at which a company can afford their services. He suggested that smaller firms could also benefit from their services, which would offer a rationale for some government support to make that possible. Crawford said the cut-off for her clientele was revenues of $2 million, although she suggested that the number of employees might make a better measure of initial size, since revenues can vary dramatically with the number of employees. Mirza observed that his clients might start at $1 million or $2 million, with just a handful of employees, then grow to $20-30 million.


# Strand A: Growing Companies

## Panel 4

## Building world-leading clusters and partnerships

**Moderator: Iain Stewart,** President, National Research Council of Canada
**Rory Francis,** Executive Director, PEI BioAlliance
**Laura Kilcrease,** CEO, Alberta Innovates
**Eme Onuoha**, Vice President, Global Government Affairs (Canada), Xerox Corporation

Francis began by observing that for some time it was regarded as poor form to talk about clusters, which he defined as geographic concentrations of interconnected businesses, dynamic research capabilities, and government partners. "It's business-led but underpinned by a science and technology platform and public policy, and an alignment of culture and bottom lines that allow for the impact that the members are looking for," he said. As for what matters with respect to clusters, it is the growing discussion of innovation ecosystems, which includes elements such as access to capital, human resources, and infrastructure public policy. "Those elements enable clusters to be successful," he said. "The other important aspect is that successful clusters do a good job of defining at the outset what success looks like — why are we here, what are we doing, and how do we achieve the targets we're setting for economic impact." He added that some clusters have deep historic roots, such as clockmakers in Switzerland, while in more contemporary terms he pointed to groups within Canada's automobile and agri-food sectors. He also suggested that the provision of funding to create clusters with result in an assemblage of enterprises, but they will often be less effective than ones that emerge in a more organic fashion because of shared interests, resources, and goals.

Kilcrease cited her own experience with the creation of clusters in Texas in the 1980s, which was done in a somewhat arbitrary fashion by advance planning. "We looked at semiconductors and we looked at software and we said if we build those two clusters, hardware will fill itself in the middle," she said. "So we actively looked at building the density of those clusters." She learned that sometimes the success of these ventures depends on something that appears to be insignificant, which in this case happened to be the presence of a specialized laundry business to ensure a supply of clothing for workers to operate in clean rooms.

Onuoha agreed with these first two sets of observations, to which he added that clusters also represent something that suits the public policy of the day. He associated clusters with collection, which refers to the recruitment of like-minded individuals for a common goal such as commercialization. Nor is this process always rational and deliberate: "The successes that have been the most compelling for our company have been those in many cases that have been an accidental interaction, a very unconventional collection of subject matter experts who were brought into our space through a heretical idea to open our global innovation value chain," he said. "Canada is no exception to that. If you are not captive to a geographic or even an industry definition of cluster, then you embrace this notion of collection — collection of diverse, talented, agile minds who aren't afraid of heretical ideas and have the space and time to ask and answer heretical questions."

Onuoha acknowledged that large, established firms like his might not seem to offer the right environment to spawn such agile initiatives. Yet he argued that these same firms offer the virtue of "anchor tenancy", which results in just this kind of agility. "We're the only corporation in our technology space that's conducting value-added advanced materials research under a global mandate in Canada, which is sad to say," he explained. "Our operation started over 40 years ago, in 1974, and it's interesting to note that the establishment of these operations was very much driven by an ambitious and curious appetite for collaboration. It wasn't necessarily informed by delicately curated public policy incentives such as tax incentives. When we decided to open up our research centre it was done not as an act of establishing our singular storefront, it was a functional interaction with universities in and around the location of our current site at Sheridan Park." These academic interactions were relevant to the company's value chain, which drove the act of engage — or collection — that was not necessarily tied to Canada or even the development of any particular product or service. It was the emergence of this skill set that drove the company's desire to do more in Canada and ultimately resulted in the research cluster as it exists today.

For his part Francis likewise acknowledged that there is no single correct model for building a cluster, but he emphasized the overriding importance of focus. "The models that have the most likelihood of success are those that have some sort of a convener, a facilitating structure to coordinate the development of strategy," he said. "Without that, and without someone to sort through the ideas that are coming from all corners, it can be a kind of cluster lag."

Kilcrease returned to the critical role of density in the success of any cluster. "If we don't have density in a cluster, after a certain period of time we don't have a cluster," she said. "You have a random group of people that might come together with a random group of companies that will end up going off on a 90-degree angle." Her point prompted Francis to assert the overwhelming importance of a leadership structure that transcends the self-interest of all the participants. "If everyone's only there around that board table because of what they can get out of this because there's some money floating around, you're dead," he said.

With respect to the role of government in providing such leadership, Kilcrease said that while most people insist that it should be a primary funder, she maintains that this is just a minor role. "I actually think we should

be a convener, we should be an accelerator, and perhaps we should be a seed funder — not a funder for life, to put money in to get some base components for the infrastructure of the cluster," she said. However, this mix will vary from one setting to the next, especially where the driving principle of a cluster is new and untested. By way of example, she discussed the emergence of carbon capture technology in Alberta, a potentially huge global sector that is still in its nascent stages and in need of support from government.

Onuoha suggested that it is incumbent upon governments to go beyond just the process of convening shared interests and make a serious attempt to understand the value chains that drive decision-making within participating private-sector partners. "If you do want to maintain anchor tenancy and the engagement of firms like my own, there is a requirement to inform sustainable presence by virtue of linking the activities back to the profitable value chain associated with the firm," he said. When this understanding exists, governments can be well placed to help de-risk the participation of these firms in a cluster by clarifying relevant regulations or legislation, something that is actually a low-cost undertaking but one that yields great impact.

An initial question from the audience returned to the issue of defining the success of a cluster. Francis began by pointing to factors such as private sector revenue growth, job creation, R&D investment by the private sector, and investments in capital equipment related to the cluster. Kilcrease referred to these as the essential "hard" metrics around success, to which she would add a "soft" measure of diversification, which examines whether participating industries are moving into new areas. This is also linked with the idea that the local reputations of these participants are being amplified, something that may be hard to measure but definitely worth noting. Unuoha added two other soft measures, the capacity to build up communities of practice and the capacity to build a future pipeline of knowledge brokers.

Writer David Crane argued that Michael Porter's original definition of a cluster predates the working reality of the digital economy, with its 24/7 scheduling and global value chains. This raises question about how these profound changes might affect the willingness to invest in a new generation of clusters.

Francis agreed that connections to global value chains are overwhelmingly important to clusters, while Onuoha highlighted the ongoing importance of regional development within clusters, which continues to drive individual participants within clusters. "There is still the imperative to create prosperity within regionally defined spaces," said Onuoha. "The geospatial aspect of clusters remains compelling from a public policy perspective." Kilcrease added that the new technology driving these economic changes also provide new tools for analyzing the behavior of clusters, such as the ability to forecast the complex information flows within social networks.

Stewart picked up on that point, indicating that the greatest impact of a cluster may lie outside the private sector, which then poses a challenge as to how to encourage and secure the ongoing participation of firms in a cluster. Francis conceded that there has to be an appropriate balance between the firm's self-interest and the desire to connect with a wider community and potential opportunities.

A representative of the Networks of Centres of Excellence program asked for examples from outside Canada where superclusters have been successfully implemented. Francis suggested that a working definition of supercluster is still under way, but he pointed to a large, dense centre like Boston where even as internal competition mounts, local interests collaborate more intensively with one another because doing so continues to yield advantages. Stewart indicated that the federal government's superclusters proposal is of great interest to the National Research Council, which is already an active participant in many parts of the country where such clusters may be proposed.

