RE$EARCH MONEY

The 15th Annual RE$EARCH MONEY Conference

Reversing the Trend:
Taking Canada's Innovation Game to the Next Level

5-6 April 2016
Sheraton Centre, Ottawa

PROCEEDINGS

Assembled and composed by Tim Lougheed & Rebecca Melville

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Welcome

Jeffrey Crelinsten & Mark Henderson

Crelinsten welcomed everyone with a reflection on the first time the word "innovation" appeared in the title or theme of a R$ conference. That was in 2011, in the context of the federal government's research support for business innovation. "It was a time when policymakers worldwide were beginning to realize that business innovation is about more than just research and that while policies geared to growing an innovation economy must include research support, they must also go beyond it," he said. Every subsequent conference has dealt with innovation, he added, with voices warning about Canada's poor performance in this regard subsequently becoming louder and more strident. More specifically, despite growing investment and respect for innovative entrepreneurship, the country still lacks the large multinational firms to anchor a multitude of smaller firms and connect them to global customers. "Too many Canadian entrepreneurs are selling early at low valuations," he noted. Moreover, government policies still focus primarily on research support and start-ups, neglecting broader industrial strategy and the need for smaller enterprises to scale-up.

Part of the problem can be attributed to a vague use of the word "innovation". "Innovation is not about research. It's about creating value in new ways," he explained. One of the principal measures guiding this discussion is Business Expenditure on R&D (BERD), which has been declining in Canada and remains low with respect to other members of the Organization for Economic Co-operation and Development (OECD). "People are interpreting that low number as evidence for a lack of innovation and risk taking by Canadian firms. I don't buy that. Doug Barber and I have talked to more than 100 CEOs of tech firms and in my experience they don't lack innovators and they don't

lack risk-takers at all. Rather our innovators don't know how to scale their businesses properly." Even those who do know how to scale are facing significant competition from larger firms as they do so, while receiving little support from government, which continues to focus on start-ups and smaller enterprises. "With very few large R&D-intensive firms in Canada, and a multitude of small ones that disappear regularly, no wonder our BERD numbers are relatively low," he concluded.

The current conference is therefore dedicated to addressing this challenge, bringing in academic, government, and industry leaders with an interest in arriving at a common solution. At a talk given by Navdeep Bains, federal Minister of Innovation, Science and Economic Development to the Toronto Board of Trade in March, he posed a crucial question in this regard: what does success look like? According to him, global leadership in a few selected technology sectors would be one outstanding measure. Among the areas under consideration by the government for such status are clean tech and artificial intelligence. Another measure the Minister proposed was the creation of large, sustainable, successful companies -- which would emerge from supporting scale-up -- as well as strong global brands. Minister Bains also asked which specific metrics, such as BERD, should be employed in order to get an accurate picture of such progress.

Minister Bains' comments reflected the government's commitment to an innovation strategy, and Crelinsten suggested that a primary goal of the conference would be to determine which elements should be front and centre in that strategy if it is to be successful.

Crelinsten thanked the many organizers and partners in helping this conference develop, especially platinum partner SSHRC. He then invited that organization's president, Ted Hewitt, to offer some words of welcome.

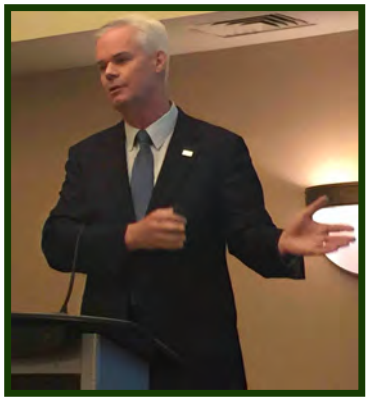
Hewitt made his priority clear: "When we talk about innovation, we're talking about taking science to action," he said. "And if it's not immediately obvious, that is a distinctly human activity." This includes everything from the initial design to the ultimate packaging of this process. "If we get the people part right at the start and at all ends of the innovation spectrum, then we are truly away to the races."

Crelinsten also asked RE$EARCH MONEY editor Mark Henderson to say a few words. Henderson acknowledged that the new government is placing science, research, and innovation near the top of its priorities, as reflected by an inaugural budget that is full of commitments, pledges, and real investments that point to more of the same ahead. All that being said, the sunny disposition mounted by the new leadership has not necessarily banished the gloomy outlook in many quarters. "Canadian science, technology, and innovation is at a critical crossroads. There's a shrinking high-tech

sector, increased competition on all fronts, and a decade of uninspired leadership and underfunding of STI that represent a clear and present danger to innovators, entrepreneurs, academics, and those who set policy for the future." He echoed Crelinsten's earlier comments about the chronic shortage of large anchor firms, which has its roots in an inability of smaller firms to scale-up. He argued that the new government appears to understand the need for such scale-up and getting an appropriate policy framework before changing regulations.

"For readers of RE$EARCH MONEY this line of thinking is nothing new. Since its inception nearly 30 years ago RE$EARCH MONEY has advocated for business-driven innovation supported by robust research in academia and government. It's easy to say and it's difficult to achieve, which is why we're assembled here today to discuss ways of reversing the trend and taking Canada's innovation game to the next level."

Henderson also paid tribute to the late Gordon Hutchinson, who founded RE$EARCH MONEY. In the publication's very first editorial, from 21 January 1987, Hutchinson complained about the underfunding and downright disrespect suffered by Canada's research community. Addressing this problem became the raison d'être of the newsletter, which has continued to this day.



Opening Keynote

"IBM Canada: Perspectives on Innovation"

Pat Horgan

VP, Manufacturing, Development & Operations, IBM Canada

Introduction by Bettina Hamelin, VP Research Partnerships, NSERC

Horgan started by describing IBM's view of the future as optimistic. He noted that next year marks the company's 100th anniversary in Canada, where the term "International Business Machines" was apparently coined and eventually adopted by the parent firm. IBM is listed in the top five Canadian R&D spenders and has been consistently for many years. IBM is also part of the reason why Canada ranks second out of 175 countries in terms of software development. The company also ranks highly in polls of attractive employers.

Speaking as a former chair of the Canadian Chamber of Commerce, he cited that organization's list of leading barriers to economic competitiveness facing the country. He singled out the call for a more aggressive and effective innovation strategy that would enable businesses to respond rapidly to change. "We need to move ahead, whatever your definition of innovation is. You need to progress, you need to improve and change even if things are going well now."

Horgan also pointed to innovation rankings from the Bank of Canada and The Conference Board of Canada of various countries, which shows the country's place as

having risen over the last few years. In addition, three provinces — Ontario, Quebec, and British Columbia — rank higher than the country as a whole.

An accompanying video referred to the significant leaps in research capability that will be possible once the power of intelligent computing can be made compatible with the human beings engaged in various types of data-intensive undertakings, such as modelling climate change. Given the complexity of all systems that are becoming integral to the economy that governs our contemporary way of life, this kind of approach will extend beyond research to improve the quality of life in other areas. That being said, however, it is essential to make the necessary investments in this new technology, which will determine who survives in the global marketplace.

More specifically, IBM's response to this call for investment has taken the form of Collaborative Innovation Centres, where the company brings its skills and expertise together with those from the academic and government sectors. "When we ask 'what can we do for the digital economy of Canada', this is our answer," said Horgan. This approach has been further refined to reflect the country's particular challenges, which includes bolstering the skills required for economic development, providing the computing infrastructure required by researchers, accelerating home-grown commercialization initiatives required by growing businesses, and attracting the R&D investment required to maintain these activities.

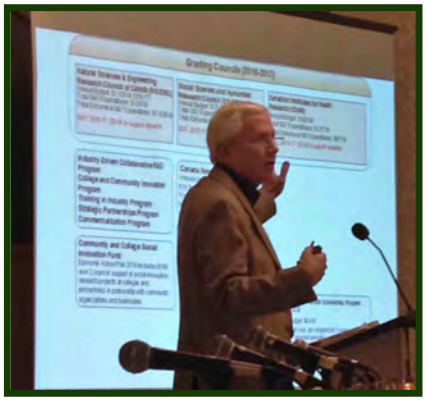
IBM's Southern Ontario Smart Computing Innovation Platform (SOSCIP) is an example of the kind of advanced computing infrastructure that will be necessary for collaborative research in areas such as energy, health, water or advanced manufacturing. Since its inception, SOSCIP has been responsible for 50 new research projects and engaged 38 businesses, creating more than 240 jobs and generating some $2 billion in revenue.

A second phase of SOSCIP doubled the size of the project, with federal and provincial participation. In February, Ontario announced its partnership in the IBM Innovation Incubator Initiative, an accelerator aimed at various business incubators being mounted elsewhere in the research community. Horgan offered three examples of the results being yielded by these efforts: Guelph-based LifeLearn, which harnesses the data processing capabilities of the celebrated Watson computer system to create an interactive diagnostic database for veterinarians; Toronto-based Blue J Legal, which offers tax law practitioners particular case backgrounds with unprecedented speed and detail; and IBM Sports Insights Central, which develops administrative frameworks and game strategies for the Toronto Raptors.

Horgan concluded that such accomplishments demonstrate that this is the right way to build partnerships. And while many of these partnerships benefit IBM directly, he counted all of them as beneficial. "Why? Because the ecosystem has become stronger.

There are many more people out there that have analytical skills and can apply them to innovative ideas. The idea of these tools being out there in front of many more people is definitely good for the country, it's definitely good for science and R&D in the country, and its also good for us."

Bettina Hamelin then asked Horgan about the difficulties surrounding the task of getting multinational firms to invest in Canada, something she experienced in working for a major pharmaceutical firm. He acknowledged that this represented a major challenge, but added that Canada has a substantial appeal in this regard.



Keynote

"Gravity: Canada's Innovation Challenge"

David Watters
CEO, Global Advantage

Watters began by outlining how different this latest federal budget was, describing it as "phenomenal". "In my 15 years of looking at budgets, I think this is the most distinct and unique that I have seen." He noted that there is a great deal to interest anyone with a stake in research and innovation, but added that there are some challenges that are also present.

He praised the budget document for almost immediately zeroing in on the central problem facing Canada: the median wage income has remained stagnant for a substantial period, particularly for younger people facing few options besides temporary or contract work. "It really is a challenging time in terms of trying to find a home, get a good job that is sustainable and meet all the basic payments to afford a standard of living that my generation took for granted." This challenge underlies the government's overriding focus on supporting and expanding the country's middle class. The budget also reflected the broader global economic slowdown and market volatility, highlighted by the recent drop in the price of oil and the loss of no fewer than 65,000 jobs in Alberta.

Watters asked the audience for their estimate of how much larger this budget was than the preceding Conservative one, which garnered responses that it might be two or three times the size. In fact, he pointed out, this latest budget sets out spending on the order of $27.6B over the next two years, more than 16 times larger than last year's budget, which came in at $1.7B over two years. While this money is obviously aimed at

stimulating economic growth, Watters warned that this scale of spending could shut out opportunities for other investments in economic growth.

He then outlined the eight chapters of the budget, which included helping the middle class, growing the middle class, addressing the needs of indigenous peoples, making the country more inclusive, supporting foreign affairs, creating a more open government, and providing a fairer tax system. Among the goals is a repeated reference to the creation of 100,000 jobs, along with raising of GDP by 0.5% this year and 1.0% next year. Watters wonders how many of these jobs could qualify as middle class, and what that definition might mean. He also calculated that each of these jobs will come at an overall cost of $276,000; given that there are about 500,000 university and college graduates each year, you could give each of them $25,000 to seek employment or create a business and still have another $15B left over for other expenditures. "I'm not saying you should do that; I'm saying we need to think very creatively about the kind of investments that we're making if we want to support the country and really focus on this younger generation and give them the support that they need."

From the perspective of spending on research, Watters argued that it is eclipsed by the emphasis on social policies, with the only such spending among the largest 25 items in the budget being money for Genome Canada, which came in 25th. While he did not deny the need for these other expenditures, he expressed concern about whether there would be any money available for the essential incremental expenditures on innovation.

