

**Industrial R&D: Is Canada Really Lagging?
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Conference Proceedings

Opening Remarks

Jeffrey Crelinsten, Co-publisher, and Mark Henderson, Managing Editor, RESEARCH MONEY

Henderson observed that many of the problems highlighted by the economic setback at the end of 2008 are in fact linked with longer-standing problems that appear to be intractable. Whether or not they are genuinely intractable, however, was one of the motivations for this conference theme. “I came up with this title for the conference a few months ago after hearing a comment from an executive at a Canadian high tech company — which shall remain nameless — that perhaps Canadian industry isn’t underperforming after all, or certainly as much as we think it is.” The underlying rationale of that comment, Henderson explained, was tied to the benefits of Canada’s proximity to the United States, the country’s rich endowment of natural resources, and a relatively small population. In this light, \$16 billion annually of industrial R&D activities may be just about right.

Innovation, productivity, and competitiveness are more than words that we probably use too much. These are things that you can do well, you can do adequately, or you can do poorly. The challenge of all of us today is to determine hopefully a course of action to ensure that Canada does better in these areas.

— Mark Henderson, Managing Editor, RESEARCH MONEY

Nevertheless, opinions may vary widely as to whether this conclusion is justified, and he suggested that posing the question should kick off a vigorous debate on these matters. “We have some highly innovative firms in Canada that have combined R&D with skilled talent and innovative marketing to produce globally successful products, processes, and services. But it could be argued that we used to have a lot more of them.” He added that the high profile failure of Nortel Networks, as well as the ongoing acquisition of other firms by foreign interests, have prompted all players to review their policies and strategies for improving their performance.

“Stated somewhat more crassly: if we can’t figure out how to create companies that create jobs and make money from new technologies, we’d better place a bulk order for pails and shovels, because we’re going to be drawing a lot more water and hewing a lot more wood in the future.”

— Mark Henderson, Managing Editor, RESEARCH MONEY

By way of summary, he argued that Canadians have to determine whether the tendencies of firms to underperform in the area of R&D is systematic, cultural, or both. The stakes in this field are high, the competition fierce, as many other countries are taking on this very same challenge.

Crelinsten added some more details to this picture. “Canada’s total business expenditure on research and development, or BERD, as a percentage of our Gross Domestic Product has been consistently low among developed nations.” The federal government highlighted this fact almost a decade earlier, but despite concerted efforts to improve Canada’s standing by this measure, it has stayed where it was then. “Is there something wrong with what we’re doing? Or perhaps the metrics we’re using are missing important factors at play.”

He referred to the Council of Canadian Academies report, which blamed Canada’s poor business innovation performance on the country’s relatively low productivity growth. That report specified six factors that were linked with this problem: inventive activity, more efficient organization of work, new marketing practices and business models, payoff from performing R&D, capture of benefits originating elsewhere, and entrepreneurial insights. Yet in the Council’s own analysis, it focused on just three of these items: R&D, employment of highly skilled people, and investment in machinery.

“Why focus on these?” asked Crelinsten. “Simple; it’s because they’re measurable. Whereas other factors such as new marketing practices and business models or entrepreneurs’ insights are very difficult to measure.”

The Council report acknowledged this shortcoming, but still endorsed the need for more investment in technology and R&D. Media interest generated by that recommendation has put firms in the spotlight, with heightened public expectations for greater levels of commercialization.

Opening Keynote: Canada’s Policy Conundrum

Bill Buxton, Principal Researcher, Microsoft

Buxton opened up by pointing out that he does not work for RIM, but that if he did work for RIM, he would conclude that the company was underperforming. And he added that if you ran the company any other way, then you should not be running the company.

“The question is: Where do you set the bar? What are your ambitions? And what are you satisfied with? If you were to say we all perform like RIM, that would be great. No it’s not. It’s not enough. You’re setting the bar too low.”

— Bill Buxton, Principal Researcher, Microsoft

He criticized the inconsistent use of the term “R&D”, so that measurements made using

R&D yield meaningless results. He also suggested that the respective roles of academia, government, and industry have to be sorted out before any progress can be made. In bringing up these points, then, he insisted that he holds opinions backed up by data, and that he would actually prefer to be wrong than right, since that would mean he would learn something.

“We win by getting to truth, not by winning the fight.”
— Bill Buxton, Principal Researcher, Microsoft

Buxton mounted two sets of slides showing where major Canadian universities ranked amongst international peers. University of Toronto ranked well, and was moving up from year to year. McGill and the University of Waterloo also held their own. But then he noted that the list of “peers” in one set of comparisons bore no resemblance to those in the other list. “That’s delusional. A self-deluding, self-serving university that doesn’t understand the difference between marketing and research and analysis. Welcome to Canada.”

According to Buxton, the skilled workforce reflected by outstanding universities is not an end in itself. It is necessary to attain high levels of productivity and innovation, but not sufficient. It is necessary to look at the larger ecosystem in which these economic goals are achieved. Using the example of promotional material from the Ontario government, he insisted that marketing premised on these misleading measures indicates nothing about whether the province is economically promising or a good place to invest. By way of testifying to this disconnect between touted potential and the harsher underlying reality, he noted that the provincial economy remains dependent on smokestack industries, despite having three universities that are among the world leaders in other sectors that show unbridled growth.

Even more offensive to Buxton was a brag by the Ontario government that it was enhancing incentives to bring in foreign students and generate revenue for post-secondary education. “Where’s the logic in this? Either we don’t believe that a skilled workforce is a competitive edge in competition and innovation, therefore, we’re going to educate all of our competitors to the same level as us. Or we believe that education does in fact have economic benefits, it’s just that we’ll sell the education as opposed to people applying what they learned in that education. We clearly don’t believe that education is the source of our potential growth and wealth.”

“The absurdity of this type of incompetent politics, that goes completely without commentary in our press and in academia, is shocking. It’s just a tacit admission of failure of policy.”
— Bill Buxton, Principal Researcher, Microsoft

By comparison, he pointed out, a minor hockey association would never tolerate such incompetence. There at least it is understood that success does not derive from a single policy, but carrying out a number of activities in a holistic way. “You have to invest, and you have to invest in the long term.” Above all, the measure of that success is not the existence of a few outstanding players. “The infrastructure is not set up to create those people. But you won’t have them if you don’t have very competent people who bring solid, sustainable wealth.”

As an example of this misconception, he referred to news celebrating how the last Nobel prize in physics was won in part by Willard Boyle, a Canadian by birth who conducted most of the work for the prize at Bell Labs in the US. He rejected the popular assertion that this honour somehow translates into Canada winning a Nobel prize. “We had nothing to do with it. We paid for the education, and reaped none of the benefits.”

“There’s not a single institution in this country worthy of respect which was not created at the expense of unbelievable risk. And yet we have a culture where you have to tear down the monkey bars in the playgrounds because our poor little kids might get hurt. We have to protect them from any risk and we build a culture where we try to coddle and make everybody safe, especially your money, especially your career. The most dangerous course of action is no risk at all. If you play it safe and you take no risk, you are guaranteed to die a long, slow death by atrophy. I don’t care if you’re an individual or a company. And until we understand how to accommodate this and train it and celebrate it, we are going nowhere.”

— Bill Buxton, Principal Researcher, Microsoft

Buxton moved on to consider other aspects of innovation, specifically its “long nose”, a graphic representation taken from *Wired* editor Chris Anderson’s conception of the “long tail”. His argument centres around an observation that it takes a minimum upward of 20 years for a technology to mature and enter the market successfully, if it does so at all. By way of example, the computer mouse — invented in the mid-1960s — did not become a consumer commodity until the mid-1980s, and did not become ubiquitous until the mid-1990s (with the advent of Windows 95). The conclusion is that most of the activity involved in R&D flies well below the radar, out of sight of public purview. He offered direct experience with this, having worked on an electronic drum device — a touch activated surface — in the early 1980s, which became the foundation for the touch screen heralded by the iPhone in 2007. “Most people are not aware of how long this nose is. The first part might be called where the invention happens, which is basic research. In the middle is refinement and augmentation, which we could say is applied research. And the third along the base is the productization.”

According to Buxton, understanding the nature of this long nose is essential to setting expectations accordingly. He referred specifically to setting priorities for investing in R&D ventures of one sort or another. “If you do not have a balanced portfolio in how you invest in this, you are going to have a poorly performing portfolio.”

“Any invention that is going to become a billion dollar industry in the next 10 years is already 10 years old. It is not about alchemy, about making gold. It’s about prospecting. It’s lying there waiting for you to mine. The investment strategies at work, and how you perform in each one, depends on whether you’re a prospector, a miner, a refiner, or a goldsmith. I would argue that if you want to have a balanced economy, you want to participate in all of those if you possibly can. But if you don’t understand that those things exist, how can you even make that decision?”

— Bill Buxton, Principal Researcher, Microsoft

Politically then, there is a fundamental discrepancy between the cycle envisioned by most governments — around four or five years at most — and that of technology, on a 20- or 30-year horizon. Buxton insisted that unless governments are willing to look to this longer horizon, and we hold them accountable for taking this view, their policies will inevitably miss the opportunities for investment and wind up hindering more than helping. As an indicator of what sort of hindering is cropping up, he pointed to his own observation that there are fewer Ph.Ds doing curiosity-driven basic research today, outside of academia, than there were in 1980. This at a time when the number of Ph.Ds in the country has risen by a full order of magnitude. “The results are shocking. No wonder we are still reliant on the automotive sector.”

For Buxton, such insights also raise the question of the kind of data that is being used to support policy decisions. Most often, he suggests, it is OECD figures on R&D investment, which he has come to challenge. He also challenges the working definition of R&D touted by Canada’s federal and provincial governments: “Creative work undertaken on a systematic basis in order to increase the stock of knowledge, including the knowledge of man, culture, society, and the use of this stock of knowledge to devise new applications.” While appealing, he notes that it addresses too much. Applied to the automobile sector, for instance, it would embrace activities on the assembly line as part of R&D. Reports based on such a broad perspective yield useless results. “Any analysis of innovation and investment for comparative purposes, if you don’t want to mix apples and bananas, has to distinguish between advance advanced research, applied research, and production.”