Ron Freedman of Research Infosource asked what cluster managers are supposed to do with money once it begins to appear. Francis replied that the list for him would begin with simply expanding their physical space, then turning to acquiring talent that is essential to his cluster in the biosciences. Kilcrease suggested that she would use it to strengthen ties between the different types of participants in the cluster from academia, government, and industry; in addition, she suggested that more funding would enable these ties to grow beyond regional or provincial borders to become truly national in scope. Kilcrease also recommended that these resources be placed in a platform technology that could be used to build up the cluster, such as big data or artificial intelligence systems. Onuoha returned to the idea of talent acquisition, which he regarded as essential to making the best use of local skills and applying them to larger global goals. "At the end of the day the collective and the creative are informed by an enlightened state of play, amongst enlightened people who are brought together and interact and pose and answer heretical questions," he said. "So a significant portion of that resource needs to be dedicated to bringing them here and keeping them here long enough to complete the mandate."

Stewart returned to the suggestion that additional funding should be put into shared infrastructure, pointing to the need for facilities that no one participant could afford but would benefit all of them. By way of example he pointed to the need for a non-profit platform to benefit cell line scale-up by more than a dozen companies working in biotechnology. Perhaps even more relevant was the way the National Research Council rescued Nortel's photonics fabrication technology and embedded it in a facility on their Ottawa campus, which has an array of customers, none of whom would be in a position to build and maintain such a site but nevertheless benefit enormously from it. "The government of Ontario, using cluster money, bought the facility from Nortel for $45 million," he said. "Its replacement value is US$200-300 million."

A final question dealt with the issue of density, asking at what point a cluster reaches its critical mass and whether that point would be different in Canada than other parts of the world, or even different within various parts of this country. Francis pointed out that the size and density of clusters varies dramatically around the world, but in his own case he takes it as a key milestone when you can attract highly talented individuals to the cluster because they will have multiple opportunities within that structure. Kilcrease suggested that the initial growth of a cluster will depend heavily on local circumstances, but over time those circumstances can be changed as the cluster matures; by way of example she pointed to the rapid uptake of clean technology in Texas, which had no history in this field but eventually became home to clusters that now lead the way.

# Strand B: Emerging Technologies
## Panel 3
## Leveraging Emerging Technologies to Benefit Canadians

**Moderator: Ursula Gobel,** Associate Vice-President, Future Challenges, SSHRC
**Joanna Berzowska,** Associate Dean Research, Faculty of Fine Arts, Concordia University; Head of Electronic Textiles, OMsignal
**Sonia Chiasson,** Canada Research Chair in Human Oriented Computer Security, Carleton University; Acting Scientific Director, SERENE-RISC
**Jutta Treviranus,** Professor & Director, Inclusive Design Research Centre, OCAD University

Gobel introduced the topic by pointing out that while Valerie Fox's opening keynote dealt with ways in which technology is augmenting humanity, this discussion would explore the ways in which humanity can and should augment technology, using three examples from cybersecurity, inclusive design, and smart textiles.

Chiasson introduced her research field as understanding the ways in which human behavior impacts cybersecurity, which includes how this behavior affects the design of systems that provide on-line security. In addition to examining the difficulties that users may have with security or privacy systems, this work examines how well these systems provide security. According to her, many observers are fond of asserting that users are the weakest link in our attempts to provide security, but she disagreed with that assessment. "My argument is that it's the design of the systems and the policies that are the weakest link," she said. "The reason I say that is that we can actually do something to fix those, whereas we're not going to design a new human. Humans are the status quo here, so how do we design the system to better adapt to human needs?"

As a demonstration of how this would work, she offered the frustrations that arise from the use of passwords and their associated policies, such as forcing people to regularly change this password and risk forgetting it. "The expectation is that they're actually improving security in some way, but if you actually look at the threat models, they don't match up," she said. "There are other security mechanisms that would make a bigger difference and yet we're still imposing that burden on users." She cited the Internet of Things as another area of concern, one that is still unknown as experts study what it means that devices such as fitness trackers or refrigerators are collecting and sharing data about us.

With respect to goals, Chiasson made some crucial distinctions between security and privacy. The former has a fairly straightforward goal — keep the bad guys out — while the latter is much more fluid in nature, depending on individual thresholds for sharing personal information. She also advised watching closely for how much of a burden is being placed on users with the hope of making them more secure. "Remember that users are human and expecting anything else is setting up your system for failure," she said. "They're going to make mistakes, they're going to forget things, they're going to take short-cuts," she said. This also applies to privacy, where technology that can be used to compromise privacy will at some point be used for just that.

Treviranus indicated that her organization is almost 25 years old, having survived all that time on competitive research grants based on themes of accessibility. "Our primary ethos is that innovation happens at the margins," she said. "Diversity is not really a challenge, it's one of our strongest assets." Above all, she insisted, diversity is something to be leveraged, rather than simply dealt with and resolved. "We know from our research that diversity results in greater innovation, better risk detection, better prediction, agility, dynamic resiliency," she said, noting that diverse systems no longer have a single fail point and are therefore harder to take down.

In much the same vein, Treviranus' organization has adopted a different definition of disability. "We say that disability is a mismatch between the needs of the individual and the service, product, or environment offered," she explained. In this context, all of us experience disability in some form or another, which provides the rationale for inclusive design that is meant to accommodate the widest possible spectrum of users. Since Canada is attempting to distinguish itself from the rest of the world in terms of its innovation strategy, an inclusive approach would be entirely in keeping with a widespread perception of Canadian society. "But if we are going to take that leadership role then there's a huge amount of restructuring and rethinking that needs to happen," she said.

Among the places that will have to undertake these changes is academia, which currently tends to winnow ideas into narrow channels for analysis, an approach that is counterproductive when it comes to innovation based on diversity. "One of the things that we find quite scary is that with big data and artificial intelligence we're just intensifying that," she said, pointing to the way in which social media has created well entrenched "echo chambers" that are utterly lacking in diversity of individuals and ideas. Such problems are entering into other aspects of information technology, such as automated help lines that cannot handle accents or speech impediments. "Anywhere AI is being deployed, if you are not typical then you have difficulties," she said. "We're feeding into this pattern of disparity." Her organization is supporting work by students to test how well machine intelligence can be adapted to overcoming this kind of challenge.

Berzowska introduced her take on the integration of human needs with technology by describing the launch of her company's "smart" shirt, a biometric garment that is much more powerful than a typical tracking device like a FitBit. Working with the same factory that produces high-end Ralph Lauren sports apparel, the result is a sensor network that is integrated into the fabric of the shirt. For athletes, the sensor network in the shirt

collects information about the wearer's movements and other details of their metabolic activity, which can become integral to shaping a training regimen and becoming a better athlete.

Although the application of this technology to sport is obvious and immediate, Berzowska sees even greater promise in the health and wellness sector. Above all, these shirts were produced in existing facilities with only a marginally higher cost, something that promises to make this kind of clothing much more widely available. She acknowledged that there could be all manner of ethical and societal concerns to be addressed should that happen, but she insisted that the prospect of helping individuals become more aware of their bodies and their health could overcome some fundamental challenges facing health care.

Above all, Berzowska observed that the fundamental work being conducted on functional fibres represents a major field in itself. "There's new kinds of fibres, which translates into all kinds of work for chemistry, material science, tons of research for manufacturing, especially what's called additive manufacturing," she said, concluding that this simply sets the technological stage for the security and privacy issues already broached by Chiasson and Treviranus.

Barry Kirk, of the Canadian Automated Vehicle Centre of Excellence, described how a team of "white hat" hackers broke into the operating system of a Bluetooth-enabled coffee pot and wondered how they would fare trying to hack into OMsignal's smart clothing. With respect to his own interest in autonomous cars, he noted that one industry analyst had calculated that the data generated by the sensors attached to such vehicles could be several times the value of the vehicle itself. "That's where the real money is," he said. "How do we balance the business case allowing industry to make some money with some very valid privacy concerns?"

