



**The 14th Annual RESEARCH MONEY Conference
“Canada's Innovation Agenda
Building our Natural Resources Advantage”**



31 March - 1 April 2015

National Arts Centre, Ottawa

**proceedings assembled and
composed by Tim Lougheed &
Rebecca Melville**

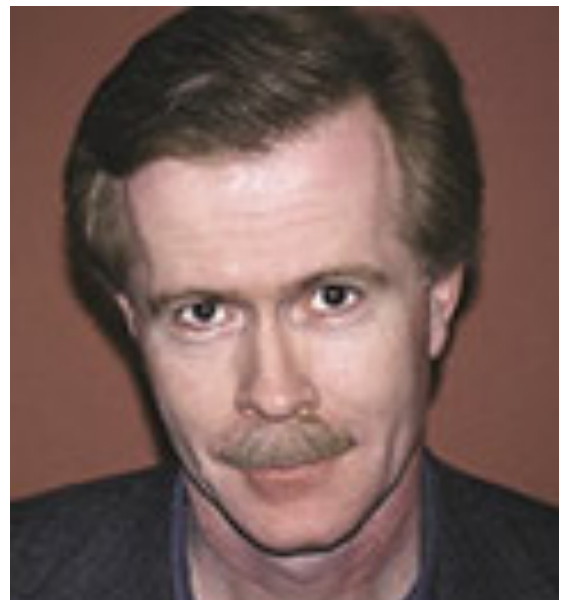
Canada's Innovation Agenda
Building on our Natural Resources Advantage
The 14th Annual RESEARCH MONEY Conference
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Day 1 - 31 March 2015

Welcome and Opening Remarks



Jeffrey Crelinsten

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Mark Henderson

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Opening Keynote

Innovation Today — New Insights, New Policies



Dirk Pilat, Deputy Director, Directorate for Science, Technology and Innovation,
Organization for Economic Co-operation and Development

Pilat began by acknowledging that Canadian observers have well-honed expertise in gauging the natural resources sector, but he wanted to introduce members of that sector to what the OECD has learned about innovation and innovation-driven policy in recent years. “I come from the Netherlands, which is a very small country, but we still happen to be the third-largest exporter of agricultural products in the world,” he said. “So we know something about natural resources as well.”

He took up the question of why we should care about innovation — why it matters — and the elements that make up the answer to this question. “If we talk about innovation, we need to take a very broad lens to it. In many countries the discussion very quickly comes back to R&D in science and technology. I think that matters, and it matters a lot, but there is a lot more that we need to look at. Innovation is something that you do in a system where a lot of different things are going on and you need to get all that together if you really want to get strong innovation performance.”

Pilat argued that we care about innovation because it is at the core of our economic growth, an observation he subsequently broke down into specific factors that contain a great deal of innovative input. The list included technology that goes into fixed capital, such as a buildings or equipment. Such investments, which include knowledge-based capital (KBC), contribute to gains in productivity. He also credited innovation for the positive features of creative destruction and disruptive technologies, which give many new enterprises a competitive edge.

“You’ll probably see that innovation accounts for at least 40 per cent of economic growth,” he said. “If you think about what Henry Ford would have said if he’d been asked what his customers wanted, it would have been ‘faster horses’. If innovation had stopped at that point in time, what would our economics look like right now? All the technological change that we’ve since seen, all the things that have happened would not have happened. We might have had more horses, but a lot of progress would not have happened.”

He also clarified the concept of “investment”, which usually conjures up a piece of property or machinery that qualifies as fixed capital. Citing figures from the US Federal Reserve that cover the period between 1972 and 2011, he painted a very different picture of where investment funding has been heading. The resulting graph showed that while investment in tangibles has been decreasing, investment in KBC — software, data, R&D, IP products, firm-specific expertise, or branding — has been steadily rising. “It’s this broader range of capital that increasingly has been driving the economy forward.”

Although some countries — including Sweden, Denmark, Finland, the Netherlands, the UK, and the US — have experienced significant increases in the proportion of business

investment that goes into KBC, Canada remains among those where most of that investment goes toward physical assets. He illustrated this trend with respect to several high profile products, such as pod-based coffee makers, sport shoes, suits, and cars. In each case KBC makes it possible to tailor these products for different tastes and a broader range of customers. "It involves an enormous amount of R&D, a lot of design, a lot of branding, to really make the product work as something that people are actually going to buy. A lot of value creation is around this broad base of knowledge-based capital that we now see in many companies."

As a further illustration, Pilat distinguished between a country's forward and backward participation in global value chains, i.e. "backward" referring to the extent to which a nation's exports rely on imports coming from abroad and "forward" referring to how much a nation's exports drive other countries' exports. Canada does not participate in global value chains to the same extent as many other industrialized countries, even though some export industries such as mining are crucial to export industries elsewhere in the world. He further broke down this distinction between various industries, where it is clear that a great deal of Canadian participation in transportation, chemicals, and electrical equipment is in fact backward participation, dependent on inputs from elsewhere.

Pilat then asked if existing policy frameworks reflected the major role of KBC investment. This is especially important when it comes to intellectual property rights. Similarly, public investments in fields such as education or broadband communications will be instrumental in determining the success of KBC. "These are new things we have to think about if we want to get the right climate for innovation in our country," he said.

Another aspect of establishing that climate is the mix of direct and indirect support for business R&D. He noted that Canada relies more heavily on indirect support in the form of tax credits, as do Korea, France, and the Netherlands. Others, including Germany, Switzerland, Sweden, and Finland, concentrate on direct funding for these R&D activities. Even as more countries are beginning to adopt tax credits as a major mechanism for promoting innovation, Pilat insisted that an appropriate balance must be struck. "You're trying to build the links between the public research system and industry by putting some public money on the table to make those connections," he said. "We find very clearly in a lot of our analysis that investment in public research is also an important driver in productivity growth."

Some parts of the world provide examples of good practice in achieving this balance, he argued, pointing to the UK's Catapult Centres as an case where indirect support for innovation has been matched with well designed direct support. Despite Canada's success with regard to the use of tax incentives, these measures can always be revisited to optimize their value and weigh them off against equally well designed direct

support. Finally, Pilat warned against an overemphasis on short-term ventures, since long-term, stable investment is essential to public research.

As for making the most of government support, he regards comparison and evaluation as crucial. "When we do look at innovation policy across countries, we see a real lack of evaluation of policies," he said. "We often do things because we've been doing them for a long time but not necessarily because we think they actually work."

Pilat assigned a major role to business dynamism in various countries. "A lot of the new jobs that are being created come from young firms that are less than five years old." He underscored this point with data showing that while dynamic new enterprises are often responsible for job destruction, those losses are more than offset by the new positions that these same firms help establish. OECD figures show dramatic job creation is tied to the work of the youngest of small businesses, while job destruction is actually much greater when these small firms operate for more than five years.

At the same time, many of these firms have difficulty growing beyond a very small size. In some countries, the average size of such firms remains at 10 employees or fewer even after a decade in business. A few countries, including Canada, see somewhat better growth, but the underlying challenge is the same. In more dynamic business sectors, this growth happens more frequently, as does the decline of other businesses. A more daunting challenge is the shrinking share of start-up businesses in many national economies. Pilat acknowledged that the reasons for this decline in start-ups remain unclear, but its implications demand further investigation.

He offered some approaches to enhancing the dynamism of businesses, such as reducing the bureaucratic barriers to starting a business as well as the legal restrictions that make it difficult for entrepreneurs to abandon a failing venture. All too often innovative firms find themselves operating at a disadvantage in the competition for resources such as R&D tax credits. This problem can often be overcome by strengthening the support for innovation through mechanism such as business accelerators, which provide access to risk capital, skills development, or networking opportunities.

Innovation is also being held back by a broadly based lack of skills, as indicated by an OECD survey that found some two-thirds of adults did not have the requisite capability to compete in a technology-rich environment. "If we're talking about innovation, we need to think about skills development, what we can do to get those skills into the workplace."

Pilat concluded that it is important to consider how a range of different types of policies can contribute to innovation, as opposed to devoting too much energy to specialized innovation policies. These policies will cover skills, regulations, and other aspects

framing an innovation system. “We need to look at many different areas to make that system work the way we would like. You need to bring it all together, which is often extremely difficult.”

He reiterated that governance, evaluation, and implementation remain the most important — if sometimes elusive — priorities attached to innovation.

Jeffrey Crelinsten began the question period by asking about the basis of the observed decline in start-up companies. Pilat indicated this trend could have several causes, including a changing relationship between large and small firms, but he admitted that for now there are more questions than answers about this significant shift.

Another question dealt with the precise nature of how small firms move from creating jobs to destroying them after the five-year mark. Pilat credited this movement to the way in which many businesses scale up their operations, as well as how they cope with maturing markets.

Nobina Robinson of Polytechnics Canada expressed an interest in how skill development policy could contribute to an innovation agenda. She asked if the OECD had information about who was applying these skills within particular organizations. Pilat noted that this represented a newer area of research with limited amounts of information, but he agreed that there were many useful insights that should be drawn from pursuing this work.

Ron Freedman asked which countries Canada should emulate with respect to innovation policy. Pilat observed that he does not endorse emulation, since institutions and economies are specific to each country. “I think you can look at specific policy instruments and learn from those,” he said. “You can learn a lot from what is being done in other countries to try and make their system work better. Our role is to provide you with some of that cross-comparative stuff.”

Catherine Cobden of the Forest Products Association of Canada followed up on that point by asking what international examples there might be with regard to the sharing of risk as a way of encouraging innovation. Pilat replied that there is evidence from a variety of approaches, including shared funding arrangement, public-private partnerships, and the identification of specific research targets, such as a particular disease, which encourages a variety of participants to join in the work. “Innovation is a risky business that companies have to be involved in,” he said. “But in certain cases it’s important that government shares that risk because there is a very clear public demand to move forward with something.”

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Keynote

Canada's S&T/Innovation Policy: To be or not to be?