In this context, Buxton referred to what he regards as major and seemingly forgotten contributions to this discussion by Edwin Mansfield (1930-1997), who was an economist with the University of Pennsylvania for more than 30 years. As part of his work on the contrast between basic and applied research, Mansfield examined the performance of 119 firms between 1967 and 1977, representing at that time 50 per cent of US R&D expenditures. Over that same period, he observed a 25 per cent reduction in investment in basic research. This could be linked with a change in applied research and overall economic productivity. As Buxton put it: “If you pull back from the tip of the nose to the mid and base, in terms of your portfolio, you do not get an improvement. What you get is a reduction in long term productivity.” For Buxton, this puts a lie to the logic of strategic

granting initiatives touted by research organizations of various stripes.

Buxton then examined the implications of IP output by two Canadian universities. He harkened back to the passage of the 1980 Bayh-Dole Act in the US, which allowed universities to retain patents on the results of their research and potentially profit from the sale or licensing of those patents. Although the legislation had no force in Canada, it nevertheless inspired many Canadian universities to seek out the same sorts of opportunities here. Among the more aggressive of these undertakings was at University of Toronto, which took the form of an Innovations Foundation, which Buxton observes has never been able to balance its own books. “It was a net drain on the budget of the University of Toronto. And my experience with it was that it inhibited the distribution of technology and transfer rather than helped it.” Nor has this outcome been exceptional among universities that attempted to take advantage of IP in this way. “None of them brought about a re-creation in their jurisdiction of Silicon Valley, which is what they were all trying to do.” Moreover, he maintains that the emergence of Silicon Valley was not actually tied to the licensing of university IP.

In contrast, the University of Waterloo took a decidedly different tack, allowing individual researchers to hold patents on their own work. Moreover, this campus is intimately linked with a successful high tech firm, whose founder is investing in some of the most abstract basic research imaginable at the Perimeter Institute.

“There are some myths that we have bought into,” Buxton offered by way of conclusion. Those myths include an assertion that the days of the big corporate research labs, and the days when the private sector can do research are gone. This myth drives the notion that applied research must be transferred to the universities, taking attention away from basic research at universities and having universities do applied work. “And by the way, while you have universities patenting along the way, you destroy the community of scholars by making it impossible for scholars to talk about their work with each other.”

In debunking the myth of the value of IP and its impact on the free exchange of ideas, Buxton explained that he was under no publication restrictions at all in this regard at Microsoft. “I have far more academic freedom to talk about my work the minute I do it working for the private sector than I do at a university.”

He added that his experience at Alias|Wavefront revealed that a healthy, profitable R&D sector could be stoked by smaller firms just as well as larger, multinationals. The academic output of his group there — from journal articles to Academy Awards — outperformed leading universities.

Above all, the most outstanding discoveries are unintended consequences of curiosity-driven research. Pioneering work on computer graphics, robotics, and digital audio technology at the National Research Council in the 1970s wound up spawning multi-billion dollar industries and changing the landscape of Hollywood moviemaking, yet these same research units were eventually abandoned for more “practical pursuits”. Likewise, even a cursory examination of the people who make the most significant

impact in a field reveals them to be multifaceted in their talent, such as Frederick Banting, whose painting prowess was sufficient to qualify him as an ex officio member of the Group of Seven. “These are not one-dimensional people.”

“If you cannot have the freedom to play and go off, you cannot have the opportunity for these things to happen. These things are far too important to take seriously. If you cannot play, you will not have the agility and freedom of mind to be able to come across these weird juxtapositions.”

— Bill Buxton, Principal Researcher, Microsoft

Buxton described these desirable people as “T-shaped”, combining essential breadth and depth. “We do not want jacks-of-all-trades, masters of none. I want experts in terms of expertise and competence, but who have literacy in adjacent disciplines.” This is especially true with respect to the three pillars of any successful innovation: business, technology, and design. “Each is an essential pillar. None on its own is sufficient.”

By way of conclusion, Buxton presented the following:

- “Academic industry-relevant research is neither. It’s not academic and it’s not research. It’s a diversion that hurts academia and prevents industry from doing what it needs to do.”
- “The shift to applied research results is a reduction of productivity, not an increase. Demonstrating industry relevance of your academic research is a reason to stop funding at the academy, not to quadruple it. And if the private sector doesn’t pick it up, it’s their own damn fault. We deserve to fail.”
- Seeking a priori economic relevance becomes an excuse for shutting down R&D ventures, not building them up.
- Risk aversion kills any incentive to perform R&D at all.

He asked if we can change our culture. Major change is entirely possible, as evidenced by such fundamental social developments as the universal adoption of gender neutral language, banning drunk driving or smoking, and picking up dog poop. “We need to collectively set up a strategy that follows the tactics used by these examples to help make a shift in our values and then damn it, act on that shift. And I may be wrong in the direction I am pointing, but I am not wrong about the need for a shift.”

“Thirty years is too long to be making these mistakes. Look at the data; the data says it’s not working. And if we can’t figure out collectively, for the common good, what the right thing to do is, then we deserve what we get. And I believe, because I’m a skeptic, that we can get it right. Because the one piece of data that we do know is that we are among the brightest jurisdictions in the world.”

— Bill Buxton, Principal Researcher, Microsoft

Keynote: Canada's Industrial R&D Performance

Fred Gault, Professorial Fellow, United Nations University MERIT, Professor Extraordinaire, Tshwane University of Technology, South Africa

Gault wasted no time in responding to Bill Buxton's pointed assertions about the failings of existing assessments of R&D activities. "If we believe what Bill says about R&D measurement, there is no point in giving this talk." By way of rebuttal, he pointed out that Buxton's references did not include the latest methodology in the field, viz. the Frascati Manual 2002 which sets forth the proposed standard practice for surveys on research and experimental development. As Gault explained, the expert group that created this manual was in place before the OECD even existed. "It's been through six editions. It is a collective thing, a consensus document which allows us to make measurement and interpret that measurement for use in policy."

He agreed with Buxton that innovations such as the computer mouse do take a long time to emerge as commercial entities.

"The time scale of the evolution of anything that makes us money is something which we should all remember."

— Fred Gault, Professor Extraordinaire, Tshwane University of Technology, South Africa

He divided his talk into three sections, dealing with "big things", i.e. factors contributing to R&D performance that operate over three distinct time scales:

- things that do not move much, asking how we might be able to influence these factors;
- things that do move, but not very quickly, asking how we might be able to accelerate them;
- one interesting fast-moving variable that remains difficult to interpret.

Gault sharply distinguishes discussion of R&D from discussion of innovation. For example, mounting a highly skilled work force does not automatically imply that you are being innovative. Likewise, performing R&D does not necessarily mean you are innovative, because you are not necessarily connected to the market or any kind of money-making venture. "R&D is not innovation."

Starting with GERD of \$30 billion and GDP at \$1.6 trillion, he arrives at a GERD:GDP ratio of 1.9 per cent, sidestepping the question of whether this is sufficiently high. Business carries out 54 per cent of this activity, higher education 35 per cent, and government 10 per cent.

“R&D is a performance measure. It doesn't matter who funds it. It matters who does it.”
— Fred Gault, Professor Extraordinaire, Tshwane University of Technology,
South Africa

Meanwhile, Statistics Canada captures BERD (Business Enterprise R&D) only as that work done in Canada by a firm, not the overall investment that might be spread amongst various affiliates, either in Canada or elsewhere. On a list of countries ranked according to BERD, he finds that they can be bunched in groups of five as highest, second highest, and third highest, with the countries in those groups remaining more or less the same over an extended period of years. Canada fits into this group of third highest, moving from 15th to 13th, for example, but never breaking into the set of second highest five.

What he takes away from this observation is that there is a great deal of inertia associated with BERD, which presents a significant challenge to any policy initiative dedicated to moving Canada into a higher international ranking with respect to this variable. “You have to change all the things around this variable to change this variable, and Bill was right on referring to change in culture.”

Gault then examined the relationship between BERD and GDP, using data from 2006. The result is a roughly linear fit, especially when you remove those countries with a ratio of less than 0.5, on the assumption that they represent countries with a distinctly different economic structure. Canada's place, interestingly enough, is exactly on this fitted line. “We're exactly where we should be,” he concludes, pointing to two other countries — South Korea and Spain — that occupy almost precisely the same place. The implication is that it would require a dramatic reinvention of our economic basis to achieve the slightly higher ratio offered by Korea, a prospect that must be weighed by Canadian policy makers.

Proceeding to the second set of variables — those that move — Gault noted that BERD increases just as GDP increases (hence the linear relationship). He notes that the proportion of BERD related to services has increased (from about 30 per cent a decade ago to some 40 per cent today). “That is a structural change that should not surprise us,” though it is complicated by the somewhat different proportion of the GDP that is made up of services. Likewise, R&D personnel is also increasing.

By way of illustrating the changes that have taken place, Gault imagined a Minister of Industry in any given country in 1989. This individual could assemble in a room some 25 CEOs who would be responsible for 50 per cent of the R&D in that country. “If you want to talk about R&D policy, changing things, making things happen, culture, relation to basic research, and the rest, you hire a hall and sit down with these people and you talk to them.”

By contrast, in 2009 this minister would have to hire a room large enough to accommodate 75 CEOs, perhaps also drawing a distinction between those representing service industries and those representing primary industries. Even today, there is still

sufficient concentration that if you really want to instill a new direction, you can speak directly to the people who will make it happen.

With respect to moving BERD, he points to instruments such as Scientific Research and Experimental Development tax credit program, ICT tax credits, Strategic Aerospace and Defence Initiative, and the NRC's Industrial Research Assistance Program. Our approach contrasts sharply with that in the United States, where the percentage of GDP allocated to direct government funding to BERD is much larger than the indirect support; in Canada, indirect support overshadows direct. "We're absolutely different from the United States in the way in which we do it. The way in which we support R&D in Canada is trot out the SR&ED program, with complementary provincial programs, everybody applies and away we go. In the United States, defence, Homeland Security, environment, various other big government departments will commission work to advance their agenda. They will support R&D, however that is a different way of doing business. It requires knowing what you want done, and having an agenda."