Chiasson noted that this same conflict was already well established in the field of "free" apps that collect user data. "As a society we're going to have to step back and think where are our boundaries," she said. "What does it mean to be willing to give up that information to have the convenience of the car being safer? I don't think it's going to be a one-size-fits-all model. People are going to have to have the opportunity to choose to enable or disable various things and be able to make informed decisions." Treviranus added that most existing user agreements do not incorporate those kinds of options, being instead an all-or-nothing proposition.

Gobel suggested that this example indicates how much we as a society are in a state of trying to catch up with this technology even as it races ahead. "What are the factors or processes that we can change to try to mitigate some of those risks from either escalating or happening at all?" she asked the panel.

Treviranus responded that design for diversity represented the best strategy. "That's a far better model in terms of being sustainable," she said. "Even if we catch up and become the leader, somebody else is going to compete to become the next leader. But if we create something where we differentiate ourselves and have a diversity of innovations, then we reduce disparity, we gain agility, we have more choices, we don't have single fail points, we don't have enterprises that are going to crash and take the entire economy down with them."

Berzowska agreed but noted how difficult it can be to develop multidisciplinary teams. Nevertheless, she insisted that it is worth trying to do so, especially as traditional disciplinary boundaries in science and technology steadily erode in the face of dramatic innovations. That observation led Treviranus to describe these systems as irreducibly complex, an entirely new environment we must learn to navigate. "All of the risks we're dealing with are complex adaptive systems," she said. "They're not static. We can't fix them. They're not problems that we're going to find a single solution to. It's going to have to be an approach and the more diverse perspectives we have on the problem, the fewer blind spots we'll have, especially when it comes to

cybersecurity. The 'white hat' hackers are a great example of the type of diverse skills that we need to bring to this problem."

Gobel posed the challenge of how to make such matters a priority for leaders, in the same sense as the budget picked "winners". Chiasson emphasized the need for a business case to outline the costs that will be entailed when — and not if — something goes wrong. Only in this way can preventive measures be embraced in all parts of an organization, rather than simply being confined to an isolated security division. Treviranus returned to the theme of diversity rather than picking winners, which implies that there would likewise be losers and therefore an ongoing tension between these two groups. "We're never going to have lasting prosperity unless it's inclusive prosperity," she said.

Berzowska answered this question by focusing on the area of textiles, which she regarded as an older, venerable technology that should be accorded respect even in the face of innovations such as those her company is introducing. "Instead of trying to re-invent smart things to put on our bodies, there's so much potential just working within that technology and augmenting it with new advances in material science," she said.


# Strand B: Emerging Technologies

## Panel 4

## Autonomous Connected Electric (ACE) Vehicles

**Barrie Kirk,** Executive Director, Canadian Automated Vehicles Centre of Excellence (CAVCOE)
**Brian Pratt,** Head of New Verticals Partnerships, Corporate Strategy & Development, Nokia
**Marianne Wilkinson,** Councillor for Kanata North in the City of Ottawa

*Driverless vehicles are coming to your neighbourhood soon! Fully autonomous vehicles (AVs) are predicted to be on the market by 2020. Many cities across Canada and the US are planning to allow testing of AVs on city streets. Auto manufacturers that have publicly announced AV programs include Ford, GM, Audi, BMW, Daimler Benz, Volkswagen, Honda, Nissan, Toyota, Peugot and Volvo. The Ontario government has already established regulations for AV pilots in the province. Public and private sector interests are investing significant resources into AV research. This panel will assess Canada's potential for success in this quickly developing industry sector.*

Wilkinson began by pointing out that her constituency is home to the largest technology park in Canada and that Ottawa actually has three times the amount of technology employment that Waterloo does. It is also home to QNX, now owned by Blackberry, which has already built its own autonomous vehicle that will be tested on Ottawa roads this summer. Ford has also acquired expertise from QNX to help them implement some of this same technology in their vehicles. In fact, no fewer than 65 million cars worldwide have QNX software in them.

"What's been happening there in the last few years has been astounding," she said. "People think Nortel went and everything went with them. But the people working for them didn't want to leave Ottawa." Four large firms took up work in the technology developed by Nortel, much of it integral to the creation of autonomous

vehicles. She has also been active in trying to create an Ottawa-based research network dedicated to this kind of software development.

Wilkinson pointed to the Centre of Excellence in Next Generation Networks (CENGN), also located in Ottawa, which is run by business people at arm's length from government, giving them the room to implement this kind of networking technology amongst various other research networks. "Industry in the tech field is burgeoning," she said, referring to Ottawa's place in an emerging digital revolution sweeping the globe. "Driverless cars are just one small part of that."

Pratt noted that while most people associate Nokia with a history of cell phones, the company actually sold that line of its business to Microsoft in 2011 and has since concentrated on connectivity infrastructure for communications providers like Bell or Telus, which also led the company to acquire Alcatel-Lucent in 2016. "Nokia's element to add to autonomous vehicles is that connectivity element," he explained, noting that there are no fewer than 2,000 employees in Ottawa working on such matters. "A lot of the talent that's enabling key products being used by the Bells, Teluses and Rogers of the world are developed right here in Kanata."

In this context, the 5G networking standard is widely discussed as being essential to minimizing delays in exchanging data that will be necessary to keep autonomous cars running safely on the road. Even so, Pratt suggested that industry observers expect there will be a need for even more data than is already being handled from on-board sensors, to include weather and mapping information from much further afield. In addition, other jurisdictions such as the United States and Germany have moved much more quickly in this sector, so that Canada is playing catch-up at this point. "What we have going for us here is great expertise across many different fields," he insisted. "With all of the different connectivity players, the telecom history of innovation, we have all the right ingredients." He described the result as a powerful ecosystem for the development of these vehicles.

Kirk maintained that the first generation of autonomous vehicles is already with us, both in the form of semi-autonomous systems that are available on many conventional cars as well as full autonomous vehicles in use at low speed in closed environments. By 2020 or so, he predicted, the next generation will have arrived. As for the impact of these vehicles, Kirk argued that they will be safer and more environmentally friendly than today's cars, since many of them will be electric. Above all, he noted that these products represent what could become part of a $10 trillion global market.

According to Kirk, establishing that market will call for some concrete steps from government as well as business. In the UK, the government created an entirely new agency dedicated to autonomous vehicles, the Centre for Connected and Autonomous Vehicles. "They took policy people from their equivalent of Transport Canada and policy people from their equivalent of ISED and created a single unit that sets policy in a synchronized fashion," he said. "I suggested that to some of the people in the federal government here and they said 'Not here. It wouldn't work.'"

Kirk also noted that while the UK allows for the testing of such vehicles on public roads anywhere in the country without a permit, Ontario is the only place in Canada where this is possible and here a permit is required. He suggested this was a reflection of the UK government's self-styled role as a cheerleader for making the country the leading global centre for this technology, which has also been backed up with some £400 million worth of government investment in associated research and testing. Meanwhile, the Canadian government recently put $100 million toward Ford's efforts in this field, which Kirk regards only as a good start. "There's going to be a lot of need for the federal government to up its game in these and other areas," he said.

Pratt then brought up the 5G Automotive Association (AA), founded through a collaboration between Nokia, Ericsson and Huawei. The goal was to ensure that as 5G came into widespread use, its operating standards would be compatible with those needed for autonomous vehicles. The organization is open to many different members and while there are about 40 so far, none so far is specifically Canadian, although he suggests that should change. "We encourage entities to come on board," he said. "There are workgroups that are looking at standards definitions for 5G, the use cases for how it can be deployed in connected vehicle domains, and even a pilot trial study group. This seems like a perfect area for Canadian initiatives to start getting on board with the big vehicle manufacturers and the parts manufacturers." He stressed that no single firm was ever going to be able to pull off what amounts to a transformation of this technology for our society, so Canadians should join the dozens of interests already actively pursuing this effort.