The budget employs language that includes "redesigning and redefining" the country's innovation agenda, with alignment, coordination, and simplification along with clear outcomes, which will ultimately position Canada as a centre for global innovation, "To me this implies a very fundamental re-thinking of all the programs and activities that support research and innovation."

Watters reiterated that the scope and ambition of the budget exceeded anything he has ever seen, much of which has not been formally costed, leaving it unclear how it will be paid for. The listed commitments include a review of support for fundamental science, a framework for promoting clean growth to deal with climate change, a new defence strategy, a new international assistance policy, renegotiating a health accord, improving the living conditions of indigenous peoples, and eliminating poorly targeted and inefficient programs.

"This is a stunning policy agenda that has been developed. If you were able to do two or three of these things — maybe four — that would be absolutely remarkable. To try and do them all is really going to be superhuman." For just that reason, however, Watters suggested that it was incumbent upon observers like those present at the conference to help the government achieve these ends. Moreover, although the budget could be criticized for placing economic goals before proven performance, he speculated that this

whole package could actually work, simply because it will win just this kind of popular support. It responds to the stated needs of the constituencies that enabled the government to get elected, even if it does leave lingering questions about whether there will be enough money to achieve its stated goals.

Watters presented the 2016 version of his intricate S&T/Innovation Ecosystem Map, which shows the complex flow of money and other activities that provide linkages between diverse players, such as taxpayers, federal departments, granting councils, universities and colleges, the private sector, and global markets. As an access point into this network, he noted that the government's policy capability has been atrophying over a considerable period. "You can either build up that capacity in individual departments or you can just build it up in the centre," he said, pointing to $99 million dedicated to the Privy Council Office, where that policymaking capacity build-up might be occurring with the aim of spreading it elsewhere in the government afterward. He also observed that the Ministry of Innovation, Science and Economic Development will be handling the development of research infrastructure, including some $800 million over four years dedicated to innovation networks and clusters. Nevertheless, the implications of this huge investment are not necessarily clear.

Elsewhere Watters expressed some disappointment at how little was being spent, such as $4M over two years for Global Affairs Canada. "If you're really trying to stimulate global competitiveness, I think there's a real lack of investment in this particular area." He also pointed to a shift in the way regional development agencies (RDAs) were administered, giving more authority to the federal government in each case. "You don't have individual ministers responsible now for the RDAs. You can well see them becoming more an instrument of central government policy than perhaps they have been in the past."

Watters focused on the implications of assigning $345 million to 70 programs supporting private sector innovation, along with $3B for Scientific Research and Experimental Development (SR&ED) tax credits. For him the sheer number of these initiatives raises questions about whether there are too many of them and some consolidation might be warranted. Meanwhile, although the granting councils expressed satisfaction with increases to their budget, Watters argued that those increases were not necessarily worthy of celebration. "Let's talk about the $30M for NSERC; that's on a budget of about $1.1B. That ends up being an increase of about 2.67%. Inflation's running at 2%; so you've got a 0.67% increase. Some people may say that's a lot and a new direction. I think it is not far off what has happened in the past and grossly underfunded in terms of what we need to do in terms of supporting research activity in general." He reiterated his underlying concern about just how much some of these increases represented and whether they should be larger. Similarly with the federally funded not-for-profit

organizations and the Networks of Centres of Excellence, Watters asked about the long-terms goals of supporting these undertakings.

The presentation moved on to a colourful graphic representation of Canada's R&D activity with respect to other countries. The dynamic imagery showed how over the last several years these various players have changed in terms of their overall spending, Gross domestic Expenditure on R&D (GERD), and numbers of scientists and engineers participating in this work. Major changes in the status of some countries, notably South Korea and China, highlight the shifts taking place within about $2 trillion spent on R&D globally. "Canada is about 1.5% of that; we're about $31.6 billion, so we're really a small player in this whole scheme of things. But that's why we need to have our research community connected to what research is ongoing on a global basis, so we can attract it and make it useful for our particular purposes."

As for how that $31.6 billion is administered, Watters explained that there are six funders of R&D (federal, provincial, private, business, academic, and foreign) but just four performers of R&D: federal, academic, provincial, and business. Moreover, more than $28 billion of that performance is carried out by academia and business. A telling graph, however, outlines the nature of what Mark Henderson dubbed a "decade of darkness" between 2004 and 2014, when the average GERD amongst OECD countries rose from 2.13% to 2.4%, while Canada's GERD declined from 2.01% to 1.6%. In other words, while OECD competitors are accelerating in one direction, we are running the race in the opposite direction. "The question I have is: does the new government understand this? If they do understand it, what do they want to do about it?" The present gap between Canada's GERD and the OECD average GERD would take about five years to eliminate and add another $78 billion to Canada's R&D expenditures. "That's what you would have to spend just to become average," he said, noting that this outsized budget contributed only $1.3 billion to filling this hole. "We're still $76.7 billion short if our objective is to reach that OECD average figure."

He further unpacked this disparity, showing that GERD was 33% lower than the OECD average, while Business Expenditures on R&D (BERD), Higher Education Expenditures on R&D (HERD), and Government Expenditures on R&D (GovERD) were 51%, 55%, and 42% lower respectively than that average.

Looking specifically at higher education, Watters offered a detailed map, which showed that the cost of getting licensing revenue for innovations is $15 million. "You're only getting a net of $6 million, and that's on the basis of about $13 billion, so if you look at ROI, it's a tiny amount. And if you look at who the license is going to, more than half are actually going offshore." Nor should this exodus be unexpected, he added, given the opportunity of training people to work in R&D and keep them here. With that in mind, he cited a troubling drop in the number of people working in Canadian R&D, which has declined by some 13% from 2008-2012. In the private sector this decline was 23%,

while in higher education the number increased by 14%. "I find this to be a disturbing piece of data." As for where the remaining people work, some 58% are in the private sector, while only 33% are in higher education and the remaining 7% are in government. As another point of contrast, Watters displayed figures showing that 10% of all Canadian R&D is in the social sciences, but 64% of university graduates are in the social sciences. An even starker contrast is with Canadian colleges, which produce fully 42% of the graduates in higher education yet receive only 2.4% of federal research funding.

Looking at the private sector, Watters revisited the implications of the small number of larger firms, some 1,500 out of more than 1.1 million in the country. Statistics Canada even lumps in organizations like Canada Post or universities into this category, so the numbers drop even more when these public sector bodies are removed. Moreover, the real action in terms of employment and R&D activity remains with the SMEs, some 75% of which have just four employees.

The push to get Canada to participate in global markets is a reminder of how dependent we are on the US, which is the nearest and most accessible of these markets. The competition is daunting, he concluded, and in this regard far too much is expected of SMEs. "We expect these firms, between four and nine people, to get into the Chinese market or the Indian market. The complexity of doing that with a small firm is just stunning. This is a huge challenge where we really do need to have governments and the higher education sector working with the private sector to find solutions."

Returning to the notion of spending an extra $78 billion in order to bring Canada's GERD up to the OECD average, Watters estimated how much each sector would have to carry out in that regard. Since the private sector currently represents 49% of the total share of Canadian R&D, this would mean an extra $38.2 billion. "What would you have to do? It's got to come from increased revenue. You're not going to have the government bail you out; those revenues have to come from sales, predominantly in export markets." Since innovative firms spend about 3.5% of revenues on R&D annually; at that rate, these firms would have to increase their export sales — which are now about $623 billion — by another $1 trillion. That is an increase of about 175%. "That's why, in my view, an innovation strategy has to be an export strategy and so far I don't see the components of that having been put into place."

Watters suggested that metrics would become crucial to gauging the effectiveness of such policies in economic, social, and environmental terms. As for why Canada's innovation ecosystem has been performing poorly, he listed nine specific reasons:

1) a continuing decline in funding for innovation and R&D
2) a lack of national objectives. "We have not defined what it is we're trying to build and achieve here."

3) no industry sector strategies
4) an inadequate understanding of how the private sector is organized, including critical elements such as the fact that 75% of firms have just four employees and services now account for 78% of the economy
5) too narrow a focus on R&D, instead of a much broader definition of innovation activity
6) inappropriate focus on commercialization of university research rather than success of university researchers
7) little effective federal or federal-provincial coordination, which requires new expertise and time
8) inadequate data on innovation performance
9) little direct support to help firms approach global markets, especially the SMEs that need the most help

As for the way ahead, Watters insisted on the need to reinvest, rebalance, and redesign programs in order to get everyone aligned in the same way toward innovation. "I like the general direction this government is moving on this agenda, but I think they're going to need a huge amount of help."

Crelinsten asked for details about the three points that an innovation agenda should emphasize. Watters began with the importance of setting a clear goal. "We've been underinvesting in this area for such a long period that you've got to get a recognition by politicians and bureaucrats about the significant challenges and investments that are going to be required." Secondly, he stressed the major distinctions between different industrial sectors, which calls for equally distinct strategies. This is best accomplished by ongoing partnerships between the public sector, private sector, and academia, so that progress is monitored by all the participants.

Ron Freedman challenged Watters' emphasis on the ratio of GERD to GDP, because Canada's measurement of GDP is distinct from that of other countries. For example, Canada does not include research in business, the social sciences, or the humanities in its calculations, while others do. He then asked what was in the budget that would generate real results for Canada. Watters suggested that singling out 1,000 high-impact firms for support is a tangible step.

Strand A

Taking Canada's Ability to Serve Global Customers to the Next Level

The key to a successful business is generating sales from customers. For a country like Canada with a small domestic market, serving customers outside the country is essential for business growth. This strand explored the importance of global customers to Canada's innovative firms and what cultural and attitudinal changes are needed to enhance Canada's reputation and performance in providing innovative solutions to the world.

(*in order*) Bogdan Ciobanu, Lisa Crossley, Matthew Saunders, Julie Pottier, Alison Sunstrum, Karna Gupta & Jeff Crelinsten

(*in order*) Julie Pottier, Lisa Crossley & Matthew Saunders

Strand A, Panel 1

Creating a customer-focused mindset

Moderator: Julie Pottier, VP, Commercial Market & Small Business, EDC
Lisa Crossley, CEO, Moseda Technologies Inc.
Matthew Saunders, President & Managing Director, Ryerson Futures

Revenue from sales is the best source of financing for any company. Customer-facing skills are essential for success in commerce. How can students acquire these skills and experience during their postsecondary education? How can Canadian start-up and early-stage firms in knowledge-based sectors develop a strong focus on customers? How can industry, government and academic leaders break out of their respective silos and together shape a culture that embraces a customer-focused mindset in knowledge-based sectors of Canada's economy?

Pottier jumped right to the primary issue at hand, namely why it is so important to focus on customers. Crossly gave some background on herself and her business to explain how she came to be so customer-focused, beginning with an account of the roller coaster rides she has endured with various IPOs.

"They're your revenue drivers. Without them you don't have a company. It's critical that you identify a customer for your product," she said, adding that this is even more important than the technology behind the business.

Saunders began with a similar story of moving through different companies and ultimately working with Ryerson Futures. His role there is to help entrepreneurs with technology that seems to solve problems in front of customers, in order to determine

whether or not it actually meets their needs. By way of example, he recalled working with a company that generates electronic receipts for retailers, providing line-item information about a purchase on the purchaser's bank account.

Pottier responded to that example by asking who is the customer, given that there are many different types of potential customers. Crossley argued that the ideal customer was the one with the greatest need for your product or service; the ultimate buyer may require a middleman of some sort.

"A lot of companies don't do that early on, figure out who will be my best customer," she suggested, referring specifically to customers who are the most motivated and will pay the quickest. In the case of health care, this can mean getting buy-in from front-line staff, as opposed to trying to get hospitals to use a system they do not want to use.

"You have to really understand the dynamics," she said, admitting that they are rarely simple.

Saunders suggested that changes to government policy, which would make it the first customer for many innovative technologies, would be of great benefit for many start-ups.

Poitier then asked about the downfalls of being customer-focused. Saunders insisted that you cannot focus on just one customer, no matter how preferred.

Crossley warned that forced validation by going through friends or biased observers will not help the cause. She argued that "fail fast" seldom happens, even though it is important to do so.