Finally, with respect to the third, tantalizing, fast-moving variable, he looked at firms performing R&D. This number appears to have doubled between 1999 and 2007, which should perhaps be cause for celebration. Why might this be so? One suggestion is that as large R&D-performing firms have collapsed, many smaller equivalents have emerged from their remains. However, the figures do not appear to be related to major upheavals such as the dot-com collapse.

"Maybe it isn't large firms collapsing and small firms appearing. Perhaps more firms want to do R&D. Perhaps more firms are discovering the SR&ED and provincial programs, with a little help from their friends in other organizations. Or is a mix of all of the above?"

— Fred Gault, Professor Extraordinaire, Tshwane University of Technology, South Africa

Gault then posed these questions to prompt further discussion:

- is Canada really lagging?
- do we need more business R&D?
- is Canada taking advantage of the global economy?

With regard to lag, then, he pointed to the case of the Canadian automotive industry, cited by the Council of Canadian Academies for not carrying out its share of R&D, yet overlooking the fact that the Auto Pact consciously created a North American industry. In that multinational context, then, the industry's R&D contribution appears to be adequate. Other instances may prove the same point.

"If we are going to compete in a global world with China, with India, Brazil, Indonesia — many countries out there ready to bury us — then we'd better become a little more

comfortable with risk, speak a few more languages, and be willing to trade across a number of borders.”

— Fred Gault, Professor Extraordinaire, Tshwane University of Technology, South Africa

Bill Buxton responded enthusiastically to Gault’s insistence that the OECD does in fact understand the difference between basic and applied research. When he asked where he could find OECD reports from the last four years that actually breaks down these numbers, Gault was sure such existed, but could not tell him exactly where to look. In this context, then, Buxton asked Gault how he reconciled a use of the term “R&D” as a single entity, not distinguishing pure and applied research. “If Mansfield’s right, then lumping these things together without making these distinctions has the potential for real distortions in terms of our analysis,” argued Buxton.

Gault responded that when he was with Statistics Canada and collecting R&D information from firms, he was not convinced that the people running those firms were properly distinguishing between these activities, and so he did not allow these results to be published. The only recourse is to expand the scope of StatsCan surveys to take this distinction into account, as well as training people in companies to make that distinction for themselves. However, it will be hard to justify this investment of time and energy simply. “People do not want to provide information for the public good, in this or any other OECD country. So you give me a reason for spending people’s time imposing a tax in order to get this information, and I’m sure my distinguished former colleagues at Statistics Canada will be able to do it.”

Buxton remained unsatisfied: “The numbers are wrong, and they distort the data. The BERD may make us comfortable that we belong where we belong, but it’s a foul definition.”

Gault responded that the distinction remained elusive even within companies where he was able to query directly, asking them if they themselves could determine where the line between pure and applied was drawn. Many could not do so.

Another questioner asked about the specific sources of information regarding Small and Medium-sized Enterprises. Gault noted that it is collected indirectly through Revenue Canada figures rather than a direct survey, so as to relieve some of the administrative burden on such firms. This approach began in 1997, aiming at firms doing less than \$1 million worth of R&D every year; more recently this cutoff point has been raised to \$1.5 million.

Panel 1: The Changing Nature of Industrial Research

Panelist: Raymond Leduc, Director, Bromont Manufacturing, IBM Canada

Panelist: Nolwen Mahé, Director for Montreal, Office of the Chief Scientist, SAP

Panelist: David Miller, Senior Vice President, The Woodbridge Group
Moderator: Peter Carbone, Chair of the Board of Directors, Coral CEA

Carbone set for the goals of the panel: get a perspective on the current status of industrial research in the field, and what is driving the current type and amount of R&D work that is being done. “If we want to understand any changes, we have to understand what the reference position is.”

He started by asking why a company would choose to do industrial R&D, and why they would choose to do so in Canada. Leduc responded by making reference to Bill Buxton’s “long nose” assertion, and in particular the extensive time frame that it captures for the R&D process to move from basic research to commercial product. “R&D and innovation is all about time — investing today for the future,” said Leduc. “You cannot run a successful business in a fast-paced industry like IT without investing today.”

Mahé noted that accepting the reality of the “long nose” could be a bit disheartening, since the horizon was so far removed from the original work. She offered a somewhat more inspirational interpretation, of R&D as a tree-like growth that branches out into different areas over different time frames.

Speaking directly to the question of why R&D is essential, Miller argued that it represents a core tenet of business looking forward. “You need to have new products, services, and processes to be competitive on a global basis.” Moreover, doing so in Canada is obvious to him, since this is his business’ home base. Canada represents a secure environment to carry out such work, referring to the respect accorded to IP and other proprietary rights. He contrasts that to a setting like China, where there is far less assurance that any innovation will remain within the firm. He also praised Canada as a source of talent, including not only the business skills but also the linguistic diversity that has enabled his company to operate around the world. And despite the rising costs associated with the stronger Canadian dollar, he insisted that the country still represented a highly cost effective location for work.

Carbone then asked about the impact of global competition, especially in determining where R&D would take place. Mahé acknowledged the influence of decisions that are being made in other countries, but she insisted that her firm was highly invested in Canada, so much so that it is logical to continue working there. “The decision to do a specific project in a specific location represents an aggregation of factors. It takes some time to come to a decision point, but for the decision regarding where to do this research, the conditions have to be stable and favourable. What we need to remain in Canada is for this aggregation of factors to be stable and favourable.” Some of those factors, she noted, included the level of support from government agencies and the kind of talent produced by the educational system.

Leduc credited the decision to base R&D in Canada to a particular vision, invariably from within an organization rather than being imposed from outside.

“The biggest hurdle you have in convincing people to do something is on the inside, not on the outside. If you have a team with a real desire, leadership, and vision that is ready to fight for Canada, then Canada is going to win most of those battles. We have tremendous people. We have proximity to the market. We work well on an international basis. We can be comfortable in a room full of people from around the world. We’re not afraid to voice our opinions, and we do it in a forceful but polite manner.”

— Raymond Leduc, Director, Bromont Manufacturing, IBM Canada

Miller explained that decisions surrounding the siting of R&D become especially important during the final phase of the “long nose”, an intense concentration of resources as a product is being prepared for market entry. At this point, the work may shift to a particular client’s home base in order to facilitate the best use of people at this stage. Nevertheless, he endorsed the virtues of leaving more fundamental steps of R&D that are likely to remain in Canada, even if later ones migrate to places occupied by customers.

Mahé also noted that there could be internal competition to locate aspects of the R&D process in Canada, with that division of the company’s business having to confront bids to move this work to other parts of the company elsewhere.

Carbone then asked the panel to weigh off the pragmatic business issues that could take R&D work out of Canada against those nationalistic, emotional factors that could keep it here. Miller used the example of the Honda Civic to illustrate how this balance is struck; in light of all the subcontracting that goes into the development of this product, many groups in many countries will invariably take part, even if the administration remains centred in Japan. Just as global supply chains have become a given in most industries, so too is a global innovation chain starting to take on the same kind of importance. Sharing this work will become essential to R&D success, just as the sharing of manufacturing has already become.

Mahé offered an analogy to an ecosystem, rather than the straightforward supply chain. If a country’s business environment features access to a diversity of companies, available for collaboration in various types of undertakings, this setting will ensure that the work remains embedded there.

Referring specifically to those elements that would drive a decision to work in Canada, Leduc suggested that these are straightforward: the track record of the participants, the cost of the project, and how likely is the result to be successful. Miller concurred, adding that past performance had to be complemented by the quality of a current proposal. Mahé further added that the agility and responsiveness offered by a Canadian candidate would also contribute to its selection.

In light of these observations, then, coupled with the touted virtues of Canada, Carbone asked the panelists why the measured statistics point to R&D spending in Canada being relatively low.

Speaking as one of the people who filled out the long forms that contribute to those statistics, Miller reiterated Buxton's assertion that the data are simply not being collected properly. Leduc added that testing techniques such as modelling would help frame where an R&D venture is proceeding, making a case for moving ahead. Likewise, Mahé described a useful European method of bringing in students to complete their education even as they are contributing to the company's R&D efforts.

Miller suggested that the value chain in Canada was too limited, which in turn limits our ability to carry out the full spectrum of R&D activities here. Many "dirty" industries have left this country, so that particular aspects of work that might depend on such industries can no longer be conducted here. "I would prefer that we invest in those industries and control them and optimize them, rather than simply divorce ourselves from reality and hope that the Chinese will do a better job on their emissions."

"By choosing to take a very thin slice of the value chain, we diminish our investment, we diminish our return. We're much better off looking at the whole system and investing in a sustainable economy."

— David Miller, Senior Vice President, The Woodbridge Group

Expanding on this theme, Mahé noted that Canada's multicultural makeup stands it in good stead, since any given project can attract participants from around the world. Leduc noted that his arm of IBM has been working diligently to pull different types of work into Canada, without attracting too much attention to this trend lest it fuel competition for the important body of activity that is consequently being concentrated here. "We're humble, but we deliver. So we're going to pick off the pieces, one by one, and drag them to Canada. Hopefully, we'll wind up with something really exciting."

Miller reiterated the necessity of locating crucial work as closely as possible to the customer. With respect to competition then, he regards it as essential to the health of any industry, and a willingness to compete as essential to the health of businesses within an industry. "To be the best, you almost have to have an elitist approach." Leduc echoed that opinion, observing that Canadians have no problem with this approach when it comes to competing in hockey, but they are less committed to it in business affairs. Mahé extended this analogy further, suggesting that enterprises succeed according to how they assemble and field their own teams.

"Innovation is actually what brings value to our customers. We need to have customers out there telling us 'this is value for us'. Strangely enough, our pace of innovation often outstrips what our customers can take. That is one of the reasons for working hand-in-hand with our customers. Getting them to adopt it is something that may take years more, and we need to fill this gap in terms of sustaining the product long enough that it can arrive in the culture."