David Watters, CEO, Global Advantage

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Debate Panel



Moderator:

Ted Hewitt, President, SSHRC

Panelists:

Catherine Beaudry, Canada Research Chair in the Creation, Development and the Commercialization of Innovation, École Polytechnique de Montréal

Paul Dufour, Fellow and Adjunct Professor, Institute for Science, Society and Policy, University of Ottawa

The question for debate was whether Canada's innovation policies focus too narrowly on research and development. Beaudry argued that this is the case and Dufour argued against the premise. By way of framing this exchange, moderator Hewitt suggested "the answer to that question probably depends on where you put people into the equation."

Beaudry began with the OECD definition of R&D, which refers to creative work undertaken on a systematic basis in order to increase our stock of knowledge. "We're not talking about innovation here," she said, adding that the accompanying OECD definition of innovation describes it as a much more complex process. "The reality is far from the traditional linear model of innovation. We cannot confuse science and technology policy with innovation policy, even though the first is partly nested in the second."

Beaudry described Canada's policy, referred to as the S&T strategy, as being clearly aimed at fostering innovation and growth. "You see innovation written there everywhere. You don't actually know what it means, but it's there everywhere. Innovation is clearly the goal of this S&T policy, therefore it is an innovation policy." This policy is centred around three key points — innovation, knowledge, and talent — but she found it to be focused on science, technology, and engineering activities. This overlooks innovation that might take place in other venues altogether, such as the remarkable accomplishment of Cirque du Soleil. She also quoted from documents describing the execution of this policy, which cite R&D activities in order to measure accomplishments. "There's very little on post-R&D policy and a huge amount on R&D policy."

Dufour agrees that there is more to innovation than R&D and insisted that policy documents reveal this fact. When it comes to the knowledge economy, it is useful knowledge that matters. Like an unwieldy monster that must be imprisoned in order to be controlled, he suggests that R&D has been captured in much the same way. "Somewhere in the bowels of the Langevin Block is an archive of material labeled "R&D: do not remove under pain of yet another science and technology policy".

Citing government statements going back as far as the 1970s, Dufour pointed out that innovation has always been regarded as a logical extension of R&D. Indeed, even these efforts to promote innovation have themselves been subject to innovation. "We tend to forget the innovations that have taken place in our own institutions to promote innovation," he said. "It's worth remembering that when the new millennium approached, a spate of policy innovation took hold in Canada's innovation ecosystem — centres of excellence were established; the Canada Foundation for Innovation; the Canadian Institutes for Health Research morphed from the old Medical Research Council; the Canada Research Chairs were established; and a genomics organization was brought back on the table as Genome Canada." In fact, he observed, "the time has come for a formal study of these various bodies, some of which may be abandoned without understanding their contributions and accomplishments.

“Our innovation policies are not too narrowly focused on R&D — they are too narrowly focused on traditional innovation,” he argued. “We have an enormous spectrum, ranging from social innovation to inclusive innovation to digital social innovation to frugal innovation to responsible innovation.”

By way of example, he envisioned a hypothetical proposal from something called the Society for Innovative Concepts to develop a crowdfunded body called Theoretical Innovations Canada, asking for people from all walks of life to submit creative ideas, no matter how ludicrous and whimsical they might seem to be. By placing innovation on a low-cost — essentially free — basis, the system for taking advantage of these ideas would be transformed and its impact could be much more profound.

Beaudry subsequently rejected the assertion that S&T was exclusive in its ability to bring the world new ideas, technologies, product designs, and services, as well as addressing huge social and economic challenges. “I’ve never seen S&T involved in social innovation or management or marketing,” she said. “Science and technology in itself doesn’t create innovation. It needs a lot of other stuff to bring a successful innovation to market. Many companies are bringing value to market using knowledge that isn’t necessarily coming from R&D.” The real challenge surrounds the fact that R&D activity can be measured in straightforward ways, while these other activities are not so readily assessed.

Dufour responded that innovation in Canada suffered from a condition he dubbed CPA — continuous partial attention. Just how much attention a country devotes to this subject, he added, can vary from culture to culture. “Culture matters when we look at innovation systems, but institutions within those cultures need to be assessed in a much more rigorous way than they have.” This observation lends credence to his original conclusion that there are many different types of innovation. “R&D is not the sole arbiter in defining some of these policies. Our concept and grasp of innovation has grown and its become much more varietal in nature.”

Hewitt began the question phase of the session by asking why we have so much trouble supporting the “value-added elements” in the innovation chain that transform the S&T and R&D activities into much more. “If you look for example at the SR&ED [Scientific Research and Experimental Development] tax credit program, it is pretty much limited to product development. You can’t claim expenses that are related to marketing, some elements of design, all of the soft things that send a product off into the stratosphere.” With such activities formally credited as part of the innovation process, perhaps it would bring policy more in line with what is required to complete the task, as opposed to just the R&D portion.

Beaudry agreed that such progress might be possible, which would enhance the role and value of the people engaged in these activities that go beyond R&D. Dufour

conceded that this would be a worthwhile result, then noted that new centres of excellence are now migrating from fields in science and technology to a much broader spectrum addressing health care and social issues. “We’re starting to see some grasp of this larger concept of innovation, rather than just R&D.”

Mark Dietrich, President of Compute Canada, acknowledged that he did not know what it would take to strike the right balance between innovation and R&D, but asked specifically what should be added to the innovation side of the equation. Beaudry offered the example of an academic institution that offered a degree without a discipline, an extreme example of breaking down traditional disciplinary silos in order to get to some entirely new place in the educational process. Dufour brought up his involvement as a member of the review committee for Grand Challenges Canada, an ambitious program to improve the way health care is delivered in the developing world. “I suspect we need a grand challenge in our innovation system. The more you experiment with these things, the more you learn, and as you learn, the more you adapt, and as you adapt you can affect outcomes in a much more specific and targeted way.”

Kamiel Gabriel, a professor at the University of Ontario Institute for Technology, cited the Greek root of innovation, which referred to novelty and modernity. He also quoted Jeremy Bentham’s 1824 work *The Book of Fallacies*, which posits that innovation is an instrument of deception, one associated with negative change. Gabriel then challenged the premise that innovation was possible at all without some form of R&D. Beaudry countered by pointing to the myriad technologies that are patented but never find any commercial use. What sets commercialized products apart is the addition of other forms of innovation, in terms of organizational design, processing or marketing. Dufour expressed his sympathy for Gabriel’s observation, since it seems intuitive that some kind of R&D is present at every step of an innovative undertaking.

Parallel Sessions

These sessions represented a new, three-part approach to interaction within the RESEARCH Money conference. A panel introduced some of the current challenges to be addressed by a given theme (driving innovation for Strand A and promoting investment in innovation for Strand B); then participants broke up into groups to consider the nature those challenges and what priority should be assigned to each one. Finally, each group reported back on their conclusions to the group as a whole. Those conclusions would provide the foundation for the next day's set of parallel sessions, which dealt with specific strategies to tackle those challenges.

Strand A: Driving Innovation through Canada's natural resources advantage



Facilitator:

Anne-Marie Thompson, Director of the Energy, Environment and Resources Division,
Research Partnerships Directorate, NSERC

Panelists:

Gary Bunio, General Manager, Technology & Development, Suncor
JP Gladu, President & CEO, Canada Council for Aboriginal Business
Lola Piché, Director of Technical Services & Innovations, North Rim

Piché introduced her firm as being primarily a consulting firm that works with exploration enterprises dedicated to oil, gas, potash, and uranium. She noted that the high costs associated with such work leads to risk aversion, which holds back many projects and compromises the health of this part of the mining sector. She also highlighted human resources as one of the leading concerns for the health of this industry, reflecting demographic shifts that are resulting in a shortage of expertise. This has led to initiatives such as workshops designed to attract new people into this business. Finally, many of North Rim's clients want quick fixes to immediate problems, which prompts her to look outside of their industry to solutions that have worked elsewhere. "Most of the traction that we're getting on R&D is coming in the areas of safety and environment for joint collaboration between industry partners, in which case they can leverage off existing programs."

Bunio distinguished three types of technology: continuous improvement, operational, and strategic. While innovative activities take place under all three definitions, the first two work within existing business paradigms while the third can launch disruptive changes. "We've found that people who are good at one aren't good at the other. If you lump everyone together and just talk about innovation it just makes it harder to innovate." He also pointed to a fundamental change in the dynamics of innovation that took place over the course of the 20th century, which started with activities undertaken primarily by major corporate players to a more theoretical process that is primarily pursued by much smaller companies. These firms regularly approach larger interests like Suncor in an attempt to sell their innovations, but many of them do not necessarily understand what is needed or wanted in the way of innovation. "How do we engage the ecosystem in a way that we can fundamentally get at some core physical problems in our business? We've been working for years now on how to agree amongst ourselves what the core business is and what the major challenges are and then go out and engage people that we think can help."

Gladu compared the state of aboriginal businesses in Canada to that of a ping-pong ball being bounced between federal and provincial paddles, whereby competing and often conflicting jurisdictions make it difficult to set a consistent strategy. "Business innovation has had to spawn from this lack of certainty," he said, adding that aboriginal populations can be found around most resource sector projects. "You don't have to look far to understand that if you do not have certainty with aboriginal communities, your projects risk failure." His organization has therefore established a program to help businesses align their interests and practices with those of these communities, so as to avoid legal conflicts and help everyone get on with the goal of developing the country's natural resources.

Piché added that the seasonal budgetary cycles associated with resource exploration and development is complicated by delays in obtaining funding from various sources.

“There’s so many moving pieces that it could end up delaying potential research projects by as much as two years just to get them started,” she said.

Gladu cited as a further challenge the need to address some of the well-known social problems facing many aboriginal communities in ways that would allow members of these communities to contribute to the country’s tax base rather than being supported by it. “It would be really interesting to see the investment dollars that we’re putting into things like immigration, when we’ve got this great work base here, and see what kind of innovative programs we can establish to support the development of our people into the asset column, which is going to improve the balance sheet of Canada.”

Bunio concurred with Gladu’s observation, noting that his personal experience of working in the north was that projects succeeded when interests aligned. Unfortunately the process of discerning those interests takes time and careful listening to different perspectives; this task is often abandoned in the face of deadlines and general impatience, so that clumsy, incomplete solutions are forced to suffice. “The innovation ecosystem takes a heck of a lot of work. It’s a bit like bamboo: you’re going to work for six months with companies and have nothing to show for it. That’s very disheartening, and yet those relationships are something you really need to work on.”