Wilkinson suggested that Ottawa has a critical mass of people working in this and allied disciplines to establish itself on the cutting edge of the technology. "We used to be known for telecommunications," she said. "We still do communications, we still do networking. But it's done mostly through software systems." Kirk picked up on this theme, pointing out that about 4% of value of a typical car today is technology, whereas this figure is expected to jump to between 40% and 60% by the mid-2020s.

A question from the audience asked about the future of non-autonomous vehicles, asking if we are heading to a hybrid world or one that is fully automated. Kirk responded that he expects full automation will ultimately become the norm for everyday driving, especially once there is sufficient on-road data to confirm that autonomous vehicles are far safer than ones driven by people. "I can see by about 2030 we're going to have a conversation nationally, globally about whether we stop people from driving," he said. "But there will always be people who love driving and I can see people in the future with an old-fashioned car in the garage with a steering wheel, brake and gas pedals, and there will be tracks that simulate cities and they'll go out there and drive around and have fun the old-fashioned way. But it will have to be on a special track, not on public roads."

Ursula Gobel of the Social Sciences and Humanities Research Council considered the impact this change would have throughout society, in areas as diverse as education to a reduction of rural-urban divides, all of which will call for research in the social sciences rather than just the technological aspects of this innovation. Wilkinson said there is already a perception that this work must be done, given such immediate impacts as commercial drivers who will be thrown out of work in large numbers and subsequently retrained for other jobs. "These are issues that I think people are afraid to touch, but they're going to happen," she said. Gobel then reiterated the point that although the social sciences component of this initiative may appear small now, it must be addressed sooner rather than later, especially in light of the possibility that this large body of skilled people could develop the technology with no thought for its impact

Pratt agreed that the existing R&D participants would likely not be the ones who will conduct this kind of work, but he added that the change will take place over a comparatively long period. By way of example, he suggested the initial phases of this change will occur on major highways, where it will be easiest to implement. This will just be the first of several stages of roll-out for this technology, he suggested, and each stage should offer sufficient time and wherewithal to assess the societal impact and prepare accordingly.

By way of putting this concern into perspective, Kirk mentioned an upcoming conference where many of Ontario's municipal leaders would be considering the impact of these vehicles on their communities He also harkened back to the early days of the automobile as we know it now. "A hundred years ago today the Model T Fords were coming off the assembly line," he said. "We know looking back how much cars changed

everything in the 20th century — individual lives, the design, look, and feel of our cities. It changed the world, mainly for the better but not always. What we are witnessing today is the birth of Cars 2.0. The change in this century will be every bit as broad and deep as the change in the 20th century due to the arrival of the car."

Wilkinson added that these cars are simply one aspect of a digital revolution that is already well under way and already affecting the way we live.


# Dinner and Keynote

## "An Elegant New Business Model: innovative ways to finance an evolving world"

HOLLY RUXIN
CEO & Founder, Montcalm TCR

Ruxin began by describing the beginning of her career and her desire to work on Wall Street and have a nice red Porsche, which eventually led her into the world of capital markets and exotic products such as derivatives. "The first thing is that I learned that the capital market is a really beautiful thing," she said. "There are products that have really helped the world." By way of example, she pointed to how futures markets give farmers the resources they need to buy and plant seeds in the spring, then harvest their crops in the fall and pay off that loan with their profits — a strategy that makes it possible for them to continue feeding their families while getting on with the work that ultimately feeds the world. Even the use of derivatives to overcome challenges in the sub-prime mortgage market was not in principle a bad thing, she suggested.

Yet her thinking took an entirely new tack in the wake of the 2008 market collapse, which left her appalled at how the greed of young traders perverted the financial system for the sake of securing their own bonuses.

Ruxin's perspective changed even more drastically after she had a son who turned out to be severely disabled. "I tell this story because he awoke in me something that had been in there, and at the time I could not have talked to a room full of people like you," she said. "He was showing me a value system that mattered."

She subsequently started her own firm that is founded on four tenets that reflect this value system. The first of these is integrity, which she regards as being indicated by transparency in all activities.

The second is collaboration. "This came up so many times today and it is absolutely the key to a better future," she said. "Collaborating is coordinating with all kinds of different people — a client's accountant, a client's estate planner, the person right next to you, the person making policy somewhere else. Collaboration is key, but it is not something I was taught on Wall Street. They did not collaborate at all, unless they had to make a deal happen."

Ruxin emphasized the role of collaboration in achieving engagement, the third tenet, which marks the ability of people to accomplish together what each of them would otherwise be unable to do individually.

She offered sustainability as the fourth tenet, a quality that has little bearing on an individual's material value but instead springs from a particular attitude. Ruxin expressed her satisfaction from reassuring $50,000 clients that they have as much right to smart investing as a $100 million client, even as she tries to allay the fears of $100 million clients who continue to live in fear that they will not have enough money.

She then turned to the concept of innovation, which she took to be an extension of asking people hard questions about how they are spending their lives and money. She recalled an argument with a friend who insisted his work for a major multinational company was making the world a better place, but when she asked for examples, he could not name one. Closer to home she sparked this kind of conflict at the social organization that deals with her son, where she proposed an investment strategy that would better reflect the values of this organization. She argued that a decision to simply buy low and sell high was not appropriate for people who regard themselves as being fully dedicated to helping severely disabled individuals find their way in the world. "There was this bifurcation of how they existed in the world and how they thought of themselves," she maintained.

Such encounters have led her to reflect on why people are afraid to act on the values that they hold in such high esteem and how to respond to this fear. "What are some of the elements that we can leave here today and think about tomorrow that might be helpful in changing these broken systems where there's a lot of push-back because people are scared?" she asked.

Ruxin insisted that the answer represents the highest calling of her generation, which will set the stage for improvements that will be carried on by the next generation. "When you really look at every decision you're making, you're saying is this solving a problem I want to solve? Is this making humanity better? We have a system that is built on commerce, not community. But economics and everything about our society tomorrow has really nothing to do with where it was. We have completely changed the game of technology and we're going to be in a completely different game 20 years from now."

In this light, she observed, it is possible to take stock of why you are doing what you do. If you are doing something you don't necessarily agree with because you must keep your job, at least you should be aware that this is the case, so that you might be able to change this circumstance at some time in the future.

Similarly, this perspective enables you to make a better assessment of those who provide you with help or advice, so you can determine if you really want their help or advice.

"It sounds really easy but none of it is easy," she acknowledged. "We all have pressures tomorrow to go do what we have to do," she said. And yet, she added, rising to such challenges is the beginning of innovation. "The real, true innovation — everything that was said today — is really coming from our hearts and having the guts to keep doing that," she said, suggesting that such activities can honour both community and commerce. "Any investments I make at my firm, they have to be impact-oriented, human-oriented. That's not just because I'm altruistic and think that's a great idea. I'm actually a value investor and those are the only kind of companies that are going to be successful. Creating businesses that help humanity is the only way of our future. It's not kind of a good idea, it is actually the only way we're going to survive. And it is the only kind of companies we're going to have going forward. Now I may be delusional but I feel very strongly about this."

Nor is it necessary to solve all the problems we have inherited from our longstanding socioeconomic order in one fell swoop. Ruxin drew analogy to the security of blockchain technology, whereby new layers of information are added steadily and irrevocably, so the result cannot be altered by hostile forces. "So it is a tall order and a very small order at the same time," she said. "But it comes from the heart and it comes from having guts. It feels good when you make decisions that resonate with yourself and ultimately it just feels better when you make decisions that resonate with humanity."