— Nolwen Mahé, Director for Montreal, Office of the Chief Scientist, SAP

Doug Barber subsequently asked the panel about the “development” half of R&D. “When you’re in a small company, the development is often about your people.” He cast this as an important observation in light of the statistics showing large companies performing R&D is shrinking, while the number of small companies is expanding. He cited personal experience in this regard, recalling how his own firm Gennum was helped by larger partners such as Xerox, which eagerly coached his staff. “We benefitted a great deal from the help that those companies gave us. Do you do anything to help these small companies in the things that you’ve learned, that have permitted you to succeed in developing your products and services and people?”

Leduc replied that his firm takes great pride in the work it does with smaller firms, describing it like a school or a university from which people graduate. He offered the example of working with a small company in Sherbrooke that had developed a phase change material that could store cold; although originally developed for cooling truck cabs, they have adapted it to help cool large IT installations, storing overnight cold for use during the day.

“Customers come to us, to get access to our people. They can find buildings anywhere in the world, they can buy commercial equipment. What they can’t get access to without coming to us directly is access to our people.”

— Raymond Leduc, Director, Bromont Manufacturing, IBM Canada

Miller acknowledged that the current economic environment was not as charitable as the question would warrant. Much of the company’s work revolves around supply chains, an area where there could be improvements in costs or quality. There is some sharing in this regard, though perhaps not as much in the field of R&D. What collaborative R&D they do with smaller companies tends to be along these lines, of streamlining processes or reducing costs.

Mahé turned the question around, suggesting that she and her colleagues had more to learn from their smaller partners, rather than teaching them. “We want to learn from them their agility, we want to learn the way they manage not to let people know they are a start-up.”

Keynote: Why Firms Do R&D

H. Douglas Barber, Distinguished Professor-in-Residence, McMaster University and former CEO & Co-Founder, Gennum Corporation

Starting from a pointed premise, “we aren’t making the products people want”, Barber tackled the academic assumption that simply carrying out research will inevitably lead to

some kind of commercial success. Barber dubbed this a half-truth, one that we have been able to sustain because much of Canada's prosperity has been premised on our rich, resource-based economy. His own career has witnessed the slow and much-resisted introduction of the notion of "development" into official support for R&D, which had traditionally focused more on pure scientific investigation than on applied commercial output. In fact, R&D incentives are often set up in such a way that money flows only when a company has no sales, actually becoming a disincentive to making a profit.

Harkening back to the federal government's decade-old call to improve Canada's international standing in R&D activity, Barber outlined some of the results of an ongoing review of industry performance that he and Jeff Crelinsten have been conducting for several years. This review distinguished various types of companies, based on their R&D intensity, which is based on the ratio of the firm's R&D spending and its revenues. In 2001, for example, they found only 228 companies that had sufficient revenue to sustain healthy R&D spending. Out of a total of almost 9,000 firms, this small group of "R&D Leaders" was conducting about 65 per cent of Canada's private sector R&D. About 6,000 firms were start-ups with little or no revenue and small firms with some revenue, but struggling.

According to Barber, people in this large group of early stage and start-up firms, which he calls "the greenhouse", are often no different from university faculty members, who embrace an ideal of doing research and being paid for the privilege. "Of the 20,000 companies doing R&D in Canada today, I would estimate that about 80 per cent of them are in this space. They will be doing something in the region of a quarter, or maybe a little bit more, of Canada's industrial R&D." Much of this work is being financed.

"Why do these companies do R&D? They do it because all good things will come soon. They can articulate a good story for why they should be funded."

— Douglas Barber, Distinguished Professor-in-Residence, McMaster University

Barber described results of interviews he and Crelinsten conducted with former CEOs and investors in 18 companies that no longer exist due to bankruptcy, liquidation or sale. These firms had been typical "greenhouse" firms. On average, they were funded for seven years, at levels of more than \$4 million annually. Yet almost half of them never had a customer! Often, he emphasized, the work being carried out was technically brilliant. These firms did not disappear because of lack of financing or inferior technology. He firmly rejected the notion that commercial success of R&D-intensive companies hinges on the funding of science and technology. "The problems in Canada are not financial, and they are not technical."

By way of defending this notion, Barber outlined the traditional conception of a linear progression of commercialization, which begins with research taking place in an academic setting and then somehow moves into an industrial setting. Such a model flies in the face of how commercial enterprises grow. Short-term stimuli, such as government

support or venture capital investment, do not guarantee successful sales. If such stimuli are applied for as much as seven years before significant sales occur, Barber insisted, they are taking too long.

“Half of the companies that we interviewed, after seven years, didn’t have a customer, had never had a sale, and could not name a customer in the market that they said they had this idea for.”

— Douglas Barber, Distinguished Professor-in-Residence, McMaster University

Another major group of Canadian firms invest in R&D at a low level, relative to their overall expenditure and sales. Because these are generally large, resource-based businesses — in areas such as mining, pulp and paper, or oil — their revenue is large, so that R&D spending is less than 0.5 per cent of the total revenue. Even so, they account for some 15 per cent of all firms conducting R&D. “They do R&D to improve their processes, technology, and productivity. They don’t work in Canada to find ways of increasing the value-added on the resource. We sell oil, we sell gas, we sell wood, we sell minerals. We don’t move up the value-added scale.”

“This group of companies tolerate the research talk, and passively support governments and academics that are caught up in the half-truth that has often failed to deliver for them. These companies do have customers, and they generally have revenue from the customers. Innovation occurs throughout this, and they actually do get feedback from their customers.”

— Douglas Barber, Distinguished Professor-in-Residence, McMaster University

Barber finally returned to the tiny group of R&D leaders that are spending about 13 per cent of their revenue on such activities, earn only 14 per cent of all the revenue brought in by all companies conducting R&D, yet carry out over 60 per cent of the country’s industrial R&D. “Their whole model starts with customer needs, and their ideas are for solutions to those customers’ needs.” This can address manufacturing, operations, and even pricing, an area that often puts off many enterprises, because they do not realize how large a portion of the market they actually command. “The commodity culture so pervades our thinking that we think we’re in a commodity market when we may have the whole market.”

Barber underscored the fact that this emphasis on customers does not resonate in Canadian academic discussions of R&D, which is regarded as an end in itself rather than one directed to supporting an enterprise. In the United States, by contrast, academics are responsible for finding a portion of their own remuneration, since the university only gives them a salary for the academic term. This obligation to finance 3-4 months of their annual salary gives them a very different outlook on the purpose of their work. This arrangement may seem less “pure” to Canadians, but it yields much more outstanding

output on the part of American researchers, who garner more than their share of achievements such as Nobel prizes.

“Customers is a word that isn’t used in Canada. And creating value for your customers is not something you talk about either. By definition, the scholarly activities of exploring and uncovering new knowledge is of value, and society should pay for it.”

— Douglas Barber, Distinguished Professor-in-Residence, McMaster University

As an example of this contrast between the American and Canadian academic perspective, he pointed to the Massachusetts Institute of Technology, which at 10,000 students is smaller than most major Canadian universities, yet has nurtured dozens of Nobel Prize winners. “Their mission is very different from the mission at McMaster, where I sit. Their mission is for their students to go out and change the country, and change the world. McMaster’s mission is for their scholars to become world renowned, to become famous for the quality of their research and their scholarly activity.”

With respect to the firms qualifying as Canada’s R&D leaders, then, they articulate much the same outlook as an institution such as MIT. They envision the potential to expand into new and larger markets, primarily by creating value for customers in those markets. That said, noted Barber, these same firms indicate that they are not always certain if they will be conducting this work from Canada. Most of their business will be found outside of this country, and they could readily justify moving closer to key clients. “What they said was that the culture of commerce in Canada is the pits, and that was a pretty universal response. That’s something we need to take seriously.”

The lesson he derived from encountering these R&D leaders is that their success exemplifies a model entirely different from the received, traditional interpretation of commercialization. “It’s different in so many ways that we just about don’t know how to comprehend it.” As further proof of how little we understand, Barber cited the fact that while most of the firms remaining in Canada had annual sales under \$100 million, they disappear from this country as they grow, so that the number with revenues over \$500 million can be counted on one hand. He subsequently showed a graph tracking growth of firms over their commercial lifetimes, with almost no Canadian examples of enterprises that make it past the \$500 million revenue threshold. Given that such progress is being displayed by competing ventures in other parts of the world, this has implications for Canada’s relative prosperity.

“Our challenge in Canada is keeping our commercial success. It’s about beliefs and culture. It’s not about money, it’s not about technology, it’s not about science. Those are all necessary elements, but we have them. What we’re missing is the right concepts about how commerce happens, and what it takes, encouraging our people to do those things and encouraging them to stay here doing it.”

— Douglas Barber, Distinguished Professor-in-Residence, McMaster University

A questioner asked Barber what he would do to transform Canadian attitudes from “it can’t happen here” to “it could only happen here”. He replied that it is essential to resolve the fundamental disconnect between the federal government — which funds a great deal of research — and the provinces, which are increasingly incurring additional expenses as those funds are administered through universities. There is no collaboration on how this funding is deployed. “We need to get the post-graduate learning experience, which is the research of the university, harmonized with the whole learning environment. And it needs to be national.” In addition, he advocated a move toward making support faculty members more self-sustaining, as it is in the United States, which would foster just this kind of collaboration.

Panel 2: Industry-University Collaboration

Panelist: Tom Corr, President & CEO, Ontario Centres of Excellence Inc.

Panelist: Robin Harkness, Associate Vice President, Program Leader, Sanofi Pasteur

Panelist: Janet Walden, Vice President, Research Partnerships, NSERC

Moderator: Tom Brzustowski, RBC Professor, Telfer School of Management, University of Ottawa

Brzustowski asked each panelist to begin by citing a success story that illustrates what happens when industry-university collaboration goes well. Corr referred to RIM and Open Text, both Waterloo-based examples. “There’s two examples of companies that are really making a difference to the economy, that came out of universities, and still have great ties to the university.”