Following the separate discussions that took place at various tables, this list of challenges emerged:

- identify early adopters to innovative technologies and services
- managing the procurement process from an SME perspective
- understanding industry needs
- creating partnerships that encourage collaboration leading to innovation
- access to risk capital
- building, maintaining or regaining public trust
- matching the education system to the business culture
- risk aversion that leads to poor adoption of innovation
- aligning industry needs with research investments and opportunities
- establishing a prescriptive regulation environment

With regard to building worthwhile partnerships, Bunio argued that honesty and humility go a long way. “At some fundamental level, you have to get over your fear of looking dumb to be truly innovative,” he said. Piché added that such efforts are often undermined by territoriality, whereby individuals or organizations cling strongly to particular projects and their activities, to the detriment of true collaboration.

Bunio also insisted that risk aversion is not the overwhelming obstacle that it is sometimes portrayed as being. “I have yet to see the industry not jump on a bona fide

good idea that has come out of left field,” he said. “If you come up with a good idea, they’re on it — there’s no question. And most of them will take the time to understand what the developer or entrepreneur is trying to do.”

Piché disagreed, pointing to regulations surrounding best practices in the resource exploration sector that serve to keep most businesses conservative and unwilling to diverge from current approaches to the work. “You want to do things the same as everybody else but have a neat sales pitch that will help you attract investment,” she said. “It actually is stifling to innovation at that level.”

Parallel Sessions

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Strand B: Investing in Natural Resources Innovation



Facilitator:

Caroline Cook, Manager, Innovation, Science Program Branch of the Canadian Forest Service,
Natural Resources Canada

Panelists:

Pierre Lapointe, President & CEO, FPIinnovations
Pierre Meulien, President & CEO, Genome Canada
Jim Taylor, Managing Director and Founder, Avrio Capital
Annie Theriault, Senior Investment Manager, Export Development Canada

Lapointe began by describing the front-row seat FPInnovations has had for changes in the natural resource sector from a forestry perspective. This included investing in Needs, Approach, Benefits, and Competition strategy established by SRI International, which altered how R&D was being conducted. “We went from cost-recovery process improvement to new products and new processes,” he said. “In order to do that we had to enter ourselves into the pre-commercial field, into venture capital, market analysis, and so on.”

Meulien portrayed Genome Canada as an early investor with an interest in genomics technology, with a split between human health applications and other aspects of life sciences. Since being created in 2000, he noted, the organization has invested some \$1 billion in public money, which was leveraged to yield another \$1.4 billion investment. “We as an organization have a very good lens as to what’s going on in academia and what’s been created,” he said. “We have a much poorer lens to the outside, as to who could help us translate some of this knowledge into use.” This shortcoming has been part of the impetus to create a new program on natural resources and the environment, which was on the verge of being launched. Toward that end, he explained that Genome Canada is seeking partners to bring genomics from the laboratory into new areas such as forestry.

Taylor introduced his company as a traditionally structured post-commercial investment firm, while Theriault’s group deals more typically with seed-stage support for start-ups and pre-commercial enterprises.

With regard to how companies in the natural resources sector are structured, Lapointe described them as being very much capital-dependent, as well as traditional in their outlook. “They have little receptor capacity and this is the challenge — to get them to transform themselves,” he said. This means anyone trying to develop an innovation will have a very difficult time finding partners to initiate and sustain that process.

Meulien described how this observation applied to genomic research, which must overcome serious hurdles in order to demonstrate relevance to potential industrial users. “There’s a huge gap in terms of the knowledge the receptor would have and how they could actually use some of these technologies,” he said, referring to a workshop Genome Canada held with the mining sector, which was an attempt to overcome this gap. “We have as much to learn about the private sector as they have to learn about what academia has to offer. There’s a huge learning curve on both sides.”

For Taylor, the raising of venture capital funding is an “enormously difficult task” in Canada, where there has been a steady decline in the number of potential partners like his firm. Theriault added that turning an innovation from a garage-based prototype into a marketable product can easily take four or five years; this would be more than half the amount of time venture capital firms allow before they exit from the investment.

Similarly, she observed that such enterprises are typically started by engineers who frequently stay in management positions longer than they should, so that refining the technical aspects of the product takes priority over getting the product to market as quickly as possible.

Lapointe offered the example of a joint venture FPInnovations undertook with Domtar to use surplus pulp and paper installations to extract nano crystalline cellulose from wood fibre to build an entirely new line of products. The technology itself proved to be sound, but finding clients for the new output became the major obstacle.

Meulien emphasized that an organization like Genome Canada can de-risk many technologies for commercialization, but there is still more to do. "It's a matter of working out exactly what to do — exactly what we'll de-risk and what will be the timeline and who will be the follow-on investors? It becomes complex. We need to talk with VCs who understand their sectors and the ecosystems associated with each one."

Taylor acknowledged that his firm would take on some of these investments but noted that there had to be a demonstrable market. "There are a lot of science projects out there, people doing things because they can not because it's solving any relevant problem. In the smaller world that I live in, people innovate because they want to create wealth. Nobody likes to admit that, but an entrepreneur goes into business to make money. He or she is going to innovate to create wealth for the people behind them." Lapointe added that FPInnovations has responded to this challenge by establishing an internal R&D culture that includes a review process where the clientele for any particular project must be clearly identified. "That's a major switch in culture for a lot of researchers."

Theriault stressed that any viable undertaking should be able to attract corporate participation, ideally from a company that would be a customer for the resulting business. Such investment serves as much more than a way of raising more capital but above all as a confirmation of the new enterprise's market potential.

These comments set the stage for discussions that took place at several tables, which singled out challenges that were subsequently presented for the rest of the room. Those challenges included the following:

- understanding just how long it takes new technologies to make their way into the marketplace, from the perspective of refining the technology itself, obtaining and maintain funding for this work, and ensuring the ongoing interest of corporate partners or potential clients.
- viewing technology transfer as a two-way street, not just a movement of ideas from universities to businesses, but likewise a movement of corporate products into academic circles.

- the need for private sector firms to have the funding and support necessary to adopt new technologies without interfering with their productivity.
- transforming technology push to market pull.
- bridging the gap between institutional innovation and industry, such as by getting industry involved earlier in the innovation life-cycle.
- integrating technical and social research skills to discern a consensus vision for society and innovations that should move us in that direction, as well as the process for moving us in that direction.
- obtaining the best timing for financing.
- confronting risk-aversion by promoting communication between companies and their customers in order to understand what might serve as the next product, coupled with communication between companies and academia in order to understand what new technologies lie on the horizon.

Lapointe interpreted several of these ideas as connected, reflecting a common need to promote innovation by building bridges between bankers and companies and clients and universities. “That link is missing,” he said, suggesting that the forestry sector was actually ahead of others in trying to establish such bridges. Meulien agreed, dubbing the need “end-to-end integration”, which covers most of the challenges being discussed. Taylor argued that besides simply building bridges between various interest groups, there is a need to align those interests.

For her part, Theriault took a somewhat different tack, calling for the means to lower barriers to the initial implementation of innovation within conservative industries. “At the end of the day those industries are conservative for a reason,” she said. “They’re not conservative because they want to be slow — if you stop the mine for two weeks it’s disastrous.”

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Dinner & Keynote Speaker

Some Secrets about Happiness



John Helliwell, Vancouver School of Economics, University of British Columbia

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Keynote speaker

Is Canadian Research and Innovation Meeting Resource Sector Needs?



John McDougall, President, National Research Council of Canada

Jeffrey Crelinsten introduced McDougall by pointing out that while he has become well known for his work with NRC over the last five years, he came to that position with some 30 years' worth of experience in the natural resources sector, including stints as a petroleum engineer at Imperial Oil and then as a consultant specializing in large energy infrastructure and technology projects.

McDougall began by noting that NRC marks its centennial next year. "Our role and mandate has always been research and development to help the country grow," he said, after noting the ways in which that mandate has mirrored the evolution of the national economy — fundamental transportation and building materials early in the 20th century, military technologies during the war years, high technology near the end of the century, and the emergence of what he dubbed the "bio-economy" or a bio-mimicking economy in the 21st century. With that progression in mind, McDougall referred to the latest consideration of the NRC values over the last few years, which has put a fresh emphasis on the organization's impact, focusing on customers, and being accountable for one's actions, becoming a leader in one's work, transparency, and collaboration.

He also listed four lines of NRC business activity. Two are internally driven: strategic R&D and technical services. Two others are externally directed: the Industrial Research Assistance Program and science infrastructure services. These fall into three distinct areas with different scopes: engineering (working with existing companies over a 3-5 year time frame), life sciences (working with emergent companies over a 5-15 year time frame), and emerging technologies (entirely new platforms over a 10-30 year time frame).

With regard to natural resources, McDougall portrayed the animating factor of this sector as people. "People need to eat, they need places to live, they need energy to do the things they do, they need other resources so they can manufacture and put products together," he said. Much of this activity remained constant throughout human history, until the unprecedented surge in population during the 20th century. This increase has been reflected by a similarly large growth in the demand for natural resources, especially in the developing world where most of this growth is occurring.

Accompanying this growth, he added, is a desire for increasing prosperity, one that is further enhanced as communications technologies enable people with less to see what they are missing. "However, having said all that, the earth isn't running out of resources. We're loaded with resources. We're very richly endowed with resources, actually — energy, minerals, biomass." Technology has enabled us to make better use of these resources, but other challenges have arisen as a consequence, specifically the environmental effects of this activity. "We see issues such as climate change and agricultural runoff into our watercourses, acidification of the sea, plastics floating around in large volume, chemicals and drugs in the environment." Unfortunately, wide variations in regional control make it difficult to address these effects in a cumulative way, taking

into account the effects on the global system rather than any discrete component of that system. “We’re struggling to build a real consensus.”