Poitier asked about how this approach changes when you begin to market globally. Crossley said channel partners are crucial in many parts of the world, such as places that would not do business with a woman. Local knowledge and interpersonal relationships are critical and setting up a sales contract can be protracted process, but once completed it is extremely valuable.

Saunders agreed that global marketing is a time-consuming process but the right partner can make everything work, offering the example of Starbucks teaming up with Tata. That being said, Poitier pointed out the importance of making sure that you do this for yourself.

Crelinsten addressed the question of scale with the panel. "I've encountered entrepreneurs who understand customers to a certain extent, but they'll say 'I'm in a sector that's a $50 billion world market. If I can get one per cent of the market, I have a

good business.' And of course that's not true. So for Canada, which is a small country that doesn't have a big domestic market — yet as David was saying you have to have an export strategy for an innovation strategy — is it the right strategy to pick a niche where the big players won't play because it's too small for them, but you can really have a good business if you're number one in the world."

Saunders replied with the example of a medical technology business that started into a $30 million market that was deemed by most to be too small to be worth the trouble; nevertheless, over the next 10 years the firm thrived as the leader in this market and was eventually sold to Siemens for $450 million. "There's not one answer to the question," he said, noting that markets for unprecedented products or services — such as those spawned by new technology — could represent the same kind of opportunity for growth.

Crelinsten pressed the point: "Did he sell to Siemens because he had picked a market that was too big for him to handle or could he have grown a $1 billion Canadian Company." Saunders noted that the firm had gone public in order to finance the company early on. "With the Canadian laws, once it's in play he had no way to stop it. That's what happened. He did not want to sell, but he was forced into it."

Crossley offered her own example of a small business that did very well by dominating a specific market. "Niches can be big enough for you to really build a business in, or they can be something that gives you a foothold in the space and also you can expand into the broader market," she said. "I don't think there's a right or wrong in terms of going after a niche, it just depends on what your goals are for the company." She added that it can also be important to get into such market first so that your role is unique, perhaps getting out before much larger interests move in to copy what you are doing. "That's just something you have to discuss with your board and investors. What are they looking for? Is it a lifestyle company, is it a $200 million company, is it a $1 billion company?"

Jeffrey Dale asked about mentors, specifically those who may have helped with building an export business. "More importantly," he added, "do you have any ideas for how we scale that up in terms of increasing the number of mentors who have that experience to help more companies?" Saunders offered the example of an imaging app for doctors, which involved sharing pictures of patients for consultation and diagnostic purposes, something that is expressly prohibited in Canada. However, India has no such restriction, and once the app was marketed there it was quickly and widely adopted in the medical community. The key, he stressed, was having a mentor who understood the country where you wanted to begin this marketing process. Crossley acknowledged that she has spent much of her career assembling a network of just such mentors who have greatly assisted her. "In the US I found there was a real entrepreneurial ecosystem and you always knew someone who could connect you with the right people," she said. "It's

much harder here. So I definitely try, as someone who's been around in the entrepreneurial community for a while, to reach out to younger entrepreneurs and help out." She added that start-ups looking for funding should also asked if their investors are likewise bringing in the advantage of this kind of network of mentors. "I've been ruthless about refusing investors who just bring money. You really want investors who have global contacts, who can show you who they could introduce you to if they come in and are members of your board."

Pottier added that EDC can help in a more formal way in matters of expanding a business into another country, such as the kinds of cultural practices that accompany contract negotiation. "Usually the best advice is from people who have gone into a market and it hasn't worked," she said. "This is where you really learn. And our experience has been that companies want to share this, they don't want the next company to go through the same pain."

Pottier asked about the role of sectors with respect to customers. Crossley described her knowledge of health care products as being premised on how these items are sold. "Depending on the sector it plays into your sales cycle."

Pottier asked about the kinds of incentives that could be provided to get start-ups off the ground. They returned to the idea that the authorities in a medical system could be the first buyer for local technologies, as happens in many European countries. Saunders argued that a tax incentive to large companies for taking products from start-ups would also be effective.

Pottier asked about what kind of training could be offered to students in order to ensure that they're prepared to enter into this kind of entrepreneurial environment. Saunders maintained that it is important to pass this kind of understanding on to people in any kind of program where they might become part of a new enterprise. "Giving students exposure to entrepreneurship benefits all of us," Crossley insisted.

A member of the audience asked for recommendations about finding customers internationally. Saunders replied that it is important to determine if that market is the right place to go first. "It's about customer traction. The money will come." University-based spin-offs with IP requirements can complicate the buy-in, he added, but where there is a much easier tech transfer program it works very well. Crossley insisted that McMaster and Waterloo, for example, have some of the most sensible royalty arrangements in this regard.

Sandra Noel, from Innovation, Science, and Economic Development Canada, asked about the role of crowd-sourcing initiatives as a means of connecting with customers before you have even finalized your product development. Saunders suggested that this approach would work for a subset of businesses, especially if what you are doing is

easy to demonstrate and grasp, such as some kind of drone-based activity. "But if you're building some SAS-based solution, that's not going to work," he said. A further risk is the sheer number of people who might ultimately be involved in your business. "It can become a challenge in future rounds of financing when you're trying to grow and scale the company and you have 1,000 people that own 5% of your company," he warned. Crossley included her own warning about the sustainability of a business built entirely around customer expectations. "Customer-focused mindset is really important but it's one piece of the puzzle."

Rory Francis of the PEI Bioalliance asked about Saunders' critique of university spin-off technologies, looking for an example of an SME that had risen above some of these challenges. Saunders suggested that examples could be found at the Biomedical Zone [http://biomedicalzone.ca], a medical technology incubator program established by Ryerson University and St. Michael's Hospital in Toronto, which is located within the hospital itself. However, Crossley doubted that the clinicians in the hospital were qualified to offer the appropriate business savvy. "That's the blind leading the blind," she said, insisting that too much technical talent in the administration of a company is a sign of trouble.

(*in order*) Bogdan Ciobanu, Alison Sunstrum & Karna Gupta

Strand A, Panel 2
Going global

Moderator: Bogdan Ciobanu, VP, IRAP & Small Business Innovation, NRC
Karna Gupta, President & CEO, ITAC
Alison Sunstrum, CEO, GrowSafe Systems Ltd.

A small country like Canada needs trade in order to survive. We have gained an advantage through global demand for natural resources; however, in order to thrive in knowledge-based sectors of the economy, entrepreneurs need to accurately identify global needs and quickly develop superior solutions. What are the ingredients for success in global knowledge-based commerce? How do Canadian innovators access global value chains and global innovation networks? How can government policy help or hinder Canadian firms from accessing global customers?

Ciobanu began by noting that Canada's economic success has been premised on exporting goods, but this trade has been diminishing in real terms to become the third-worst performance amongst 34 OECD countries. This raises the questions of why this has happened and how companies can overcome this problem by moving into international markets.

Sunstrum began by commenting on how terrible it has been to be an entrepreneur and her company went international because it was impossible for them to do business in Canada. Her own daughter, ex-military, said working for the company was harder than war. "Running a company anywhere in the world means you must address multiple markets." Among the bright spots has been a partnership with IBM Canada, which has been building networks with smaller firms like hers.

Gupta pointed out that most of Canada's growth focused on US trade, as opposed to the emerging markets where most of the world's economic growth has been occurring. He also reiterated the early insistence that government procurement policies pale in comparison to what is happening elsewhere in the world. Similarly, there needs to be more support to help companies overcome the many hurdles that are involved in entering other markets. This is often why smaller companies get bought early, which means entrepreneurs never acquire the experience necessary to grow and run any kind of larger enterprise.

Ciobanu asked for solutions to the procurement problem. "We're really slow to adopt new technologies in Canada," said Sunstrum, adding that this trend is exacerbated by the excessive cost of capital in this country. Gupta argued that access to capital, markets, and talent are essential to success, and capital is the key stumbling block as companies become larger and exceed the size of a start-up. Another problem they identified is the IP regime, which is poorly developed, along with a Canadian lack of the expertise necessary to sell products.

Sunstrum disagreed with this assessment about talent; she argued that the reason it is not being developed is that there are few companies able to employ it, so people go elsewhere. "We're not developing strong enough companies that can keep that talent employed." Gupta politely disagreed, then returned to the fundamental challenge of access to capital.

"We need to have the Canadian government be a lot more entrepreneurial," said Sunstrum, recalling the difficulty in mounting a Webinar with a federal department. Such opportunities are crucial to showcase Canadian firms to larger enterprises that could become partners, such as the PEI BioAlliance.

A question from the audience asked why there had been no mention of Foreign Affairs or Trade Commission Services. Gupta indicated that they do use these services, but it needs to be made more consistent. Sunstrum's experience was less positive, as she has not found the information she needed after going to another country. "I would really like to see people give me advice before I go into a country," she said.

Freedman asked about the basic challenge of moving from becoming a small company with a local market to a larger company with an overseas market. "How does a company move from a domestic focus to an international focus?" Sunstrum replied that this is not just a matter of flying there to meet people, but that is all they have been able to do and it is difficult. "That is probably one of the toughest things we do," she admitted.

Gupta pointed out that international trade often calls for in-country agents, especially in places like the Middle East. "To start, you really have to fly there all the time," he said, adding that it is matter of doing your homework in advance and finding mentors in order to understand culture as well as laws. You need to find people who have done business internationally and are now mentoring.

Doug Barber noted that his company Gennum was established with no Canadian customers, which meant going into many different countries. After telling some tales about the challenges they faced he concluded that it is not a simple game.

Ciobanu asked about policy changes that might help. Sunstrum pointed to investment rules, specifically a means of rewarding investors for supporting Canadian enterprises. "If we want to be an innovative nation, research and development expenditures are where we start."

Gupta pointed out that regulations around stock options are crucial, as this is the currency used to reward employees and investors in enterprises that have no cash. He added that similar kinds of incentives are needed to harness knowledge in a knowledge economy.

Freedman asked Ciobanu what IRAP can do in this context. He replied that IRAP is working with Global Affairs Canada, delivering various international programs.

Rory Francis pointed out that some key measures, such as the ability to provide executives with stock options, are hard to gain approval in Canada. He asked why governments fail to understand the value of these policy initiatives. Gupta offered the example of health informatics, which often fails to gain pick-up because of Canada's own internal disparities (i.e. provincial control of health care). "Big ideas don't come to fruition."

Sunstrum blamed it on a national inferiority complex, which can be contrasted with the aggressive behaviour of countries like Ireland or Australia. "You definitely have to get out there and sell it."

Strand B

Taking Canada's Talent Pool to the Next Level

One of the biggest challenges innovative companies face is attracting and retaining talent. On one hand, global competition for the top graduates in technical fields is fierce and Canadian firms struggle to compete with large multinationals. On the other hand, Canadian graduates generally lack exposure to and experience with business skills such as communications, management, marketing and sales that are essential for innovative firms to scale up and compete globally. Furthermore, traditional academic priorities and culture have been slow to adapt to the fourth industrial revolution, making industry collaboration difficult and therefore denying student exposure to business innovation practices. This session will explore what Canadian educational institutions need to do in order to equip their graduates with the skills, experiences and mindset necessary to work in and lead Canada's innovative companies of the future.

(*in order*) Neal Hill, Bettina Hamelin,
Allison Sekular & Debbie Lawes

Strand B, Panel 1
Rejuvenating the talent pool

Moderator: Neal Hill, Vice President, Market Development, BDC
Bettina Hamelin, Vice-President, Research Partnerships, NSERC
Allison Sekuler, Vice-President, Research (Interim), McMaster University

Youth unemployment (13%) and underemployment (28%) are intolerably high in Canada. In academia, Canada's young researchers have to wait until their mid-30s or early 40s to launch their careers. The vast majority of graduates who pursue careers in industry or government enter the workforce with little or no experiential learning and are ill-equipped for an increasingly service focused economy (now 78% of Canada's economy). How can we transform Canada's postsecondary education institutions to equip Canada's youth with the skills and experiences required to meet Canadian needs in a competitive global context?