Harkness indicated that some of his company’s products have been developed in direct collaboration with university partners. The firm actually has its roots in Connaught Laboratories, which were part of the University of Toronto. Having since merged with Sanofi-Aventis in France, this expansion has broadened collaboration with other partners. Walden argued that the real success story has been the development of highly skilled people to address matters of economic significance. She pointed to the expertise at the University of Alberta that has been assembled to deal with the challenge of developing the province’s oil sands. Similarly, a small company called Integran, which specializes in advanced metallurgical nano-technologies, has spun off from materials work that was being done at the University of Toronto; it continues to collaborate with the university by way of adding to its staff from the pool of graduates, as well as developing new products in order to enter new markets.

Brzustowski laid out the premise that university-industry partnerships emerge whenever industry defines a problem that cannot be solved by existing knowledge, calling for original investigation. The demand for this knowledge represents a “market pull” for the university, enticing young people to enter this area and the related industry. “That’s a nice theoretical description,” he concluded. “How much of this is true?”

Corr insisted that this represents an accurate picture, referring specifically to the University of Waterloo's venerable co-op program. This and other initiatives have successfully consolidated the "market pull" for new talent within industry. Harkness concurred, offering the example of the pertussis vaccine that was developed through a national network of experts; the success of this project continued well after the product itself hit the market. "The clinical networks, through the universities and through the hospitals, were expanded. As a result, we went from producing 2.5 million doses of vaccine a year to 50 million doses. And we still have this network of clinicians that are working on the project. Money has gone back into the university to help establish a human challenge centre at Dalhousie University in Halifax, for anyone that has a vaccine to bring forward into humans."

Walden clarified the initial premise by considering what kind of problems and solutions are being brought forward, cautioning that there is no one-size-fits-all arrangement. Some problems may be better suited to a college setting than a university; some may be short term interactions, while others evolve into long term partnerships. "It's really critical up-front to offer a spectrum of opportunities that does not skew the business into going into the wrong kind of partnership for the wrong reason."

Corr noted that the model for centres of excellence had evolved in this way. Initially, networks revolved around identifying interesting intellectual property being developed at a university, then find an industry partner who also found it interesting. That strategy has now been inverted, with industry partners driving the research agenda, with a commitment to jobs and economic development preceding the search for any specific IP.

Harkness reiterated this view of intellectual property as a challenge, particularly in dealings his company has with university technology transfer offices. "We need to be realistic and we need to work as partners. Frequently there's an expectation that it's worth more than it is. Commercialization is viewed as licensing a patent rather than having a product. The unfortunate thing is that if the entry cost is too high, industry will walk away."

For Walden, one of the biggest hurdles to the success of university-industry collaboration has been building an effective working relationship. "How does an industry find the right academic partner, attract their interest? From the academic perspective, how do we know what the problems are in industry, and how do we know who to talk to?"

Brzustowski confronted the panel with the prospect that universities might actually be better off at a remove from industry, concentrating on more fundamental, abstract, and long-term investigations rather than the day-to-day demands of the business community. "Do university-industry partnerships displace curiosity-driven research? Can they co-exist?"

Corr insisted that there is room for both types of research. Not all research will have commercial potential, nor is it necessarily intended to be so. Nevertheless, there is also a

need for more short-term work that will lead directly to market-ready IP. “A good balance of both is needed. You never know when basic research is actually going to turn into something that could be commercialized, and create an industry around it.”

Sanofi-Pasteur is eager to strike that balance as well, according to Harkness. “When we set out to explore developing a vaccine for a new target disease, we know what the organism is. We scan the field for experts working with that organism. It could be very basic research, someone who has devoted much of their life to looking at this organism, if out of their work there’s an indication of certain molecules that might be relevant to vaccine development. We would then approach those people and see about developing or applying their discovery into our business.”

Walden resisted any strict delineation between pure and applied research. She argued that interesting research queries are where you find them, be it in the published literature, through exchanges with colleagues, and from industry as well. It is not skewing the university’s research mandate to draw from each and every one of these sources.

“Many researchers are working across the board all the time. Part of their portfolio is in fundamental research, part of it is more applied. There’s also a huge myth out there that if you’re working with industry, somehow you’re working in the applied spectrum. Not so. We have industrial chairs that are 20 years in duration. These are long-term research programs, they’re not specific projects to answer a specific question.”

— Janet Walden, Vice President, Research Partnerships, NSERC

Brzustowski quoted Michael Raymond, acting head of the National Research Council, who repeatedly said that the intellectual property created by publicly funded research should be turned over as quickly and as easily as possible to somebody who can make money with it in the Canadian economy. “How far away are we from actually doing that?” asked Brzustowski.

Harkness indicated that progress had been made in this regard, but it still depends on successful negotiations with universities, who must see this step as the first one of many on a long and expensive journey. “The idea of commercialization being the licensing of a patent, as opposed to bringing a product forward, that mind-set still hasn’t completely hit home.”

Corr has direct experience with this issue, having worked at two universities with radically different IP policies. At Waterloo, researchers simply owned their work outright. “The incentive to commercialize that IP is left 100 per cent in the hands of the inventor, the entrepreneurs, and the employees of the company that are going to get involved.” In contrast, once universities insert themselves into this arrangement, it serves only as a disincentive for potential partners. Better to get the possibility of innovation out the door as quickly as possible, he maintained, than to let its progress become bogged down by negotiations.

Walden took up Corr's assertion, reviewing how universities' outlook on technology transfer has evolved. Where they initially saw these operations as self-sustaining, money-making ventures, they are coming to understand that the returns on this work take a very different form, over a much longer term, through alliances with businesses that emerge from academic research.

Bill Buxton interjected from the audience, asking if anyone could think of a university technology transfer office in Canada that had not always run at a loss. Corr argued that Waterloo's office did make money, but only because of the policy that left negotiations in the hands of the researcher, rather than university administrators. "It's done very well, but it's had to earn its way. By and large, the researchers there are free to do whatever they want, and if the tech transfer office at the University of Waterloo is seen as a viable provider of services, then they'll sign up with them and the university will take a piece of the action."

"For people who have the experience in building companies and doing commercialization, the tech transfer office isn't needed. Even with that said, where the university takes nothing from the deal, unless the tech transfer office is engaged, the tech transfer office made money ten of the ten last years I was involved with it."

— Tom Corr, President & CEO, Ontario Centres of Excellence Inc.

Brzustowski finally asked the panel to look toward the future, and at a new model of collaboration with a broader interpretation of "open" innovation that draws from a wider variety of research sources. By way of example, Harkness described work on a tuberculosis vaccine that began at a state-run research institute and has now moved into the company for the next phase of clinical development. His organization actually has a division dedicated to external research and development, which scans the world for technologies or ventures that could have applications for their work.

Walden suggested that open innovation could have various interpretations depending on particular sectors. Open innovation might be understood as skirting any claim on IP in order to fast-track an information technology discovery, but research pertinent to the pharmaceutical industry will still face a daunting array of costly follow-up work before its potential can be realized. Corr added that the virtues of open innovation can also be stymied when universities impose ownership restrictions or other limitations on the use of any resulting product. Similarly, Harkness noted that when participants in a project belong to different institutions, those respective employers may also try to impose their own claims, further complicating matters.

During questioning, Mahé added another criterion that could impede open innovation: liability, such as the university being responsible for any leak of information through agents such as students. Walden replied that NSERC was currently drafting specific sets of roles and responsibilities during the course of a collaboration, for students, faculty

members, and industry. Brzustowski asked if this process could be streamlined by framing sector-specific templates, but Walden said that lawyers generally impose an individual agreement in each and every case.

Ron Freedman asked the panel if any Canadian university had ever defended a patent in court. Corr said that Waterloo had done so, and Walden recalled a couple of cases that nearly went to court, noting that this is an expensive step that most parties would want to avoid. Freedman followed up by asking what the rarity of such defences implies about the ownership of IP. After estimating that the value of all the IP owned by all Canadian universities comes to around \$60 million, he proposed that the federal government could simply buy out these rights and so permanently avoid any further interference from these institutions in the R&D process.

Corr rejected this prospect as impractical, since only a small portion of this IP pertains directly to commercialization activities that generate a financial return for the university. “You can’t look at the royalties collected by the tech transfer offices as a measure of anything.” That applies especially at the University of Waterloo, where researchers are encouraged to take inventions directly to market rather than going through this office. “When I started there, [university president] Dave Johnson said ‘look, don’t screw around with the IP policy here or they’re going to hang you from this tree out in front of your office. You just make a bunch of rich guys and gals and I’ll get the money from them later.’ And he does a wonderful job of doing that.”

“We got zero in royalties from RIM when Mike walked out the door. We got zero from the profs when they started Open Text. But they have created thousands and thousands of jobs in Waterloo. Over the last three years, the Waterloo community through the university has got \$200 million back from RIM as donations. How do you measure that in light of royalties?”

— Tom Corr, President & CEO, Ontario Centres of Excellence Inc.

Rory Francis, Executive Director of the Prince Edward Island BioAlliance, suggested that the specific terms of a university’s IP policy were not as important as the clarity of the policy itself. “They’ve got to be seen to be commercially oriented. They often don’t know what that really means, but they get pulled in that direction without necessarily having the right people in those offices, who understand the needs, the timelines of the private sector and that university folks can’t be seen to be robbed blind of something that’s very valuable.” The same applies to potential innovations found in public sector research agencies.

Walden listed two initiatives, Federal Partners in Technology Transfer and the Alliance for the Commercialization of Canadian Technology, which are starting to work together on the clarity Francis demanded.

Bill Buxton recalled two frustrating instances involving projects Microsoft offered to

universities in the US and Europe, making \$10 million available on the condition that these institutions would make no claim on the resulting work. In both cases the money was turned down by administrators who preferred not to sign away IP rights that might conceivably have been worth more. He added that he had never taken part in an academic project that was entirely funded from a single source, raising the question of why an institution would seek a claim for 100 per cent ownership of the outcome. If that is the desire, then take the work in-house and do it in a corporate setting, rather than a university. If such ownership is not crucial, then simplify the whole situation by letting go of any claim to it.