With regard to how such a consensus might emerge, McDougall presented a hierarchy of economies, which includes four categories — underdeveloped, lesser developed, highly developed, and knowledge — engaged in manufacturing at the initial stages to innovation at the more advanced stages. Success in manufacturing is relatively straightforward, he suggested, but successful innovation is much more challenging; the latter requires capital investments that must be carefully maintained and can disappear, as evidenced by the demise of a major enterprise like Nortel, which left a great deal of economic damage in its wake. Above all, innovation-based economies are premised on high consumption, which magnifies the impact on the environment.

Looking more specifically at Canada, McDougall noted that although this is a large country endowed with a significant proportion of the world’s reserves of vital resources such as oil, water, and minerals, much of this material is found in isolated settings. “Often these things are far from markets, and often they have limited access to infrastructure,” he said. Our ability to make any of these resources more accessible can make a big difference in local economic success. As a sector, natural resources is comparable in size to manufacturing — some 20% of GDP and around 1.8 million jobs — but with this added complication of operating in some of the country’s more remote corners.

He then considered the question in the title of his talk, namely whether Canada’s research and innovation agenda for natural resources is meeting the country’s needs. He suggested it is not, and that more must be done than simply finding and extracting more commodities. He recommended an additional emphasis on the construction of infrastructure to get resources to global markets, making resource-based workplaces and their allied communities safer and healthier, and assessing the environmental as well as social effects of this activity.

McDougall also raised the larger question of whether this means of supporting ourselves is ultimately sustainable. Among the most fundamental aspects of this question surrounds the ongoing growth of our population, which will continue to put pressure on resources and the environment, perhaps to the extent that we might not survive as a species. “Where does the consensus come in terms of how to respond?” he asked. As daunting as that question may appear, he voiced his own optimism that a balance between resource production, community sustainability, and landscape management could permit us not just to survive, but to thrive. Nevertheless, he pointed out some obstacles to achieving the necessary consensus to do so.

“People will not vote to destroy their personal prosperity or opportunities to improve their lives,” he insisted, noting that this resistance will come even in the face of serious

challenges such as environmental degradation. “We need intelligence, we need incentives, and we need innovation. That takes leadership, plus policy, plus investment. We’ve got to get away from the idea that significant parts of the world consume substantially more than the value-added wealth they produce.” Outsourcing production from the developed world to the developing world has realized some short-term gains, but now the consumer expectations of the developing world are exceeding the productive capacity of the developed world. This situation is generating ever greater environmental effects, which means that a great deal of innovative activity will be directed to reducing those effects through more careful use of natural resources. This could take such forms as more efficient building designs or adoption of renewable energy sources, but he says even greater gains can be made in bio-mimicry, which would regard resources in the form of a cycle so as to control both their consumption and disposal. By way of example, he offered the idea that landfill or sewage could be converted into fuel, which could yield a source of hydrocarbon fuel as great as the country’s known natural gas supplies.

Moving toward this new economic model will require setting aside many current economic rivalries and could well call for some sacrifices. “That may even entail in the developed world a short-term reduction in the standard of living in order to achieve a higher quality of life globally in the long term.”

Jeffrey Crelinsten observed that the challenges outlined by McDougall provided some clear direction for economic development. “What a huge opportunity for entrepreneurs to solve those problems and build a global business.” he said.”

A question from the audience considered whether a knowledge-based economy could be totally divorced from manufacturing. McDougall conceded that no major economy, no matter how advanced, could afford to be without some kind of manufacturing base. “You do have to make something because without that you lose the knowledge economy’s ability to continue.”

Panel Discussion

Tradition meets tech — new solutions in the natural resources sector



Moderator:

Mark Dietrich, President & CEO, Compute Canada

Panelists:

David Boulard, President, Ensyn Technologies Inc.
Kevin Kuchta, Director of Product Development, Qwantech
Alison Sunstrum, Co-CEO, GrowSafe Systems Ltd.

Dietrich premised the discussion on each individual's description of their business and the role that innovation plays in its success, with the ultimate aim of identifying recommendations for how innovation more generally can help resource-based enterprises.

Sunstrom introduced GrowSafe as a combination of engineering, computing capability, and animal science to devise new ways of improving animal welfare, farm profitability, and a reduced environmental footprint. "Those three things to us mean sustainability," she said, referring to a data platform that has called for a significant amount of R&D. She described their operation as an application for the Internet of Things, which represents a new convergence of technology and opportunity to embed communications capability in objects.

Kuchta described Qwantech's software products that provide the mining industry with the ability to assess how various assets are performing. This means taking the industry's accepted metrics and incorporating them into a much more ambitious system that will make this information even more useful. The greatest challenge facing this small company is in fact its size, he argued, and the fact that such innovation might be expected of much larger, better known players such as SAP.

Boulard introduced his company's biofuel production technology, which has reached the demonstration phase and is being used to run a hospital off the energy produced from cellulosic fibre. He acknowledged that it remains difficult to market an alternative fuel source in a world that runs on established lines of fossil fuels, simply because there is perceived to be a risk attached to this choice.

Dietrich then posed three questions to each of the panelists:

- are there parts of the Canadian innovation system that have helped you?
- are there pieces that you definitely wish existed in the Canadian innovation system?
- are there other parts of the world that have practices we should adopt?

Kuchta cited IRAP and SR&ED as two primary aspects of the innovation system that have benefited Qwantech. His company has had the experience of introducing products to clients, who then ask for something more sophisticated, which can be an exceedingly research-intensive way of doing business. Instead, they try to provide open-ended tools that allow these same clients to create what they need, which has been a costly but necessary undertaking for a small firm.

Sunstrom identified those same two programs as being similarly valuable to GrowSafe. The company was unable to find a Canadian market initially and therefore quickly learned how to export and compete internationally. She acknowledges that they used to apologize for the somewhat isolated setting where they operate, but she says that has now become a point of pride. "In Canada we need to understand that innovation occurs

everywhere, not just in Toronto and Calgary,” she insisted. She added that the personal costs associated with the entrepreneurial lifestyle are nothing less than daunting, especially in terms of financing risks and investing huge amounts of time; if we want to have more of this kind of activity, she argued that this process must be made somewhat easier.

“If you’re trying to do anything novel in Canada, it’s tough,” said Sunstrum. “You go into a grant application or you go into any process and the people you’re talking to likely don’t have an understanding of what you’re trying to say.” More specifically, she would like to see the grant application process simplified with a single point of entry that would send the request off to all possible sources of support. “You come find me instead of me having to spend so much time going to find you.”

With regard to examples from other countries, she explained that GrowSafe technology is being employed in every major agricultural university. “Our collaborations in other countries are way more effective than they are here. We have good collaborations in Canada, but our tech transfer is about 20 years behind what I’ve experienced in the United States. That’s protection of my IP: I can walk into UC Davis and acquire a collaborative research and development agreement within six weeks — no problem.” She also pointed to small countries like New Zealand, Holland, and Finland, all of which manage to do substantial international trade in agricultural commodities. “I love those countries because they make it easy for me to collaborate.”

Boulard expressed the same enthusiasm for IRAP and SR&ED, which have helped to build up Ensyn, but he saw much more that could be done. “One of the biggest things that we desperately need is procurement,” he said. “It’s incredible that given the purchasing power of the government of Canada, when we’re in a traditional fuel marketplace, that to get my product into any government facility is extremely difficult.” By contrast, he pointed to the United States, where a renewable fuel standard has created a valuable, stable market for biofuels.

Dietrich returned to the question raised by John McDougall in the previous presentation, namely whether Canada’s research and innovation system is meeting the needs of the natural resources sector. Kuchta recalled his own experience with universities, which were often invited to take part in mining projects but lacked the internal expertise to manage those projects; Qwantech found itself brought into such projects in order to fulfill this role. Sunstrum, for her part, pointed to a lack of funding that made it impossible to establish short, medium, and long-term research programs. “There’s some great research being done, but it’s likely going to be dropped before it gets to market because we don’t have the funding heart to take it all the way through,” she said. Sunstrum also bemoaned the loss of scientists and graduate students from Canada, something else that is tied to a lack of funding. “We also need to understand that tech transfer is not a one-way street from universities; it also comes up in the private sector,

and our company is an example.” Boulard added that sorting out IP ownership has been a problem that has kept Ensyn back.

Kuchta noted that his company’s product was originally designed for health care, but migrating it into that market turned out to be exceedingly difficult, even when the product was demonstrably functional. The mining industry, on the other hand, was willing to assume sufficient risk to try out the product after seeing a demonstration. Sunstrum’s experience was similar, forcing them to make changes to the product at their own expense in order to retain access to markets and stay ahead of any competition. This is also essential to providing solutions that are easy for customers to understand and use, but which have opened up opportunities to improve the product in ways that return even more value to those same customers.

Boulard suggested that what has made the difference to Ensyn has been finding champions who know what the company is doing and help it reach the market. These champions can be technology partners who work with them to deliver Ensyn products into the existing marketplace. Nevertheless, such partners are still incapable of procurement, which remains a stumbling block for the widespread use of alternative fuels.

Kamiel Gabriel of the University of Ontario Institute of Technology asked Sunstrum how the technology transfer process with Canadian universities could be revised to match the efficiency she has encountered in the United States. She suggested that an easier point of entry, such as the principal investigator, would be best, since they will have the clearest understanding of the work. “My solution covers computer applications, modelling, mathematics, and animal science. I can’t get the university departments to talk, let alone try to develop an IP relationship.” Part of the problem surrounds metrics, she added, whereby researchers collaborate with her firm but pursue their part of the work independently and often at a very different pace; she admitted that she has become better at setting up university research contracts that have specific objectives and milestones much more definitively in order to avoid such problems.

Perry Mangione of the National Research Council asked Sunstrum what she liked about dealing with New Zealand, the Netherlands and Finland, so that Canada might emulate this behaviour. Sunstrum indicated that she appreciated the willingness of these countries to fund their activities, as well as the speed with which these governments act on requests. “That’s one big fall-down in Canada — the speed of technology transfer — trying to develop contracts with PIs who don’t have real relationships with their tech transfer departments. The universities have to be told how to partner.” Kuchta added that Dubai offered his firm an office and students to work in that office and a hospital for research, along with funding.