# Opening Keynote

# "Winning at New Products: The Idea-to-Launch Program for SMEs"

Robert Cooper
President, Product Development Institute

Introduced by Jeffery Nerenberg
Director, Regional Development, NSERC

Nerenberg introduced Cooper as an influential thought leader in product research and in particular the pioneer of what has become known as the Stage Gate Approach. He recalled an opportunity he had to attend one of Cooper's seminars many years ago. "What I learned that day opened my young and inexperienced eyes to effective product development, project management, and even strategy building," he said, pointing to one lesson in particular that continues to inform his work. "It's important to know what not to do. If I can paraphrase what Dr. Cooper said that day, it's 'ready, fire, aim'. As in, if you don't know where you're headed you might want to pause and figure out what specific direction you want to take."

Cooper began by defining a product as much more than a physical commodity, but rather anything that you can take to a marketplace for sale, use, or consumption and get paid for it. This could include physical products, less tangible products such as software, or services such as financial products. Even a business model qualifies as a kind of product. "I'm talking about deliverables to the marketplace," he said. "I'm not talking about process innovation, the production of products. That's a very important part of R&D. Some of my US clients spend more on R&D on process innovation than they do on product development."

He described the introduction of new products as a major economic trend in Western economics, where such items represent about 30% of company sales over the last three years. "Isn't that amazing," he observed. "30% of what you bought or what you see in the supermarket wasn't there three years ago."

In some industries, such as high tech, all of a company's products will be new, while in older, established sectors such as steel, the number of new products will be far lower. Companies expect to increase their rate of new product release by some 21% over the next five years, as evidenced by the tremendous amount of work that is being done to create and market such products. "For a variety of reasons that aren't going to go away, you can expect the speed of innovation at the company level to really pick up," he said.

A survey of CEOs shows that more than half of them regard innovation as the most crucial factor in their firm's success, which contrasts significantly to a decade ago, when a similar survey found cost-cutting and lean production to be the top priority. No less significantly, innovativeness is regarded as a leading factor that drives a company's investment values.

In this context Cooper quoted former Proctor & Gamble CEO A.G. Lafley: "Innovation is a prerequisite for sustained growth. No other path to profitable growth can be sustained over time." Cooper added that this is a message he tells anyone who is enamoured of cost cutting or mergers and acquisition as a way of making money. "The only way you can survive and grow in the long term is to get great new products out that absolutely delight your customers," he said.

That being said, he stressed that this approach is anything but easy, since new products have an alarming failure rate. According to the Product Development Management Association (PDMA), only one in nine new product concepts will succeed. Moreover, about 46% of the resources a firm invests in new product development will go toward unsuccessful ventures. In fact, some 40% of new products fail right at launch. "After all the development work has been done, after all the alpha testing, the beta testing, field trials — everything's been done," he said. "And still they screw up. This is not a game for the faint of heart."

Aspects of successful innovation have been outlined by the American Productivity and Quality Centre (APQC) in Houston, the world's largest non-profit benchmarking society. Cooper and his colleagues worked with them to examine the entire spectrum of innovation activities at all levels within firms, an analysis that yielded four primary features associated with success, which was measured by outcomes such as making money, timeliness, return on investment. The four drivers were:

1. **Having a product innovation technology strategy for the business**. He noted that fully half of businesses engaged in this kind of work have no such strategy. "They wander," said Cooper. "They take a path through the woods and see opportunities on the left and the right, but it's almost a random walk. On the other hand some companies have a very clear strategy about where they're heading, where they want to focus their R&D efforts."

2. **Resources**. "It's not just having deep pockets," he insisted, pointing to a wide variety of studies that show companies that spend a lot on R&D are no more successful. "It's what you do with the money. There's a whole body of knowledge in this area, about how to pick the right projects, how to get the right mix and balance of projects, consistent with your risk tolerance level."
3. **Execution**. Using a soccer analogy, he described successful execution as the creation of a playbook based on a team occupying different positions on the field rather than simply chasing the ball. This is where Stage-Gate concept originated as a way of drafting just such a playbook.
4. **Leadership**. Cooper recalled a successful change of management at Guinness, which essentially had not had a new product since the American Revolution in the 1700s. Nevertheless, effective leadership instilled a vibrant culture within the company that had a positive effect.

Cooper then offered a list of the five most important drivers for creating winning products.

1. **Incorporate the voice of the customer from the very beginning**, which reflects an understanding of that customer's unmet, unspoken needs. Most companies have a difficult time achieving this, he added, since it does not emerge from casual conversations but hard study. "It means physically getting out from behind your desk, buying a plane ticket, setting up some interviews for you and a small team, and going there and doing a formal interview to determine needs, wants, preferences, points-of-pain," he said. "It's very tough work. It's not casual conversation, it's a study."
2. **Due diligence**, in the sense of doing your homework at the beginning of a project to ensure success later. "Most people when they get a new idea immediately want to go into the lab or the engineering department and start developing the product to get something physical built," he said. "Wrong. Do some homework, my friend." Cooper described this as front-end loading, moving the centre of gravity of the work forward to spend more time at the beginning. "You may think it's going to take an extra month, but it will pay off in spades later on because this enables you to make fact-based decisions."
3. **Create a high performance, cross-functional team**, one that is both empowered and accountable, with appropriate coaching. Diversity is vital to ensure that all aspects of execution will be covered, but so too is this team's exclusive dedication to the work. This can be difficult in smaller organizations where multi-tasking may be necessary, but larger enterprises should free people up to work on one thing and see it through to the end.
4. **Focus**. Like dedicating people to single products, firms must likewise learn to dedicate themselves to fewer projects. Above all, Cooper argues, they must be disciplined about eliminating the ones that are not going to work. Tough gates with teeth. If a project will not work, it must be stopped as early as possible. "At some point you've got to sit down at a gate meeting and say guys, does it meet the fundamental criteria: strategic fit, competitive advantage, attractive market, technical feasibility, can we make money? If it doesn't meet those five criteria, out."
5. **A game plan**, one that determines all the steps and responsibilities associated with taking a new product to market.

How do Canadian companies fare in this regard? Although Cooper and many others would like to know, there is no data like that from APQC or PDMA for this country. He did find a Quebec manufacturers association (which he left unnamed) that offered some information. This data reveals that the proportion of annual sales derived from new products in that province was around 13%, whereas in the United States this measure is 38%. This pattern was repeated in analyses of how many new products were commercial successes, how many met their sales and profit targets, and how many were launched on time.

When Cooper and his colleagues broke down this data to look more closely at key criteria linked to the success of new products, the Quebec firms almost invariably scored below global averages for these

measures. In light of this information, it is important for managers to determine what these figures mean and what is responsible for this result. Although there is not enough information to answer these questions, he offered some clear conclusions:

- Poor performance in new product development is not just bad luck. "It's due to poor practices," he said. "People do things wrong. They don't do voice of customer, they don't do the front-end homework, they try to do too many projects."
- Throwing money at the project is not enough. "Money is a necessary but not sufficient condition for success," he said, lauding the efforts of programs such as IRAP that help firms obtain the funding they need. "But it's not the only thing. It's how they spend the money. That comes out time and again in ours and other studies."

Returning to the sports analogy, he introduced IRAP Big Ideas to Winning Product Developments (I2D) initiative. Much as a coach reviews each game to ensure the next one will be played better, this initiative tries to ensure that each new product development will be better than the last one. I2D focuses on training groups of people responsible for product development in medium size firms, exposing them to business principles rather than purely technical content. With the help of a support panel of advisors, participants are guided through such material, but with business content instead of the technical seminars.