“Eliminate patents from universities and take it off the table as a means of rewarding academics, and life will become simpler. The thing that’s valuable isn’t the patent but the wetware, the brains that walk out of the universities and into your organization.”

— Bill Buxton, Principal Researcher, Microsoft

Walden and Corr each responded by referring to the fact that universities may not always want to assert ownership, but they did want to preserve the right to publish the results of research, even if it pertained to some IP that would ultimately be held by a corporate partner. If this stipulation can be met, then most academic participants will be satisfied.

Panel 3: Policy Implications

Panelist: Jim Roche, President & CEO, Stratford Managers Corporation

Panelist: Samuel Stevens, Executive Director, Ontario Region, NRC-IRAP

Moderator: David Crane, Global Issues Columnist and Author

Crane set the discussion in the context of the world’s recovery from the recent economic crisis, which is leading to new competitive pressures. “For Canada that means if we don’t get smarter, we’ll get poorer.” Unfortunately, just as the stakes get that much higher, we may find ourselves becoming ever more risk averse. In that light, therefore, he asked the panel to consider the broader question of just what sort of problem our policy is trying to solve.

Stevens spoke directly to Fred Gault’s discussion of Canada’s low BERD ranking, and specifically a slide that showed the ratio between direct and indirect support for business R&D. “While I’m not taking issue with the SR&ED program, because I think it’s a good program, it does favour larger firms, or well capitalized firms. While big firms, or well capitalized firms, can carry R&D expenses until they get their SR&ED refund, small firms can’t. They just don’t have the cash flow to carry it.” That is a problem in Canada, where some 87 per cent of firms have fewer than 20 people and 75 per cent have fewer than 10 people. These are enterprises that cannot be enticed into anything as risky as an R&D endeavour.

Meanwhile, Canada has only 3,000 firms with more than 500 employees, many of which are subsidiaries that would only do R&D in whatever country they are based. On the other hand, there are 20,000 medium size firms of 100 to 500 people, and many of these are also subsidiaries that will not do R&D here. Our goal, therefore, should be growing more firms large enough to carry out this work, as well as making this a less risky program for smaller enterprises.

“We don’t have enough firms who’ve got the financial heft to do significant R&D. Take three firms in the United States: Pfizer, Merck, HP. Those three firms did more than \$16 billion in R&D in 2007. That’s more than all the firms in Canada, all the 1.1 million firms.”

— Samuel Stevens, Executive Director, Ontario Region, NRC-IRAP

Roche cast one of the challenges as that of overlooking the high quality of life that is already enjoyed by Canadians. We regularly compare ourselves with the United States, which can be misleading because it is a full order of magnitude larger. “The structure of industry in Canada versus the US is pretty much the same, except for the very large companies.” Nevertheless, our quality of life is diminishing relative to the United States, because of a gap that he regarded as cultural in nature, rather than structural. “Compared to many of our global competitors, we are complacent and risk averse.” Moreover, those incentives to R&D that we do provide are in fact unfocused, intended to appeal to one and all, rather than being targeted to achieve optimal results.

“Many companies fail or struggle because they try to do too much. And in Canada, we’re trying to do everything. Our focus is lacking. We should be focusing on the winners. There are clusters that are winning, and we should be supporting them more than we’re supporting every other cluster. I’m not talking about discovery or fundamental research. I’m talking about the industries in Canada. The support would be for business research, not university-based research.”

— Jim Roche, President & CEO, Stratford Managers Corporation

Roche insisted that we cannot expect the envelope of money for such purposes to grow, and so it must be reallocated to greater effect. If \$3.6 billion is currently devoted to SR&ED, he would advocate re-directing \$1 billion of that to programs like NRC-IRAP, which are very effective.

Crane recalled his disagreement with Bill Buxton’s portrait of “smokestack” industries such as the automotive sector, which can be properly cast as high tech enterprises. Stevens agreed, suggesting that there is a considerable amount of innovation in automobile manufacture, which is making itself evident through the entire supply chain. As such, it is well worth the kind of targeted support that Roche outlined.

Crane addressed the ongoing dilemma of watching Canadian firms reach a certain size and competence, only to see them then snapped up by foreign interests or otherwise shut out of the market. Roche suggested that this may simply be a stereotype, as Canadian companies regularly acquire American ones. Crane countered that these Canadian takeovers may have a minor economic impact in the US, while US takeovers have a much greater impact here. Roche continued by saying that the acquisition of a Canadian high tech firm by an American one may not necessarily be a bad thing, since it means US money being invested here. Similarly, many “branch plant” operations in fact do a lot of R&D in Canada.

Roche also pointed out that when Canadian firms are taken over, we do lose part of the management skill set that enabled those firms to compete on a global basis. However, the individuals who possess these skills seldom leave the country, but simply carry their expertise into the next generation of Canadian enterprises. “Most entrepreneurs are serial entrepreneurs,” he concluded.

Crane extended this conclusion: “What we’re seeing in the world today is a ferocious competition for talent. Financial capital will chase after human capital more than we’ve seen in the past. Companies which are quite knowledge intensive, meaning they have good research and development arms, are going to become increasingly takeover targets, simply to buy the people who are engaged in that activity.”

Stevens agreed with Roche’s perspective on takeovers, while insisting that many Canadian firms still lack good management talent. “We’re not short on technical expertise,” said Stevens. “We’ve got really smart engineers and scientists, but they don’t have that management experience or knowledge.” More problematic is when founders of firms lose control over the organization’s destiny to later investors, who simply regard the whole operation as another asset to be bought or sold. Reflecting on the loss of Tundra to IDT, when a merger with Gennum could have reaped better results for Canada, Roche insisted that the outcome was determined by nothing more than price, and Gennum could have obtained Tundra had it bid higher.

Crane returned to Bill Buxton’s presentation, and in particular his assertion that universities were being pushed away from more fundamental research activities into work with shorter time horizons and specific outcomes such as job creation, as well as an emphasis on IP that erodes the traditional community of scholars. Stevens responded by saying that there was nothing in principle wrong with universities turning their attention to technical problems that businesses did not have the resources to solve. “To try and force them into doing more is pushing them into something that they don’t do well. But I wouldn’t say stop it altogether; there has to be a balance.”

“We should maintain the role of universities as generators of new knowledge and trainers of high quality personnel. They should focus on what they do well, and let companies commercialize, driven by customer needs and wants.”

— Samuel Stevens, Executive Director, Ontario Region, NRC-IRAP

Roche praised NSERC's Strategy for Partnerships and Innovation program as a means of bridging the significant cultural gap between universities and businesses. "I'd like to see more activity of that nature."

Crane suggested that just this kind of activity could be taking place on many campuses where pre-competitive R&D centres have been established in sectors such as automotive, jointly managed by industry and the university. "This seems to have several benefits. It educates the university on the kinds of challenges industry faces. It gives graduate students exposure to what industry is all about and the kinds of things they need. And for companies it's really a cost-efficient way of doing early-stage applied research."

Doug Barber challenged Stevens on his interpretation of the mandate facing universities. While agreeing that this institution's mandate is not a commercial one, Barber maintained that research eclipses training, which is increasingly being carried out by contract staff or technical assistants. "If the real emphasis was on preparing Canadians to succeed in life, the professors would have to do research just to keep on doing that." Instead, we have a substantial cadre of researchers who muddle through the task of training. "That's why people go out with half a tool kit. The learning environment doesn't put the other half in, and it could put it in."

"If you want a policy direction to go, get to the business of preparing young people for life. It means facilitating commerce and enabling wealth creation. Those have to be some of the learnings they have. However, we live in Canada. It would be virtually impossible for the federal government to put the billions into the universities that it does for preparing young people for life. That's constitutionally not allowed."

— Douglas Barber, Distinguished Professor-in-Residence, McMaster University

Even when the rest of that tool kit is supposedly restored, as in the MBA degree, Barber insisted that it was insufficient. "Many of the disappeared firms have been led by technical people with MBAs. The MBA is a technical degree, like the engineering degree. You learn how to add numbers, and put them into business plans; you don't learn anything about winning the confidence of a customer."

Stevens built on that point with Peter Drucker's quote that the purpose of a business is to create a customer. If most of those customers are global, as they must be for most successful Canadian enterprises, then a national R&D strategy must therefore be cast as an export strategy. In this context, Roche returned to an observation of how eager we are to fund science and technology, when this is not where the greatest need lies. "The problem is in the ability to identify the customer need and then develop a technology that meets that need, a marketing strategy to attract that customer, a sales strategy to find other customers, and operations strategy to deliver those customers. These aren't R&D problems."

“If we want companies to be more successful, rather than giving more money just for R&D, we should be giving money to these organizations to help them strengthen their sales, marketing, business operations, strategy development, and overall corporate leadership skill sets.”

— Jim Roche, President & CEO, Stratford Managers Corporation

Brian Guthrie, a principal at Stantec, indicated that mission-oriented projects invariably succeed, as highlighted by the moon landing. “Look at the innovation that came out of that; it was mission-oriented. Was it public, was it private, was it IP? None of that stuff mattered. It was a bunch of people who wanted to do it and they made it happen.” On that basis, he advocated picking paths where we could make serious inroads into the global economy, asking the panel for their suggestions of appropriate paths. Stevens offered the auto sector as a promising field, where a well developed pool of expertise has been developed over the long term. Similarly, he regarded ICT and clean technologies as obvious candidates, but one lower profile field in which Canada is a global leader is water treatment technology. Roche concurred, adding that Canadian governments needs to take greater risks in order to reap greater rewards. Going to the moon, by way of example, was an exciting way to nurture an enhance tolerance for the risk that would be essential to this venture.

“We as citizens have a responsibility to tell our bureaucrats and to tell our politicians that we expect risk, and we expect failure at times, and it’s okay with us.”

— Jim Roche, President & CEO, Stratford Managers Corporation

Crane suggested that one way of encouraging this mission-oriented mind-set would be for governments to sponsor competitions to solve particular problems, in much the same way that a prize was offered by Britain for a solution to the problem of determining longitude in the 17th century. Part and parcel with that suggestion, according to Roche, should be a scientific advisor to the Prime Minister, helping to identify these high profile problems.