Canada's Innovation Agenda
Building on our Natural Resources Advantage
The 14th Annual RESEARCH MONEY Conference
National Arts Centre, Ottawa | 31 March - 1 April 2015
Day 2 - 1 April 2015

Jeffrey Crelinsten asked Boulard about his company's work with Natural Resources Canada. Bollard indicated that this was not a funding arrangement but collaboration on areas of common interest, including engines and different types of fuels.

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Panel Discussion

Driving innovation through industry-academic partnerships

Moderator:



Trevor Raymond Stuthridge, Executive Vice President, FPIInnovations

Panelists:

Javier Gracia-Garza, Deputy Chief Scientist and Director General, Science Program Branch of the Canadian Forest Service (CFS), Natural Resources Canada

Ted Hewitt, President, Social Sciences and Humanities Research Council of Canada

Mario Pinto, President, Natural Sciences and Engineering Research Council of Canada

Referring to the innovation map presented by David Watters, Gracia-Garza said what jumped out at him was the way in which various participants in the innovation process interact with one another. More specifically, he is interested in how money flows as part of those interactions, which is something he deals with as part of his role in the Canadian Forest Service. "One of the roles that CFS plays in this innovation ecosystem is that we are performers of science but we are also funders of science, funders of that R&D," he explained. Much of this work, he added, is intended to support early adopters of technology by conducting the up-front work that will minimize some of the risks and unknowns surrounding that technology. Given that much of the support for science is now premised on the notion that this research is dedicated to some kind of practical solution, Gracia-Garza indicated that a high priority for such solutions is in the area of environmental solutions. "Demonstrating that we are managing our resources in an environmentally sound manner is something that requires a different type of innovation," he observed, noting that much of this kind of innovation calls for more fundamental scientific inquiry, including the integrated landscape perspective described by John McDougall. In this way, for example, it becomes possible to harvest wood products in a certifiably sustainable manner and market them accordingly.

Gracia-Garza also regarded social issues as a key part of how natural resources are used, which in turn calls for a separate branch of social sciences research to ensure the success of businesses in this sector. Similarly, he sees the need for those businesses to develop receptor capacity for some of the new expertise that is emerging, i.e. an ability to identify the value that someone with a doctorate in genomics might be able to bring to forestry.

Hewitt outlined the growing significance of SSHRC projects that involved partnerships with industry, which can be supported with grants on the order of millions of dollars. These activities also call for collaborations with organizations like the Ontario Centres of Excellence, which support the participation of students at both colleges and universities in such projects. He suggested the success of such ventures lies in their very existence, since social sciences have not traditionally been considered an obvious aspect of innovation. Out of 3,500 partners for all of SSHRC's post-secondary initiatives, some 350 are with industry. While this proportion is small, Hewitt insisted "in a world where you might not expect industry partners, 350 is a big number. The mere fact of participation for industry in these projects is significant in and of itself. No company is going to invest the time of its personnel or dollars into projects for which they believe there will be no return." As for the nature of that return, SSHRC has been working with The Impact Group on ways of framing the value-added for these projects. Often this return can come as a response to what Hewitt called people problems, such as setting up communications with a community near a natural resource or shaping environmental policy for a new building technology.

Pinto recounted his own direct experience with different aspects of the innovation process. “When one embarks on such an adventure, capitalizing on the different strengths in individual sectors, one hopes that the whole would be greater than the sum of the parts,” he said. Unfortunately, that whole often includes redundancies and discord that are opposed to the spirit of collaboration that is necessary for success; in his new post as NSERC president, he is already looking at ways of getting beyond these limitations to set up more fruitful synergies. “It became evident to me that NSERC has to define its place in that innovation continuum, because it’s not at all obvious to policymakers where we fit in, given the plethora of organizations and departments active in this space.” His response has been to enhance investments in discovery, which represents the foundation for the applications that are expected to contribute to innovation. This approach also adds value to strategic partnerships, specifically the de-risking of a potential application for that discovery and paving the way for future investment in that application. “My definition of innovation is a very hard definition,” he added. “It’s not innovation until its monetized or it has societal impact. To do innovation properly, it’s going to need much more than what we provide. We provide the front end — access to the brain trust, great ideas — but in order to develop them further, it needs much more. We need venture capital, angel investors, market research. It’s that whole mix that might give these fledgling SMEs a fighting chance.” With this in mind, NSERC has been reaching out to other organizations such as the National Research Council to simplify the application process for prospective clients. “The end goal is very simple to me: to innovate in Canada, to manufacture in Canada, to sell in Canada, and to sell internationally.” To the extent that research plays a fundamental role in achieving that goal, he declared the distinction between discovery and applied science to be false, as they are two sides of a common undertaking. “Let’s admit that there is no distinction. Let’s focus instead on excellent research and innovation and tap in to the different trigger points in a complementary way.”

Stuthridge noted that a leading challenge surrounds the fact that important information about industrial processes and other data does not make its way into the establishment of academic research priorities. “How do we get more value out of that commercial information strategically?” he asked, suggesting the need to reverse the flow of this information to innovation frameworks so that the entire system will function better.

Hewitt expressed his understanding that private firms might not always be willing to share the data that lies at the heart of their respective business plans. Rather than expect this work to flow into academic settings, SSHRC is therefore helping academics gain a higher profile for their work amongst such firms. Although this work is published in many places, it is not always easy to find and so his organization is also trying to ensure that interested parties not only know where to look but have the earliest possible access to it.

Pinto responded to Hewitt's comments by portraying this kind of open access to academic research as a work in progress. He also conceded Hewitt's point that private enterprises could not be expected to share the details of their intellectual property, but they were sometimes willing to share their market research, which could be even more important. "To know when you're embarking on something that's never going to have an impact, that is a very powerful data set that industry can bring to the table," he said, recalling an example from his own career of a medical diagnostic kit that was a technical innovation but a market failure. "We forgot to do our market research and ask the physicians if they would actually use a 10-minute colour test in their offices," he explained. "The answer is they refused to. They still send it out for three weeks of culturing."

Gracia-Garza offered his own example of what happens when industry releases its data, specific information collected from work that CFS had done with companies on the use of remote sensing to characterize forest resources. He found that in eastern Canada, where there were a number of private firms collecting this data, these same firms were open to sharing their findings. The result was not just an application that met the needs of their industry, but other applications, such as the study of aquatic systems. "By providing all of this information to the public, they are starting to find a lot more applications for the kinds of services that they could be providing," he said.

David Wolfe of the Munk School of Global Affairs asked Pinto what NSERC was proposing that was distinct from what NRC is already doing through IRAP, rather than perhaps coming up with something more ambitious, especially as so many major economic powers are dedicating themselves to fostering innovation. Pinto responded that NSERC is attempting to learn more about these international efforts by talking with institutions in these countries, such as the National Science Foundation in the US and the Fraunhofer Institute in Germany. "We're not very good at learning from history — what works and what doesn't work," he said, noting that some of these organizations have been candid with him in revealing what has not worked for them. "Let's not assume that everything we're doing is not working and everything another country is doing is working."

Pinto also underscored the fact that NSERC funds an academic population of some 11,300 professors and another 30,500 students. "That is a force," he argued. "And we have to capitalize on that force and bring them to the table. But we have to stop exaggerating our capabilities. Each of us has to admit what our niche area is and we have to stop over-promising, over-committing, and exaggerating. Together we can create an ecosystem where the transitions are more or less seamless, but we bring to the table our respective strengths and not our weaknesses."

Rory Francis of the Prince Edward Island BioAlliance asked for more detail about the nature of an appropriate interface between various institutions and cultures that

participate in the innovation system. Pinto recalled running an innovation office whose success was premised not just on open interaction between cultures, but by solidifying venture capital flow and bringing in professional management for start-ups who could make hard go/no-go decisions about how to proceed. "If you're going to play in the innovation space you'd better play by the innovation space rules," he said.

Gracia-Garza described a broader innovation interface that the CFS maintains, one that is premised on information coming from all sides. "Working with the forest sector, we make a significant effort to communicate with each other in the provinces, academia, the private sector, and the federal government," he said.

Hewitt adopted an optimistic outlook on these interactions, despite the complaints that are often heard about the state of such collaboration. "For every company that's out there saying it's really too hard to work with universities, there's got to be five or more who will tell you how great it is to work with universities," he maintained. "The problem is they're not shouting it from the rooftops. And the dollars tell the story."

Parallel Sessions

These sessions represented a new, three-part approach to interaction within the RESEARCH Money conference. The session moderator reviewed the challenges identified on the previous day. Then participants broke up into groups to consider specific strategies to tackle those challenges.. Finally, each group reported back on their conclusions to the group as a whole.

Strand A: Driving Innovation through Canada's natural resources advantage



Facilitator:

Anne-Marie Thompson, Director of the Energy, Environment and Resources Division,
Research Partnerships Directorate, NSERC

Panelists:

Catherine Cobden, Executive Vice President, Forest Products Association of Canada
Kevin Kuchta, Director, Product Development, Qwantech
Lola Piché, Director of Technical Services & Innovations, North Rim
Alison Sunstrum, Co-CEO, GrowSafe Systems Ltd.

Based on the previous day's discussion, two challenges were identified as the target for solutions to be proposed in this session. Those challenges were:

- an effective solution for increasing the capacity of the Canadian innovation ecosystem to understanding the needs and pain points of Canadian industries.
- an effective solution for enhancing the added value for all interested parties in natural resource development.

Representatives of each discussion group subsequently presented their conclusions.

With regard to increasing the innovation ecosystem's understanding of industry requirements, one discussion group proposed investing in organizations that would foster communication between these key stakeholders. Industry associations may be one of the easiest places to start, since they are already poised for such dialogue. As a representative of just such an association, Catherine Cobden acknowledged the pre-existing channels between the forestry sector and the research community; however, she added that it might be legitimate for researchers to demand more from this relationship, in order to set clearer goals. When this concept was expanded to a more specific proposal of workshops that might be mounted by such an association, Alison Sunstrum acknowledged that she liked the idea of such workshops in principle, but worried that they might not yield any specific result of interest to her firm. "I'm really looking for a tangible outcome," she said. "If you had a series of case studies, some best practices, some amazing failures, and some other things, I'm going to really learn from that workshop."