"They go off for about two or three months, pull together a full business case, do their market analysis, talk to their customers, come back with a full-fledged product definition, and reasons to go forward," he said. At that point they check in with the I2D team, which will then approve them to apply for IRAP support.

As for the results that I2D has achieved, Cooper identified some clear impacts. In four key areas – use of voice-of-customer research, doing up-front homework, employing cross-functional teams, and focusing on the right projects – the proportion of businesses engaged in these activities jumped significantly after participating in the I2D program, typically from 10% or less to as much as 94%. "What you see are dramatic behavioural changes," he said. "We've put about 200 firms through this program, and it seems to be working and there seems to be some momentum for carrying on."

A questioner asked if the program handled start-ups, and whether the approach varied in any way to accommodate these firms. Cooper conceded that they had not worked with many start-ups, but noted that some things would have to change with a $5 million company as opposed to a $50 million company.

Another question dealt with the distinction between genuinely new products and old products that are being re-packaged when it comes to setting goals for new product releases. "A division manager could simply draw that line in a different place. But more importantly, a division manager could meet that target simply by killing off old products. Does this not destroy the incentive to maintain a fleet of successful older products and continuously improve them?" Cooper indicated that this was one of the most challenging problems in product innovation. "It's difficult to come up with performance metrics for innovation that meet all the tests," he said, adding that his group's approach to this dilemma is to employ several different metrics and compare them.

When Jeff Crelinsten asked if this strategy had ever been attempted within government, Cooper recalled a project done in the UK. Crelinsten also asked if the findings provided any insights for people in government working with companies trying to launch new products. "The first piece of advice is to find the problem before you leap to a solution," Cooper replied. "The other thing is that there's an awful lot of very good literature on this area, but unfortunately it has not been well disseminated."


# Panel

# Innovation challenges and opportunities: Views from the C-suite

**Moderator: Larry Lam,** Partner, Industrial, Clean and Energy (ICE) Technology Venture Fund, BDC Capital
**Tabitha Creighton,** SVP, iQmetrix; CEO, InvestNextDoor
**Jason Flick,** Co-Founder & CEO, You.i TV
**Vicki Saunders,** Founder, SheEO

*Successful companies innovate to provide solutions for their customers better than the competition. This panel of business leaders shares the challenges and opportunities facing Canadian entrepreneurs competing globally and how government and other stakeholders can help or hinder their progress.*

Lam set the context for the discussion by examining some of the working definitions of Innovation, which tend to emphasize products rather than techniques for solving a problem. However, many definitions regard innovation as something that permeates an organization, rather than being confined to specific products or technologies. Since the vast majority of Canadian companies are not technology driven, this observation raises the question of what kind of innovation might help these enterprises become stronger, more competitive, and more efficient. He charged the panel with discussing this question, starting with the primary criteria that have already been covered throughout the conference; access to talent, access to markets, and access to funding.

Creighton responded with some examples of why innovation represents a challenge for many firms, especially smaller ones with limited access to resources such as talent. She also referred to Bob Cooper's identification of focus as a key driver of innovation. "I've worked with some of the largest corporations in Canada over the course of my career and implemented capital portfolio management programs where a

surprise to me was the concept of needing to kill projects," she said. "People really don't like the idea of killing projects. It doesn't look good when you do a budget review." She suggested that is matched by the challenge of approaching customers directly in order to engage with them in a more authentic way. "It's almost as if you don't want to ask your customers questions because you're afraid to hear the answers," she said. Nevertheless, the potential learning and useful feedback to be acquired in this way makes it an obvious place to start on a path toward innovation.

Flick pointed to the difficulty of getting young people to enter STEM programs in school, as well as the later problem associated with finding individuals who have experience in scaling up an enterprise. He argued that bringing such talent and experience into the marketplace – or into the country from elsewhere – will significantly contribute to the ability of these firms to innovate.

Saunders described talent as a crucial asset for entrepreneurs, who are eager to seek out collaborators who can carry out tasks more efficiently than can be done in house at their own organizations. "The gig economy is such an interesting game-changer," she said. "You have to totally change your leadership style in order to figure out who are the masters and the experts in all of these different pieces that you need, rather than hiring someone full time to do that – we just don't have time for that anymore, in my case."

With regard to access to capital, Saunders referred to the growing concentration of the world's wealth in fewer and fewer hands, which puts the onus on workers to distinguish themselves in some way with unique skills and knowledge. Her organization is trying to help female entrepreneurs navigate this hostile, winner-take-all landscape with a more holistic outlook that offers support to individuals who might not otherwise receive it. This includes a fund made up of $1,100 contributions from 500 female business people, which will be distributed in a repayable fashion to five other female entrepreneurs, so that the money stays in a form of perpetual motion. "Now you have 500 women on your team, so if you're one of those five women who get selected, they can help you with anything else you need – we can introduce you to customers, plus become your early customer. "It's not just the money," she concluded. "It's the money, it's the network, it's the access to customers, and it's getting investments."

Creighton noted that her firm is based in the US because of regulator differences that would not allow them to have the same relationship with investors in Canada. That being said, she notes that small Canadian firms have the same capital problems as the ones she is dealing with in the US, namely they are essentially cash-based operations that cannot attract the attention of investors and find downright predatory rates from traditional lenders. In this atmosphere, alternative sources of support like her firm have come into their own as a means of supporting many of these smaller enterprises.

Flick acknowledged the value of these creative strategies for obtaining funding, but he indicated that most growing firms find themselves unable to make the key leap from $10-20 million sales to $100 million in sales, at which point they would join the ranks of medium size firms. Among the barriers that contribute to this problem is the need to engage in marketing and raise the company's public profile, which is an expensive undertaking that remains out of reach.

Creighton picked up on this point, that helping these growing firms endure and succeed should be a key priority for innovation policy in Canada's comparatively small market, where very few players will have the ability or the opportunity to grow to the vaunted "unicorn" status of $1 billion in revenue. "What kinds of innovative things can we do to support an ecosystem so companies aren't hitting a wall?" she asked. "How do you, when you hit that maturity point for your particular company, not then shrink? There's a whole good

conversation we can have there about how to create a thriving ecosystem within a marketplace that is never going to be full of unicorns."

Flick recalled how difficult is was for his firm to sell products to the Canadian military, which preferred to do business with higher profile suppliers from France. "Why is it the government can't buy locally?" he asked. "It's really expensive to do business outside of Canada."

Lam returned to the notion of how we can promote a culture of innovation amongst smaller firms whose key priority is generating cash to survive. Saunders responded by noting that many of her clients have little idea how remarkably innovative their products are. By way of example she described a woman who had developed a breathable food wrap that kept fruits and vegetable fresher longer, a product that turned out to be wildly popular. "She really didn't realize what she had," Saunders explained. "So having this ecosystem with people around you to get excited about your product, who become customers and start to support, it increases your boldness. She's now exporting all over the world. She stands taller; she looks like a completely different person since she came into our network."

Saunders dubs this initiative "radical generosity", premised on the idea that you will dream bigger and have more confidence if you are surrounding by people who embrace and encourage you in an almost aggressive fashion. "That does not happen when you're pitching in an accelerator," she added. "You get kicked in the ass all the time; you do not get a hug. I know that sounds a little strange to say but we are seeing huge results by creating different kinds of environments that encourage people to do more than they think they're capable of doing."

Flick added that the powerful technology wielded by giant firms can transform small companies, as Ottawa-based Shopify has demonstrated by adapting on-line purchasing tools developed by Amazon. SME entrepreneurs must therefore embrace innovation at all levels, even in unlikely areas of their business like human resources, if they are to break out of constant rounds of just trying to make it through the next quarter.