Hamelin began by stating the none-too-surprising observation that building and maintaining a talent pool is among the top priorities of NSERC. More specifically, she concentrated on Canadian PhD students, whose population has grown by 50% over the last 15 years, with fully half of them being immigrants. While most of these students enter their respective programs with the aim of establishing a career in academia, less than 20% of them will end up in tenure track positions, with another 30% occupying non-tenure track posts of one sort or another. A significant portion of the rest end up in the private sector, which follows from a growing number of private sector links that are being established at universities across the country. "Our talent pool, when it comes to PhDs or graduate students, they're quite diverse, they're team players, they're entrepreneurial." Of greater concern, she concluded, is whether or not these individuals are finding positions that make full use of their considerable educational background

with jobs in Canada. In light of the decline of R&D employment in many sectors, as described earlier by David Watters, she suggested that it would be helpful to build networks for these students to find the best available opportunities. Finally, she reminded the audience not to overlook colleges, where a great deal of talent emerges. "Colleges have a tremendous talent pool, which is evolving as colleges play much more of a role in applied research and they have the knack for working directly with industry." All that being said, Hamelin concluded that these young people may well have a better idea about what is best for them, making it worthwhile to engage them in a dialogue as to the best way forward.

Sekuler agreed with Hamelin's assessment of the changes that have taken place in the academic world, which lead to many graduate students not ultimately ending up in the academic sector for their careers. Nor did she regard the institutional planning around these changes as being strictly an immediate concern, but something that affects the view 10 or 20 years down the road. "Who are the students who are going to be coming through the system? What educational system do we want to be designing for them? How are we going to be thinking about our position in the world and where do they want to be in the world?" Among the challenges facing Canadian universities is the fact that programs tend to specialize to a significant degree and thereby oppose the growing tendency of students to shift direction in their studies as well as their career ambitions. "They don't necessarily get exposed to a wide enough range of skill sets." Nor did she mean vocational skills sets but more fundamental skills such as communication, critical thinking, or numeracy. "Students should be graduating from their undergraduate degrees ready to do anything. They should be learning how to learn, as opposed to what we normally are doing in the universities in Canada, which is training them to become professors from the day that they set foot on campus. That's not going to happen. Most of them don't want to do that; there aren't the jobs for that. So why are we training people in such a highly specialized manner?"

In this respect, Sekuler does not regard universities as being set up to deal with their own educational future. Although they style themselves as liberal in nature, they are actual quite conservative in practice. "We have the same departments we have today because those are the departments we had 100 or 200 years ago. Does that make any sense in today's world? Absolutely not. But we're loathe to change." Until that change occurs, the goals of ensuring student success will not be realized. As just one example, she pointed to the growing prominence of aboriginal students within the Canadian population, a cohort that is seldom formally recognized. Similarly the growing proportion of immigrant students are treated like any other, despite what are often highly specialized needs. "We can't educate everybody in the same way. We need to have a more personalized education model that takes into account people's interests and skills and backgrounds. We have to become disruptors of the educational system. We have to think more about how do we gear what we're doing not to what was here 100 years ago but to who's coming over the next 100 years. Until we start to do that I don't think we're

going to make as many gains as we would like to see and we're going to fall further and further behind in the world economy."

Sekuler also pointed to her own observations of PhD students she works with, all of whom are acquiring a wide range of skills that would be of interest to any prospective employer, but which are eclipsed by the tendency to view academic accomplishments through the narrow lens of publishing and nothing else. "We don't have to reinvent the PhD, we have to reinvent the way that we're explaining to students how to use what they're learning."

Hamelin disagreed about Sekuler's description of the overly narrow specialization occurring in Canadian universities, although she did concede that these institutions must now answer to students who have a much clearer conception of the standards being set by other post-secondary systems all over the world. She did agree that the prospects of PhD students would benefit from the widest possible cultivation of skills, while also noting the proliferation of professional Master's degrees that help students place themselves with a carefully target skill set.

Sekuler reiterated her argument about specialization, indicating that the most sophisticated of American universities kept students course requirements to a minimum, so as to help them achieve a substantial breadth of education. "We don't have to be this specialized. You can have more breadth and have students do just as well or even better than our students are doing." She added that it is more common for American students to take at least one semester abroad, something that provides them with a better sense of the how the rest of the world functions. Canadians tend not to do so because these foreign programs often do not match the requirements students need once they return to Canada, so they could wind up taking an extra term here in order to be able to complete their degrees. "What we're doing by having such a great number of specialist courses that are required is limiting the skills that students are acquiring, we're limiting their ability to go out and explore the world — and become more interesting people along the way — but also we're limiting their ability to learn how to interact with different people."

Hill echoed Sekuler's observation with the experience of his son, who was already enrolled in engineering at the University of Toronto, but after inquiring about transferring to an American university discovered that he would face far fewer limitations on the kind of program he pursued. Hamelin responded that such flexibility varied widely with the type of degree a student was seeking and she added that Canadian universities are being more creative and pro-active in offering their students the ability to study abroad.

Still on the theme of contrasting Canadian and American educational experiences, Hill asked about the well-observed difference between the two cultures in terms of nurturing risk-takers. Sekuler indicated that by setting much of the system up to prepare students to pass tests, they would be less inclined to confront failure and learn from it, which creates a life-long aversion to risk. She also cited the advantages of working directly

with students to consider how their academic program could evolve to overcome these challenges, something she adopted at McMaster as an initiative called Student Proposals for Intellectual Community and Engaged Scholarship, which invites graduate students to mount projects that may or may not succeed. In this way, she advocated giving students at all levels some degree of control over their learning process, and if their approach fails, at least they should get credit for trying because they likely learned a great deal from it.

For her part, Hamelin disagreed that Canadians are inferior risk-takers; she argued that the nature of the granting system forces people to take the step of carrying out much of their work even before they know that work could be funded. In contrast, Hill pointed to information he had gleaned from Global Corporate Venturing, which deals with corporations become involved in venture capital activities. "They have a list of 1500 companies worldwide that are active in venture right now. Of the 1500, from Canada: three." Sekuler noted that risk-taking in research varies widely from one discipline to another, depending on how individuals are evaluated in their work. NSERC Discovery program, for example, supports a program of work rather than a narrowly defined project, so researchers can adapt their work significantly as they proceed. The US, on the other hand, tends to tie funding to work that has already been demonstrated. She argues this is part of why Canada punches above its weight in aspects of pure science.

A member of the audience asked about the role of collaboration, particularly collaborations between universities and colleges. Hamelin pointed to a number of networks that have been established to promote interactions across provincial lines. Likewise, she envisions a great deal of potential in partnerships between colleges and universities. Sekuler added that such partnerships call for these institutions to transcend their traditional loyalties to their own best interests and help develop a set of higher, common goals.

A second questioner asked about whether there was sufficient data to make sound decisions regarding the future of graduate programs. On a related note, he also asked if the diversity of options within Canada's post-secondary institutions was sufficient to meet the needs of today's students. Sekuler replied that the question of diversity leads back to the idea of personalized education. "We definitely need to be making better use of the data, but we have to be able to know what the right questions are so we can get the right data."

(*in order*) Ted Hewitt, Janet Scholz & Ian McDonald

Strand B, Panel 2
Unleashing innovative talent

Moderator: Ted Hewitt, President, SSHRC
Ian McDonald, AVP, TD Lab and Enterprise Innovation
Janet Scholz, Former President & CEO, ACCT Canada

The traditional paradigm that sees a linear progression from academic research and discovery to industrial innovation has cemented an ineffective system in our postsecondary educational institutions. Faculty and students work on scholarly research, disconnected from university administrators' attempts to commercialize promising results. While companies have evolved toward an open innovation paradigm, whereby diverse players collaborate on finding solutions to specific problems, postsecondary education institutions in Canada have been slow to adapt. How must our institutions evolve to engage faculty and students on relevant work with industry and government and build the relationships and experiences they need to participate and excel in open innovation collaboration?

Hewitt picked up on a point from Dave Watters' talk, specifically the broken linkages between fundamental discoveries made in the academic sector and potential commercial opportunities. Although he could point to many examples of institutions that have made inroads in building partnerships with business, "I'm wondering if we can't go further. What might be a model that would bring out the talent of our young people, provide industry with the support it needs, which would be less cumbersome and more productive. I'm thinking: open innovation."

He offered examples of open innovation platforms mounted by Apple, Google, Netflix, and Toyota. The drug industry, in particular, has concluded that its traditional restrictions on sharing of information has held back discoveries and development, leading many of these companies to work more openly with academic partners. These examples suggest that this approach is more efficient in getting new ideas — and products — to market, something he would like to see happen in the country's colleges and universities.

Scholz responded by describing technology transfer as just one aspect of an extensive continuum of activities that define innovation, starting with basic research and ending with the introduction of a new product in the marketplace. This dynamic is part of a larger ecosystem that includes cultural and environmental processes that determine how well innovation operates. In this light she suggested that open innovation is not as simple a concept as it may appear to be. "One size does not fit all," she added. "It depends on which sector you're working in as to what the proper pursuit and management of disruptive technology looks like. An open innovation system doesn't mean everything's out there for free and everybody's just sharing it all about."

She did agree that the closed-shop model represented by the pharmaceutical industry, which used to define most academic-industry liaisons, is no longer widely embraced. Instead, institutions are examining which sector they are working with and what will work best in each case.

McDonald agreed that many of these more ambitious collaborations were working well in companies such as his. "If we want to be open we need to be open to all levels of collaboration. We need to challenge and reward rule-breakers and at least evaluate those as alternate methods."

Hewitt then asked what colleges and universities could do differently by way of improving this situation. Scholz focused on key performance indicators as her most important criteria, ones that are often misaligned and causing various steps to be less effective. McDonald argued that there is no systemic change to be recommended, but instead examples from individual cases that succeeded, such as academic institutions that were pro-active in asking businesses about what problems need to be solved.

At this point Bruce Rayburn of Agriculture and Agri-Food Canada observed that the discussion revolved around a somewhat dated view that educational institutions should make a priority out of getting their graduates hired into jobs as quickly as possible. Instead, by using incubators and accelerators for graduates to act on opportunities, companies are relieved of the risks of hiring individuals who have yet to prove themselves in a business setting. "They're not hiring people, they're acquiring a spin-

off," he said. Similarly, he added, a business can post real problems for students to solve and gauge their skill level in the resulting responses.

This comment prompted Hewitt to ask about the effectiveness of initiatives such as entrepreneurship on campus, and whether some of the onus for creative solutions to innovation should come from the business sector itself. McDonald outlined how his own firm hires teams of student to engage in precisely these kinds of laboratory-based problem-solving exercises. He noted that it has been much more common for firms to open up difficult problems within industry to the creative thinking found among students as a way of building bridges between sectors.

Scholz corroborated this observation, suggesting that companies are increasingly open to academic overtures from faculty members as well as students. "What it takes is a brilliant scientist to have a vision," she said. "We need to find those academics and help them in their careers." Nor is it a matter of counting patents, she added, but collecting information about the level of participation and what commercial products it has generated. Returning to the notion that key performance indicators are the most revealing way of assessing success, McDonald maintained that there is just as much to be learned when these arrangements fail as when they succeed. In this context, he added, open innovation is highly attractive because one does not have a major investment in IP should the venture not pan out.

Margaret Dalziel of the University of Waterloo pointed out that her institution scores very high in international rankings for promoting entrepreneurship, far higher than any other Canadian school. "The reason is not the IP policy, but the bold experiment of founding the university almost 60 years ago where students were going to do co-ops," she said. At the time this was not seen to be a game changer, but over the long term this strategy has set it distinctly and positively apart. "The reason Waterloo does so well at launching start-ups is because the students are very savvy, every other term being with a company."

Denise Amyot of Colleges and Institutes Canada offered specific measures collected by her organization, which has found that 84% of colleges support student-driven entrepreneurial initiatives, although only about a third of the overall student body engages in such activities. Increasing this proportion might be a worthwhile government policy initiative. She also noted that colleges usually let IP revert to industry partners, which makes them highly receptive to the possibility of open innovation.