Another discussion group raised the need to bring project partners closer together in order to resolve conflicts that often surface between shorter, highly focused time lines of industry and the longer, open ended agendas often adopted by academic research groups. Cobden agreed with this assessment and echoed a suggestion to break down any barriers that would prevent partners from establishing a common pace and set of objectives. "There's nothing industry hates more than silos," she said. "Working across partnerships to break silos, so that they feel there's efficiencies and effectiveness is very helpful." Kevin Kuchta offered the specific example of the overwhelming abundance of sources where industry might be expected to seek out the latest technical developments, which can lead to fruitless interactions with inappropriate partners. For just this reason, Web-based information should be as clear as possible to avoid this kind of problem.

A third group tackled this same question of information overload, arguing that it stems from a lack of necessary work that should be done prior to formal interactions between industry and researchers, which could include academic groups as well as smaller businesses that are bringing their own proposed solution to a larger client. Bringing these groups together as early as possible was deemed essential, so that the

researchers could be certain of just what their prospective partners require of them. Sunstrum praised this framing of the situation: “You handled a two-way technology transfer,” she said. Cobden likewise praised the discussion of incentives for researchers to accelerate their activities, which will be essential to optimizing the results on both sides.

With regard to enhancing the added value of natural resource development, it was suggested that community engagement in these activities should be promoted as early as possible. While partnerships between academic researchers, industry representatives, and government were regarded as necessary in this process, there was a cautionary note sounded against the notion that government officials might be picking winners and losers as part of this process. Panelists then asked for more details about how this kind of engagement would take place, such as communities engaging in outreach campaigns to attract the attention of forest companies looking to locate a new facility. Such initiatives could open up a dialogue so that the terms of such a venture could be as beneficial as possible to both the community and the company. Another aspect of this interaction was the possibility of establishing environmental credentials in areas such as safety or sustainability. Such credentials represent another kind of value added, which assigns the resulting products a premium status that can be priced higher and still find a ready market. This can obviously provide natural resource firms with some competition, but it can likewise be an element of making this industry an attractive addition to a community.

By way of conclusion, Cobden pointed to a crucial distinction between collaborative and competitive work, which must be acknowledged in any partnership, especially when the members include newer, smaller firms that may be growing rapidly with outstanding products or services. Lola Piché noted that there is often much more than a specific product being commercialized, but also the development of personnel and technical capabilities. “There’s a lot of room for transfer of knowledge in different ways as well,” she said.

Parallel Sessions

These sessions represented a new, three-part approach to interaction within the RESEARCH Money conference. The session moderator reviewed the challenges identified on the previous day. Then participants broke up into groups to consider specific strategies to tackle those challenges.. Finally, each group reported back on their conclusions to the group as a whole.

Strand B: Investing in Natural Resources Innovation



Facilitator:

Caroline Cook, Manager, Innovation, Science Program Branch of the Canadian Forest Service,
Natural Resources Canada

Panelists:

Pierre Lapointe, President & CEO, FPIinnovations
Pierre Meulien, President & CEO, Genome Canada
Alison Nankivell, Vice President, Venture Capital Action Plan, BDC
Don Roberts, CEO, Nawitka Capital Advisors Ltd.

Based on the previous day's discussion, three challenges were identified as the target of solutions to be proposed in this session. Those challenges were:

- linking academic and government resources
- addressing receptor capacity within industry for new ideas
- trying to align the interests of the investment continuum with the innovation continuum

Robert Therrien of NSERC spoke on behalf of the group examining the question of linking academic and government resources. He identified an existing model for this process, whereby the federal government provided funding to FPInnovations through the Canadian Forestry Service as well as parallel funding to the academic community for work in areas that have already been identified by industry as priorities.

Pierre Meulien identified the weak participation that industry generally plays in the risky, pre-commercial R&D process and asked if there might be a way of creating incentives for firms to get involved. It was considered that the only real incentive would be the definitive de-risking of new technology through some kind of public funding. Alison Nankivell argued that there has to be some kind of trusted, independent body conducting triage on proposed innovative ventures. "Industry's not interested until it looks like it's at a certain stage," she said. "The issue is how to get some kind of government entity in that earlier phase that maybe is working as a quasi-venture fund." Therrien responded that the federal government was not in a position to begin funding pilot plants in order to establish the scale-up viability of some new idea, while Don Roberts insisted that the costs of such activity have to be broached at some point if this work is going to take place at all.

Mark Dietrich, CEO of Compute Canada, discussed the challenge of aligning interests between investment and innovation. He explained that this discussion group redefined the problem, by casting the challenge as one of bringing market insights into research circles, as opposed to getting research findings into the market. Moreover, there is not necessarily a lack of capital for this work, but instead a need to align capital to the proper opportunity. With that in mind, he described the role of business incubators and accelerators as essential to launching new ideas into a commercial context. For that to happen, however, any of those incubators and accelerators should be aligned with similar operations in other places, such as the US or Australia. Finally, seed funds led by industry representatives could validate each opportunity and facilitate the progress of deals; as with incubators and accelerators, these funds should be co-ordinated with similar funds elsewhere in the world. Above all, companies with vested interests in the outcome of this work should be the ones providing such funds as well as the representatives to manage them. In other words, by bringing industry members together to identify problems to the research community, the resulting efforts to turn the solutions to those problems into viable lines of business should lead to genuine business deals.

Nankivell described this proposal more specifically. "Specialist funds are generally global funds," she said. "There isn't enough qualified deal flow in Canada to justify a pulp and paper fund or a oil and gas technology fund. But having an affiliated fund that has people in Canada working with say people in pulp and paper in Finland or Korea or whatever, then you're looking for best-in-class solutions globally and you're also exchanging global views and presumably attracting international corporates and gaining legitimacy."

Dietrich suggested that the form of technology development would vary from one sector to another, such as the testing of prototypes in a working mine or forest site. Roberts applauded the identification of the need for a sector-based character to these activities, but underscored an equally important need that private money as well as public money should be committed to the process. "At the end of the day we've got to make money on this," he said. "We've got to search the globe for those fund managers who have got the expertise."

Mike Matheson of the U15 Group of Canadian Research Universities presented the group discussion that took place on receptor capacity, which he described as a multi-faceted problem. "It's a cultural problem, it's a business problem, it's an investment problem," he said. "It's about getting really good products into the hands of people that can use them, who can then see themselves using them, who can see the advantage of using them, and are then able to take those and deploy them." Because of the difficulties of trying to insert such innovations into the real-time system that businesses rely upon for their survival, the group concluded that a demonstration facility of some sort is required to test new technology at or near scale, a facility at least partially paid for by the industries that stand to benefit from it. Given that such an installation would be sector specific, they estimated that for a pulp and paper example, it would cost some \$120 million to establish. "One of the pieces that we found to be really important, especially for innovations that would take place at the mill level, was being able to prove to the mill managers that this could in fact drive their bottom line, improve their margins, help them meet their targets, and make their annualized bonus," he said.

Roberts suggested that Canada has become far too good at de-risking technologies only to see them deployed elsewhere; he argued that a facility like this, which could take in technologies de-risked elsewhere but not yet deployed, could reverse this process and take these innovations to full deployment here. "From a public sector cost-benefit analysis, this would be more effective for Canada," he said. "It's very important that we not restrict ourselves to Canadian technologies."

When asked to comment on which of these solutions might be feasible, Pierre Meulien declared the demonstration plant concept to be a winner, something that would draw support from the public and private sector to provide innovations with a clear value

proposition for the private sector. Pierre Lapointe agreed, especially with Roberts' suggestion that this approach would bring technologies from around the world to fruition in Canada.

Nankivell added that her own experience with investment funds demonstrated to her how readily businesses will move to be near the perceived source of support for an innovation. If Canada can turn itself into the place where innovation takes those final steps toward the market, this will become the destination for many firms with an interest in that innovation. "We don't have to be so focused on 'in Canada'," she said. "If we look realistically at most innovation, it's been created by people from other parts of the world who came to Canada. So what does it matter if it's international or Canadian? It's just a question of creating the desire and the mindset in Canada that you want best-in-class innovation happening here. And if you do that, the money will follow. There's no shortage of money, there's a shortage of good deal-flow."

Roberts reiterated his earlier enthusiasm for bringing this kind of activity to Canada and added that it will require a high degree of specialization and focus to make the country the kind of destination that Nankivell was describing. "One of the key questions for policymaker is 'where are we going to place our bets?'" he said. "If it's by sector, then tell me what specific sector we're going to use. That requires some courage, because there will be people who feel left out."

Closing Plenary



Reports on the activities that took place within each set of parallel sessions were given by “reporters” who attended and noted the proceedings in each case.

A report on Strand A, Driving Innovation through Canada’s natural resources advantage, was provided by Debbie Lawes, a contributing editor to RESEARCH MONEY. She noted that the group started with a number of different challenges, but when it came to solutions quickly converged on a single one: what is an effective solution for increasing the capacity of the Canadian innovation system for understanding industry needs and pain points. The essence of the proposed solution was collaboration, which sounds simple but can be difficult to achieve in practice in any way that achieves sustainable results. One way of ensuring a positive outcome is to engage stakeholders as early as possible, perhaps even before any kind of research program has been established. “You want to engage with all the key stakeholders, which would be academia, big companies, small or medium size companies, communities, and government,” she said. “You want all the players at the table, all as equal partners defining what the problems are and defining the pathway that’s needed to find solutions. One group described this as a networked solution team, pulling them together to identify the needs of industry.” She added that such interactions not only require careful listening by the participants, but tangible resources such as time, money, trust, and generosity.

Such collaboration can be jump-started by exercises such as speed-dating, Lawes noted. These simple events make it possible for outsiders to get a quick and effective overview of an institution’s research thrusts and expertise. Various institutions such as granting agencies have built up working models for deeper collaboration between academic and industry partners, but she cautioned that there is no one-size-fits-all approach that will work in every instance. “You have to be incredibly flexible with these models because every industry is different,” she said. “Not only industries, but technologies are also different in terms of how long they take to get to the commercialization stage.”