Creighton agreed, but suggested that there can often be a profound disconnect in exchanges between observers like the panelists and people in small firms trying to incorporate technology into their business. While academics and other analysts bandy about the term "innovation" in broad and sometimes abstract ways, entrepreneurs simply regard themselves as undertaking "hacks" to improve how they go about their work, and while there may be a great deal of common ground between these two conceptions, it all too often missed on both sides. "I sit in on a lot of entrepreneur sessions, teaching them about how to do crowd-funding," she recalled. "One of them said to me 'Tabitha, everything you said is really interesting but it's like speaking human to a dog'.

She added that a large number of the people running these firms have little or no formal business education and the framework of ideas that circulates in government and academia simply does not exist for them. In this context even the most well-meaning advisors can appear to be patronizing to entrepreneurs who simply do not see the relevance of exotic terminology. "Between what I'm saying and what they're hearing there's this huge disconnect," she said. "We have to use language that's relevant if we're going to help people understand the opportunities that they have. Rather than say to them 'let's do an innovation contest', say 'we're going to help you make money with your hacks'."

When each of the panelists were asked what ambitions they have for their efforts, Saunders replied that she would like her organization to be active in 1,000 regions around the world. This goal is part of a long-term

market strategy that already extends as far as New Zealand and Europe, extending the network of support for members to become as diverse as possible.

Flick noted that his firm is growing so quickly that it's approaching the limits within Canada, which will pose a challenge in terms of finding very different sources of funding than it has obtained so far.

Creighton presented a more distinctive vision of work she would like to pursue, specifically an attempt to get baby boomers and millennials working together consistently on an enterprise. She touted this as a way of heading off the management gap that is expected to open up as ever greater number of boomers retire. "If you are running a company today, and you have a 20-year vision and you expect your company to be around, I challenge you to think about how you bring a millennial literally into your C-suite and help them to understand what this company is doing and where you want it to go. The challenge that I have is to sincerely think about how you start to embed a generational shift into your organization. One of the threats to innovation and potentially one of the largest opportunities for Canadian companies to innovate is to anticipate and take advantage of this entirely new way of thinking about how commerce works and where innovation actually sits."

By way of response a member of the audience noted that when they extracted terms such as entrepreneur and innovation from an advertisement for innovation workshops and simply described these events as growing a business, the number of female participants jumped significantly. The conclusion she reached was that women were eliminating themselves as potential applicants because they did not regard their business as being technology-based, even if it was in fact so. Creighton and Saunders both acknowledged that they have observed the same phenomenon and have altered the kind of language that is used to describe activities and events in order to prevent potential female applicants from filtering themselves out. Saunders insisted that even such apparently innocuous clichés such as sports analogy can have the effect of excluding those who cannot relate comfortably with such imagery.


# Panel

# Inside the policy trenches: Priorities and external collaboration opportunities

**Moderator: Tom Corr,** President and CEO, Ontario Centres of Excellence (OCE)
**Richard Botham,** Assistant Deputy Minister, Finance Canada
**Lawrence Hanson,** Assistant Deputy Minister, Science and Innovation Sector, Innovation, Science and Economic Development (ISED)
**David Manicom,** Associate Assistant Deputy Minister, Immigration, Refugees and Citizenship Canada

*Senior government policy makers discuss departmental roles and priorities in advancing Canada's innovation agenda and identify opportunities for collaboration with industry, the investment community, academia, provincial governments and international partners.*

Botham began by commenting on the skills and innovation initiatives in the budget. He pointed to some specific thrusts in policy, such as bringing new entrants into the work force through work-integrated learning and co-op education opportunities. Other initiatives attempt to make it easier for businesses to navigate through various parts of the federal government as they seek help. He noted that while any such budget only has limited fiscal room to drive changes in policy direction, this one nevertheless attempted to tackle

government program activities in a sweeping, fundamental way, aiming for greater coherence around such themes as innovation and access. He also identified as important the move toward identifying innovation in specific sectors as being important to the country's future, along with a renewed emphasis on the value of clusters and changing the government's procurement policy.

Hanson suggested that the budget was acting on a number of recommendations that have been made around innovation over the last few years, such as making programs more accessible to the business community. "That's a significant responsibility that has been put on our department," he said. "It's one that we welcome and we've always seen as being important." In this light, the department is now in the process of determining how to reorganize itself to embrace new priorities such as superclusters. "What we're doing now is a recognition that if we just kept making minor tinkering adjustments of how we did things, we couldn't get the significant change that we wanted," he concluded, adding that his is not the only department that is finding itself in this position.

In Manicom's overview of the budget, he focused closely on the implications of the skills strategy, as seen from the perspective of bringing newcomers to Canada. "The global skills strategy is very much not about simply filling labour market needs but about investment being driven by talent, where talent is available, and talent coming in that catalyzes economic activity." He described how the significant backlog in applications for permanent resident status in Canada was resolved by a major re-working of the methods for accepting and reviewing these documents. The success of this approach has now led to similar changes in applications for short-term employment in Canada, which he expected to have similarly positive results. "It's a very exciting time," he said. "With Brexit happening, with a little election to the south that you may have noticed, with very high youth unemployment and very highly skilled people all across the EU, with 400-500,000 English speaking Indians with IT backgrounds, if we can't attract that global talent to Canada right now then we should get out of the business."

Manicom went further into the specific topic of how the government intends to attract and retain the highly skilled workers that are crucial to an innovation economy. He insisted that business must form a core part of the solution, so that people who are guided into key areas are in fact able to find work in those same sectors of the economy. The goal is to ensure that dedicated business channels receive fast and predictable service from government, a concept that is new for government and will undoubtedly require some adjustment. For example, it will be necessary to have people attending meetings elsewhere in the world where talent is being identified and where industries are discussing where they would like to set up shop. This information will be essential to creating dedicated channels to drawing this talent to specific places in Canada.

Hanson built on Manicom's description, which he suggested was a logical extension of the budget's directives. Nor did he regard the issue as being one of bringing in talent from abroad. "Just domestically, we also need to be taking steps to ensure that we're developing our own talent," said Corr. "And making sure that the education and skills they get through post-secondary institutions can be applied outside of academia as well." As a corollary this kind of initiative will build relationships between these educational institutions and industry, which can become self-sustaining once they have become established.

With respect to the desire to have the federal government work more closely with other levels of government, Hanson indicated that there the government has reinstituted regular meetings between ministers across the country with common interests in various aspects of innovation. This also applies to mapping out Canada's regional strengths, such as specific expertise and capacity in key areas. Botham added that this is a logical approach. "It's clear that the federal government doesn't have a monopoly on good ideas in any space in particular, but the innovation space as well," he said. "It's important for federal officials to be well aware of

different approaches that are being taken in the provinces." At the same time, he conceded that it can be difficult to distinguish truly national priorities from regional or local priorities, but this tension has always been present and will never be fully resolved. That being said, he highlighted the important role of the federal government to help make just these kinds of distinctions in collaboration with local or regional governments. "There is no great advantage to every province investing to establish a world-beating capability at the same time and in the same area," he said. "I don't think that's an optimal allocation of resources and the federal government can have a role as a convener in bringing parties together to determine what truly is the comparative advantage and what kinds of investments would make a meaningful difference to elevate those capabilities to a world-beating level."

Manicom provided a few concrete examples, including the immigration pilot program that is part of the Atlantic Canada growth strategy, an unprecedented case of a federal immigration program for a single region. During the execution of this initiative, he has gauged its ongoing success by the sizable number of employers who have chosen to participate. "Economic immigration programming to the Atlantic provinces can bring immigrants to the Atlantic provinces, it can't keep them there," he said, referring to specific selection criteria that were tailored for this region. "What we're trying is a program where every person coming will have an integration agreement with their employer and community before they arrive. If they're arriving with an employer that knows immigrants have particular types of needs and that their families have needs, maybe if it doesn't go beautifully in the first three months, rather than heading to Toronto, they'll work it out."