With regard to IP, Scholz dismissed it as secondary to the success of innovation, which is a matter of distributing the risk of new ventures in a way that makes it attractive to all participants. "It's not whether it's colleges or universities, or whether it's companies or it's a patent or a copyright; it's not about that, it's about this iterative process that

distributes the risk and we haven't figured out how to do that yet." In the same vein, McDonald insisted that many of these ventures remain stuck in silos, making it necessary to break down these barriers in order to optimize the chances of success.

Philippe-Olivier Giroux, a policy analyst with NSERC, asked whether the open innovation model would begin to take the emphasis of this activity away from specific products and toward nurturing the skills of the participants. "Whether it's related or not to the research product or what was done when these students were in class or working with faculty is not really relevant," he said. "What is relevant is the company and the skills and what it does and its interest for business." In this sense he was advocating for the developing of "pure" entrepreneurship, apart from any final product or service. On a different note, he also asked the panel whether metrics being collected by NSERC and other organizations are in fact of any practical value to companies in the private sector.

Scholz responded that data such as IP should be employed as a proxy for achievement. "It's an indicator of something, but it's not a proxy for success, it's not a proxy for determining if you have a system that's working." She added that there were many other activities — some harder to quantify than others — that could serve as much better indicators of entrepreneurial progress. This list includes student ventures, university spin off companies, and new ideas making their way into the marketplace. "It's a bigger process than just a patent or a licence," she said.

Hewitt added that a great deal of activity still goes unmeasured, such as that in the social sciences, which is only now coming under the purview of Statistics Canada. "So when we start to measure that, guess what, a lot of these social sciences and humanities grads are going to look a lot more important."

Dinner and Keynote

"Canada and Business Innovation: What would we wish for?"

Céline Bak
President, Analytica Advisors

Bak placed her remarks about innovation in the context of supply-side and demand-side economics. More specifically, she suggested much of the discussion surrounding this topic in the medium term would form a highly critical examination of the emergence of oligopolistic economics in the United States, including an ongoing review of the causes of wealth concentration as outlined by Thomas Piketty's celebrated book, *Capital in the Twenty-First Century*.

She noted that the subject is also coming to the fore in political discourse, which has been highlighted in comments by American Democratic Presidential nomination contender Bernie Saunders, as well as journalistic analyses in outlets such as the *New Yorker*, *The Economist*, and various Canadian publications. In each case, she noted, observers are wondering about what other kinds of economic progress could be made in the absence of this form of capitalism.

"In the US the concentration narrative goes like this: one of the major causes is concentration of markets," she said. "Sector-based economic analysis enables us to detect a new and disturbing degree of corporate concentration since 1997." More specifically, she cited revenues in fragmented industries dropping from 72% of the total in 1997 to 58% in 2012; meanwhile in concentrated industries revenues have risen from

24% to 33%. Bak observed the tremendous variety of industries characterized by markets where fewer than 10% of firms control two-thirds of sales, which includes dog food, batteries, coffins, and pharmacies.

She pointed to other factors responsible for this major shift, such as the role of lobbying, intellectual property and associated litigation, and increasing corporate ownership defined by institutional shareholders. Nor are these trends an exclusively American phenomenon, Bak argued; if anything they are more pronounced in Canada. Among the most prominent examples is a huge jump in the value of Canada's oil and gas exports along with a significant decline in the number of firms operating in this sector. The same pattern has been repeated across Canada's entire export economy, which has recorded the greatest fall in share of global market exports among the world's 24 major economies in key sectors such as automotive, aerospace, and clean technologies.

"We're talking about the world's biggest loser here," she said, noting that the value of these losses were on the order of half of what the US has spent on the Iraq and Afghanistan wars.

The prospect of reversing this concentration and its effects has therefore become part of a new political economic dialogue, Bak suggested. "We owe it to ourselves to stop and reflect on this. It is the opportunity for a New Deal for innovation in Canada."

People working within her field of specialty — environmental technologies dedicated to clean air and water — have been anticipating just such an opportunity by tracking the performance of this sector over time. "Our goal throughout this research was to earn a place at the policy table for innovation-based firms working within our highly concentrated Canadian economy whose dominant firms have very deep pockets to develop policy proposals and to convey their perspective as and when it is relevant to the government's agenda."

She regarded this information as vital to putting clean technologies in perspective with the losses endured by Canada's export economy over the past decade. "We did lose ground in the global race, yet by any measure clean technology is a great Canadian innovation success story, especially when it comes to jobs and the contribution to society." The database mounted by Bak contains some 800 firms that employ around 50,000 people working in innovative manufacturing enterprises that are engaged in

international distribution. Some 9,000 of these jobs were added just in 2013, at a time when other branches of the economy were struggling to hold the line on job losses.

She also credited this growth to supply-side programs designed to promote clean technology industries, including public sector investments in institutions such as universities and the National Research Council. "It's ironic because both health-related companies and clean-technology companies make significant contributions to public policy and therefore represent a legitimate opportunity for demand-side policies driven by these public policy holders.

Bak advocated formal "nudging" of government to take stock of these developments and embrace policy goals that take advantage of the best available technologies. "This is akin to applying the gold standard concept in life science to climate change and environmental protection," she explained. Such demand-side policies would remove many of the barriers to participation that face smaller firms in such high priority areas as climate change, in much the same way that government procurement efforts can augment the capabilities of innovative firms in the health care sector.

"I submit that mitigating and adapting to climate change will require changes to existing systems to protect the air and water and land," she said. These changes will also require funds to improve the international competitiveness of the industries responsible for these systems. She offered these recommendations for doing just that, which could be applied to any innovation-based industry:

• implementing regulations that account for innovations such as best available technology
• implementing a substantial price on carbon
• legislating a public procurement framework that infrastructure investment must include procurement from innovation-based firms
• levelling the fiscal playing field with policy that takes full account of commitments such as the elimination of fossil-fuel subsidies

These demand-side measures would also include providing support to other essential participants in the implementation of these innovation technologies, such as municipal governments, which are not in a position to assume the risk that accompanies these kinds of investments. Similarly, the capacity for new investments in research and development could be expanded by building connections between researchers and the private sector. Canadians could also provide direct support by purchasing government-sponsored "green bonds" that would be part of low-carbon economy fund, which would be based on clean innovation investment criteria.

"As our commodity-led industries are buffeted by price volatility, we need innovation-based loans to make competitive exports from all sectors," she said. She cited Mark Carney's comment that we are in a long-term commodities super cycle, which Bak points to as the jumping-off point for rent-seeking economic policies based on nothing more than commodity extraction and sales. "I believe we can do more than ride short-term commodity cycles," she said, referring to a need to confront the impact of economic concentration in ways that will allow innovative firms to play a much greater role in the economy. "Some of them will grow into large firms and then we will be on an upward cycle of innovation and diversification, diversification and innovation."

When pressed by a question from the audience for more detail on precisely how to implement these demand-side policy changes, Bak responded that this would take the form of an altered political narrative, which she sees signs of emerging. "We need to be ready when that moment comes," she insisted.

A representative of a mining research group asked Bak where he should go for ideas and help on the introduction of clean technology in this sector. She acknowledged that there was no formal industry association that could be approached in this way, but she is attempting to assemble the elements of such as network and offered to put the individual in touch with people working in various parts of the industry.

Asked for a definition of clean technology, Bak referred to an introduction to the topic found on her organization's Web site, http://www.analytica-advisors.com. "We defined it seven years ago to include companies that have intellectual property that addresses something to do with energy, air, water, and the earth." This covers the fields of industrial energy efficiency, technologies in recycling, recovery, and remediation, and even some agricultural companies. "Using that taxonomy, we identified over 800 firms and that number is very interesting, because in Canada we have 700 aerospace firms; that's an industry that's been around about three times longer. And we have 450 automotive firms, an industry that's been around about five times longer. So in terms of the number of firms I'm confident that definition will hold water and we're already starting to see mergers and acquisitions with a number of firms that are coming in."

Bak noted that she is regularly advised to add service companies to this list, but she argued that Analytica Advisors has filled a void left by Statistics Canada and that is their first priority. If the government agency began to gather this information, she would then be inclined to broaden her organization's perspective.

Another questioner suggested that given the global impact of problems such as climate change Canada might find itself under pressure to make the technology owned by such firms freely available to the world, so that the environmental role of these firms could be profound even though their economic role would be very limited. Bak insisted that

technologies are not disembodied, but instead have to be created and developed within the context of a firm. In principle one could make clean technologies freely available, but she concluded that it would not necessarily have much practical effect. Moreover, much of what will be carried out in this field will take the form of services rather than goods, since one of the key aspects of bringing these technologies to market will be the financing and regulation that surround them. "We need a CMHC for municipalities to buy into this, and we need to be bold about saying things like that, when we start having this discussion about economic concentration and the need to use regulation to force innovation and smaller firms into big concentrated industries. So think of policies that you're advocating, if you think they're good for innovation, think of them as being really good for middle class jobs, which we all know is what this government wants."

Another question focused on small business innovation (SBI) research and how to promote it. Bak recalled once asking in an innovation discussion if anybody had ever done a study that gives us a perspective of GDP consequences of small business procurement acts and SBI. This information is not being systematically collected, even though it would likely provide a good rationale for government to take an equity position in the adoption of innovative technologies. "The shareholders of innovation-based firms are not the same ones that own the companies that control the world's chemical industries," she said. "It's about economic diversification and redistribution — or as I like to call it, "freedistribution" — of wealth."

Bak added that this observation is the result of her own career, which has featured an extensive benchmarking of the role of these innovative firms, which has convinced her of their potential to usher in positive economic change. "I have this naive idea that if we actually had evidence of the impact of those policies, we would act on them."

A member of the audience pointed out that this information about SBIR does exist, but specific methodologies have resulted in sometimes conflicting results. "I think it's really important that we stop asking about the impact on GDP," insisted this member of the audience. "It's not a measurement, it's an estimation and it's fraught with assumptions; it's not really the right way to pose the question. We have to be looking at the impact of these programs by different dimensions of firm performance and firm capability."

A final question asked about the source of resistance to the adoption of innovation, to which Bak pointed to Peter Drucker's celebrated observation: "Culture eats strategy for breakfast." She concluded that these innovative firms represent a major shift in culture, which sometimes wreaks havoc on any traditional approach to economic policy.

Keynote

"A Review of Canada's Innovation Eco System: Where we are and What we need to do next"

Tom Jenkins

Chair of the Board, OpenText

Introduction by Ted Hewitt, President, SSHRC

Hewitt introduced Jenkins as having been cited for five years in a row by KMWorld magazine as one of its 100 most influential people globally. "Tom's a leader, an entrepreneur, and proof positive to all of us here today that basic research and private enterprise can be very powerful allies."

Jenkins commenced from the perspective that the arrival of new governments in Ottawa and various provinces offered the prospect of renewed thinking, opening up topics that had not been dealt with previously. In terms of where the country is now, the country's business R&D expenditures remained stalled, largely because major firms such as Nortel, Blackberry, and Bombardier have ceased to be major players in this field.

Even more crucial, he insisted, is our export profile. "We must never forget, in a globally shrinking world, that the export numbers really matter. So when we innovate, we have to pay particular attention to export GDP creation."

He reminded the audience that in addition to the obvious role players in our innovation ecosystem — private interests, the federal government, and academia — there are also

varying degrees of participation by provinces, which reflects the highly decentralized way in which our country is run. Moreover, we have had a traditional conflict between developing an invention strategy versus an innovation strategy, as though the two were not compatible. "For some reason, this discussion got framed as an 'either/or'. We have to have excellence in research, but we've got to create value in society from it or we will never have the virtuous circle." By way of example, he referred to his own background with Open Text, a firm that was established by excellent research in mathematics.

As for what needs to change in order to promote innovation, Jenkins started with the notion that the Canadian government has to be a customer. He recalled an OECD meeting where the participants explained to him that the United States enjoys so much success with innovation precisely because it has "squared the circle" of public procurement. The classic example of this process is the development of the laptop computer, which was originally designed for thousands of field employees of the Internal Revenue Service, who required the capabilities of a desktop computer when they were travelling; this government agency promised hardware designers it would be their first customer if they came up with a portable version of this technology, which has since become ubiquitous.