Doug Barber chimed in with his own endorsement of the virtue of directed R&D, which has proven to be effective in enabling eight countries with populations smaller than Ontario to outperform us. At the same time, he would like to find a way of formally backing our winners and enabling them to stay in Canada as they grow. Roche clarified his early comments in this regard, noting that he was referring to picking winning sectors, not winning companies. Conversely, we will have to accept the fact that this means some companies will face greater challenges if they are not working directly in one of these preferred fields. “We shouldn’t be creating an environment that makes it impossible for companies not in the focus areas. Rather we should create an unbalanced playing field to support those industries, those clusters that have demonstrated in Canada that they can be successful.”

Special Presentation: Inaugural John de la Mothe Award for Contributions to Science Policy

Recipient: Fred Gault

“This is in fact a very bittersweet moment for those of us at Research Money,” said Ron Freedman. He explained that the award honours the memory of a close friend and professional colleague, John de la Mothe, who died three years earlier. “He was quite a character, a real gadfly and bon vivant.”

He noted that while there are plenty of awards on the business and academic landscape, there was nothing to acknowledge the fact that sometimes individuals play a valuable role in the field of science and technology policy. “We didn’t want it to be an annual award. We didn’t want to have to find somebody every year who was deserving of the award.” Instead, the process would be taken in-house, as people at Research Money conduct an independent assessment of available candidates.

As for why Fred Gault made an admirable choice, Freedman cited his singular contributions during his tenure at Statistics Canada. “Fred was the guy who was responsible for the S&T statistics that we all rely on to know what is happening in Canada.”

Regardless of the criticism regularly leveled at those statistics, Freedman insisted that Canada has one of the world’s leading systems for measuring progress in research and innovation. The rudiments of this system were already in place when Gault arrived at this division, but he took it much further.

“Fred really moved the yardsticks. He is the renaissance man of science and technology statistics, not just in Canada but internationally.”

— Ron Freedman, Co-publisher, RESEARCH MONEY

In addition to leading his organization forward within Canada as well as on the world stage, Gault was innovative and entrepreneurial in his approach. “StatsCan’s work in this area is a side activity, not a core mandated one. Whenever most surveys happened, it was because Fred and his colleagues had to go out and raise the money from other government departments and other places. In that he was singularly successful, raising money from Industry Canada and many other organizations to do the things that could not be funded directly out of the StatsCan budget.”

“He was a leader, he was an entrepreneur, he was an innovator, and last but not least, he’s a scholar. Unlike many people in government jobs today, this was not just another stop on the road to career progression. He really brought a scholarly approach to the work

done at StatsCan and many of the publications that he authored”
— Ron Freedman, Co-publisher, RESEARCH MONEY

“It’s nice to hear these words while I’m still alive,” Gault jovially acknowledged. He emphasized how much he enjoys working with the people in this field, and indicated that he would be continuing to work with them, albeit from other parts of the world. “I look forward to going on contributing to this subject for a few years to come. And having worked with John de la Mothe over the years, I am particularly delighted by the receipt of this award.”

H. Douglas Barber

Co-founder and Former CEO, Genum Corp and Distinguished Professor in Residence,
McMaster University

H. Douglas Barber, born on a Saskatchewan farm, attended the University of Saskatchewan obtaining his B.Sc. with Great Distinction, winning the Governor General's Gold Medal, and a M.Sc. in Electrical Engineering. As an Athlone Fellow and NATO Scholar he received his Ph.D. from Imperial College, University of London in 1965. Dr. Barber began employment in 1965 in a new microelectronics initiative at Canadian Westinghouse, Hamilton, Ontario, Canada. In 1973 he was one of the founders of Linear Technology Inc., now known as Genum Corporation, which designs, manufactures and markets microcircuits. Genum has grown profitably at 20% per year and now employs about 650 people. Dr. Barber was President and CEO when he retired in 2000. He retired as a Director in 2007. Doug Barber was a part-time Engineering Physics Professor at McMaster University from 1968 to 1994. In 2001 he was appointed Distinguished Professor-in-Residence. He is a past Chair of the Board of Governors and recently has been designated an Honorary Governor. Dr. Barber also presently serves on various research boards, task-forces and committees at the University. The recipient of numerous awards and distinctions that honour engineering and entrepreneurial achievements, Dr. Barber was made an Officer of the Order of Canada recently awarded an Honorary Doctorate of Science from the University of Saskatchewan. Dr. Barber has been involved in numerous advisory committees and corporate directorships, including director of DALSA Inc. from 2005 to 2008, NetAccess Systems Inc. since 1994 to 2009. He also is presently a director of Micralyne since 1997, AllerGen NCE Inc. since 2003, and The Institute of Quantum Computing since 2006. In 2009 Dr. Barber joined the Boards of the Centre for Probe Development and Commercialization, the Centre for Surgical Innovation and Invention and the IRAP Advisory Board. Dr. Barber has authored 29 refereed papers and several patents. He speaks frequently on business, technology, learning, innovation and economic development. He and his wife, June, have raised a family of four whose families now include ten grandchildren. He is a man of faith with over 37 years of active involvement in their church.

Tom Brzustowski, RBC Professor, Telfer School of Management, University of Ottawa;

Board Chair, Institute for Quantum Computing, University of Waterloo

Tom Brzustowski is the RBC Professor in the Telfer School of Management of the University of Ottawa. He is also Chair of the Board of the Institute for Quantum Computing at the University of Waterloo. His recent work on innovation, R&D, productivity, and related issues is published in the Internet Journal *Optimum Online* and the book: *The Way Ahead - Meeting Canada's Productivity Challenge*, published by the University of Ottawa Press in 2008. Dr. Brzustowski was President of NSERC from 1995 to 2005. A registered professional engineer (P.Eng.), Brzustowski taught mechanical engineering at Waterloo from 1962 to 1987, and also served as Vice-President, Academic at the University from 1975 to 1987. After that he was Deputy Minister of Colleges and Universities and later of the Premier's Council in the Government of Ontario. Tom Brzustowski is an Officer of the Order of Canada, Fellow of the Royal Society of Canada and of the Canadian Academy of Engineering, and holds honorary doctorates from numerous Canadian universities. In 2006 he was awarded the Gold Medal of Professional Engineers Ontario.

Bill Buxton

Principal Researcher, Microsoft Research

Bill Buxton is a relentless advocate for innovation, design, and - especially - the appropriate consideration of human values, capacity, and culture in the conception, implementation, and use of new products and technologies. In December 2005, he was appointed Principal Researcher at Microsoft Research. Prior to that, he was Principal of his own Toronto-based boutique design and consulting firm, Buxton Design.

Buxton began his career as a composer and performer, having done a Bachelor of Music degree at Queen's University. He then studied and taught for two years at the Institute of Sonology, Utrecht, Holland. In 1975 Bill started designing his own digital musical instruments. This is what led him to the University of Toronto, where he completed an MSc in Computer Science, and subsequently joined the faculty. It is also the path that brought him into the field of human-computer interaction. From 1987-89, Buxton was in Cambridge England, helping establish a new satellite of Xerox's Palo Alto Research Center (EuroPARC). From 1989-94 he split his time between Toronto, where he was Scientific Director of the Ontario Telepresence Project, and Palo Alto, California, where he was a consulting researcher at Xerox PARC. From 1994 until December 2002, he was Chief Scientist of Alias|Wavefront, (now part of Autodesk) and from 1995, its parent company SGI Inc. In the fall of 2004, he became a part-time instructor in the Department of Industrial Design at the Ontario College of Art and Design. In 2004/05 he was also Visiting Professor at the Knowledge Media Design Institute (KMDI) at the University of Toronto. He currently splits his time between Redmond and Toronto. In 1995, Buxton became the third recipient of the Canadian Human-Computer Communications Society Award for contributions to research in computer graphics and human-computer interaction. In 2000 he was given the New Media Visionary of the Year Award at the Canadian New Media Awards. In 2001, The Hollywood Reporter named him one of the 10 most influential innovators in Hollywood. In 2002, Time Magazine named him one of

the top 5 designers in Canada. Also in 2002, he was elected to the CHI Academy. In October, 2005, he and Gord Kurtenbach received the "Lasting Impact Award", from ACM UIST 2005, which was awarded for their 1991 paper, Issues in Combining Marking and Direct Manipulation Techniques. In 2008 he became the 10th recipient of the ACM SIGCHI Lifetime Achievement Award, "for fundamental contributions to the field of Computer Human Interaction." In 2009 he was elected Fellow of the Association of Computing Machinery (ACM), for his contributions to the field of human-computer interaction. Buxton has been awarded three doctorates Honoris Causa: Doctor of Design from the Ontario College of Art and Design, Toronto, Ontario (June, 2007), Doctor of Laws from his alma mater, Queen's University, Kingston Ontario (June, 2009), and Doctor of Industrial Design, from the Technical University of Eindhoven, The Netherlands (Nov. 2009). From 1998-2004, Buxton was on the board of the Canadian Film Centre, and in 1998-99 chaired a panel to advise the premier of Ontario on developing long term policy to foster innovation, through the Ontario Jobs and Investment Board. He is on a number of academic advisory boards, the Department of Industrial Design of the Technical University in Eindhoven, the Netherlands. Buxton is a member of the Association of Computing Machinery and the Industrial Designers Society of America.

Peter Carbone
Coral, CEA

Peter Carbone is currently the Chair of the Board of Directors of Coral CEA, a company chartered to implement a new model of commercialization in Canada. Peter is a successful executive known for his thought leadership, business acumen and technology leadership and is often called on to address new business and technology challenges. He is a pathfinder with a track record of creating innovative solutions, strategically managing technology and innovation, successfully launching and running new businesses. With more than 31 years of industry experience, holding CTO, CRO, GM, R&D, VP Corporate Strategy and senior business positions in several high tech companies, he has developed a reputation for gaining first mover advantage in emerging markets, and delivering business results. Peter has been responsible for research and technical development required to support a rapidly evolving information and communication technology (ICT) marketplace and provides leadership and oversight on strategic projects and initiatives. He has also held senior external leadership positions, including Vice-chair of the IT Association of Canada, an industry member to the ATIS board and a faculty appointment in the innovative Lead to Win Program.