A report on Strand B, Investing in Natural Resources Innovation, was provided by Ottawa-based science and technology writer Tim Lougheed. He described how the first day's exchanges reduced a list of some 12 varied conceptions of key challenges in this area down to a core of three distinct ideas: linking academic and government resources; addressing receptivity of a conservative set of industries to innovations in their field; aligning interests between the working cultures of various participants in the innovative process. On the second day the panels served as the presiders of a "feasibility pit", where representatives of three discussion groups put forth their bid to solve each of these challenges. With regard to linking academic and government resource, it was observed that this challenge is being met through NSERC's industry collaboration programs, which put forward problems proposed by industry — along with research funding — for university researchers who might be interested in pursuing these problems. Even when such efforts succeed, however, they invariably do so at small scale; for a practical, commercial solution such solutions must be demonstrated at the scale where industry operates. With additional support on the order of \$60 million, then, this group concluded that a facility for such scale up demonstration could be established.

Lougheed noted that the second presentation, which dealt with the problem of making innovative ideas more attractive to the natural resources sector, met some obstacles because of the fundamental conflict between innovation fostered by the federal government on behalf of Canadian interests and industries that operate in a largely global context often with little or no nation-specific interest. This difficulty was resolved by the third presentation, which proposed the establishment of a demonstration site representing a braintrust based in Canada, made up of private resources, where problems within industry are tackled with an industry-specific focus. In principle any country could create their own such braintrust, but if Canada dedicates itself to do the best job in this regard, companies from around the world would come here to participate in this work. Nor would the innovations being considered by such a braintrust necessarily be of Canadian origin; discoveries and technologies from around the world could be brought here for review and potential commercialization.

Ted Hewitt then offered his own concluding observations on the conference, starting with his enthusiasm for the dynamic interactions that took place and concrete solutions that emerged. He noted that he was regularly reminded of the need to conceive of the innovative process as either an end-to-end or a 360-degree model. "All along that continuum are a variety of factors that contribute to the success or failure of a product, service or whatever in the marketplace," he said. "So what belongs on that continuum? The value-added elements that are or should be incorporated within the conceptualization of the research and development and delivery process: design, marketing, knowledge-based capital, community research." He expanded this list further to include skills, structuring and managing collaboration, as well as pointing to

innovative government-industry collaboration models, such as the Business-Led Networks of Centres of Excellence program and various initiatives led by Quebec. “We have to stop thinking about that research — those critical insights — as the cherry on the sundae,” he concluded. “We have to start thinking about how to make the blizzard. Blend it in, straight through, beginning to end, always available to you.”

Mario Pinto framed his own set of concluding remarks around the image of a Möbius strip, which has no beginning or end and only one side. “We should stop being preoccupied about where innovation begins, and where the spark comes from,” he said. “It really doesn’t matter. It’s the fluid dynamic between different sectors that’s going to make it work. So let’s just get on with it.” He suggested that the next step should be to determine what various organizations do best. In the case of NSERC, he acknowledged that its contribution is a necessary part of innovation but not sufficient on its own. “We need all of you, and we need to combine forces, and we have to do it at the outset, so there’s no push and no pull — you’re working together from the beginning,” he maintained. “NSERC would like to be that facilitating body that initiates all those first states and hopefully leads to more productive relationships.” Above all, he argued, the real value proposition was one of sharing risk so that all participants could make better progress.

He then described how NSERC has been building relationships with other R&D-centred organizations across the country, so as to minimize redundancies and take advantage of synergies. “This is the model we’re going forward with in the spirit of true collaboration, where we leave our respective egos at the door, leave our fiefdoms at the door,” he observed. “It means we’re each going to have to give up something; I don’t have much problem with that. At the end of the day, if the gain is worth more than what you give up, it’s much better.”

Pinto then listed NSERC’s investments in three key natural resource sectors. With regard to forestry and food, he pointed to 129 industrial partners and 296 NSERC-funded professors working in this area. “That’s a force that you have to tap into,” he stated, noting that NSERC support also goes to students who go on to work in these industries. He portrayed this significant network of human capital as a structure that can be built up to foster R&D activities and ultimately innovation. Likewise in the oil sands and heavy oil sector, a similar series of networks and human resources has been assembled through NSERC. “If Canada is going to the land of small and medium enterprises, let’s embrace this, let’s celebrate it, and let’s do it well.”

By way of introducing the speaker, Social Sciences and Humanities Research Council President Ted Hewitt noted that Helliwell's insights into the nature and meaning of happiness has broader implications for how nations and societies should conduct their affairs. "John's work exemplifies not only the role social sciences and humanities research plays in helping to create more prosperous, healthy, and just societies, but more specifically how happiness and well being can contribute to fostering and strengthening a culture of innovation."

After leading the audience in a rousing round of "If you're happy and you know it clap your hands", Helliwell pointed out that this expression of happiness is known as an "emotional report". While the social sciences have long surveyed populations to obtain such reports on various negative emotions, it is only comparatively recently that research has sought out reports on the positive emotion of happiness. More specifically, these surveys specifically ask individuals how happy they are with their lives, which calls for a much more subtle and sweeping report than simply asking about one's emotional state at the moment. Since 2010, a national survey in the UK has gone further than any other jurisdiction to ask for four distinct responses: satisfaction with life, happiness yesterday, anxiety yesterday, and purpose in life.

Helliwell added that social context was extremely significant. He also drew a further distinction made by surveys that maintain that the influence of positives in life outweighs the absence of negatives. "If you believe that, then it changes how you think about life," he said. "It certainly changes how medical practices ought to be run." By way of example, he described an experiment where students were taken to a hotel and exposed to cold viruses; whether they got sick, and how sick they became, was directly linked to the degree of their positive outlook at the time of exposure and only weakly connected to the absence of negative effects on life perception.

Helliwell's talk focused on three "secrets" to happiness, which he acknowledged are not really secrets but rather common sense observations that are seldom articulated in a clear way. The first is the importance of trust. "Intuitively people know that trust is important, but it's much more important than they think it is," he said. "And it's much more prevalent than they fear it is." Societies lacking in trust, he warned, are demonstrably stultified and will lose their vibrancy, ultimately coming apart. While evidence of this observation has generally been lacking, there are now some findings to support it. He and his colleagues enticed Statistics Canada into including a question on the general social survey that asked how likely people thought it was that a lost wallet would be returned. The published result was an expected probability of 25%, which prompted the *Toronto Star* to conduct an experiment whereby they dropped 20 wallets all over the city's downtown. Of those 16 wallets — 80% — were returned, which speaks to a significant gap between what people believe about societal trust and how members of that society actually behave.

The second “secret” revolved around generosity. Studies of this behaviour traditionally revolved around the notion that people are essentially self-interested and always seek to maximize their own economic advantage. However, Helliwell notes that once this assumption was put to the test, it was overturned. “The big surprise is that people are instinctively and universally generous and happier for being so,” he said, citing research that showed just this when test subjects were given money with the explicit instruction to give it away. Moreover, he added, people are more generous than they think they are and they get more happiness from generosity than they think they will. Curiously, this is confirmed by ancient philosophers who insisted that happiness is an outcome as opposed to a goal. Helliwell takes that to mean that if you conduct generous acts thinking it will make you happy, that will not happen; in other words, there is considerable power in not knowing that this behaviour will make you happy.

“There is a way in which the empirical psychology is starting to flesh out a lot of what previously had been armchair philosophical puzzles,” he observed. “That’s why I regarded myself as Aristotle’s research assistant when I entered this field.”

The final “secret” is collaboration, which Helliwell touted as crucial. “What makes people happy is to do things together for the benefit of others,” he explained. More significantly, he added, if the conditions for collaboration are met, innovation can proceed at an extraordinary pace. Those conditions include an organizational structure that is flat, non-hierarchical, and the absence of any dominant, overriding personality. He then discussed the surprising example of the Singapore prison system, which applied this principle to an institution that is usually held in public and bureaucratic disdain. The underlying philosophy was that of connecting prisoners to the community through joint ventures with organization such as elder care facilities. “But most importantly, the prisoners were busy discovering talents and teaching each other,” he said. “They had a shared objective for a bigger purpose and they were in it on a co-operative basis not an adversarial basis.” As an outcome, he noted, recidivism in the Singapore prison system went to below a third of where it had been, and the level has stayed there. Moreover, the prison system was regarded as the best employer in the public system and members of the public have expressed their satisfaction with seeing released prisoners moved to their area.

Similarly, peer support programs that provide support to cancer patients regularly focus on the effect these activities have on the patients, rather than the caregivers. When this perspective was investigated, researchers found even more benefits accrued to the people providing this support. “The people who were giving the peer support gained more in magnitude and it lasted longer than the people receiving it,” he said. “We hear a lot about caregiver burn-out; it’s just looking at the wrong part of the picture in an unbalanced way.”

Ron Freedman raised the issue of social inequality, which is widely discussed as a growing problem in our society. Helliwell maintained that this discussion focuses exclusively on income inequality, while ignoring five other constituents of happiness outlined in the World Happiness Report that he co-edited. He pointed to an example where birth weights for children born to poor parents were increased through government programs that mitigated smoking during pregnancy, a gain of health and long-term happiness that is distinct from income. "If you're trying to measure socio-economic inequality, why do you just look at income inequality?" he asked. "You should certainly look at these results for birthweight inequality, but more generally you would look at the inequality of subjective well being, because it encapsulates all these six factors together. Why feel sorry for someone who is having a low income by choice and living a simple life and has all the necessary supports? You should feel sorrier for the lonely than for the poor; that would be another way of putting it. Interestingly, it's much easier to do something about the lonely than it is to do something about the poor. And if you do something about the lonely, they're more likely not to be poor. It may be the most effective thing you can do. We're gradually trying to twist the inequality debate toward the inequality of well being and to focus on the powerful sources of diminishing that."

Helliwell emphasized that the social determinants of happiness are much stronger than the material ones, which leads people to overstate the happiness they would derive from some material gain and understate that which would come from social gain.