"This matters, it really matters to commercialization, that government be that first customer," he said, adding that in a democratic environment there is the added challenge that procurement with public funds must be matched by good value for the investment. Similar challenges face academic institutions, which must adapt to the concept of commercializing their work.

Referring to a definitive series of articles on this subject in the September 2011 edition of Institute for Research on Public Policy publication *Policy Options*, (http://policyoptions.irpp.org/magazines/innovation-nation/), Jenkins described a cascade that starts with competition within business, which leads to innovation and then improvements in productivity. "The single most important thing we have to have for industry is competitive pressure," he said. "If they don't have competitive pressure, then we basically do not drive that need for innovation and productivity."

More specifically, he noted, a key measure is Canada's lagging productivity with respect to the United States, our largest trading partner. Today that gap stands at about 30%, which is largely due to a lack of investment in information and communication technologies. Placed in more concrete terms, this gap represents a shortfall of about $12,900 in average household income. "A lot of people think of productivity as working harder for less money," he explained. "No. Productivity is about working less, working smarter."

Jenkins examined another facet of the importance of competition, as a source of innovative ideas. "This is why procurement is so important," he said. "Almost two-thirds

of all the inspiration for innovation within organizations comes from a demanding customer. But it's got to be in a competitive environment."

A 2011 report *Canada's Competitive Imperative*, prepared by Roger Martin, Chair of the Institute for Competitiveness & Prosperity, outlined that from 1985 to 2011, Canada has progressed from having 15 to 42 corporations that are considered global leaders. But fewer than 10% of these firms come from sectors that exist within some kind of protection regime. "Everybody in Canada thinks that we have a wide open market," said Jenkins. "Well we don't. The Wilson report, *Compete to Win*, [https://www.ic.gc.ca/eic/site/cprp-gepmc.nsf/vwapj/Compete_to_Win.pdf/$FILE/Compete_to_Win.pdf] absolutely proved and showed this." He added that we have good reasons for Acts of Parliament that legally restrict competition in six sectors — transport, uranium, telecommunications, broadcast, financial services, and culture — with the valid aim of defining Canada's distinct identity as a nation. However, since these measures were first implemented, the rest of the world has changed dramatically, especially with respect to the evolution of a global economy. In this context, then, firms can enjoy higher profits without the need to pursue R&D or innovation; the cascade [from competition to innovation] that Jenkins previously described now indicates that sub-optimal competition leads to sub-optimal innovation and sub-optimal productivity.

As for what can be done about this problem, Jenkins returned to Roger Martin's report, which presented a balanced model for innovation, one that puts pressure on organizations to compete while also supporting them in their competitive efforts. Jenkins also cited the report he oversaw in 2011, *Innovation Canada: A Call to Action*, which offered six recommendations that he suggested had largely been embraced by government, as evidenced by federal budgets from 2012 to 2016 that included changes to R&D tax incentive programs, additional money to National Research Council's Industrial Research Assistance Program, a national procurement strategy, and no less than $800 million to establish innovation clusters. "Successive governments have done a great job looking through and figuring out what are the pieces that they're prepared to act on," he said.

As for what comes next, Jenkins insisted that a balance must be struck between facing global competition and maintaining domestic control. All the regimes that Canada has taken such pains to protect must now be opened up to the global economy in order to promote innovation. He provided the example of disruptive enterprises like Uber or Airbnb, which have skirted traditional regulatory regimes in order to provide new services to consumers. "That's the way the world is today and we've got to reorganize our society to accommodate that; or we can put our head in the sand," he said. "But we've got to have that discussion." The other balance he reiterated was the need to have both science and commercialization.

As for the role of government, it is not just a matter of being a better customer for innovative enterprises, but being a better co-ordinated customer. "Sometimes we're sort of like five-year-olds playing soccer. We all run to the ball and we really should be playing position. We have a complex array of small, direct support programs. We need to consolidate and streamline them. We need to have a thoughtful discussion about how to go about doing that." By way of example, Germany's famous Fraunhofer Institute System remains a powerful model to study. No less compelling have been the results of that same country's approach to science, the Max Planck Institute System, which combines pure and applied science, and the Leibniz Association, which co-ordinates non-university research institutes. "There's a lot to be learned from how they square their circle."

Canada already has considerable resources available for this kind of co-ordination, since colleges and universities already represent no less than $1.1 trillion in revenue, $8.5 billion in research, and some 1.5 million employees. In this regard Jenkins was struck by the importance of a national recognition of the role of innovation, when newly minted Prime Minister Justin Trudeau celebrated the strategic place of the Waterloo region. There has also been recognition within the new budget of exports as a key part of the country's economic success. Similarly, the budget put a large amount of money into innovation clusters and science, reflecting an acknowledgement of the place these activities occupy within the economy.

Finally, Jenkins' celebrated the Governor General's commitment to changing Canada's approach to innovation by launching a dedicated set of innovation awards reflecting accomplishments in this area. "The awards will be something that will go a long way to changing the culture of the country," he said. "It will be a long-term multi-dimensional effort. It is not 100 people meeting at the Grand Hall in Rideau. It's much more than that. This is the first award program in the history of our country, which will reach out and touch well over 100,000 people every year. It's because the nominating partners are the groups all throughout the country — by region, by sector — that are already recognizing innovation." Further to this collaboration with the Governor General, Jenkins is also writing a book with him about innovation in Canada. This work has already mustered more than 1,000 stories in a National Innovation Database, which will be featured in a national campaign when the book is published in March 2017.

By way of conclusion, Jenkins told members of the audience that their actions would loom large in the implementation of a new perspective on innovation. "What you do matters. The conversations you have, whether it's with ministers or deputy ministers, it really does matter." Similarly, government must begin to take risks in terms of procurement policies and academia must understand the need to aspire to both excellence in science and in the commercialization of scientific insights.

(*in order*) Frank Des Rosiers, Marta Morgan, Marc Fortin,
Lawrence Hanson & Kenneth Knox

Panel

What can the federal government do to enhance its contribution to the innovation agenda?

Moderator: Kenneth Knox, Chair, Science, Technology, & Innovation Council (STIC); CEO, Knox-Vannest Inc.
Frank Des Rosiers, ADM, Innovation & Energy Technology, NRCan
Marc Fortin, ADM (Science & Technology), Department of National Defence (DND)
Lawrence Hanson, ADM, Science and Innovation Sector, ISED
Marta Morgan, Associate Deputy Minister, Finance Canada

Knox made it clear to the audience that they were being presented with the individuals who write or approve briefing notes, as well as policy statements, for the federal government, so this was an ideal occasion to offer them observations or new ideas. He then began by asking Morgan to explain the role of the federal government in stimulating and supporting innovation across the economy and society.

Morgan picked up on a central theme from Tom Jenkins' presentation, which is that business competition is crucial to innovation. "One of the first roles of the federal government is ensuring that the business environment, in which businesses and individuals operate, is conducive to growth," she said. "This means that our framework policies are conducive to growth, that we allow for the reallocation of resources of labour and capital across the economy, that we have the flexibility in our economy and that our framework enables that." Another key element is the government's role in supporting

talent as well as the wider ecosystem, such as supporting research through the granting councils at universities and colleges or through the tax system.

Des Rosiers added to Morgan's remarks by discussing more specifically how government acts on this commitment to promote innovation. "Educating that discussion in a very active fashion with all our partners is the commitment that government has made," he said. Referring to Tom Jenkins' description of co-ordination amongst government and others with regard to innovation, Des Rosiers suggested that government can apply a considerable tool set for this process right across the country. Similarly, Jenkins' discussions of the importance of exports is reflected in the need to maintain the large volume of exports that we already handle in areas such as forestry, mining, and agricultural products. Finally, on the question of government procurement, Des Rosiers placed this in the context of government operations, which can be refined and improved to become better.

Fortin noted that some of the government's major investments over the last few years have been on the research side of the equation, in bodies such as the Canada Foundation for Innovation. As laudable as this practice may be, it represents only a necessary and not sufficient condition for innovation. More diversity of investments is required to fully support this process, as reflected by the diversity of an innovation ecosystem. On that same theme, he added that ecosystems thrive on trial and error by various participants. "Are we prepared to take risks and focus on some areas, and adapt our interventions to the need of a given sector?" he asked.

Doug Barber noted that Canada has a sizeable stake in international commerce and he asked the panel for specifics on the amount that Canada receives from world trade as well as what it pays out. Morgan did not have specific figures to offer, but she confirmed the idea that trade is an essential feature of our economy and no less essential to efforts to enhance that economy. "It's a global marketplace that supports our standard of living," she said. "Any part of an innovation agenda must be outward focused, and has to be focused not just on Canada but on the world and our key trading partners."

At Knox's prompting, Dave Watters volunteered some specific numbers for our trade deficit — on the order of $650 million — but he also broke down the components of that deficit. "We actually import more intellectual property — about $12 billion — than we export," he said. "The whole issue is diversification and how much an innovation strategy is linked to going global and therefore exports. There the issue is how we get these small firms comfortable in terms of getting access to these larger markets."

Barber then followed up on his initial question by noting that if we are such an export-dependent country, how conscious are we of that status. Des Rosiers insisted that companies with a vested interest in exports are exceedingly aware of this fact.

Knox suggested to Hanson that although government should not pick winners, in terms of identifying specific industries or sectors to support, it should nevertheless pick the right races. Hanson replied that the caution surrounding winners is well warranted, but Canada's areas of strength remain well known, including ICT clusters, aerospace, life sciences, and energy. "The reality is that we have to drill down and more fully understand where our greatest strengths lie and where we can leverage them," he said. Nor is this a task for the federal government alone, but in conjunction with partners in provincial governments as well as the private sector.

Morgan pointed to the current federal budget, in which the government identifies priorities around innovation that feature some $800 million over four years to clusters and networks, along with considerable investment in clean technology. In this context, the search for winners remains a major challenge. She identified the ability to attract private sector funding as a key indicator of how successful these ventures might become.

Knox then refined his question further, asking if it is a matter of picking races we are already positioned to win or races where we lack the strength to win and require additional resources to do so. Fortin argued that the concept of "picking winners" is an oversimplification, since the process of determining where funds will go is elaborate and multi-faceted. "We need to bring in the ecosystem to work with us, on the understanding of what are the opportunities," he said. "It's up to this system to work together and identify what is to be done."

Hanson reinforced this point, maintaining that time and diversity are required to develop winning initiatives. By way of example he pointed to the emergence of regenerative medicine and stem cell research in Toronto, which was the result of ongoing investments in infrastructure, academic chairs, and a variety of local hospitals. "There are these disparate program elements, but they're not working in isolation from one another," he said. "They're combining to create these critical masses in certain areas."

Crelinsten asked Morgan and Fortin if their confidence of the academic strengths in certain areas warranted letting market factors decide where to go next. "What about asking the private sector, as well as Social Sciences and Humanities academics who study markets, so that we could be driven by the market opportunity? What are the market opportunities in the world for us to do well as exporters?" Fortin agreed that this is the logical next step once the country's capabilities have been built up in key areas.

Freedman asked Fortin and Des Rosiers about the constraints that are imposed on their own respective abilities to operate. Des Rosiers pointed to access to capital as a major restriction, since many NRCan undertakings are capital-intensive and the shortage of

venture capital is especially well known. He added that finding adequate talent and optimizing the outcome of investments also pose ongoing challenges. More specifically, as the country's largest funder of energy R&D, their own regulations prohibit them from using their own energy labs for work they support. "Which is kind of dumb," he concluded. "If we receive funding from the US Department of Energy, no problem. If we receive funding from an outside firm, no problem. But bizarrely enough, when we're the instigator and we're the ones trying to encourage collaboration, we forbid ourselves from doing this — by sheer stupidity, if I may be so candid. This is the kind of stuff we're trying to fix."

Knox agreed. "We do constrain ourselves, as a federal ecosystem, with rules," he said. "And they're made for all the right reasons. We've got a fiscal year-end, but we've got academic programs that go beyond fiscal year-end. We've got to have more flexibility in how we do human resources. All those things." Fortin noted that many of these rules have been in place for a long time and are well defended by interests such as unions, making it tough to change them.