Tom Corr
President & CEO, Ontario Centres of Excellence (OCE)

Dr. Tom Corr was recently appointed as President and CEO of Ontario Centres of Excellence (OCE) – a non-profit organization that drives the commercialization of cutting-edge Ontario-based research across key market sectors to build the province's innovation economy and secure its global competitiveness. Previously, Dr. Corr was the CEO of the Accelerator Centre (AC) at the Waterloo Research and Technology Park and

Associate Vice-President of Commercialization at the University of Waterloo (UW) and Director of Commercialization - IT & Communications at the University of Toronto. Dr. Corr's career also includes over 30 years in the IT sector including positions as Managing Partner at Catalyst Partnership; founder and CEO of Momentum Systems; founder and CEO of Applied Development Corp., and President of Canadian Data Processing Corp. His education includes a Doctor of Business Administration degree from Henley Management College/Brunel University in England, an MBA from the University of Toronto, and an Advanced Post Graduate Degree in Management Consultancy from Henley Management College. Dr. Corr has also completed his certification as a corporate director by the Institute of Corporate Directors and holds the ICD.D designation. Ontario Centres of Excellence currently manages more than 630 research, commercialization and talent projects that will bring innovation to the marketplace and foster the training and development of future innovators, entrepreneurs and business leaders. Recently, OCE was selected to administer the delivery of the Industry-Academic Collaboration Program (IACP) – a key driver of the new Ontario Network of Excellence (ONE).

David Crane
Global Issues Columnist and Author

David Crane is an award-winning Canadian writer on economic, political and environmental issues. His writings appear in publications across Canada. He is a member of the National Statistics Council, an advisory body to Statistics Canada, the President's International Advisory Council at the University of Toronto, the President's Advisory Council at Victoria University, the advisory board of the Canada-U.S. Law Institute, and the board of the North American Institute. He has also served as a board member of the University of Toronto's Innovations Foundation, a member of the Ontario Science and Technology Council, a member of the original steering committee of the Toronto Vital Signs Project, and as a member of the Challenge Dialogue of the Alberta Energy Research Institute. David Crane also served for five years as a judge for the Entrepreneur of the Year Award. A graduate of the University of Toronto, he has an Arbor Award from the University of Toronto for his contributions to the university, honorary doctorates from Wilfrid Laurier University and Victoria University (part of the University of Toronto), and an award of recognition from Conestoga College. He was awarded the Queen's Jubilee Medal for his contribution to Canadian life and a Social Work Doctoral Award by the Social Work Doctors' Colloquium. A member of the Davos Circle, an association of long-term participants in the World Economic Forum, he has written several books, including *The Next Canadian Century*, *The Canadian Dictionary of Business and Economics*, and *Controlling Interest* and contributed to many others. David Crane is currently writing a book on how Canada should position itself in the global economy.

Fred Gault
Professorial Fellow, United Nations University MERIT and Professor Extraordinaire,
Tshwane University of Technology, South Africa

Fred Gault is a member of the management team working on the OECD Innovation

Strategy to be released in June 2010. For two decades he was responsible for science, technology and innovation statistics at Statistics Canada and during that time he chaired the OECD Working Party on Indicators for the Information Society (1997-2002) and the Working Party of National Experts on Science and Technology Indicators (NESTI) (2002-2008). After Statistics Canada, he joined the International Development Research Centre (IDRC) in Ottawa as a Visiting Fellow and worked on the place of innovation indicators in the development agenda before moving to UNU-MERIT where he manages IDRC funded projects on innovation in Africa. Currently, he is Professorial Fellow at the United Nations University MERIT in the Netherlands and Professor Extraordinaire at the Tshwane University of Technology in South Africa. His book, Innovation Strategies for a Global Economy: Development, Implementation, Measurement and Management, published by Edward Elgar, jointly with IDRC, will be released in July 2010.

Robin Harkness

Associate VP, Program Leader, Sanofi Pasteur

Dr. Robin Harkness has dedicated most of his 25 year career to the vaccine industry – in particular, the translation of basic research to the development of new and improved human vaccines. Robin currently holds the position of Associate Vice President, Program Leader, at Sanofi Pasteur. After completing his undergraduate degree at Carleton University, Robin went on to train as a microbiologist earning a Ph.D. from the University of Victoria in 1984. Following a post doc at the University of Munich as an NSERC Fellow, he joined the University of Tübingen as an Associate Professor in the Institute for Microbiology. In 1990, Robin was recruited to Sanofi Pasteur, the vaccine division of the Sanofi Aventis Group, as a research scientist in the company's Canadian research division. In the following years Robin rose through the Sanofi Pasteur ranks in successive senior management roles: first, as Director Microbiology Research, then as Associate Vice President Research Canada, and finally in 2007 to his current role as Associate Vice President Program Leader in the company's global R&D division. In this role, Robin's primary responsibilities include development and implementation of short- and long-term strategic plans for several emerging disease targets.

Raymond Leduc

Director, Bromont Manufacturing, IBM Canada

Raymond Leduc is Director and Senior Location Executive with IBM Bromont where he leads a 2600 person high technology operation providing microelectronic solutions for IBM's server products and major OEM customers. He held various management positions in engineering and finance before being named to head the plant in 2003. Raymond obtained both his B.Eng and M.B.A. from McGill University and recently completed a Directors Education Program from the Institute of Corporate Directors. He is a member of the National Research Council and Vice-Chair of the board of the Canadian Manufacturers and Exporters.

Nowlen Mahé

Director, Montreal Office of the Chief Scientist, SAP

Nolwen Mahé is the Director for Montreal of the Office of the Chief Scientist (oCS). The oCS brings technology intelligence to SAP and is responsible for ensuring awareness and planning for critical technologies, especially externally driven ones from industry, academia, and customers, in isolation or through co-innovation. The oCS group in Montreal has a special interest in mobility and related technologies; a familiar area for Nolwen who spent most of her work life in the telecommunications domain. Over the past 25 years, Nolwen has been a developer, a product manager, a research director as well as a grass-roots entrepreneur. Her functional expertise spans the product lifecycle, organization of research, product/project management as well as productization and product marketing in an international setting. She gained her technical degrees at Institut National des Sciences Appliquées (INSA) and École Nationale Supérieure des Télécommunications (ENST), both in Rennes, France, and complemented them with an MBA at McGill University.

David Miller
Senior VP, The Woodbridge Group

David Miller graduated from The University of Toronto with a Bachelor of Applied Science in 1982 and is a member of the Professional Engineers Ontario (PEO). David joined The Woodbridge Group in 1983 and has progressed through a variety of technical and technical management positions culminating in his appointment as Senior Vice President, The Woodbridge Group, as well as President of XanaThane Chemical Business Unit. In addition to his role as head of technology for all business units globally, David has responsibility for Purchasing, Product Development, Product Design, Research and Development, Facility and Machinery Engineering. He was instrumental in forming and expanding a tool and die-making business. David has experience as a director on several boards, currently and historically, including European, Asian and India-based enterprises. David lives in Bolton, Ontario with his wife, Pat, and two children.

Jim Roche
President and CEO, Stratford Managers Corporation

Jim is a successful entrepreneur with over twenty-five years of leadership experience, having been a founding member and General Manager at Newbridge Networks (now Alcatel-Lucent), a co-founder and CEO of Tundra Semiconductor (now IDT) and the CEO of CMC Microsystems. He is currently the CEO of Stratford Managers, a management services company that focuses on commercialization and growth in innovation-based companies. He is also the President & CEO of CANARIE, Canada's advanced research and innovation network. In addition to his corporate duties, he also serves on numerous boards and committees including the ICT Advisory Board for DFAIT, the Committee of Research Partnerships for NSERC, the Expert Panel on Business Innovation for CCA and others. He is also an Executive-in-Residence at the Telfer School of Management at the University of Ottawa and is frequently called on to speak about entrepreneurship, commercialization of innovation, and strategy development.

Sam Stevens
Executive Director, Ontario Region, NRC-IRAP

Sam Stevens is Executive Director for the Ontario region of the National Research Council's Industrial Research Assistance Program (NRC-IRAP). He has overall responsibility for delivery of a \$100 million program in the Ontario Region, involving a staff of 85 located in 32 offices across the Province. Prior to assuming his current position in 2007, he was a Regional Director in both the Atlantic and Ontario Regions between 2001 and 2007. Sam has extensive North American experience in executive roles ranging from President & CEO, Vice President, and Executive Director in both small private and large public technology based corporations. Two of these firms were start-ups, which he brought to a multi-million dollar sales level, prior to them being acquired by larger firms. In an earlier stage of his career, Sam also worked as a research scientist and research manager in Environment Canada and the Ontario Ministry of the Environment respectively. Sam holds a Bachelor of Science in Chemistry from Mount Allison University in Sackville, a PhD in Chemistry from University of New Brunswick, and he did Post-Doctoral research at the Universite de Bordeaux in France, and received a Business Management Certificate from Duquesne University in Pittsburgh, Pennsylvania. He has authored and co-authored 60 scientific publications and reports. He is also inventor or co-inventor of 14 patents, one of which is generating tens of millions of dollars per year for the assignee firm.

Janet Walden
Vice-President, Research Partnerships, NSERC

Janet Walden is the Vice President responsible for the Research Partnerships Programs with the Natural Sciences and Engineering Research Council of Canada (NSERC). Janet began her career working in the forestry industry, as an environmental chemist. In 1982, she joined NSERC and since 1997 has been Vice President for Research Partnerships. Janet is responsible for creating and evolving a highly successful spectrum of national policies and partnership programs designed to stimulate increased public-private collaborations and technology transfer, and maximize the benefits to Canada of university research. She has 25 years of experience in leadership positions with NSERC, including 7 years as Director of the Networks of Centres of Excellence. Under her guidance, NSERC's partnership initiatives have grown to over \$180M per annum involving more than 3,600 university researchers and over 1,400 companies annually.