Corr asked Botham to comment on challenges to advancing the budget's innovation agenda. "You have to understand your audience," Botham indicated. "You have to make things real and compelling for them." He noted that the government had emphasized widespread consultations as part of this process, something that has proved important to assessing the perception that Canada has not reaped the commercial benefits of innovation that it perhaps should be obtaining.

Hanson agreed with this observation, adding that the greatest challenge in any such budget initiative is getting general agreement from a number of people with an equal number of very good ideas, only some of which can be implemented in the final document. "When you're building a package on something as significant and complex as innovation, the challenge you're trying to face is creating a balanced package that addresses the issues we've identified," he said. "You also want to have your eye on the next step. A great idea is not a great idea if you don't have the means and capacity of implementing it."

In that same context, Manicom pointed out that much of the implementation of budget goals can be achieved through policy design as opposed to outright spending. This approach can be hard to quantify but it nevertheless yields concrete results that are observed regularly, if only anecdotally.

David McInnes, an advisor with the Canadian Agri-Food Policy Institute, described how this organization mounted a cross-country tour to gauge reaction to the recently released report from the Advisory Council on Economic Growth, *Unleashing the Growth Potential of Key Sectors*. "The government and the Council have created an unprecedented opportunity for one of Canada's most important sectors, which is agri-food," he said. "The question now is can the challenge be taken up by the sector to respond? It's not just industry — we're talking about food systems, which includes scientists, academia, financial services, municipalities, technology providers. It really is a systems view of how we create change."

David Crane suggested that the budget reflects the need for a better understanding of how financial capital follows human capital, which will not be the case in light of NSERC's too modest budget increase, which will restrict that organization's ability to produce outstanding human capital. He also noted the absence of

additional support for Statistics Canada, a body that is essential to taking stock of just these kinds of developments. "It was not an impressive budget, in my view," he said. "It was a budget that shows the government is still very much on a learning curve and still doesn't understand a lot of the issues it's dealing with."

Botham responded that there are initiatives in the budget providing support for Statistics Canada, but they are not readily apparent as they are embedded in different parts of the budget.

Valerie Walker, Vice-President of Innovation and Skills at the Business Council of Canada, picked up on the discussion of external collaboration with the government and asked how much government values these partnership opportunities. Hanson responded that public policy tends to be meaningless in the absence of such collaborations. "We can never assume we have a monopoly on good ideas," he observed, noting that everyone benefits when outside collaborators pick up on government initiatives. Manicom referred back to the external consultations that had been done to draft the budget's policy initiatives, adding that these exchanges extended to discussion of how these initiatives would ultimately be implemented by many of the same organizations that had taken part in those consultations.

Diana Royce of AllerGen asked about Botham's earlier portrait of clusters as a place-based strategy, while here he focused on the key role of expertise located in universities and colleges across the country. She wondered how ISED will reconcile this apparent contradiction in its approach. Botham replied that the cluster initiative will not necessarily interfere with or stop what is happening in the post-secondary sphere. "I look back to the creation of CFI [Canada Foundation for Innovation] and one of the important developments that I saw implemented was the request for plans from universities, plans for specialization and forward capital planning," he said. "To me that's a building block of a place-based strategy." From such plans, he noted, will emerge details such as the presence of local anchor firms in the private sector, regional supply chains, or local supply of highly skilled labour.

Hanson agreed and suggested that the cluster initiative discussed in the budget has some of the same implications as the Canada First Research Excellence Fund. "It was the same idea: come to us and demonstrate that you have an existing strength through a competitive process and there can be meaningful funding associated with that," he said. "It was not about capacity building but saying you're already in an important place and you can take advantage of investments that will take you to the next level."

Royce also harkened back to Canada's experience with Severe Acute Respiratory Syndrome (SARS), an outbreak that successfully mustered a national effort to address. "The country came together in different regions and there was capacity in various labs and in universities and communities across the country," she said. "We were able to connect together very rapidly and provide a globally leading response to that outbreak. I want to caution you not to forget that with these latest investments not to impoverish the excellent capacity we have to contribute in many areas that is not local but national."

Ron Freedman of Research Infosource asked how Canada generally is faring in innovation and whether there is a leading barrier to innovation that should be highlighted. Hanson suggested that a great number of positive steps had been taken, but the overarching challenge was one that has always been there, namely gaining commercial advantages through innovation. Botham added that this ongoing challenge is magnified by the low, slow growth that developed countries are experiencing everywhere. "Given the ambitions that Canadians have, we've got to change that growth trajectory," he said. "It's not just about maintaining a standard of life that we would all like to have. It's to deal with demographic changes, emerging economies, and other things we've been talking about for at least a decade."

Botham also indicated that changing the country's growth prospect may require investments that will prove to be challenging, since they may require the kind of business leadership we do not currently have. He acknowledged that some initiatives undertaken over the past two decades have been highly successful, but often isolated in particular areas, such as large capital investments in universities made through CFI. "A huge challenge is just improving the coordination of those successes," he said.

From the perspective of immigration, Manicom suggested that efforts to bring outstanding human capital into Canada have steadily evolved to become among the best in the world. As for helping this talent contribute to the economy and stay in this economy, he conceded that there is still some progress required. For his part, Corr concluded that Canada's innovation efforts are proceeding well and leave him extremely optimistic.

David Watters asked how this elaborate program of innovation was going to roll out. "Who is going to be the brain that coordinates all these activities?" he asked. "This all has to be integrated somehow. What are the mechanisms of government that you're going to be looking at to try and advance and implement this particular plan?"

Hanson indicated that he did not think of this aspect as being a problem. "We do these things now by working together and by treating this as a whole-of-government activity," he said, pointing to the variety of departments and allied agencies that are in constant contact with one another. "There's a big difference between complex and complicated. These are complex issues but in terms of just trying to work together, I don't think that's overly complicated."

Watters further asked if there were milestones and other indicators in place to help manage this complexity, especially in light of the fact that this is the sixth attempt by the government to articulate and implement an innovation policy. Hanson insisted that a sequencing of roll-out was not typically how any such initiative is implemented, but that tracking and assessment is standard for any program, including this one. Botham added that the institutional structures identified in the budget should make a difference to the way an innovation agenda is implemented. Manicom further noted that where different government departments might once have implemented policy in relative isolation from one another, as well as prospective outside partners, there is much more interaction now. "We work not only on concept, but also design and refinement in workshop-like settings with provinces, the private sector, and other government departments," he said. "You'll see the difference when we roll these programs out. They'll be 80-90% right when the implementation is done and need tweaking rather than major reforms two years after.

Jeff Crelinsten revisited the point raised by Royce about place-based innovation and the definition of cluster. "It is really going to be a place or is it a sector?" he asked. Botham responded that a cluster need not be defined as existing in some narrow geographic space. "One can think of important elements of a cluster being located in different places," he said. "The government will set a frame for defining how it thinks of a cluster, but what will be particularly meaningful will be how companies define what a cluster is for them." Crelinsten took this answer to mean that observers should not concentrate on a detailed description of a cluster but rather consider the goal that drives the creation of the cluster.

He then concluded with a question about whether this budget — which emphasized the mechanics of mounting talent and trade as opposed to higher-level metrics such as proportion of GDP spent on research — represented a new direction for government when it comes to innovation. Hanson enlarged this point to stress that the budget by necessity deals with a system. "You cannot only focus on talent, you cannot only focus on R&D, you cannot only focus on firm growth, because the reality is if we look at these things they're all

decidedly interrelated," he said. "There's an innovation ecosystem. The government has to take action in all of these areas and some of these areas where we already are active we need and ought to change our approach. We've heard and we know and we've consulted and some of those need to be changed."