Knox then asked Des Rosiers for an update on clean technologies, one of the sectors highlighted by the latest budget. He explained that the potential in huge markets like India and China is considerable, as is the current stage of development for these industries in Canada. So too are the government mechanisms in place to drive some of these innovative technologies into the marketplace. "This is one of those happy spaces in terms of terms of collaboration, where firms, universities, provinces, and the feds all seek out the promised opportunity and work with us to do something about it," he explained.

Des Rosiers also pointed to a lesser-reported aspect of the Paris climate summit, which was a commitment to double the funding to energy R&D over the next five years, as well as ensuring that private sector investors participate more fully in such work. This initiative also includes agreement to encourage such work across international borders. He noted that such promised collaboration in this field is highly encouraging.

Morgan added that improvements to regulatory frameworks can further enhance Canada's appeal as a place to invest in new areas such as clean technology. Hanson added that there is no narrowly defined clean technology sector but instead clean technology dimensions to existing sectors, such as energy, forestry, mining, fisheries, or agriculture.

Marc Dietrich returned the discussion to the topic of procurement, such that government would look not only at the price of particular goods and services but also their respective environmental footprints, as well as the footprint of products it induces government suppliers to use. He asked if this kind of information had been mooted for government

procurement, in much the same way that food products now have comprehensive nutrition labels.

Des Rosiers responded that this kind of analysis is already under way, with a full life-cycle consideration of goods and services used by government. The US government has already laid out its own specific requirements in this regard and Canada is examining a similar strategy.

Conor Meade, an economist with The Evidence Network, asked what success would look like for an innovation agenda. "What are the short-term indicators that are going to be on our dashboard in the next one to five years to indicate that we're on the right path?"

Morgan identified three types of economic growth: a larger labour force, better prices for our products, or improvements to productivity. "We have been relying on the first two for quite a long time in Canada and they are no longer as available to us as they have been," she said. Demographic shifts are working against increases in the number of workers and international trade prices remain highly volatile. "We have to increase our productivity and innovation has to be core to that. And I mean innovation in its broadest sense: innovation in research, innovation in new technologies, innovations in marketing, innovations in business strategy. In the shorter term, we'd like to see more companies with innovation at the core of their business strategy. We'd like to see more growing companies, more high-growth companies. It's such a multi-faceted issue that we need to look for success across the whole range of the ecosystem."

Knox then asked Hanson if the government has an idea of what the indicators on this dashboard would look like. Hanson replied that the new government has already announced that it wants just these kinds of indicators to drive action. Knox took this and other responses from the panel as evidence that there is an opportunity for input into federal government measurements around innovation.

Watters asked the panel how they will approach the process of inviting such input in the form of public consultations. Morgan pointed to an advisory committee on growth that has already been struck, which will be outlining the key elements of a long-term growth strategy for the government. Hanson echoed this sentiment, insisting that a commitment to a broadly based consultation process is in place. Knox took this response to mean that the ministers themselves want to be engaged in these processes.

A final question from Knox returned again to the subject of procurement, seeking a sense of whether the government is employing the optimal extent of its buying power to encourage innovation. Fortin cited the Ebola vaccine as an outstanding example of an investment by the Ministry of Defence many years earlier. At the time it was seen as a

long term planning measure, looking ahead to the possibility that members of the Canadian Armed Forces might be called upon to serve in Africa in areas where Ebola is endemic. Although this was not going to a large-scale purchase by government, it was enough to warrant supporting the process to develop such a vaccine, which subsequently arrived at just the right time to help during a serious outbreak of the disease in Africa. Similarly, the Light Armoured Vehicle is being sold around the world after being developed for the Canadian military to purchase first.

Knox presented the counter-example of government resisting offers from solar panel manufacturers to install their product on the roofs of government buildings. Fortin acknowledged such problems, but noted that government purchasing does not contribute to the competition that Tom Jenkins had earlier identified as the essential precursor to innovation. "I think it's a red herring to see procurement as a solution," he said. "It is among the instruments that you can use, but it has to be used wisely." Knox persisted, passing along the observations of people who have told him that Canada needs its own equivalent of the American DARPA program that yields so much cutting-edge technology. Fortin insisted that Canada has such a program, although it does not go by that name. "We are investing in basic research and investing in crazy ideas," he said.

A question posted on-line asked about what metrics the government should apply to its way forward. Hanson responded that the best measurements will focus on our areas of strength where we stand to make the greatest gains. Morgan asked to make a finer distinction between metrics and processes, a distinction that will depend on what kind of outcome is being sought. "We want collaboration among the players in the innovation ecosystem, which means we want adjustments from the private sector if we're on the commercialization end of the spectrum. We want to make sure that there's some tangible manifestation of market potential. We want to build on our strengths." Hanson pointed out that this approach is already being exercised in the aerospace industry, which seeks to advance the capability of firms that are already actively engaged in this work. Crelinsten cautioned that these analyses might be troublesome if they demonstrate that Canada has some strength in an area that no one wants.

(*in order*) David Ross, Carl Rodrigues, Amer Matar & Andrew Dixon

Industry Panel

Moderator: Tom Corr, President & CEO, OCE
Andrew Dixon, COO, Igloo Software
Amer Matar, CTO, Moneris Solutions
Carl Rodrigues, President & CEO, SOTI
David Ross, CEO, Ross Video

Each of the panelists introduced themselves and offered a brief description of their respective enterprises. Dixon explained that his Kitchener-Waterloo-based Internet solutions company emerged from a research project designed to connect academics across international borders. Since 2008 this capability has been expanded to provide similar networking assistance to mid-sized firms around the world. "We're doing very well," he said. "We're also at the cusp that so many companies of our size are at, in needing to scale up globally to compete with much larger

Matar described Moneris as a collaboration between the Royal Bank and the Bank of Montreal with some 1,800 employees, which handles a significant proportion of North American electronic payment transactions. The company handles such business on behalf of major retailers across Canada, ranking among the top 10 providers of such services around the world.

Rodrigues presented the heart of SOTI's business as enterprise mobility management, overseeing complex systems such as those handled by American Airlines to track passengers, luggage, aircraft, and all other associated documentation on a real-time basis. With about 500 employees and offices in countries around the world, the company has about 2,000 partner firms and some 15,000 customers.

Ross explained that his firm makes almost all of the equipment found in a television or video production control room. That means their clientele consists not only of all the familiar broadcasters around the world, but other video operations such as big screens found in major sports facilities.

Corr then asked members of the panel to comment on whether medium-sized firms that are neither start-ups nor major anchors have been overlooked by Canada's innovation policies. Ross asserted that this was exactly the case. "It's almost like there's nothing more we could do to make it harder for mid-sized companies to grow," he said, pointing to examples such as the shrinking cut-off limits for SR&ED programs. "They think you're a big company at half the size that they used to think you're a big company 20 years ago. If you make more than $3 million — regardless of the size of your company — they start to grind you down. They take away your SR&ED money and you don't start seeing the same cash flow until you make $7 million in profit. That's more than double."

Matar echoed this sentiment, indicating that SR&ED was of some value early on in the experience of Moneris but it is no longer helpful to them. "I think there's a huge missed opportunity in partnering with mid-sized enterprises," he said, noting that smaller firms can benefit from working with larger ones that have the talent and resources to drive their growth.

Rodrigues confirmed that his experience was similar, adding that the software world is especially beset by IP issues, such as patent trolls that can generate onerous legal costs. Dixon further pointed to the scale-up limitation posed by sales and marketing as they compete directly against giants like Microsoft. "I stay awake at night wondering about how many deals I'm not in because nobody knows about me," he said. "I just don't have the resources to promote myself to the same extent that some of these organizations do."

Corr then asked if the United States had developed programs to address some of these problems, which Canada might do well to emulate or adapt to our needs. Rodrigues suggested that the American government had signalled its affinity for the technology industry when President Obama personally toured many companies. Ross agreed that this reflected a distinctively different mind-set. "Canadians, for better or worse, as soon as we get to a certain size, we get scared and we sell out," he said. Among the novel strategies that might counteract this tendency would be to provide additional support to firms taking the ambitious and daunting step of exporting, perhaps by increasing SR&ED limits in such cases. "If SR&EDs work, why do we cap them? Mid-sized companies are selling around the world, trying to beat Microsoft, trying to beat Sony, trying to beat Google. If it worked for the three-person company in the garage someplace up in Gatineau, why doesn't it work for mid-size companies that are kicking butt around the world?"

Rodrigues suggested that the answer to that question goes a long way toward explaining the absence of Canadian brands on the global economic scene. As these companies are scaling up, they are far more likely to find the support they need from American investors than Canadian ones. "Canadian tech is alive and well," he concluded. "It's just living in a US company." He added that this observation hits even closer to home with respect to talent, as American firms snap up the best and brightest educated at Canadian expense. "Give them reason to stay in Canada," he said, explaining that public support for up-and-coming mid-sized firms would go a long way toward retaining this expertise.

Ross underscored this point by maintaining that most "innovative" entrepreneurial ideas were variations of those found elsewhere around the world, making it incumbent on Canadian entrepreneurs to prove their worth by beginning to compete in that larger arena. Only by growing will that be possible.

Dixon cited the need for members of the Canadian business community to begin working closely with government policymakers, something US firms take for granted, so much so that many of those firms are better at working with the Canadian government policymakers than most Canadian firms. Such interactions make it possible to sort out miscommunications and misunderstandings that can interfere with business success.

Corr asked about whether questions around innovation needed to be framed in a new way and what that indicates about problems with the current approach to this subject. Dixon replied that there is no shortage of innovative ideas and innovations, but a lack of effort at implementing these innovations on a global basis. He returned to Rodrigues' earlier point about retaining talent, as well as attracting foreign talent through immigration policies. This is especially important to him, since the Kitchener-Waterloo region where Igloo is based turns out some of North America's top talent that is prized globally, as evidenced by the fact that it is one of Microsoft's leading recruitment sites.

Matar added that keeping talent is more important than attracting it in the first place. Moreover, many of the best people are being lost just as they are reaching their peak contributions, so that the loss is all the more keenly felt. Rodrigues related stories from software engineering students who tell him about the pull that Silicon Valley exercises on them, despite efforts to offer them equally attractive opportunities in Canada through mechanisms such as incubators. "The incubators are incubating, I think, talent for the US," he said, noting that government investments in these operations does not prohibit them from gearing up an enterprise for a quick sale to some American interest. "The goal is not to use that capability to make money for Canada," he said. "The goal is to incent those companies to stay in Canada." Nor is this easy, he insisted; it is expensive to make your business as appealing internationally as Google has become to students and prospective partners. Even so, it must be done if Canadian innovation is to thrive. "It

takes money, it takes commitment, and it also takes some passion. You've got to want to be Canadian."

Ross acknowledged that American firms had repeatedly tried to buy him out, but he prefers living in Canada. However, he reiterated that the current government strategy mitigated against this attitude, since even as his firm has grown several times the size it was a couple of decades ago, he still has no more access to talented individuals than he did then, which makes it difficult for him to take on the task of keeping these people in Canada as well.

Corr followed up on this point by asking Ross about the specific problems mid-sized companies have raising capital. He suggested that such difficulties set these companies up to resolve their financial problems by turning to American investors and start down a slippery slope of losing control to outside shareholders or owners. "My question is: why the hell isn't there competition to the BDC? It's the one institution that does not want to screw you over financially. Why isn't there an Ontario version of the BDC?" Nor is this a matter of adding to the province's tax burden by giving away money, he added, but instead a means for the province to bring in new money from its investments, as opposed to venture capital firms that are eager to take money away.

Matar argued that immigration contributes vitally to the way forward, not simply in providing a larger talent pool for new enterprises, but also in shoring up the growing size of markets where those enterprises can sell.

Dixon related his own experience of having his firm being turned down repeatedly by prospective Canadian backers while being eagerly sought out by American ones, which was typical of a pattern that sees so many firms head south simply because that is where the most opportunity can be found.