Dirk Pilat asked about the starting point for building these elements of happiness within a society. Helliwell replied that in some cases the roots of the process goes back centuries, to the foundation of a given culture that supports principles of trust, generosity, and collaboration. He cited the increasing happiness levels of francophone Quebecers over the last 30 years as a powerful Canadian example of what this process looks like over a shorter term, whereby the silent revolution and the concept of "Maîtres chez nous" has eliminated sense of isolation and alienation that had afflicted this group.

He added that "life is lived locally", meaning that immediate, community-based forces weigh more heavily on the determination of happiness than do broader, national factors. A recent outstanding testament to this was the finding that people affected by the Fukushima earthquake in Japan expressed being happier after this calamity than they were before. "They had rediscovered, reinvented, and recognized the depth of their willingness to collaborate and cooperate in looking after each other," he said. "They gained enough from that to offset the rest." Elsewhere, when this kind of social capital is absent, similar disasters have the opposite effect, leading to deteriorating levels of happiness.

Jeffrey Crelinsten asked how Helliwell's research has affected the philosophy of development, specifically from helping people to helping them help themselves. Helliwell referred specifically to the Barefoot College, a development initiative in India

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that targets social needs in a community first and foremost. “It’s a willingness to combine all the actors from very different places on a non-adversarial, non-grasping, non-rule driven way. If the outcomes are good and they’re cooperating with other people, the material parts of it are more or less irrelevant.”

Referring to his title and the allusion to Hamlet's reflection on dealing with life's challenges, Watters began by suggesting that Canada is on the wrong path to building a well performing innovation system. Nor does he foresee any kind of top-down solution to this problem coming from government. Instead, the only way forward will be a ground-up strategy based on individual decision-makers.

Watters defined innovation in four distinct ways, according to the OECD Oslo Manual, as a product, process, marketing method or organizational method that is new or significantly improved in some way. Activities related to innovation take place in a business or within an innovation system, which he went on to describe. These activities have ancient roots, as demonstrated by artifacts thousands of years old, which speak to changes in tool design or information recording that represented significant changes in the way people worked and lived.

In this context, an innovation ecosystem consists of public and private institutions that support various aspects of this activity. The result could be new knowledge or technology, which is subsequently disseminated within businesses that bring this change to global markets. The key stakeholders in this system are therefore government, private firms, academic institutions, and customers.

Looking specifically at Canada's innovation ecosystem, Watters outlined five participants: federal government, provincial government, universities and colleges, the private sector, and global markets. These are linked through various programs providing support for R&D, but he regarded colleges and universities as the "jewel" in the system. "They permit the translation of terrific talent into the system," he said, referring to some 500,000 graduates a year who emerge from these places. He added that this new talent overshadows the intellectual property that is turned out by the same institutions.

With regard to how these activities reach out to global markets, Watters insisted that the vital question is whether employment is being created within Canada. "If you're not creating employment in Canada, I would debate how effective an innovation system you have."

Innovation matters, he argued, because it can improve business productivity, which through better processes, organization or marketing can improve our competitiveness, standard of living, and quality of life. However, Watters maintained that Canada's innovation ecosystem is weak, obtaining low rating in domestic and international rankings and early critical comments from significant observers such as the Prime Minister and the Deputy Minister of Industry Canada.

Watters then introduced his printed graphical illustration of Canada's innovation ecosystem, which he would ultimately like to post on-line as a wiki in order to hone it

further. One end of the structure included the federal government and its granting councils, as well as the provincial government and their pertinent departments. Another part of the organization was made up of 48 National Centres of Excellence, which serve as a bridge between the academic sector and the private sector. Finally, this representation offers the economic, social, and environmental outcomes from the system. This document also outlines six major funding sources for R&D in Canada, as distinct from the destinations for that funding, where the R&D work is being done.

“We’ve got a \$30 billion research and development system, we have about a \$32 billion university system, we’ve got \$10 billion every year being put into this system by the federal government — if we’re not satisfied with the outcomes that we’re getting, then it’s really up to us to decide how we could change this over time.”

Watters presented a graph that clearly portrayed the country’s declining R&D expenditures, as reflected in a drop of the proportion of that expenditure relative to GDP (GERD/GDP) from 2.01% in 2004 to 1.57% in 2014, even as the OECD average for GERD/GDP was increasing to 2.4%. “There is a very significant gap there in our performance. The question we have to ask is: is this the path we want to be on? Maybe it’s acceptable to us and maybe it isn’t, and if it isn’t what do we want to do in terms of changing it?”

Other countries have in fact changed their approach, as illustrated by a more subtle graphic representation of scientists and engineers in the population in relation to GERD. “If you were to add a dynamic to this you would see many countries actually increasing their capability as Canada is decreasing its capability.” This raises secondary questions about whether we will have the talented individuals necessary to understand and implement innovations that could benefit our way of life. Watters’ innovation map also includes a report card ranking the country’s performance in key areas.

Looking more closely at specific government data, he considered information from Natural Resources Canada on the performance of the forestry and metals and minerals sectors. “I found remarkable the economic impact and the amount of innovation that is going on in each one of these sectors and their importance to Canada.”

Meanwhile, he noted the high ratio of indirect versus direct support for R&D, with some \$3.6 billion available in tax breaks as opposed to just \$356 million going toward dozens of programs for private sector innovation. He added that it has been some 25 years since the country undertook a formal review of the policy that drives this ratio. The list of federal programs that represent direct R&D investments can be arranged like the periodic table of the elements, each with its own distinctive characteristics.

Another contrast Watters noted was between the amount of federal R&D support that annually goes to universities (about \$3.2 billion) and to colleges (about \$71 million). In

light of the overall underfunding of the system, he suggested that evening up this ratio might be a good point of discussion. He also broke down provincial support for R&D and illustrated provincial levels for BERD, which showed Ontario underperforming in comparison with Quebec. This contrast pointed to a larger shortcoming he found in Canada's R&D policy.

"We don't understand the private sector very well from the point of view of public policy making," said Watters, who offered the example of a respected Industry Canada survey that excludes any firm with fewer than 20 people on staff. "That is 87% of all firms in Canada. You're doing a survey and drawing conclusions on the basis of a population of only 12.7% of the firms out there. I'm not sure that's going to help you in terms of many aspect of your policy making."

Similarly, he noted, when the Council of Canadian Academies studied industrial research and development, they did not survey the private sector. "I just find that strange. I would have thought that you would try and find out from the private sector how you are innovating, how much time to spend on it, what resources you put into it, and so on."

Watters examined the prominent role of SMEs, which make up 99.9% of all firms in the country, which only has 1,568 large enterprises. Interestingly, in the 2013 Globe and Mail survey of the top 1,000 companies in Canada, fully 524 were in the natural resources and energy sector. In contrast, just 23 were in advanced manufacturing and 33 were in information and communications technology. Similarly, the revenue for companies in natural resources and energy likewise dwarfed that of other sectors.

In answer to the question of why Canada's innovation ecosystem is performing poorly, Watters blamed a lack of clear targets for this system (such as increasing employment or exports) and the decline of funding toward the essential activities of the system. In addition to an inadequate understanding of how the private sector is structured, he also cited the excessive focus on R&D, which is just a narrow portion of the broad range of activities that make up innovation. Finally, he noted a lack of federal-provincial coordination in matters of innovation and an absence of support for firms that try to move into international markets.

As for improving this ecosystem, Watters would like to start with a target, even something as arbitrary as creating 500,000 new jobs, which happens to be the same as the number of new graduates each year. This target could be achieved by exporting new, innovative products to global markets, which will be enabled by collaborative networks dedicated to promoting innovation and taking advantage of the entrepreneurial ambitions of graduates. Learning to manage those networks is therefore a primary challenge, which starts with each of us.

“I think we need to focus a little less on technology and more on how to structure and align effective collaboration systems,” he said, offering up the iconic example of Mennonite neighbours who readily build barns for one another in short order.

Watters was asked a key question by Gary Bunio, General Manager of Technology Development for Suncor. “We talk tremendously about innovation at the front and the back end of the conversation. In the middle we talk about R&D, and that language is very different. So what’s missing in this conversation that allows this to be?”

Watters replied that other members of the OECD have been addressing this distinction, studying knowledge based capital and other aspects of innovation that transcend the role of R&D.

Jeffrey Crelinsten added that the reason R&D garners so much attention is the same reason someone looks under a street lamp post for keys that were lost elsewhere — the light is better there. “Because we can measure R&D we talk about it and people are struggling with how you measure this other stuff. I’m convinced there are ways to measure it and the OECD, for one, is working on that.”

Jeffrey Crelinsten welcomed everyone to the event. He began by noting that Canadian prosperity largely derives from the country's abundance of accessible natural resources.

In innovation policy circles, however, the role of resource-based trade is taken for granted, dismissed, or even denigrated. The iconic expression of Canada as populated by "hewers of wood and drawers of water" continues to conjure up images of an economy dependent on selling raw materials with no innovation. Crelinsten, for his part, said this critique has become too simplistic in today's environment.

"This old characterization is getting stale because of a lot of changes taking place around the world. Globalization has increased competition from other countries that also have abundant natural resources that are accessible, so they can process them and ship them around the world. There's depletion of easy-to-access resources at home; that's forced some sectors to find new ways to exploit harder-to-reach assets. Rising environmental concerns have introduced new requirements on exploration and extraction industries. And alternative sources of energy and materials have introduced new competitors."

All of this, he concluded, means Canada's natural resources industries have had to become much more innovative in order to keep up. "Not only do they drive innovation internally, they also increasingly depend on solutions offered by emerging knowledge-based companies in sectors like clean-tech, ICT, robotics, remote sensing, Internet of things."

Crelinsten also argued that these developments have been accompanied by a deepening understanding of innovation. Whereas this concept was formerly applied only to new types of products and processes, it has more recently been associated with business models, marketing methods, and organizational changes.

As a comparative small player in the global economy, one lacking large multinational corporations that could anchor a national economy, Canada must excel at nurturing collaboration between industry, government, and academia so we will be in a position to offer innovative solutions to the world. Crelinsten presented the RESEARCH MONEY conference as a gathering of expertise dedicated to discussing how Canadians can achieve this goal. With that in mind, this year's format has been adapted to introduce a set of highly interactive group discussions to take advantage of just how much experience and knowledge has been assembled in this one venue.