Corr asked about the panelists' experience in collaborating with universities and the role of universities in encouraging such collaboration. Ross acknowledged that he had had mixed results in this sphere, as many researchers are most interested in the subject matter of their work as opposed to whether that work can be turned into something that could be commercialized. "Most of the time it's almost faster to put an engineer on it in your own company to get something done on a timeline exactly as you want, to make sure you own the IP and you have regular meetings than to shuttle people back and forth to universities if it's somebody who doesn't quite get it and isn't really in the commercialize viewpoint. I would say it's not always very efficient."

Rodrigues suggested that a greater incentive for companies to collaborate with universities is to engage in the ongoing hunt for talent. "Half the time the money that is spent on research is wasted," he said, especially since in any dynamic firm there are already a number of potentially outstanding research ideas that have been generated by

interactions with customers that are far more likely to lead to commercial results. On a related note, he returned to the importance of a clear immigration policy that not only helps firms bring in the talent that they need but also to discourage those same firms from setting up shop outside Canada in order to gain easier access to such talent.

Matar picked up on the notion that customers can promote valuable research as much as any university collaboration. "Some of your best innovations around finding solutions or evolving solutions are going to come from your customers. Your customers tell you what their problems are and if you can solve it for them that's some of the best innovation." As for working with universities, he cautioned that the ownership of IP sometimes poses a stumbling block to commercialization.

Dixon suggested that companies bear some responsibility in helping universities contribute to the success of collaboration, as exemplified by a major donation Research in Motion founder Mike Lazaridis made to the business school at Wilfrid Laurier University. Dixon interpreted this move as an attempt to cultivate the next generation of CEOs, something that would benefit the entire business community. "The private sector needs to be willing to give back to the community as well, and step in to help with the guidance and mentorship of those schools, to be able to provide real-life examples of what it's like to run a company and help to foster growth there."

Margaret Dalziel of the University of Waterloo suggested that the regularly repeated complaint about promising graduates leaving Canada can be linked to their education, which focuses excessively on technology. "All of the aspirations that they develop are technically related, so they want the jobs that are most exciting technically. They don't have a broad enough education where they're thinking 'how can I contribute to the

Dixon responded that this tendency might be overcome by promoting Canada as a more innovative country where this technical excitement can in fact be found. "We develop incredible things in this country yet what are we known for: natural resources, maple syrup, not the things that we really do." Ross recalled his own experience as a recent graduate when his own father had to talk him into joining the family firm, which Ross regarded as being too small and challenging to be worthwhile. "We really need to build name-brand — not just medium companies — we need to build some large companies," said Ross. "If we can't even support mid-size companies, I don't know how we're going to get big companies." In that light Rodrigues emphasized the need to help firms ramp up their sales and marketing to the same level as other major contenders for the attention of talent, who might then begin to look at Canada in a new light.

On a somewhat different note, Ross explained that acquiring smaller firms can be an effective approach for growing a company, something he has done many times. However, the appeal of a dynamic small firm for such an acquisition is diminished if that

step means it will lose its SR&ED eligibility, which will sap the momentum of any pre-existing R&D effort.

Matar noted that the problem of attracting talent becomes somewhat less daunting after realizing that the real competition is not the entire US but just the extraordinary draw represented by Silicon Valley. "It just takes something around how you brand Canada, or certain destinations in Canada, as Silicon Valley North."

Another questioner noted that Canadians regard Silicon Valley as a single entity when it is effectively more diverse than that, while Canada might be able to present a single hub that could be positioned to compete with it. Matar suggested that he was most comfortable with Toronto as the centrepiece of his operations. "It's probably the proximity and ease of access that causes me to do that." An interaction with Waterloo, in contrast, struck him as being more cumbersome, especially if physical access to that centre eats up a day just sitting in traffic. Ross confessed his own biases in having good proximity to Ottawa, which he said gets short shrift from a government more intently focused on affairs in Toronto and southern Ontario. He recalled surprising the premier by noting that Ottawa has no fewer than 1,700 technology firms, more than four times as many as are found in Kitchener-Waterloo.

Bettina Hamelin of NSERC suggested that young people are much more open to risk than is usually assumed, meaning many of them would be pleased to work with a small, nimble firm. She harkened back to the previous day's discussions about how to optimize the talent being produced in Canada, which led her to ask this panel if they are finding the talent they need in Canada and if not, how that talent could be produced here.

Rodrigues replied that there was no outright shortage, but instead the challenge of keeping it in Canada. That means allowing companies here to keep more of their income so they can become more profitable or widening accessibility to incentives like SREDs. "We have to create some of those iconic firms here and in the short term that's going to take a lot of investment," he said. "Those companies that are ready to do that and willing to do that, the government should support them to actually create that brand to keep them here. It's not a production issue, it's more about a series of policies that work together in combination with things like immigration, with taxation, with funding, with motivating our kids. It's not an easy question."

Dixon made specific reference to the challenge of keeping people with PhDs in Canada, which is a matter of matching the interest of such individuals in working on deep problems, which often requires resources beyond that of most Canadian enterprises.

(*in order*) H. Chaim Birnboim, John Helliker,
John Zimmerman & Bettina Hamelin

Lunch and Presentation

The TACCAT Network: Connecting companies to Canada's Technology Access Centres

Moderator: Bettina Hamelin, Vice-President, Research Partnerships, NSERC
H. Chaim Birnboim, Founder & Chief Scientific Officer, DNA Genotek; Founder, deltaDNA
John Helliker, Director, Strategic Partnerships, Legend 3D
John Zimmerman, General Manager, Ocean Rodeo

Hamelin set the goal of these presentations as introduction to TACCAT (Technology Access Centres/Centres d'accès à la Technologie), the research centres linked to college, polytechnics and cégeps designed to build collaborations between companies— particularly small- and medium-sized enterprises — and polytechnic, college and institutes. By providing these firms with access to expertise, technology, and equipment, they can improve their ability to innovate and become more productive.

"Colleges are evolving at a tremendous rate in Canada and they're an example to the world in terms of what they do and what they deliver," she said. With specific reference to TACCAT, she presented it as a means for smaller firms to quickly get ahead. There are currently 25 Technology Access Centres at publicly funded colleges across the country, with another five in the works to be added this year. The three presentations that followed were therefore emblematic of the program as a whole.

The first of these presentations was made by John Zimmerman, whose Saanich-based company Ocean Rodeo specializes in technical marine apparel and kiteboarding gear. The firm has been working with Camosun College in Victoria on products such as dry suits, which have found a market beyond water sports with customers such as BC Ferries, which are acquiring them for use by their personnel. More specifically, Zimmerman explained how the work with Camosun has enabled the company to design a new type of control bar for kiteboarding.

"It's allowed us to do a couple of things," he explained. "One, the cost of the bar has dropped from about US$18 to just two dollars. It's also made it much lighter, because it's a single moulding. But most significantly it's let us introduce to the market a whole new way of controlling the kite. We expect that this is not only going to result in an increase in sales for our small Canadian company, but it's going to lead to opportunities with other, much larger brands."

Zimmerman credited TAC with making it possible to determine if the redesigned control bar would hold up to the rigours of the sport, something that might otherwise have been impossible for the company to do. "We are delighted by the relationship we have with the college," he concluded. "It's led us to have great exposure to working with some really bright minds."

The second presentation, by Chaim Birnboim, started with a description of his personal journey from researcher to entrepreneur with a company employing upward of 100 people. "It was a simple idea, and sometimes that's what it takes to get something going well," he said, referring to DNA Genotek, which he founded and then sold to an American firm, OraSure. While still affiliated with that enterprise, he is now working on a spin off of the original technology, which allows fetal DNA to be collected from the blood of expectant mothers. There is a significant demand for this kind of service but current methods for collecting this important information have been very limited until now. There is a desire to know as soon as possible about the genetic state of a baby, but the most comprehensive method — extracting amniotic fluid from the womb — can be hazardous, which only adds to the appeal of this far less invasive approach of a simple blood test.

"The technological challenge is that the amount of DNA that is actually present is actually very tiny," said Birnboim, who predicted that the current work would make determining an unborn child's DNA as simple as drawing blood during a clinical visit. He credited the prospect of such progress to his new firm's collaboration with TAC, which has provided him with staff and facilities that have advanced the work on this technology.

The final presentation was made by John Helliker, Director Strategic Partnerships for Legend 3D and Director of the Screen Industries Research and Training (SIRT) Centre at Sheridan College in Toronto. He showed a video that demonstrated the company's flagship technology, which can convert a conventionally filmed movie into a 3D format during post-production. The images on display included feature films by major Hollywood studios, which are among the company's most prominent clients. "The history of Legend 3D in Toronto corresponds to the growth of SIRT as a Technology Access Centre," he said.

He added that Legend was founded in 2001 but did not have a presence in Canada until it became involved with SIRT, which was established in 2013. "It's a very competitive international business, film and television and gaming. Companies come and go and look for opportunities where they can really grow their business."

In Legend's case, that opportunity was driven by a search for talent. After identifying SIRT, Helliker recalls, the company realized that it could do much more for Legend than improve the calibre of its employees. By 2015 the company had decided to set up shop in Ontario and take advantage of SIRTNet, a broadband fibre-based technology platform that helped the firm grow from 60 employees to more than 300. "As a college, our mandate as a Technology Access Centre is to build a competitive advantage for companies, to build a competitive advantage for the province and for the country," he said. "We're part of an innovation ecosystem. We work with the University of Waterloo's Institute for Computer Research. We work with York University's Centre for Vision Research. We work with the town of Oakville and the City of Toronto. We see ourselves as an innovation and collaboration platform."

After the presentations Ron Freedman asked how these working relationships originated, whether firms sought out the colleges or vice versa. Zimmerman recalled how he found out about the TAC program at a conference after realizing that SREDs were no longer of any value to him. Birnboim added that his discovery of the program was even more fortuitous, when he was put onto it after looking for laboratory space. In Helliker's case the connections were a little more formal but not necessarily as the result of aggressive marketing by TAC. In light of these answers, Freedman then asked Hamelin how TAC was going to promote itself. She acknowledged that various colleges were "shy" in this regard and she was looking forward to bringing them together to share their best practices in reaching out to prospective clients.

Conference Wrap Up

Jeffrey Crelinsten
Publisher & CEO, RE$EARCH MONEY

&

Ted Hewitt
President, SSHRC

In listing the major insights that he would take away from this year's conference, Crelinsten began with the fundamental observation that research and innovation are distinct from one another. He returned to Jenkins' strong emphasis that support for research and innovation is not an "either/or" option but very much a "both/and" necessity. "They're different, but when you say they're different it doesn't mean one is better than the other," he said. "We'll never survive as a trading nation without both."

Crelinsten also pointed to evidence that government is listening to various perspectives on innovation, with the ultimate aim of establishing a common goal so that the country's diverse efforts do not work at cross-purposes. "It's about firm performance and growth — that's the bottom line," he said. "It's about trade, it's about having companies — big ones, medium ones, small ones — trading and doing well. They're profitable, they have market share, they have customers, and they're successful. The other thing, as an

aspirational goal, is to build anchor firms: big, multinational Canadian companies in different sectors of the economy, so that we're in global value chains. Just as we're happy to have IBM open up an R&D lab or an incubator in Canada, let's try to get Poland and Brazil anxious to get one of our anchor firms to open an R&D lab in their country. It's about plugging into a global innovation network, a global value chain. When we look at our strengths, that cluster initiative, let's think about where the opportunities are to plug into these global networks to sell."

For his part, Hewitt commented on the overwhelming importance of working together, avoiding silos through creating collaborations of all kinds between public, private, and academic partnerships. He also pointed to the fact that Canada's economy is dominated by the service sector, which means that while it is worth supporting innovation in areas of science and technology, it is even more important to support new developments in sales and marketing, design, consumer preferences, or branding. "That's what we refer to as social sciences, and we don't even count it," he said, noting that Statistics Canada is only now beginning to tally up these kinds of R&D undertakings. "If we don't count it then we can't support it, so this is a whole other avenue that we have to explore."

Finally, Hewitt returned to the ongoing need for all of us to take chances. "We need to hear more from failed entrepreneurs," he said. "A lot of folks we bring up to talk to us have worked the system and managed to move through and found ways to grow their companies. I want to hear from people who are somehow unable to do this because I want to know what the blocks were and how we might in fact support them in their efforts."